

Developing a Brief Sensation Seeking Scale for Children: Establishing Concurrent Validity With Video Game Use and Rule-Breaking Behavior

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Despite the importance of life-cycle models to sensation seeking research, past studies have typically focused on adolescents and adults. This is especially problematic for researchers studying the role of media use in the development of risky behaviors (e.g., violent video game consumption and aggressive behavior). To facilitate research with child populations, a brief sensation seeking scale for children (BSSS-C) is developed and validated with a sample of fourth, fifth, and sixth graders ($N = 136$). The BSSS-C is found to be internally reliable ($\alpha = .82$) as well as a strong predictor of several risky child behaviors. Higher sensation seeking children were more likely to play video games, including violent subgenres (e.g., shooters), and to enjoy playing video games that contained specific acts of violence (e.g., weapon use). Higher sensation seekers were also more likely to engage in rule-breaking behavior, such as bringing prohibited cell phones to school. The results suggest that sensation seeking may be related to risky behavior at a very young age.

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Sensation seeking is a biological trait that has proven to be a key predictor of human behavior (Zuckerman, 1996). High sensation seekers may have lower baseline arousal, a situation that prompts them to seek out highly arousing experiences, including those that are risky, dangerous, or violent (Roberti, 2004). According to the activation model of information exposure (AMIE; Donohew, Palmgreen, & Duncan, 1980), sensation seekers also come to prefer material that helps them maintain an optimal level of arousal. For example, research has found that high sensation seekers are attracted to violent movies, video games, and Web sites (Aluja-Fabregat, 2000; Krcmar & Greene, 1999; Slater, 2003). This is an interesting finding since past studies have shown that consumption of violent material is a predictor of violent behavior as well (Anderson, Shibuya, Ihori, Swing, Bushman, et al., 2010).

Given the aforementioned findings, it is possible that pursuit of arousal draws high sensation seekers toward violent media which, in turn, increases the likelihood of violent tendencies. More specifically, high sensation seekers may find stimulation in violent media (e.g., violent video games) and consumption of this material could serve to create or reinforce cognitive associations between violent behavior and arousal. Cognitive associations between violence and arousal may help to explain patterns of violent behavior across the lifespan (i.e., childhood, adolescence, and adulthood). For instance, researchers have argued that a violence cycle may be created by violent video game consumption (Lemmens, Bushman, & Konijn, 2006). Aggressive children are drawn to violent content, which may desensitize them to violence over time, making them more likely to engage in violent behavior later on in life. A similar pattern may be present for higher sensation seeking children (see, e.g., Slater, Henry, Swaim, & Anderson, 2003).

Unfortunately, children are understudied in sensation seeking research, a practice that makes violence-cycle or life-cycle models (like the one mentioned above) difficult to assess. Two barriers hinder sensation seeking research with children: a) the lack of efficient, reliable measures and b) the tendency to focus on high risk behaviors (e.g., assault, drug use) that are less common in preadolescent populations. The present study addresses both barriers by developing a brief sensation seeking scale for children (BSSS-C) as well as examining its relationship with violent media use and several low risk, but still prohibited behaviors (e.g., bringing cell phones to school). The latter also serves as a test of concurrent validity (DeVellis, 2003), in that the BSSS-C should be significantly related to these behaviors if it is properly constructed.

SENSATION SEEKING

Sensation seeking is a trait and it appears to be somewhat hereditary (Fulker,

Eysenck, & Zuckerman, 1980; Zuckerman, 1994). It also has been linked to biochemical processes within the body, including the release of dopamine and production of testosterone (Bardo, Donohew, & Harrington, 1995; Linnet, Moller, Kumakura, Cumming, & Gjedde, 2008; Zuckerman, 1994). The former may explain the relationship between sensation seeking and drug addiction, whereas the latter is the basis for frequently observed gender effects. Researchers have consistently found that males report greater sensation seeking than females (e.g., Kosten, Ball, & Rounsaville, 1994; Martin et al., 2002; Russo, Stokes, Lahey, Christ, McBurnett, et al., 1993).

High sensation seekers prefer sensations that are “varied, novel, and complex” (Zuckerman, Bone, Neary, Mangelsdorff & Brustman, 1972, p. 308), which is an impulse that may lead them to pursue risky or dangerous behavior. Sensation seeking has been related to a number of risky behaviors, including alcohol abuse (Dom, Hulstijn, & Sabbe, 2006), illicit drug use (Yanovitzky, 2005), consumption of violent material (Slater, 2003), and criminal behavior (Newcomb & McGee, 1991; Vermeiren et al., 2003). At least some of this behavior is believed to be a byproduct of sensation seekers looking for stimulation (Roberti, 2004).

Measuring Sensation Seeking

The most frequently used measure of sensation seeking is form V of the Sensation Seeking scale (SSS-V; Zuckerman, 1994). The SSS-V is a reliable 40-item forced choice test ($\alpha = .83-.89$) with four underlying dimensions: thrill and adventure seeking, disinhibition, experience seeking, and boredom susceptibility (McDaniel & Mahan, 2008). One noted limitation of the SSS-V is that it includes items about alcohol and drug use (e.g., “I have tried marijuana or would like to”). The inclusion of these items is potentially problematic in that it confounds research attempting to examine relationships between sensation seeking and alcohol/drug use (McDaniel & Mahan, 2008).¹

Because of the length of the SSS-V, researchers have constructed two brief sensation seeking scales: One scale with 8 items (BSSS-8; Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002) and another with 4 items (BSSS-4; Stephenson, Hoyle, Slater, & Palmgreen, 2003). The BSSS-8 and BSSS-4 include items representing the four dimensions captured by the SSS-V. The BSSS-8 has demonstrated moderate reliability ($\alpha = .74-.76$) but the reliability of the BSSS-4 is somewhat low ($\alpha = .66$).

Researchers have also developed two reliable measures for assessing sensation seeking in adolescents. A 20-item measure ($\alpha = .82$) was developed specifically for this population (SSS-A; Stephenson et al., 1999). However, the SSS-A may be lexically complex for young children, and several items are specifically tailored to the experiences of adolescents and young adults. A 2-item sensation seeking scale was also developed to study adolescents (Slater, 2003) and has proven to be reliable ($\alpha = .83$). This measure is

ideally suited for studying sensation seeking in large survey situations, but it may not represent all dimensions of the construct.

SENSATION SEEKING AND CHILDREN

Researchers have rarely examined sensation seeking in children. Children are defined here as age 13 or younger, which equates to roughly the sixth grade or below (e.g., Anderson, Williams, McGee, & Silva, 1987; Hinshaw, 2002; Kupersmidt & Coie, 1990). It is unfortunate that so little research examines sensation seeking in children, as studying younger populations facilitates understanding of life-cycle or developmental research (e.g., Steinberg et al., 2008). Indeed, a central question about sensation seeking remains largely unanswered; namely, is sensation seeking an innate characteristic or something that develops over time? Farley (1986) argued that sensation seeking was primarily established by genetics, a perspective that has been echoed by others (Fulker et al., 1980; Zuckerman, 1994). Existing life-cycle research suggests that sensation seeking behavior changes with age, perhaps peaking in late adolescence or early adulthood (Kafry, 1982; Steinberg et al., 2008). A combination of genetics and hormones could explain this trend, but so could the influence of environmental cues (Bardo et al., 1995). For example, longitudinal research has suggested that consumption of R-rated movies may increase sensation seeking over time in adolescents (Stoolmiller, Gerrard, Sargent, Worth, & Gibbons, 2010). Of course, at present, it is still unclear if sensation seeking *does* vary with age. Life-cycle studies have been conducted with modified versions of the SSS-V, which contains items that may artificially deflate child sensation scores (e.g., questions about drinking alcohol and wild parties).

Measuring Child Sensation Seeking

One barrier to studying sensation seeking in children is that researchers are still trying to develop a suitable measure for younger populations. Kafry (1982) used a simplified version of the SSS-V in a survey of kindergarteners, second graders, and fourth graders ($N = 68$), but the scale had low reliability ($\alpha = .57$). Russo et al. (1991) also modified the SSS-V by removing twelve items and altering the remaining 28 to make them appropriate for children. The resulting scale was labeled the Sensation Seeking Scale for Children (SSSC). An initial validation with children aged 7–12 years ($N = 126$) demonstrated excellent test-retest reliability ($r = .71$) but low internal reliability ($\alpha = .49$). To improve the internal reliability of the SSSC, Russo et al. (1993) conducted another study with a modified version of their original scale. The modified SSSC included 26 items and was found to be reliable ($\alpha = .83$). However, subsequent research using the modified SSSC either did not

report reliability (Martin et al., 2002) or found it to be unreliable ($\alpha = .40-.50$; Morrongiello & Lasenby, 2006). The SSSC also has an atypical dimensional structure that does not seem to conform to the original explication of the construct.

To address these issues, Morrongiello and Lasenby (2006) created a new SSSC for studying physical risk taking in children aged 7–12. The scale consisted of 40 items that ultimately loaded on five underlying dimensions (thrill seeking, experience seeking, boredom susceptibility, behavioral inhibition, and behavioral intensity). The authors did not report an overall reliability score for the measure as they wanted researchers to use each of the subscales separately. Individual subscales had reliabilities ranging from .32 to .79, and the authors ultimately recommended dropping two of the subscales (boredom susceptibility and experience seeking). In line with this recommendation, a follow-up study utilized only three of the subscales (27 items) with reliabilities ranging from .66 to .78 (Morrongiello, Lasenby-Lessard, & Corbett, 2009). Finally, three brief measures have been developed. Steinberg et al. (2008) used 6 items from the ImpSS in a large survey ($N = 935$) of individuals ranging in age from 10–30. Unfortunately, it is difficult to evaluate the efficacy of this scale for children as the authors did not report reliability by age group. For the entire sample, the scale was moderately reliable ($\alpha = .70$). The 2-item brief measure created by Slater (2003) was recently utilized in a study of 310 Dutch youth aged 7–17 (Bijvank, Konijn, Bushman, & Roelofsma, 2009). Again, reliability was reported for the entire sample ($\alpha = .83$) making it difficult to assess the utility of the instrument with children. Most recently, a 4-item measure was proposed (Stoolmiller et al., 2010) based on the SSS-V and the Arnett Inventory of Sensation Seeking (AISS; Arnett, 1994); this was utilized in a four wave study and demonstrated low reliability ($\alpha = .58-.64$)

To summarize, researchers have developed reliable and valid measures of sensation seeking for adults and adolescents, but attempts to measure this construct in children have met with varied success. Simply modifying the SSS-V yielded an unreliable scale (Kafry, 1982; Russo et al., 1993) and shorter measures have had similar problems as well as included items about drinking and drugs, captured only one dimension of sensation seeking, or exhibited atypical dimensional structures (e.g., five dimensions rather than four). In light of past work, researchers would benefit from a sensation seeking scale that is reliable with children (and demonstrated to be so), representative of the four underlying dimensions of sensation seeking, and as efficient as possible. Efficiency is important in measurement as it increases the likelihood that an instrument can be utilized by low skilled populations and in a variety of contexts (see Hoyle et al., 2002). This may be especially true of research with children because they have limited attention and lower reading and writing skills. To address these shortcomings, the present study utilizes a modified version of the BSSS-8 (because it is brief, reliable, and

representative of the four dimensions of sensation seeking) combined with items from several of the other measures of child sensation seeking (Russo et al., 1991; Russo et al., 1993; Stephenson et al., 1999; Stephenson, Velez, Chalela, Ramirez, & Hoyle, 2007) to construct a brief sensation seeking scale for children. Thus, the new measure utilizes many elements that have proven successful in the past while addressing limitations that have potentially hindered progress.

Sensation Seeking and Child Development

Measurement issues aside, researchers have identified several key relationships concerning sensation seeking in children. Past research has found that sensation seeking is related to pubertal development in males (Steinberg et al., 2008). Like their adult counterparts, male children have higher sensation seeking scores than female children. In addition, as male children advance through puberty their sensation seeking scores increase whereas females remain relatively unchanged. This pattern is consistent with other research, which has found a positive relationship between sensation seeking and levels of testosterone/estradiol (Zuckerman, Buchsbaum, & Murphy, 1980).

Kafry's (1982) survey of kindergarteners, second graders, and fourth graders found that children's sensation seeking scores were lower than those typically observed in adolescents and adults. Subsequent research has suggested that sensation seeking has a curvilinear relationship with age, rising sharply from ages 10 to 14 and peaking in late adolescence and early adulthood (Butkovic & Bratko, 2003; Russo et al., 1993). No gender or age differences were significant in Kafry's (1982) study, but her sample size (and, hence, power) was very low.

Higher sensation seeking children in Kafry's (1982) study were more interested in complex puzzles and visual stimuli, likely because these activities are more arousing than their less complex alternatives. Higher sensation seeking children also expressed a greater preference for dangerous play behavior (e.g., jumping down stairs, diving hazardously into a swimming pool), which is a finding that has been replicated in several subsequent studies (Morrongiello & Lasenby, 2006; Morrongiello et al., 2009). Finally, higher sensation-seeking boys were more likely than their peers to have engaged in risky behaviors, including playing with matches, hitting peers, smoking, damaging property, taking money from their mother's purse, shoplifting, and skipping school (for a discussion of risky behaviors, see Sullivan, Childs, & O'Connell, 2010).

The present study looks to extend existing work by examining sensation seeking in younger children. In line with past research, we hypothesize that male children will have higher sensation seeking scores than female children (Hypothesis 1a). Moreover, over the course of pubertal development it is

predicted that male children's sensation seeking scores will increase whereas female children's scores will remain unchanged (Hypothesis 1b). Sensation seeking scores aside, the present research is once again focused on risky behavior; however, our primary interest is in the relationship between sensation seeking and two outcomes: a) video game play and b) rule breaking behavior.

Video Game Play

Kafry (1982) found that higher sensation seeking children were more interested in complex puzzles and visual stimuli. Video games are complex visual stimuli that often contain puzzles or strategy-oriented tasks. Consequently, it is possible that higher sensation seeking children may be more likely to play video games than their lower sensation seeking peers. Consistent with this idea, recent studies have found that higher sensation seeking adolescents are more likely to go online (Livingstone & Helsper, 2007) and to be addicted to online gaming (Chiu, Lee, & Huang, 2004). Although researchers have yet to examine the relationship between sensation seeking and children's video game play, it is hypothesized that higher sensation seeking children will be more likely to play computer games (Hypothesis 2a), home video games (Hypothesis 2b), and portable video games (Hypothesis 2c).

There is evidence that higher sensation seeking adolescents are more likely to play a particular type of video game, namely those containing violence (Slater, 2003). Violent video games as well as other types of violent material appear to be arousing and, hence, attractive to sensation seekers (Slater, Henry, Swaim, & Cardador, 2004; Weaver, 1991). Although it has yet to be documented, it seems reasonable to hypothesize that, similar to their adolescent counterparts, higher sensation seeking children will be more likely play violent video game genres. Specifically, we hypothesize that sensation seeking will be positively related to playing fighting games (Hypothesis 3a), shooter games (Hypothesis 3b), action games (Hypothesis 3c), and sports games (Hypothesis 3d).

Another genre of video game that is very popular at the moment are role playing games (RPG) or multiplayer online role playing games (MMORPG). RPGs (e.g., *Zelda*, *Final Fantasy*) and MMORPGs (e.g., *World of Warcraft*) often contain violent (Williams, 2006) as well as nonviolent (but still potentially arousing) activities such as adventure, world building, and novel social relationships. For example, in many MMORPGs, players can pursue virtual jobs, character role playing, and socialization. Williams (2006) observed that "the content [in MMORPGs] is as much the fellow players as the plot or game mechanics" (p. 83). Given that violence and other potentially arousing stimuli are common aspects of these games, we hypothesize that sensation seeking will be positively related to playing MMORPGs (Hypothesis 4a) and RPGs (Hypothesis 4b).

Sensation seeking could be related to consumption of other video game genres as well. Puzzle and strategy-oriented video games (e.g., *Tetris*) may offer higher sensation seeking children the opportunity to engage in puzzle play via a highly complex visual environment (Kafry, 1982). Similarly, music and party video games (e.g., *Dance Dance Revolution*) are often interactive and fast-paced, two characteristics that sensation seekers find appealing (Palmgreen, Stephenson, Everett, Baseheart, & Francies, 2002). Accordingly, we hypothesize that sensation seeking will be positively related to playing puzzle games (Hypothesis 5a) and party games (Hypothesis 5b).

Enjoyment of Violent Video Game Content

Researchers have noted that media consumption is distinct from enjoyment (Krcmar & Kean, 2005; Weaver, in press). Therefore, in addition to consumption, it is useful to consider whether sensation seeking is related to the enjoyment of specific video game content. There is good reason to believe that the arousing nature of video games could indeed increase enjoyment for higher sensation seeking players. As noted above, existing research demonstrates that video games can increase physiological arousal (e.g., Ivory & Kalyanaraman, 2007). Violent video game content in particular leads to both physiological and self-reported arousal in children (Fleming & Rickwood, 2001) and adults (Calvert & Tan, 1994). Mehrabian and Wixen (1986) found that video games that elicited higher levels of arousal were rated as more enjoyable by adolescent players. Although Mehrabian and Wixen (1986) did not specifically examine sensation seekers, it has been theorized that higher sensation seeking players should enjoy this sort of high-arousal content more than lower sensation seeking players (e.g., Sparks & Sparks, 2000). This is consistent with research on other forms of media which has found that sensation seeking predicts enjoyment of arousing violent content (e.g., Aluja-Fabregat & Torrubia-Beltri, 1998; Slater, 2003). In line with the above, we hypothesize that sensation seeking will be positively related to enjoyment of games containing fighting (Hypothesis 6a), punching (Hypothesis 6b), weapon use (Hypothesis 6c), crime (Hypothesis d), extreme sports (Hypothesis 6e), and racing (Hypothesis 6f).

Rule Breaking

Kafry (1982) found that higher sensation seeking children were more likely to engage in risky behavior, including at school (e.g., skipping school). Media use can also be risky, especially if children are using media in prohibited ways or places. In response to increased social and portable media, some schools have implemented policies banning social media (e.g., cell phones) and portable video game machines (e.g., PSPs, Gameboys) on school grounds. If higher sensation seeking children are drawn to these

media and are more likely to engage in risky behavior, then it stands to reason that they will be more willing to violate rules concerning prohibited media. Thus, we hypothesized that sensation seeking would be positively related to bringing prohibited items to school, including cell phones (Hypothesis 7a), portable video game devices (Hypothesis 7b), and chewing gum (Hypothesis 7c).

METHOD

Participants

Fourth, fifth, and sixth graders ($N = 136$) were recruited from three elementary schools located in three medium-sized Midwestern towns (population 30,000–100,000). The schools were all public and served kindergarten through sixth grade. Students were asked to complete a brief survey in exchange for a small reward (a \$3 yo-yo). The schools were also provided with compensation on a per student basis (\$5 per student).

Participants ranged in age from 9 to 13 years old ($M = 10.87$, $SD = .88$). Slightly more girls (55.9%) participated than boys (44.1%). The sample was fairly balanced across grade level, with roughly equal numbers of fourth (39.0%), fifth (37.5%), and sixth graders (22.8%; 0.7% missing). Most of the participants described themselves as White, however there was also a relatively large percentage of Hispanic children in the sample (consistent with the demographics of the region): 70.6% White, 1.4% Black, 20.6% Hispanic/Latino, 2.2% Asian/Pacific Islander, 1.5% Native American/American Indian, with 3.6% describing their race as other.

Procedure

Principals of elementary and middle schools in the area were contacted through mail. The mailings explained the purpose of the study, the benefits to the school, and the benefits to the students. If a principal agreed to let the research team visit, then the researchers contacted individual fourth, fifth, and sixth grade teachers at that school. Thirty recruitment letters were sent out to schools, and six principals expressed interest in the study. Three schools were selected at random from those six to participate. Across the three participating schools, eight teachers (three from fourth grade, three from fifth grade, and two from sixth grade) volunteered to let researchers visit their class.

On the first visit to each classroom, the researchers provided all students with consent packets that needed to be taken home to their parents to be signed and then brought back to the school. A drop box was then left in the classroom for approximately one week to collect returned packets. If time

permitted, the researchers stopped by the school a second time to check on the number of packets in the drop box. In total, 160 packets were sent out and 136 were returned (85% return rate). After sufficient time had passed, the researchers contacted the teachers again to set up a third visit.

During the third visit, students with complete consent packets were allowed to participate in the study. Surveys were then passed out to participating students. Researchers and homeroom teachers monitored participants and answered questions during the survey. The majority of questions were clarification questions (e.g., what a certain type of video game was, what “ethnicity” meant). Upon the survey’s completion, the students lined up single file to receive their yo-yos.

Independent Variables

DEMOGRAPHICS

Participants reported their gender (*male* = 0; *female* = 1) and grade (scored 4, 5, 6).

BRIEF SENSATION SEEKING SCALE FOR CHILDREN

Reliable measures of sensation seeking exist for adolescents (Stephenson et al., 1999) and adults (Zuckerman, Kuhlman, Joirman, Teta, & Kraft, 1993), but attempts to develop a similar measure for children have yielded mixed results (Kafry, 1982; Morrongiello & Lasenby, 2006; Russo et al., 1991; Russo et al., 1993). In light of these measurement difficulties, a pilot study was conducted at two local elementary schools that did not participate in the primary study.² In the pilot, a modified version of the BSSS-8 was used to assess sensation seeking (Hoyle et al., 2002). The scale was modified to fit the target population (i.e., young children).³ Participants responded to eight questions using 5-point scales (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*). The eight questions were, “I would like to explore strange places,” “I get restless when I spend too much time at home,” “I like to do things that scare me a little bit,” “I like new and exciting experiences, even if I have to break the rules,” “I prefer friends who are exciting and unpredictable,” “I would like to try bungee jumping,” “I get bored quickly,” and “I would like to try sky-diving.” The eight questions were averaged to form a scale ($M = 3.07$, $SD = .77$). The initial scale had moderate reliability ($\alpha = .65$).

Psychometric research has demonstrated that, all other things being equal, the internal reliability of a scale can be increased by adding items (i.e., the Spearman-Brown Prophecy Formulation, see DeVellis, 2003). In accord with this principle and based on the results of the pilot study, six additional items were added to the pilot scale. The six items were “I like hanging out with older kids,” “If somebody dares me to do something, I do

it,” “I like telling jokes,” “I think bugs and snakes are pretty cool,” “I’m the first one of my group to try new things,” and “I would like to try using a parachute.” These items were modeled after those used in other measures of sensation seeking (e.g., Russo et al., 1991; Russo et al., 1993; Stephenson et al., 1999; Stephenson et al., 2007). The mean, reliability, and underlying factor structure of the BSSS-C are presented in the results section.

Dependent Variables

VIDEO GAME PLAY

Participants responded to a question that asked, “How often do you do these things?” Several activities were located below the question. Participants indicated how often they did each of the activities using a 4-point scale (1 = *never*, 2 = *once a month*, 3 = *once a week*, 4 = *almost every day*). Three of the activities listed were “play computer games” ($M = 3.10$, $SD = .93$), “play home video games (e.g., Xbox)” ($M = 2.72$, $SD = 1.11$), and “play portable video games (e.g., PSP)” ($M = 2.28$, $SD = 1.17$).

VIDEO GAME PLAY—SUBGENRE

Participants responded to a question that asked, “How often do you play these types of games?” Several video game types were listed below the question. Participants indicated their preference using a 4-point scale (1 = *never*, 2 = *once a month*, 3 = *once a week*, 4 = *almost every day*). Nine game types were listed, including shooter ($M = 1.94$, $SD = 1.18$), action ($M = 2.64$, $SD = 1.17$), fighting ($M = 2.11$, $SD = 1.22$), sports ($M = 2.86$, $SD = 1.16$), MMORPG ($M = 1.81$, $SD = 1.06$), RPG ($M = 1.81$, $SD = 1.05$), puzzle ($M = 1.73$, $SD = 0.86$), and music and party ($M = 2.09$, $SD = 1.01$).

ENJOYMENT OF VIOLENT VIDEO GAME ACTIVITIES

Participants were provided a lead-in statement “I like to play video games . . .” and then asked to rank their agreement with several violent video game activities (e.g., where you fight other players, where you learn to use lots of weapons). Participants indicated their preference using a 5-point scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*). Six violent video game activities were listed, including fight other players ($M = 2.63$, $SD = 1.44$), use lots of weapons ($M = 2.77$, $SD = 1.54$), punch other characters ($M = 2.83$, $SD = 1.54$), commit crimes ($M = 2.63$, $SD = 1.53$), do extreme sports ($M = 3.43$, $SD = 1.36$), and race other players ($M = 3.76$, $SD = 1.23$).

RULE BREAKING

None of the elementary schools involved with the current study allowed students to bring cell phones, chewing gum, portable video game devices, knives, or matches to school. Given that, students were asked “How often do you bring the following items to school?” Participants indicated their preference using a 4-point scale (1 = *never*, 2 = *once a month*, 3 = *once a week*, 4 = *almost every day*). No participant reported bringing a knife or matches to school, thus, these two items were dropped from analysis. Students did report bringing cell phones ($M = 2.10$, $SD = 1.33$), portable video game devices ($M = 1.51$, $SD = 0.96$), and chewing gum ($M = 2.01$, $SD = 1.17$).

Power Analysis

G*Power was utilized to calculate the power of the design. Three power analyses were conducted ($\alpha = .05$, $k = 3$, $N = 136$) for three standard effect sizes, small ($f^2 = .02$), medium ($f^2 = .15$), and large ($f^2 = .35$) (Cohen, Cohen, West, & Aiken, 2003; Erdfelder, Faul, & Buchner, 1996). The design had excellent power to detect a large (.99) or medium effect (.97), but low power to detect a small effect (.25).

RESULTS

Factor Analysis of BSSS-C

Principal components analysis was utilized to examine the underlying structure of the BSSS-C. Consistent with the original explication of the construct, four factors were identified with eigenvalues >1 , explaining 31.7%, 10.4%, 9.5%, and 8.1% of the variance in sensation seeking. To aid in interpretation of the four factors, varimax rotation was utilized (see Table 1). The first factor represents thrill and adventure seeking, which is logical as four of those items (1–4) have been associated with that dimension in past psychometric research (e.g., Hoyle et al., 2002; Morrongiello & Lasenby, 2006). The second factor appears to be disinhibition, as two of those items (8, 9) have loaded on this dimension previously (Hoyle et al., 2002; Russo et al., 1993). Two items (10, 11) loaded cleanly on a third factor, which may be experience seeking. A third item (12) loaded above .40 on the first and third factor. Past research has suggested this item might be a thrill and adventure seeking item (Russo et al., 1993), but children may struggle to distinguish between this and experience seeking (hence, the cross load). The final factor is boredom susceptibility.

Four factors are visible in the initial factor analysis; however, several indicators suggest that the BSSS-C should be treated as a uni-dimensional

TABLE 1 Principal Components Analysis of Sensation Seeking Items

	Factors				<i>M</i>	<i>SD</i>
	TAS	D	ES	BS		
1. I would like to try sky-diving.	.86				2.99	1.66
2. I would like to try using a parachute.	.86				3.17	1.49
3. I would like to try bungee jumping.	.84				3.11	1.57
4. I would like to explore strange places.	.64				3.44	1.31
5. I'm the first one in my group of friends to try new things.	.44				2.82	1.10
6. If somebody dares me to do something, I do it.		.76			2.25	1.13
7. I like hanging out with older kids.		.72			3.20	1.15
8. I like new and exciting experiences, even if I have to break the rules.		.69			2.41	1.36
9. I prefer friends who are exciting and unpredictable.		.51			3.23	1.22
10. I like telling jokes.			.75		3.55	1.27
11. I think bugs and snakes are pretty cool.			.74		2.91	1.41
12. I like to do things that scare me a little bit.	.44		.49		3.14	1.39
13. I get bored quickly.				.80	3.28	1.29
14. I get restless when I spend too much time at home.				.77	3.21	1.26
% of variance explained	31.68	10.40	9.53	8.07		
Eigenvalue	4.43	1.45	1.33	1.13		

Note. Results of a principal components factor analysis using varimax rotation with Kaiser normalization. TAS = thrill and adventure seeking. D = disinhibition. ES = experience seeking. BS = boredom susceptibility.

instrument. First, an examination of the scree plot indicated that only one factor was above the “elbow” (DeVellis, 2003). Second, only the first factor had an eigenvalue greater than a 1.5, which means that the other factors only accounted for the equivalent of about one item worth of variance each (DeVellis, 2003). Third, only one of the four factors was internally reliable: thrill and adventure seeking ($\alpha = .82$), disinhibition ($\alpha = .69$), experience seeking ($\alpha = .45$), and boredom susceptibility ($\alpha = .51$). This is not surprising, as the reliability of individual factors has often been low in past research (e.g., Greene, Krmar, Walters, Rubin, & Hale, 2000; Morrongiello & Lasenby, 2006; Zuckerman, 1994). All of this supports the conclusion that the BSSS-C should ultimately be viewed as uni-dimensional.

In light of this interpretation, all 14 items were combined into a single, uni-dimensional scale. As a uni-dimensional measure, the BSSS-C was found to be internally reliable ($\alpha = .82$). Scores ranged from a low of 1.0 to a high of 5.0 ($M = 3.06$, $SD = .73$). Importantly for the present study, the scale was reliable across gender (males: $\alpha = .78$; females: $\alpha = .80$) and grade (fourth: $\alpha = .83$; fifth: $\alpha = .77$; sixth: $\alpha = .85$).

TABLE 2 Sensation Seeking by Grade and Gender

	Male	Female	Both
Fourth grade	3.29 (.55)	2.98 (.88)	3.11 (.77)
Fifth grade	3.27 (.68)	2.80 (.59)	3.02 (.67)
Sixth grade	3.38 (.72)	2.76 (.71)	3.00 (.77)
All Grades	3.30 (.63)	2.86 (.75)	
<i>n</i>	58	76	

Note. Means with standard deviations in parentheses. Higher scores reflect greater sensation seeking.

Sensation Seeking by Gender and Grade

It was hypothesized that males would have higher sensation seeking scores than girls (Hypothesis 1a) and that males' scores (but not females' scores) would increase with pubertal development (Hypothesis 1b). A two-way analysis of variance was carried out with sensation seeking as the dependent variable and grade and gender as fixed factors. These results are reported in Table 2. Consistent with Hypothesis 1a, males had higher scores than females, $F(1, 134) = 12.99, p < .001, r = .29, d = .62$ (95% CI: .27, .97). No significant main effect was found for grade, $F(2, 133) = .27, p = .76$, nor was there a significant grade \times gender interaction, $F(2, 133) = .44, p = .64$. Thus, Hypothesis 1b was not supported.

Sensation Seeking and Video Game Use

A series of hierarchical multiple regressions were carried out to examine the relationship between sensation seeking and video game use. Three predictor variables were entered in separate blocks in the following order: Gender, Sensation Seeking, and Gender \times Sensation Seeking. Gender was entered in the first block and included in an interaction term because sensation seeking significantly varied by gender. All predictors were centered per the guidelines of Aiken and West (1991). Interactions were analyzed using probing procedures outlined by Hayes and Matthes (2009).

Hypotheses 2a–2c questioned the relationship between sensation seeking and children's video game play on computers, home video game machines (HVG), and portable video game machines (PVG). These results are reported in Table 3. Consistent with Hypotheses 2a and 2b, sensation seeking positively predicted computer game play and HVG play. Inconsistent with Hypothesis 2c, sensation seeking was not related to PVG. However, there was a marginally significant Gender \times Sensation Seeking Interaction for PVG play. Sensation seeking was positively related to PVG play for females ($b = .35, S.E. = .18, p = .05$) but not for males ($b = -.18, S.E. = .27, p = .47$).

TABLE 3 Frequency of Video Game Play by Gender and Sensation Seeking

	Comp		HVG		PVG	
	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Gender	-.02	.00	-.26***	.11***	.05	.00
Step 2: SS	.23**	.05**	.28**	.08**	.07	.01
Step 3: SS*Gender	.05	.00 ^a	.07	.00 ^b	.15†	.02† ^c

Note. Standardized betas and R^2 change are listed at each step. R^2 , F , and p for the full regression equations are as follows:

^a $R^2 = .05$, $F(3, 130) = 2.82$, $p = .041$.

^b $R^2 = .19$, $F(3, 130) = 10.33$, $p < .001$.

^c $R^2 = .03$, $F(3, 129) = 1.51$, $p = .085$.

† $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$.

Comp = playing computer games.

HVG = playing home video game machine.

PVG = playing portable video game machine.

Hypotheses 3a–3d predicted that sensation seeking would be positively related to playing four genres of violent video games. Table 4 reveals that sensation seeking was positively related to playing shooter games, fighting games, and (marginally) action games. There was also a significant Gender \times Sensation Seeking Interaction for fighting games and a marginally significant Gender \times Sensation Seeking Interaction for action games. Among males, sensation seeking was positively related to playing fighting games ($b = .85$, $S.E. = .21$, $p < .001$) and action games ($b = .59$, $S.E. = .23$, $p = .01$). Among females, sensation seeking was unrelated to playing either type of game (fighting games: $b = .29$, $S.E. = .17$, $p = .09$; action games: $b = .06$, $S.E. = .18$, $p = .76$). Interestingly, higher sensation seeking children were not drawn to sports games. Thus, Hypotheses 3a and 3b were strongly supported, Hypothesis 3c was marginally supported, and Hypothesis 3d was not supported.

TABLE 4 Frequency of Violent Video Game Play by Gender and Sensation Seeking

	Shooter		Fighting		Action		Sports	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Gender	-.53***	.37***	-.35***	.22***	-.29***	.12***	-.05	.01
Step 2: SS	.25**	.05**	.31***	.08***	.17†	.02†	.09	.01
Step 3: SS*Gender	-.05	.00 ^a	-.15*	.02 ^b	-.15†	.02† ^c	-.12	.01 ^d

Note. Standardized betas and R^2 change are listed at each step. R^2 , F , and p for the full regression equations are as follows:

^a $R^2 = .42$, $F(3, 128) = 30.05$, $p < .001$.

^b $R^2 = .32$, $F(3, 130) = 19.61$, $p = .041$.

^c $R^2 = .16$, $F(3, 127) = 8.15$, $p = .073$.

^d $R^2 = .03$, $F(3, 130) = 1.18$, $p = .18$.

† $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$.

TABLE 5 Frequency of RPG and Nonviolent Video Game Play by Gender and Sensation Seeking

	MMORPG		RPG		Puzzle		Party	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Gender	-.07†	.03†	-.11**	.03**	.30***	.06***	.38***	.10***
Step 2: SS	.29**	.08**	.19*	.03*	.20**	.04**	.26**	.07**
Step 3: SS*Gender	.04	.00 ^a	.02	.00 ^b	.08	.01 ^c	.16†	.03† ^d

Note. Standardized betas and R^2 change are listed at each step. R^2 , F , and p for the full regression equations are as follows:

^a $R^2 = .11$, $F(3, 125) = 4.95$, $p = .003$.

^b $R^2 = .06$, $F(3, 124) = 2.76$, $p = .045$.

^c $R^2 = .11$, $F(3, 125) = 4.75$, $p = .004$.

^d $R^2 = .20$, $F(3, 127) = 9.93$, $p = .055$.

† $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$.

RPGs often contain violence, hence, it was hypothesized that higher sensation seeking children would be more likely to play both MMORPGs (Hypothesis 4a) and RPGs (Hypothesis 4b). Both hypotheses were upheld (see Table 5) as sensation seeking was positively related to MMORPG play and RPG play.

Past research has found that higher sensation seeking children are attracted to puzzles and highly stimulating social activities, thus, it was hypothesized that higher sensation seeking children would be more likely to play puzzle games (Hypothesis 5a) and party games (Hypothesis 5b). Both hypotheses were upheld as sensation seeking was positively related to puzzle game play and party game play. There was also a marginally significant Gender \times Sensation Seeking Interaction for party game play. Sensation seeking was positively related to playing party games for females ($b = .58$, $S.E. = .15$, $p < .001$) but not males ($b = .10$, $S.E. = .20$, $p = .61$).

Sensation Seeking and Enjoyment of Violent Video Games

Higher sensation seeking children are more likely to play certain types of violent video games, but that does not reveal whether they enjoy such content. It was hypothesized that sensation seeking would be positively related to enjoyment of six violent video game activities (Hypotheses 6a–6f). These results are reported in Table 6. Consistent with Hypotheses 6a–6f, sensation seeking was positively related to enjoyment of games with fighting, punching, weapon use, crime, extreme sports, and racing. There were also significant Gender \times Sensation Seeking Interactions for games with fighting, weapon use, and (marginally) punching. Among males, sensation seeking was positively related to enjoyment of games with fighting ($b = 1.15$, $S.E. = .25$, $p < .001$), punching ($b = .97$, $S.E. = .27$, $p < .001$), and weapon use ($b = 1.36$, $S.E. = .23$, $p < .001$). Among females, there was no relationship

TABLE 6 Enjoyment of Video Game Subgenres by Gender and Sensation Seeking

	Fight other players		Punch other characters		Learn to use weapons		Commit crimes		Do extreme sports		Race other players	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Gender	-.33***	.19***	-.33***	.19***	-.47***	.35***	-.38***	.19***	-.08†	.02†	-.02	.01
Step 2: SS	.27**	.05**	.29**	.07**	.32***	.08***	.29***	.07***	.22*	.04*	.28***	.08**
Step 3: SS*Gender	-.25**	.06*** ^a	-.14†	.02† ^b	-.27***	.07*** ^c	-.07	.01 ^d	-.02	.00 ^e	.08	.01 ^f

Note. Standardized betas and R^2 change are listed at each step. R^2 , F , and p for the full regression equations are as follows:

^a $R^2 = .30$, $F(3, 133) = 19.20$, $p = .001$.

^b $R^2 = .29$, $F(3, 132) = 16.41$, $p = .074$.

^c $R^2 = .40$, $F(3, 132) = 42.46$, $p < .001$.

^d $R^2 = .28$, $F(3, 130) = 15.99$, $p < .001$.

^e $R^2 = .06$, $F(3, 130) = 3.07$, $p = .030$.

^f $R^2 = .10$, $F(3, 131) = 4.62$, $p = .004$.

† $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$.

TABLE 7 Willingness to Bring a Prohibited Item to School by Gender and Sensation Seeking

	Cell phone		PVG		Chewing gum	
	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Gender	.25†	.02†	.09	.00	.17	.00
Step 2: SS	.33***	.10***	.14†	.02†	.30**	.08**
Step 3: SS*Gender	-.05	.00 ^a	.08	.01 ^b	-.03	.00 ^c

Note. Standardized betas and R^2 change are listed at each step. R^2 , F , and p for the full regression equations are as follows:

^a $R^2 = .12$, $F(3, 131) = 5.81$, $p = .001$.

^b $R^2 = .03$, $F(3, 130) = 1.38$, $p = .25$.

^c $R^2 = .08$, $F(3, 130) = 3.89$, $p = .011$.

* $p < .05$ ** $p < .01$ *** $p < .001$.

PVG = playing portable video game machine.

between sensation seeking and enjoyment of these types of games (fighting: $b = .07$, $S.E. = .20$, $p = .73$; punching: $b = .34$, $S.E. = .22$, $p = .11$; weapon use: $b = .15$, $S.E. = .18$, $p = .42$). It is notable that higher sensation seeking children were more likely to enjoy games with extreme sports and racing, as this runs somewhat counter to the earlier finding that sensation seeking is unrelated to playing sports games. Then again, enjoyment and use are two unique outcomes. Moreover, the enjoyment questions focused on specific types of sporting activities (e.g., extreme sports) that may be more appealing to sensation seekers.

Sensation Seeking and Rule-Breaking Behavior

Hypotheses 7a–7c posited that sensation seeking would be positively related to children's willingness to break rules. These results are reported in Table 7. Sensation seeking was positively related to bringing prohibited cell phones, chewing gum, and (marginally) portable video game devices to school. Thus, Hypotheses 7a and 7c were strongly supported and Hypothesis 7b was marginally supported.

DISCUSSION

The BSSS-C was found to be a reliable measurement tool with strong concurrent validity. Future work should test the predictive validity of the BSSS-C by examining, for example, whether the measure can predict rule-breaking behavior in children over time. Additional psychometric research could investigate the stability of the measure over time (i.e., test-retest) as well as convergent and divergent validity. Concerning the latter, it would be useful to compare the BSSS-C with the SSSC (Morronegiello & Lasenby, 2006), the

2-item brief measure (Slater, 2003), and perhaps a simplified version of the ImpSS (Zuckerman et al., 1993). Comparing existing measures often identifies strengths, weaknesses, and uncertainties and can suggest optimal measurement approaches for various situations (DeVellis, 2003; Jensen, Bernat, Davis, & Yale, 2010).

Once again, sensation seeking was found to be higher in males than females. Developmental differences were not significant, but they may manifest when pubertal development is accounted for (Steinberg et al., 2008) or with a larger pool of grades in the sample. A valuable long-term research goal would be to examine sensation seeking across a wide range of ages; for example, administering the BSSS-C to individuals ranging from 5 to 25 years of age. This approach could answer questions about the origins and progression of sensation seeking during formative years and help to elucidate life-cycle or violence-cycle models. An alternative research program could track the same group of children over time, assessing sensation seeking annually or biannually. Paired with parent, teacher, and child interviews, such a study could provide a more holistic account of sensation seeking.

Higher sensation seeking children in the present study were more likely to play computer and home video games (e.g., Xbox 360). This is consistent with past research suggesting that sensation seekers are more likely to go online (Livingstone & Helsper, 2007) and exhibit video game addiction (Chiu, Lee, & Huang, 2004). Interestingly, higher sensation seeking children were also more likely to play RPGs and MMORPGs, two genres of video games that are often at the center of video game addiction research. Taken together, these results suggest that higher sensation seeking children are especially vulnerable to compulsive utilization of internet technology, which likely appeals to their constant need for arousal by offering readily accessible stimulation.

Researchers have argued that sensation seekers pursue arousal in media just as they do in the real world (Palmgreen et al., 1995; Slater, 2003). Children in this study seemed to conform to this logic, as higher sensation seeking children were drawn to several genres of video games. Higher sensation seeking children were more likely to play and enjoy violent video games. Higher sensation seeking boys, in particular, were drawn to fighting games and those with weapon use. Conversely, Slater (2003) found that sensation seeking was not related to playing video games where the player fired a weapon. However, he did find that sensation seeking was related to a composite measure of media violence exposure (including video game play). The difference in our findings could stem from sample (children vs. adolescents), measurement (the BSSS-C vs. the 2-item sensation seeking scale), and/or question wording. This difference aside, the attraction to violent video game content is concerning in that consumption of this material is related to aggression and risky behavior (Lemmens et al., 2006).

Sensation seekers were drawn to other video game genres as well, including puzzle and party games. Past work has found that higher sensation seeking individuals are occasionally attracted to low risk activities that can also develop their cognitive and social skills. For example, sensation seekers are more likely to be involved in chess (Joireman, Fick, & Anderson, 2002) and interested in science (Hwang & Southwell, 2007). Future research should attempt to identify why some sensation seekers pursue risky stimulation whereas others are drawn toward low risk activities. A plausible hypothesis is that higher sensation seeking children will pursue low risk, but cognitively stimulating activities if they have sufficient access and encouragement.

In the present study, sensation seekers were more likely to engage in rule breaking behavior. The need for optimal arousal likely provides sufficient motivation to engage in risky behavior, a relationship which may be enhanced by the additional rush that could stem from rule breaking. Researchers should investigate whether rule breaking is, in and of itself, sufficiently arousing to attract sensation seekers. Such a finding could have implications for policy (i.e., whether to make an activity illegal or against the rules). Similar work has been conducted with video game labeling (Bijvank et al., 2009).

Limitations

The study had several limitations. First, the study utilized a survey design, so it is impossible to know the actual ordering of variables. Causality can only be speculated about as correlations do not allow researchers to unpack the direction or nature of relationships. Second, students at elementary schools in the Midwest served as participants, but their responses may not be typical of children in general. For example, none of the elementary schools were located in a major metropolitan area, which may have provided more or less variance for certain items (e.g., no student in the sample had ever brought a knife to school). In addition, the students were more likely to be Hispanic than the U.S. population in general. This is characteristic of the sampling area, but a factor that may prove meaningful if subsequent research identifies, for example, ethnic-based differences in sensation seeking. Third, and finally, Internet access and computer ownership were not measured. It is possible that some of the results would be different if these two factors were taken into account.

Conclusions

Sensation seeking continues to be a useful construct for understanding human behavior. Past research with adolescents and adults has identified relationships between sensation seeking and a variety of risky, dangerous,

and violent activities. The present study contributes to this growing body of research by demonstrating that sensation seeking predicts risky behavior in children as well. Continued work with children will help to elucidate these issues as will longitudinal research tracking the evolution of children's sensation seeking through puberty and beyond.

NOTES

1. Researchers have developed alternatives to the SSS-V, including a reliable 19-item measure ($\alpha = .87$) that uses a true/false question structure and combines sensation seeking and impulsiveness (ImpSS; Zuckerman, Kuhlman, Joirman, Teta, & Kraft, 1993). The ImpSS has two underlying dimensions (sensation seeking and impulsiveness) instead of four, and is one of five scales in the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ).
2. The pilot study was conducted in a mid-size town located in the Midwest (population 100,000). Fourth and fifth graders ($N = 120$) were recruited from two local schools. One of the schools was a public elementary school (kindergarten through 5th grade) and the other was a private Christian school (kindergarten through 12th grade). Students were asked to complete a brief survey in exchange for a small reward (a \$3 yo-yo). The schools were also provided with compensation on a per student basis (\$5 per student). Participants ranged in age from 8 to 12 years old ($M = 10.27$, $SD = .87$) and were evenly split in terms of gender (59 girls, 59 boys, 2 missing data; for a complete description, see Jensen, Imboden, & Ivic, in press).
3. The original BSSS was created for adolescents and adults. The eight items from that scale are: "I would like to explore strange places," "I get restless when I spend too much time at home," "I like to do frightening things," "I like new and exciting experiences, even if I have to break the rules," "I prefer friends who are excitingly unpredictable," "I would like to try parachute-jumping," "I like wild parties," and "I would like to take off on a trip with no pre-planned routes or timetables." In the current study, several of the items were changed to remove words that might be difficult for fourth and fifth graders (e.g., frightening, excitingly) and others were cut (e.g., "I like wild parties" and "I would like to take off on a trip . . .") and replaced with items that might be more relevant to young audiences.

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