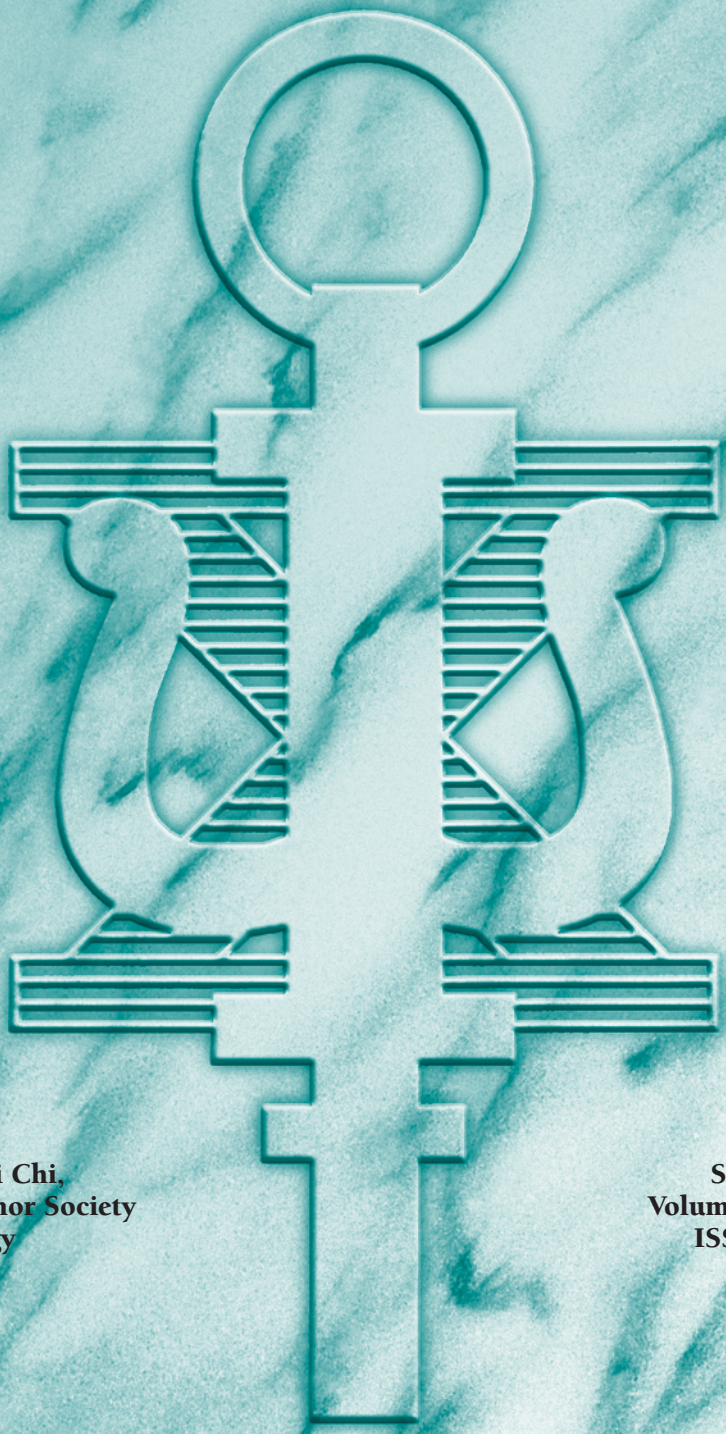
Psi Chi

Journal of Undergraduate Research



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Because the articles in this journal are primarily the work of undergraduate students, the reader should bear in mind that: (1) the studies are possibly less complex in design, scope, or sampling than professional publications and (2) the studies are not limited to significant findings. The basis for accepting papers for publication is the agreement among three professional reviewers that the project, hypothesis, and design are well researched and conceived for someone with an undergraduate level of competence and experience.

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Exercise and Autism Symptoms: A Case Study

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The current study employed a single-subject design to examine the effects of exercise on core autism symptoms in a 12-year-old boy. We recorded the frequencies of self-stimulation, eye contact, verbal initiation, negative mood, and positive mood before and after a 5- to 8-min mildly strenuous running intervention twice a week. In replication of previous autism research, the results revealed a significant postexercise reduction in self-stimulation across all 18 days of data collection. The intervention failed to produce significant improvements in the other 4 behaviors. A brief period of physical activity appears to be an inexpensive and easy method to decrease self-stimulation. Future autism research should further investigate the differential effects of various exercise durations on core autism symptoms.

Exercise and Autism Symptoms

Autism is a type of pervasive developmental disorder affecting all spheres of a child's life (Bauman & Kemper, 2006). The core diagnostic criteria of autism include a marked impairment in the ability to relate to others, delayed language, and restricted or repetitive patterns of behavior. No known cure or effective prevention measures currently exist. Major autism symptoms which are frequently targeted for improvement include self-stimulatory behaviors, infrequent eye contact, lack of verbal initiation, and unhappy mood. Typical interventions, such as applied behavioral analysis (e.g., Anderson & Romanczyk, 1999), occupational therapy (e.g., Sams, Fortney, & Willenbring, 2006), therapeutic horseback riding (e.g., Bizub, Joy, & Davidson, 2003), and pharmacological treatment (e.g., Findling, 2005), target these problem areas. A recent but understudied intervention for autism is physical exercise (Celiberti, Bobo, Kelly, Harris, & Handleman, 1997). The aim of the current study was to examine the effects of moderate physical activity on core autism symptoms.

Symptoms of Autism

Self-stimulation. The restricted or repetitive patterns of autistic behavior are often manifested through self-stimulation (Rosenthal-Malek & Mitchell, 1997). These characteristic stereotypic behaviors include body-rocking, hand-flapping, head-nodding, object-tapping, and sniffing. Repetitive vocalizations, such as song snippets or nonsense words, are also common (Schreibman, 2005). Stereotypic behaviors can be extremely disruptive in both educational and social settings (Celiberti et al., 1997).

Infrequent eye contact. One of the most useful behaviors for discriminating between children with autism and typically-developing children is impaired eye contact (Clifford, Young, & Williamson, 2007). Longitudinal studies have shown that this behavioral marker can distinguish children by 12 months of age who are later diagnosed with autism (Zwaigenbaum et al., 2005). Even beyond infancy and childhood, individuals with autism continue to show impairments in eye contact (Autism Speaks Inc., 2007).

Lack of verbal initiation. Another important diagnostic criterion for autism is impaired verbal communication (Voder & McDuffie, 2006). Even with treatment, approximately 35% to 40% of children with autism do not learn to speak as their primary mode of

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communication (Chan, Cheung, Leung, Cheung, & Cheung, 2005). Children who do talk usually begin speech by repeating other people's words, especially the last few words of a sentence (Wing, 1972).

Unhappy mood. The mood of a child with autism can be highly unpredictable (Wing, 1972). Temper tantrums are common, especially if a familiar routine is disrupted. Resistance to change often leads to an unhappy mood, shown through typical tantrum behaviors (e.g., crying, screaming, kicking). Some children exhibit severe tantrum behavior, throwing fits significantly greater in intensity and duration than tantrums of typical children (Schreibman, 2005).

Autism Interventions

Applied behavioral analysis. After several decades of treatment research for children with autism, applied behavioral analysis (ABA) remains the consistently preferred intervention (Autism Speaks Inc., 2007). This approach involves an objective measurement of behavior, an assessment of current functioning, an individualized curriculum, the systematic use of reinforcers, and the promotion of generalization. Hundreds of published studies have replicated the utility of ABA methods to help individuals learn specific skills, such as self-care, academic tasks, and communication (e.g., Lovaas, 1987; Schreibman, 2005).

Occupational therapy. According to Autism Speaks Inc. (2007), the aim of occupational therapy (OT) is to enhance an individual's independence and participation in meaningful life activities. For children with autism, OT normally addresses sensory issues such as over- or under-responsiveness to sensory stimuli (Sams et al., 2006). A second important focus of OT programs involves developing fine and gross motor skills (Stackhouse, Graham, & Laschober, 2002).

Therapeutic horseback riding. Therapeutic horseback riding, one of the more recent autism interventions, is a type of animal-assisted therapy (Bizub et al., 2003). Children perform exercises on a horse to target flexibility, equilibrium, reflex integration, and coordination (e.g., throwing and catching a ball). In addition to these physical benefits, therapeutic horseback riding can improve negative mood states and social interactions (All, Loving, & Crane, 1999; DePauw, 1986; Martin & Farnum, 2002).

Pharmacological treatment. Although no pharmacological treatment has proven effective for the overall core symptoms of autism, atypical antipsychotics and antidepressants can improve common secondary autistic behaviors, such as tantrums and self-stimulation (Findling, 2005; Hollander et al., 2005; McCracken et al., 2002). The most common side effect from medication is undesired weight gain (Potenza, Holmes, Kanes, & McDougle, 1999). Several studies thus emphasize the importance of diligently monitoring weight gain in medicated children, and they further suggest an exercise regimen to combat extra pounds (Malone, Cater, Sheikh, Choudhury, & Delaney, 2001; Martin et al., 2004).

Exercise. The earliest support for exercise as an autism intervention came from anecdotal evidence highlighting exercise as a technique for controlling self-stimulatory behaviors (Powers, Thibadeau, & Rose, 1992; Watters & Watters, 1980). Special education teachers reported that students appeared to be more attentive and cooperative after physical activity such as gym class, field trips, or other outdoor excursions. This early interest in the beneficial results of exercise led autism researchers to further explore the effects of physical activity on stereotypic behaviors. Overall, these studies touted exercise as a promising area of research for decreasing self-stimulation in individuals with autism (Celiberti et al., 1997; Elliott, Dobbin, Rose, & Soper, 1994; Gordon, Handleman, & Harris, 1987; Kern, Koegel, & Dunlap, 1984; Kern, Koegel, Dyer, Blew, & Fenton, 1982; Levinson & Reid, 1993; Lochbaum & Crews, 1995; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980). The physical activity must occur at sufficient intensity in order to decrease self-stimulation (e.g., Kern et al., 1982).

One possible explanation for the relation between strenuous exercise and decreased self-stimulation is that the physical intensity level simply exhausts people to the point that they are subsequently too tired to engage in physically active behaviors. If true, exercise would produce not only a reduction in stereotypic behaviors, but it would decrease positive behaviors as well. Several autism studies (Kern et al., 1982; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980), however, have ruled out this so-called "fatigue effect" by showing that exercise leads to a decrease only in disruptive behaviors, not to a general decrease in all behaviors, such as appropriate ball-playing.

Given the lack of support for the fatigue-effect explanation, recent studies have suggested alternative hypotheses for why exercise reduces self-stimulation. According to one theory, physical activity produces physiological arousal in a manner similar to self-stimulation, thus reducing the need for the inappropriate behavior (Allison, Basile, & MacDonald, 1991). According to another, exercise can provide sensory feedback similar to self-stimulation but in a more acceptable manner (Lovaas, Newsom, & Hickman, 1987).

A serious problem underlying the exercise and autism research literature concerns a lack of consistent methodology or design (Lochbaum & Crews, 1995). Although several studies have reported an encourag-

ing relation between exercise and reduced stereotypic behaviors, the interventions have spanned different intensities and durations, and many researchers have used the adjectives "mild," "moderate," or "vigorous" to describe the prescribed exercise without clear operational definitions. Perhaps most striking is the gap in autism research concerning the effects of exercise on other variables. For example, no studies investigating the influence of jogging on self-stimulation have examined eye contact or verbal initiation as dependent variables. The relation between exercise and mood is also understudied, although studies with nonautistic populations generally support the claim that exercise improves mood (Dodson & Mullens, 1969; Folkins & Sime, 1981; McCann & Holmes, 1984).

Current Study

Given these gaps in the autism literature, the specific effects of exercise on the core autism symptoms remain unclear. Thus, the aim of the current study was to examine the relations between moderate physical activity and self-stimulatory behavior, eye contact, verbal initiation, and overall mood in a boy with autism. Although some psychologists have criticized single-subject designs, a recent article provided justification for the use of case-based research in specific research settings (Borckardt et al., 2008). Case-based designs that track a single participant across baseline and intervention phases provide therapists a means of systematically evaluating the efficacy of their treatment while working with individual patients. To contribute to this efficacy literature, the current case study addressed the following four hypotheses:

1. An exercise program will reduce the frequency of self-stimulation, as seen in past autism studies (Celiberti et al., 1997; Elliott et al., 1994; Gordon et al., 1987; Kern et al., 1984; Kern et al., 1982; Levinson & Reid, 1993; Lochbaum & Crews, 1995; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980).
2. The exercise program will increase the frequency of eye contact. Although past exercise and autism studies have not specifically mentioned this variable, they have reported increased levels of engagement, social play, and appropriate responding after exercise (Kern et al., 1982; Powers et al., 1992). Based on their social nature, these behaviors may include increased eye contact as an underlying dimension (i.e., a child who is engaged by a conversation maintains eye contact with the person speaking).
3. The exercise program will increase the frequency of verbal initiation by decreasing the interference of self-stimulation. Self-stimulatory behaviors can be a significant distraction for children with autism, limiting the variety of actions or number of objects about which they may communicate (Voder & McDuffie, 2006). If exercise reduces the frequency of self-stimulation, the person would have more attention available to coordinate between other people and objects, which may lead to more verbal communication (Charman, 2003). Another line of evidence that supports the relation between verbal initiation and exercise comes from the OT literature. Several studies have reported increased language use and social interaction in children with autism after OT (Case-Smith & Bryan, 1999; McClure & Holtz-Yotz, 1991; Sams et al., 2006). Moderate physical activity shares certain sensory features with an OT session, such as joint pressure and gross motor movement. These commonalities may result in similar improvements in verbal initiation after exercise.
4. The exercise program will improve mood. Although this specific relation has not been empirically demonstrated in the autism literature, studies with nonautistic populations have consistently reported an improvement in mood after physical activity (Dodson & Mullens, 1969; Folkins & Sime, 1981; McCann & Holmes, 1984). Furthermore, researchers examining therapeutic horseback riding for children with autism have found they exhibit happier moods after these sessions, and riding shares certain parallels with exercise (All et al., 1999; Bizub et al., 2003; Martin & Farnum, 2002). For example, a horse's movements mirror those of a human gait, and riders describe the sessions as "strenuous without being overtaxing" (Bizub et al., p. 382).

Method

Participant

The participant was a 12-year-old boy with autism, diagnosed by the Childhood Autism Rating Scale (CARS; Schopler, Reichler, DeVellis, & Daly, 1980) at the age of 32 months. His CARS score of 34.5 placed him in the *Mildly-Moderately Autistic* range. He received scores indicative of more severe difficulties in the areas of *relating to people*, *emotional response*, *visual response*, *fear or nervousness*, and *verbal communication*.

During the current study, the participant lived at home and attended a special education class in a public middle school. After school and on the weekends, he received one-on-one ABA therapy (25 hr/week on average). His wide variety of instructional programs included expressive labels, sight words, verbal imitation, writing, self-help skills, recreation, sequencing, and mathematics. The first author became one of his ABA therapists 17 months prior to data collection,

working with him an average of 10 hrs/week. She received training and monthly supervision from a certified ABA consultant.

Once a week, the participant attended a 45-min OT session. His occupational therapist spent 15 min on activities to improve functional performance; 15 min on exercises to develop strength, endurance, and range of motion; and 15 min on neuromuscular reeducation of movement, balance, coordination, kinesthetic sense, posture, and proprioception.

The participant also attended a weekly 50-min therapeutic horseback riding session. The instructor incorporated exercises targeted at balance, coordination, and motor skills (e.g., throwing a bean bag into a hula-hoop on the ground). Each session included one or two additional children with autism.

The participant's daily pharmacological treatment included the antidepressant fluoxetine (Prozac®) through Day 5 of the study and the atypical antipsychotic ziprasidone (Geodon®) through Day 9. His physician prescribed Prozac to treat anxiety and Geodon to treat aggressive behavior. His Prozac prescription changed to fluvoxamine (Luvox®) on Day 6. On Day 10, his medication regimen was switched completely due to undesired weight gain to include the following prescriptions: the atypical antipsychotic quetiapine (Seroquel®), the anxiolytic clonazepam (Klonopin®), and the antihypertensive medication guanfacine (Tenex®).

The child passed his annual physical exam 7 months prior to data collection, with the physician's approval of an exercise intervention. His parent gave consent for his participation in the study.

Intervention

Although we intended to implement a 15-min running intervention, the participant refused to remain on the treadmill for the entire length of time. Instead, he ran for 5 min 45% of the days and 8 min 55% of the days. The treadmill, located in the participant's home, moved at 4.5 mph, a pace chosen to be mildly strenuous (e.g., increased breathing rate or slightly flushed face) but not painful (e.g., shortness of breath or cramped muscles). The appropriate intensity level has been shown to be critical for reducing stereotypic behaviors (Celiberti et al., 1997; Elliott et al., 1994; Kern et al., 1984; Levinson & Reid, 1993). During each exercise session, the experimenter verbally reinforced the participant (e.g., saying "Good job") on average once per minute for running. The exercise intervention occurred two afternoons per week.

Dependent Measures

Frequency of self-stimulation. Wing's (1972) definition of self-stimulatory behavior, that is, repetitive body movements or repetitive movement of objects, served as an adequate definition because the participant's familiar tutor could easily identify his specific stereotypic behaviors. Particularly common examples included hand-flapping, scratching, sniffing people or objects, twirling a plastic straw, rocking from front to back or from side to side, and jumping. In the current study, one continuous movement counted as one incident of self-stimulation. For example, the participant's rocking back and forth counted as one incident if the movement was not divided by a rest interval of 1 s or more.

Frequency of eye contact. We defined eye contact as meeting and holding the gaze of another person for at least 2 s duration. Each continuous gaze counted as one incident of eye contact, separated from the next incident by the participant looking away.

Frequency of verbal initiations. Speaking at least one word, unprompted and in an audible voice, defined verbal initiation. One word or one continuous sentence counted as one incident. Any period of silence longer than 1 s after the onset of verbal initiation marked the offset.

Negative and positive mood frequency. The Aberrant Behavior Checklist (ABC), a rating instrument for assessing maladaptive behavior of individuals with developmental disabilities (Aman, Singh, Stewart, & Field, 1985), served as the basis for the operational definitions for negative and positive mood. The following items from the Irritability and Lethargy subscales indicated negative mood: screaming inappropriately, throwing a temper tantrum, acting irritable or depressed, crying over minor annoyances or hurts, stamping feet, resisting any form of physical contact, and responding negatively to affection. Other indicators of negative mood included throwing himself on the floor and refusing to obey requests. Although the ABC does not specify adaptive behaviors, the opposites of the previous negative items provided clear indicators of positive mood: smiling, laughing, singing, skipping, requesting physical contact, responding positively to affection, and obeying requests. Any period of absence of these behaviors after their onset indicated their offset.

Design and Procedure

The current study employed a single-subject design. Unlike traditional designs comparing experimental to control groups, the single-subject design involves a comparison between time periods for the same participant (Bloom, Fischer, & Orme, 2006). These time periods include both a nonintervention or preintervention phase and an intervention or postintervention phase. Specifically, the current study employed the repeated preintervention-postintervention design, in which we

measured the participant's targeted behaviors immediately before and immediately after each exercise session (Thyer & Curtis, 1983). The preintervention data allow the single-subject design to use the participant as his own control (Bloom et al., 2006).

Thyer and Curtis (1983) asserted that their design reduces threats to internal validity because only the duration of the intervention separates the pre and post measures, decreasing the possibility of extraneous factors influencing the dependent variable. Thus, the preintervention-postintervention design is logically more powerful than the basic *A-B* design, which simply combines a baseline observation period (*A*) and an intervention period (*B*). Indeed, Thyer and Curtis's design has been praised as "one of the most useful designs" for single-subject research, given its dual benefits of increased internal validity and practical applicability (Stanley, 1985, p. 33). The preintervention-postintervention design is especially useful for treatments where participants may show an effect immediately following a therapy session, such as an exercise intervention.

The current study, which gained approval from the Human Subjects Institutional Review Board, lasted from January 14, 2008 until March 14, 2008. The first author collected frequency data on the participant's self-stimulation, eye contact, verbal initiation, and mood before and after the running condition. A Fujitsu Lifebook Tablet™ computer, with the BASC-2 Portable Observation Program™ software (Version 2.0; 2006), kept track of observed frequencies of pre- and postintervention data. The data collection protocol called for recordings two afternoons per week, beginning the behavioral observation directly after the participant returned home from school when he normally experienced his ABA therapy. However, he did not attend a full day of school on Days 2, 3, 9, 10, 11, 13, 14, 17, and 18 due to snow cancellations (2 days), behavioral problems (3 days), or medical appointments (4 days). On those days, data collection still occurred during his normal ABA therapy, immediately before and after the exercise intervention. All observation periods in the study were 30 min, divided into 10-min time blocks to allow a more detailed assessment of his behavioral variability on any given day. The one exception involved the self-stimulation variable. Because of the participant's relatively high frequency of self-stimulation, we used six 5-min time blocks during the pre- and postexercise observation periods for this behavior.

Data Analysis

To analyze the data, we used the SINGWIN™ (2006) program, "the most comprehensive program for the analysis of single-system design data" (Bloom et al., 2006, p. 530). With a single-subject design, inferential statistics are not appropriate for data analysis because these measures are built on the variability of a sampling distribution, and the current sample included only one participant.

To determine the statistical significance of changes in the outcome variables, we used the conservative dual-criteria (CDC) approach (Bloom et al., 2006). Using preintervention data, one computes a mean and a regression line and then adjusts both of these lines by .25 of the standard deviation of the preintervention data. This product is added to each line, which gives the CDC approach its conservative nature. The adjusted lines are plotted with the postintervention data to show significant changes in behaviors. For a positive behavior (e.g., eye contact), all observed frequencies that fall above both adjusted lines count as successes. For an undesirable behavior (e.g., self-stimulation), all observed frequencies that fall below both adjusted lines count as successes. One compares the total number of successes to the number of observations expected to satisfy both criteria by chance alone, using the binomial equation.

The versatile CDC test is especially useful for a single-subject design because it maintains accuracy even with autocorrelated data. According to Borckardt et al. (2008), autocorrelation (i.e., the value of one observation depending on the value of one or more of the prior observations) is an issue often cited by critics of the case-based approach. This lack of independence between observations violates important assumptions behind conventional statistics, so the CDC method controls for autocorrelated data through conservative adjustments. In the current study, the SINGWIN program computed the CDC approach, with alpha levels set at .05. In addition to testing differences between preintervention and postintervention data, this approach analyzed the consistency of target behaviors and the temporal effects of exercise across the time blocks.

Results

Figure 1 presents the participant's self-stimulation frequency pre- and postexercise, with each data point averaged over 6 consecutive intervention days. The "intervals" along the *x*-axis represent each 5-min time block during the 30-min observational periods. The CDC analyses revealed a statistically significant postexercise reduction in self-stimulation across all days (see Table 1). Table 1 also shows that the exercise intervention failed to produce significant improvements in eye contact, verbal initiation, negative mood, and positive mood. In fact, the participant exhibited significantly fewer positive mood behaviors after exercise on 12 of the 18 intervention days. No consistent patterns in

TABLE 1

Total Number of Postexercise Observation Intervals Below or Above Both Criteria[a] *and the Total Number Needed for Significance for Each Variable*

Days	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18
Self-stimulation, *N(b)* = 18						
N(b)) below both	18*	17*	16*	17*	18*	18*
Needed below both	13	13	13	13	13	13
Eye contact, *N(b)* = 9						
N(b) above both	4	0	4	0	2	4
Needed above both	8	8	8	8	8	8
Verbal initiation, *N(b)* = 9						
N(b) above both	4	2	3	2	1	4
Needed above both	8	8	8	8	8	8
Negative mood, *N(b)* = 9						
N(b) below both	7	0	6	2	5	6
Needed below both	8	8	8	8	8	8
Positive mood, *N(b)* = 9						
N(b) above both	0	1	2	1	0	0
Needed above both	8	8	8	8	8	8
N(b) below both	9*	8*	7	7	9*	9*
Needed below both	8	8	8	8	8	8

Note. *N(b)* = the total number of postexercise observation intervals. Self-stimulation data were collected in six 5-min blocks; other variables were collected in three 10-min blocks.

[a]The two criteria were the adjusted mean and regression lines, as computed by the conservative dual-criteria approach.

*$p < .05$.

observed frequencies appeared between the postexercise time blocks for any variable.

Discussion

The participant's significant postexercise reduction in self-stimulation clearly supports the study's first hypothesis and replicates past autism research (Celiberti et al., 1997; Elliott et al., 1994; Gordon et al., 1987; Kern et al., 1984; Kern et al., 1982; Levinson & Reid, 1993; Lochbaum & Crews, 1995; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980). One noteworthy difference between the current study and previous studies concerns the duration of the exercise intervention. The participant remained on the treadmill for a relatively brief period of 5 to 8 min, compared to the typical 15- to 20-min exercise sessions in past studies. Although he ran for considerably less time, the participant still experienced a significant decrease in self-stimulatory behaviors, suggesting that exercise can be an easy and efficient intervention for children with autism. The reduction of self-stimulation is important because these stereotypic behaviors often interfere with positive social behaviors and learning in the classroom, making the integration of children with autism into mainstream schooling more difficult (Rosenthal-Malek & Mitchell, 1997). In addition to being an inexpensive and relatively simple method to decrease self-stimulation, an exercise intervention can provide a complementary treatment option to traditional contingent behavior management. By identifying antecedent conditions (e.g., physical activity level) that alter problem behaviors (e.g., self-stimulation), parents and teachers of children with autism can prevent undesirable behaviors before they even happen, instead of treating them with aversive stimuli after each occurrence (Elliott et al., 1994).

The current study found that self-stimulation decreased after as little as 5 min of mildly strenuous

physical activity. Future research should further investigate the differential effects of various exercise durations on stereotypic behaviors for individual children. What amount of time is optimal for the greatest reduction in an individual's self-stimulation? A similar question involves the durability of the behavioral improvement. Although the current participant maintained a relatively low frequency of self-stimulation across the postexercise time blocks, other researchers have reported a gradual increase in self-stimulation after the first 10-min observation period (e.g., Celiberti et al., 1997). Understanding the duration of exercise effects carries practical significance for parents and teachers, as they can incorporate multiple exercise sessions into their children's daily routines to consistently decrease problematic self-stimulation.

Our results did not support the hypotheses that exercise would increase eye contact and verbal initiation. One explanation for the failure to find significant improvements involves this participant's overall low frequencies of these two behaviors. He often exhibited zero occurrences of eye contact and verbal initiation during an observational time block or even across an entire session. The CDC approach requires a minimum of five nonzero data points during an observation to detect a statistically significant change (Bloom et al., 2006). Future research should examine the effects of exercise on eye contact and verbal initiation using a broader sample of children with autism, including those who naturally exhibit a higher baseline rate of prosocial behaviors, which may be necessary for exercise to cause an improvement.

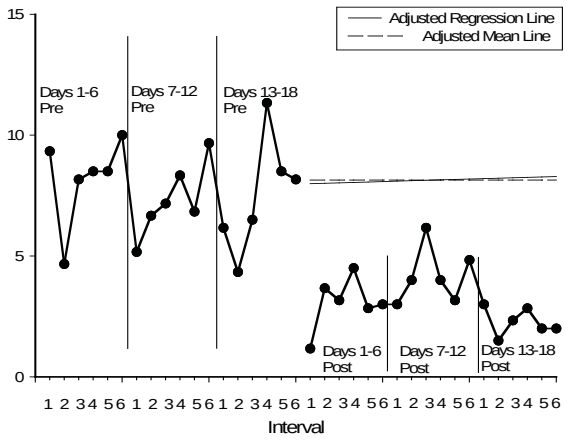
An intriguing new area of autism research may provide a link between exercise and improved social communication if exercise raises core body temperature. Recent reports from parents and clinicians suggest that certain behaviors of children with autism tend to improve during periods of fever. Curran et al. (2007) conducted a prospective study to examine this fever effect beyond case reports and anecdotes. Their sample included 60 children (aged 2-18 years) with autism spectrum disorders. Half experienced fever episodes, defined as a body temperature of greater than 38.0ºC. The other half were afebrile, matched on age, gender, and language skills. Parents of the febrile children responded to the ABC (Aman et al., 1985) at three times: the first day of the child's fever, one day after the fever disappeared, and one week after no fever symptoms. Parents of the afebrile children responded to the ABC at similar time intervals. Significantly fewer aberrant behaviors were recorded for the febrile children compared to the afebrile children. Improved communication was the most notable behavioral change, and this improvement did not depend on the height of fever. If the important biological mechanism for reducing autism symptoms is raising body temperature, perhaps exercise can produce similar therapeutic effects. The current participant tended to sweat heavily after 5 min on the treadmill, so future research might include recording body temperature and looking for communication improvements in children with higher baseline rates of eye contact and verbal initiation.

The participant's mood results produced a surprising finding. Contrary to the hypothesis that exercise would improve mood, his frequency of negative mood behaviors did not significantly change. Furthermore, his frequency of positive mood behaviors significantly decreased after exercise on 67% of the days. For this particular boy, the experience of running on the treadmill did not appear to be enjoyable. Although previous studies have reported children with autism jogging or running for 20 min at a time (e.g., Kern et al., 1982), the current participant threw tantrums and refused to run beyond 8 min. This unexpected finding serves as a reminder that not all children or adolescents will comply with a given intervention, and parents and teachers should rely on effective methods that can be easily incorporated into daily routines. One methodological difference is the current study's treadmill use, compared to the exercise conditions in other studies where participants ran around a gymnasium or an outdoor grass field. The treadmill presents fewer sensory distractions (e.g., trees, cloud, additional children) and more physical limitations (e.g., necessity to run in a straight line) than a gymnasium or field. These differences may partially explain the unexpected findings related to mood.

A second potential explanation involves the

FIGURE 1

Self-stimulation frequency pre- and postexercise averaged over 6 consecutive intervention days.



relation between self-stimulation and positive mood behaviors. Previous studies (e.g., Martin & Farnum, 2002) have suggested a link between happy mood and certain stereotypic behaviors such as hand-flapping, which may be an expression of excitement for children with autism. If so, a significant postexercise reduction in self-stimulation might also decrease the frequency of positive mood behaviors. Indeed, the current participant exhibited a moderate correlation between his baseline frequencies of self-stimulation and positive mood, $r(54) = .67$. The close relation between these two behaviors may explain why positive mood frequency decreased along with self-stimulation after exercise.

The current study contained several limitations. An inherent concern for any single-subject design involves external validity. How generalizable are the current participant's results to a larger population of children with autism? His postexercise reduction in self-stimulation replicated previous findings from studies with a wider variety of participants. This consistency of effects strengthens the authors' contention that exercise decreases self-stimulatory behaviors in this population. The eye contact, verbal initiation, and mood results, however, may be less applicable to other children with autism. A key point is that autism is a spectrum disorder; children are differentially affected, each experiencing difficulties along a continuum (Bauman & Kemper, 2006). This wide range of problem behaviors and symptom severity limits researchers' ability to generalize about the effects of an exercise intervention.

An additional methodological concern involved threats to internal validity. Due to unforeseen and uncontrollable circumstances (e.g., medication changes, school cancellations, participant behavioral problems), the treatment could not be implemented in the originally intended way with a consistent medication regimen, a regular school routine, and a 15-min running condition. The study was further limited to 9 weeks of pre- and postexercise data collection. An improved design would track the participant over a longer period, granting enough time for the behaviors to stabilize and providing more observational data for a representative average. Future research should also rely on multiple observers to record the participant's targeted behaviors. This methodological improvement would provide a measure of interrater reliability and minimize the threat of experimenter bias.

Although the current single-subject design study contained limitations related to external and internal validity, it produced an in-depth analysis of the effects of exercise on a child with autism. A primary advantage of this approach was the ability to observe and record five variables simultaneously. Future autism research should maintain this focus on multiple behaviors, given the complex spectrum nature of the disorder. The exact effects of physical activity on the core symptoms of autism appear to depend on multiple factors, including the exercise duration, the exercise setting, and the characteristics of the child. The relative importance of these individual factors remains unknown, thus highlighting the need for further exploration and future experiments in the area of exercise and autism.

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ADHD, Boredom, Sleep Disturbance, Self-Esteem, and Academic Achievement in College Students

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*The study examined boredom, sleep impairment, self-esteem, and symptoms of Attention Deficit Hyperactivity Disorder in relation to academic achievement and performance. Participants (*n = *166) from general studies courses across a midwestern university's campus were examined using the Boredom Proneness Scale (BPS), the Athens Insomnia Scale (AIS), the Rosenberg Self-Esteem Scale (RSES), and the Adult Behavior Checklist (ABC) in relation to grade point average (GPA) and ACT scores. The results indicated significant correlations (*p < *.01) among the BPS, AIS, RSES, and ABC, but only the BPS and ABC were correlated with GPA. No correlation existed for the variables in relation to ACT scores. Results suggest that more sensitive measurements of academic achievement are needed.*

According to the latest text revision of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV-TR; American Psychiatric Association [APA], 2000), Attention Deficit Hyperactivity Disorder (ADHD) is a childhood-onset behavioral disorder with symptoms divided into two major categories—Inattention and Hyperactivity-Impulsivity. Although symptoms lessen with age for some children, roughly 10-60% of children with ADHD continue to display symptoms of ADHD in adulthood (Root & Resnick, 2003). Root and Resnick suggest that those with ADHD might exhibit different symptoms of the disorder as they age, but they will continue to have the disorder. Recent research has focused on the manifestations of ADHD in adults. Kass, Wallace, and Vodanovich (2003) found associations between symptoms of ADHD and both boredom proneness and sleep disorders in college students, and they suggested that future research should examine whether the findings apply to individuals diagnosed with ADHD. Research with children has suggested that problems stemming from symptom-related behaviors of ADHD can affect self-esteem and academic achievement as well (Edbom, Lichtenstein, Granlund, & Larsson, 2006; Weiss & Hechtman, 1993). The current study extends research by Kass et al. and examines boredom proneness, sleep disturbances, self-esteem, and academic achievement in college students exhibiting symptoms of ADHD and in individuals diagnosed with the disorder.

Kass et al. (2003) studied possible factors related to adult ADHD. Children diagnosed with ADHD often exhibit sleeping problems (Golan, Shahar, Ravid, & Pillar, 2004; Stein, 1999) and symptoms of inattention and boredom, including difficulty concentrating on the task at hand (APA, 2000). Kass and colleagues hypothesized that, in the adult population, boredom proneness and sleep disturbances would be indicative factors for symptoms of ADHD, as assessed by Johnson and Lyonfields' Adult Behavior Checklist (ABC; as cited in Smith & Johnson, 1998). Kass et al. also used the Boredom Proneness Scale (BPS; Farmer & Sundberg, 1986), the Athens Insomnia Scale (AIS; Soldatos, Dikeos, & Paparrigopoulos, 2000), and the Epworth Sleepiness Scale (ESS; Johns, 1992) in the study. The results of the study by Kass and colleagues concluded that boredom proneness and sleep disturbances were significant predictors of higher scores on the Adult Behavior Checklist, suggesting that both of these factors are significantly associated with symptoms of adult ADHD.

Research has recently expanded to address the existing association between symptoms of ADHD and low self-esteem in children and adults. A longitudinal twin study by Edbom and colleagues (2006) examined the relationship between ADHD-symptom scores at the ages of 8 and 13 years old with self-esteem scores.

* Faculty Sponsor

Self-esteem scores were assessed using the "I Think I Am" questionnaire, a self-report scale based on other well-known self-esteem, self-concept, and self-image inventories. As expected, the researchers found that children with higher ADHD scores at both 8 and 13 years of age had statistically significant lower self-esteem scores than their co-twin controls (Edbom et al.). Ramsay and Rostain (2005) identified low self-esteem in adults with ADHD as well, noting that the stress resulting from symptom-related behaviors and frequent failure often results in low self-esteem in the adult ADHD population.

In the typical population, levels of self-esteem play a key role in influencing academic achievement among young students. A study conducted by Wiggins and Schatz (1994) tested the potential impact self-esteem has on a student's academic achievement. The researchers examined self-esteem, grade point average, and standardized test scores for fifth and sixth graders and found that self-esteem scores were more predictive of academic achievement (GPA) than scores on standardized tests. Rosenberg (1979) also noted that students with higher grades reported higher global self-esteem. In the present study, the researchers sought to establish a similar relationship between self-esteem and academic achievement in college students exhibiting symptoms of ADHD.

High academic achievement is often difficult for individuals exhibiting symptoms of ADHD. Barkley (1998) noted that academic achievement is a frequent problem area for children with ADHD. According to Weiss and Hechtman (1993), difficulties with hyperactivity, impulsivity, and inattention that are core symptoms of the disorder negatively affect academic achievement. Specific problems resulting from symptoms of the disorder include cognitive and impulsive disorganization, poor task performance, and lack of motivation. Children with ADHD often experience learning deficits stemming from failure to pay attention to previously taught lessons (Weiss & Hechtman).

While academic problems associated with ADHD have been frequently studied among children and adolescents (Barkley, 1998; Weiss & Hechtman, 1993), research is sparse concerning academic achievement among college students. Recently, Frazier, Youngstrom, Glutting, and Watkins (2007) published an article on two interrelated studies examining achievement in individuals with ADHD. The first study was a meta-analysis of literature published since 1990 on the topic. The findings revealed decreasing impairment from symptoms with age, with children being more significantly impaired in achievement than adolescents, and adolescents being more significantly impaired in achievement than adults. The second study examined achievement levels for college-level students with ADHD and concluded that symptoms of ADHD have a negative effect on scholastic performance at the college level (Frazier et al.). The present study seeks to address issues associated with academic achievement in college students exhibiting symptoms of ADHD.

The current study is a necessary expansion of the work done by Kass et al. (2003) to examine factors associated with academic achievement in college students exhibiting symptoms of ADHD. It examines boredom proneness, as assessed by the Boredom Proneness Scale, and sleep disturbance, as assessed by the Athens Insomnia Scale. Self-esteem is based on the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965; 1989). In their discussion section, Kass et al. also note the importance of including individuals diagnosed with ADHD in future research. To address this issue, the present study includes a "yes" or "no" response question asking participants if they have ever been diagnosed with the disorder. Symptoms of ADHD are assessed using the Adult Behavior Checklist. Similar to the work by Frazier et al. (2007), academic achievement is based on cumulative grade point averages (GPAs) and scores on the ACT.

The researchers hypothesized that scores on the BPS, AIS, and RSES would be correlated with one another. Higher scores on the BPS and AIS and lower scores on the RSES would be associated with more symptoms of ADHD, as indicated on the ABC, and would additionally be associated with lower GPAs and lower scores on the ACT. The study also examined any potential differences existing between those diagnosed with ADHD and those who had never received a diagnosis.

Method

Participants

One hundred sixty-six college students from a mid-sized university in the midwestern part of the United States agreed to participate in the study. The participants were gathered from a convenience sample of students enrolled in various general studies courses. Participants consisted of 114 women and 51 men, with a mean age of 21 years old ($SD = 4.95$) and a mode of 19 years old. Participants were predominantly White ($n = 137$), with the remainder representing a variety of ethnicities: African American ($n = 15$), Hispanic ($n = 5$), Asian ($n = 5$), and Other ($n = 4$). Of the participants, 68 were at the freshman level, 60 were sophomores, 25 were juniors, and 10 were seniors. The remaining 3 participants were categorized as "Other." The mean reported GPA was 3.2 ($SD = .54$). For the ACT, the mean score was 22.69 ($SD = 3.57$) and the mode was 22.

Of the 166 participants, 3 men and 9 women

indicated having been diagnosed with ADHD. All participants who indicated being diagnosed with ADHD were White. The mean age of the participants with a diagnosis was 22.83 years old (*SD* = 9.36) and the mode was 19 years old. In the ADHD subgroup, 5 participants were at the freshman level, 6 were sophomores, and 1 was a junior. The mean reported GPA was 2.97 (*SD* = .59). For the ACT, the mean score was 21.67 (*SD* = 2.74) and the mode was 20.

Materials

The items on the questionnaire addressed demographic information regarding gender, age, ethnicity, and academic level (e.g., freshman, sophomore, junior, senior), as well as cumulative undergraduate GPA. Participants in their first academic semester were asked to check the provided box and leave the space for GPA blank. Because these first semester freshman did not yet have a cumulative GPA, an additional question included composite scores on the ACT. The demographic questionnaire was followed by the measures assessing boredom proneness, insomnia, and self-esteem, respectively, as described below. The measure assessing ADHD was listed last to minimize participants' awareness of the ADHD component until the end of the questionnaire. An additional question was included at the end of the questionnaire with a "yes/no" answer format asking participants if they had ever been diagnosed with Attention Deficit Hyperactivity Disorder. For each of the measures described below, a mean substitution procedure was used if a respondent failed to answer any question on a subscale. This procedure, which substitutes the mean of the remaining items of the subscale for the missing item, allowed data to be included for the four participants with missing data on any multi-item scale.

Boredom Proneness Scale. Boredom proneness was assessed using the Boredom Proneness Scale (BPS; Farmer & Sundberg, 1986), a 28-item self-report questionnaire. As suggested by Kass et al. (2003), the scale was converted to a 7-point Likert scale, ranging from 1 (*highly disagree*) to 7 (*highly agree*). Negatively worded items were reverse coded, and a total score was derived by summing the ratings on the 28 items. Higher scores indicate greater boredom proneness. The 7-point Likert scale format of the BPS has internal consistency ranging from .83 to .85, respectively (Kass et al.; Vodanovich & Kass, 1990), and test-retest reliability of .83 (Farmer & Sundberg, 1986). The internal consistency (Cronbach's alpha) for the BPS in the current study was .79. The scale has shown strong relationships with self-ratings of boredom, providing preliminary evidence for the validity of the measure (Farmer & Sundberg).

Athens Insomnia Scale. Insomnia was measured using the Athens Insomnia Scale (AIS; Soldatos et al., 2000), an 8-item questionnaire measuring sleep disturbances on a scale ranging from 0 (*no problem at all*) to 3 (*very serious problem*). Ratings on each of the eight items on the AIS are summed to produce an overall sleep disturbance score, which ranges from 0 to 24. Higher scores indicate greater sleep impairment. Soldatos et al. reported that the AIS has an internal consistency of .87 to .89, with test-retest reliability of .88 to .89. In this study, the internal consistency (Cronbach's alpha) for the AIS was .85. Soldatos et al. reported that the AIS has an external validity of .90.

Rosenberg Self-Esteem Scale. Self-esteem was measured using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965, 1989), a 10-item self-report questionnaire measuring feelings of self-worth and self-esteem. Items on the scale are rated on a 4-point scale, ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Reverse coding was used and a summary score (ranging from 10 to 40) was derived so that higher scores indicate greater self-esteem. Rosenberg (1965, 1979) reported test-retest reliability of the scale as .92, and later studies (Blascovich & Tomaka, 1991; Schmitt & Allik, 2005) have also found test-retest reliability to be high, ranging from .81 to .88. In this study, the internal consistency (Cronbach's alpha) for the RSES was .89. The scale also has demonstrated adequate convergent and discriminate validity (Blascovich & Tomaka; Byrne, 1996; Robinson & Shaver, 1973).

Adult Behavior Checklist. Symptoms of ADHD were assessed using Johnson and Lyonfields' Adult Behavior Checklist (ABC; as cited in Smith & Johnson, 1998), an 18-item self-report questionnaire. The questionnaire is a screening instrument that measures symptoms indicating potential diagnosis of ADHD. The questionnaire is divided into the two subscales of Inattention and Hyperactivity, each consisting of 9 questions. The questions are paraphrased from the diagnostic criteria listed in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; APA, 1994). Items on the scale are rated on a 4-point scale ranging from 1 (*never or rarely*) to 4 (*very often*). A total score is derived by summing the ratings on all items. In addition, ratings on the first nine questions are summed to produce an Inattention Subscale score. The remaining items are summed to produce a Hyperactivity-Impulsivity Subscale score. Higher scores indicate greater numbers of ADHD symptoms. The ABC has an internal consistency ranging from .74 to .78 (Smith & Johnson, 1998). In the current study, the internal consistency (Cronbach's alpha) for the total ABC scale was .88, for the Inattention Subscale was .85, and for the Hyperactivity-Impulsivity Subscale was .81. Smith and Johnson (1998) provide evidence for the factor structure of the DSM-IV criteria assessed by the ABC, and preliminary validity studies (as cited

in Smith and Johnson, 1998) suggest that high scores are associated with difficulties in maintaining attention and in inhibiting responses.

Procedure

Approval was obtained from the College Committee for Research Involving Human Subjects prior to conducting the study. On the approved questionnaire format, the ABC was listed last to minimize participants' awareness of the ADHD component until the debriefing. For this reason, the question (using a "yes/no" answer format) asking participants if they had ever been diagnosed with ADHD was placed at the end of the questionnaire. Various professors teaching general studies courses across the campus were contacted to gain permission to administer the questionnaires in their classes. After consent was obtained from the professors to enter their classes, dates were arranged to distribute the questionnaires. The surveys were distributed in a 2-week period early in the spring semester to seven regular-session classes across the campus. Before the survey was administered, individuals were informed that the research was concerned with factors associated with academic achievement. Participation was voluntary and formal consent assuring confidentiality and anonymity was obtained through written forms requiring participants' signatures. Participants were assured that they could withdraw from participation at any point during the study. Participants were asked to remain quiet until all questionnaire packets were completed and returned to the administrator. After the consent forms were collected, the manila envelopes containing the questionnaires were distributed. A debriefing form was given to participants upon completion of the questionnaire.

Results

Table 1 presents the correlations of the measures for the entire sample of participants. The results of the two-tailed correlation analyses of the whole sample of participants indicated significant correlations among the BPS, AIS, and RSES with the significance level of $p < .01$. As can be seen in Table 1, self-esteem was negatively correlated with both boredom proneness and insomnia symptoms, and boredom proneness was positively correlated with insomnia symptoms.

Significant correlations with the two-tailed significance level at $p < .01$ were identified for the BPS, AIS, and RSES with the ABC. ADHD symptoms had a significant positive correlation with both boredom proneness and insomnia symptoms, but symptoms of ADHD were negatively correlated with self-esteem. In addition, the Inattention subscale of the ABC was positively correlated with boredom proneness and insomnia symptoms, but it was negatively correlated with self-esteem. Similar patterns of relationships were present for the Hyperactivity-Impulsivity subscale of the ABC, boredom proneness, insomnia symptoms, and self-esteem.

As demonstrated in Table 1, boredom proneness and symptoms of ADHD were negatively correlated with GPA. However, GPA was not significantly associated with insomnia symptoms or with self-esteem. GPA had a weak negative correlation with the Inattention subscale of the ABC, but no significant correlation existed between GPA and the Hyperactivity-Impulsivity subscale of the ABC. When a stepwise multiple regression analysis was used, the only variable that predicted GPA was boredom proneness, $R^2 = .05$, $\beta = -.23$, $t(150) = -2.82$, $p < .01$. None of the variables predicted ACT scores. No correlation existed between ACT scores and scores on the BPS, AIS, RSES, or ABC. Overall GPA had a significant positive association with ACT scores.

Participants were divided into two groups based on their responses to the item concerning whether they had ever received a diagnosis of ADHD (with a rating of 1 assigned to a "yes" answer and a rating of 2 assigned to a "no" answer). A significant correlation with the two-tailed significance level at $p < .01$ was identified between the ABC and a reported diagnosis of ADHD, $r = -.307$. Eleven of the 151 participants who had an established college GPA indicated that they had received the diagnoses of ADHD. However, there were no significant differences in GPA between those with an ADHD diagnosis and those without, $t(11.332) = -1.41$, $p > .05$. Table 2 contains the mean scores for ADHD symptoms (as assessed by the ABC), boredom proneness, insomnia, self-esteem, GPA, and ACT for college students with and without a self-reported diagnosis of ADHD.

Discussion

The authors were interested in the relationships that boredom proneness, sleep disturbances, self-esteem, and ADHD have with academic achievement. The findings of the study indicate correlations supporting the first and second hypotheses. The initial hypothesis predicted that scores on the BPS, AIS, and RSES would be significantly correlated. The second hypothesis proposed that higher scores on the BPS and AIS and lower scores on the RSES would be associated with more symptoms of ADHD as indicated on the ABC. As Kass et al. (2003) had found, boredom proneness and insomnia symptoms were positively correlated. Additionally, boredom proneness and insomnia symptoms were positively correlated with ADHD symptoms as assessed by the ABC. Boredom proneness, insomnia symptoms, and ADHD symptoms (Overall ABC, Inatten-

TABLE 1

Correlations Among ADHD Symptoms, Self-Esteem, Insomnia, Boredom Proneness, Grade Point Average, ACT Score, and Age

Measure	IABC	HABC	RSES	AIS	BPS	GPA	ACT	Age
ADHD symptoms (ABC)	.88**	.87**	-.42**	.40**	.49**	-.18*	.02	.08
Inattentive symptoms (IABC)		.52**	-.52**	.38**	.54**	-.19*	.03	.14
Hyperactive symptoms (HABC)			-.20**	.33**	.30**	-.13	.00	-.00
Self esteem (RSES)				-.34**	-.50**	.00	.01	-.08
Insomnia (AIS)					.30**	-.15	-.01	.04
Boredom proneness (BPS)						-.23**	-.09	.10
Grade point average (GPA)							.39**	-.03
ACT score (ACT)			.					-.09

*p < .05. **p < .01 (two-tailed tests).

TABLE 2

Mean Scores for College Students With and Without an ADHD Diagnosis

Measures		ADHD Diagnosis	No ADHD Diagnosis
ADHD symptoms (ABC)	*M*	43.92	34.34
	SD	11.65	7.41
Boredom Proneness (BPS)	*M*	102.33	94.32
	SD	17.75	15.96
Insomnia (AIS)	*M*	8.00	7.76
	SD	3.22	4.62
Self-Esteem (RSES)	*M*	29.00	32.29
	SD	5.41	4.91
GPA	*M*	2.97	3.23
	SD	.59	.53
ACT	*M*	21.67	22.79
	SD	2.74	3.60

Note. For the ABC, BPS, AIS, and RSES, $n = 12$ for those with an ADHD diagnosis and $n = 153$ for those without an ADHD diagnosis. For students with an established GPA, $n = 11$ for those with an ADHD diagnosis and $n = 140$ for those without an ADHD diagnosis. For those who reported an ACT score, $n = 9$ for those with an ADHD diagnosis and $n = 138$ for those without an ADHD diagnosis.

tion subscale, and Hyperactivity-Impulsivity subscale) were negatively correlated with self-esteem as assessed by the RSES.

The final hypothesis proposed that lower scores on the RSES and higher scores on the BPS, AIS, and ABC would be associated with lower GPAs and lower scores on the ACT. The findings of the study partially supported the third hypothesis. That is, only boredom proneness and ADHD symptoms were found to be negatively correlated with GPA, and only boredom proneness was predictive of GPA. An important finding with regard to the ABC indicated that the Inattention subscale had a significant negative correlation with GPA, but the Hyperactivity-Impulsivity subscale had no significant correlation with GPA. Contrary to the hypothesis, ACT scores were not significantly associated with boredom proneness, sleep impairment, self-esteem, or symptoms of ADHD.

The findings of the current study suggest that boredom proneness is predictive of GPA. Awareness of the relationships identified in the current study among boredom proneness, sleep disturbances, and self-esteem with symptoms of ADHD in college students could help instructors to monitor the perceived levels of boredom in struggling students and to utilize interactive methods of instruction to reduce students' proneness to boredom. Such efforts might result in greater student participation and subsequently improve course grades. Instructors also might provide additional assistance to those students to combat boredom proneness, low self-esteem, sleep problems, and symptom-related behaviors of ADHD.

Multiple reasons should be considered as potential explanations for why boredom proneness, sleep disturbance, and self-esteem are associated with symptoms of ADHD, but only boredom proneness contributed significantly to the prediction of academic achievement (as measured by GPA), and none of the variables predicted ACT score. Given the self-report nature of the questionnaire format, it is possible that participants did not provide accurate cumulative GPAs or ACT scores. For a variety of reasons, participants may give self-reports of higher GPAs and ACT scores that might not reflect actual achievement levels. This would impair the accurateness of correlations and regression analyses, resulting in lower correlations than what might really exist. It is also quite possible that GPA and scores on the ACT do not provide precise assessment of academic achievement. Future research on the subject should better define academic achievement, such as in-class participation and performance or time efficiency of studying.

Students' use of coping strategies may be an additional reason for participants' reported higher grades. If one is aware of boredom proneness, sleep disturbances, self-esteem issues, and symptoms of ADHD prior to attending college, one might be more likely to seek help early. That is, students would seek out tutoring assistance, behavioral management, and counseling during high school to prepare for post-secondary education, or soon after arriving at college. This allows students to learn various coping strategies to overcome associated issues. For example, behavioral management and counseling would provide assistance for time-efficiency, better decision-making skills, and learning techniques to offset the effects of boredom and ADHD symptoms. Some researchers (Glutting, Youngstrom, & Watkins, 2005) suggest that college students with ADHD symptoms may be a distinct subset in the ADHD population. They proposed that college students with ADHD are more likely to have greater academic ability, to experience better academic success during elementary and secondary school, and to have more efficient adaptive skills than their ADHD counterparts who did not further their education (Glutting et al.). Future research should seek to address these potential issues by further examining the differences within the ADHD population.

The present study expanded current identification of the factors related to symptoms of ADHD first described by Kass et al. (2003). In addition to boredom proneness and sleep disturbance, global self-esteem is negatively associated with a greater number of ADHD symptoms. However, the level of global self-esteem did not contribute to the prediction of academic achievement. Rather than using a global self-esteem measurement such as the Rosenberg Self-Esteem Scale (Rosenberg, 1965, 1989), future research should utilize a questionnaire format that measures specific self-esteem (such as academic self-esteem or self-efficacy). Had a different scale been used, the results of the study might have found a more robust relationship between self-esteem and academic achievement.

In addition, a larger sample size including a greater number of participants indicating a diagnosis of ADHD may have produced results with greater significance. The present study consisted of 166 participants, with only 12 participants being diagnosed with ADHD. The percentage of participants diagnosed with ADHD in the sample approximates the 4-5% prevalence rates of the disorder in the adult population (Ramsay & Rostain, 2005), but it does not constitute a large sample size. The researchers could have potentially inferred diagnosis based on number of symptoms indicated on the ABC; however, the ABC functions more like a self-report screening tool because the additional criteria for diagnosis of ADHD are not included in the scale. Therefore, more diagnosed participants are needed

to clearly examine them as a subgroup of the ADHD population.

Future research should obtain information pertaining to participants' medication usage. In the present study, the researchers did not ask participants if they were taking medication to treat symptoms of ADHD. However, such information is pertinent to the strength of the correlations and relationships among the tested variables. A participant diagnosed with ADHD might report fewer symptoms across all measures while taking a prescription to treat ADHD symptoms. This would result in weaker correlations among the measures and inaccurately represent the naturally-occurring relationship among boredom proneness, insomnia symptoms, self-esteem, academic achievement, and ADHD symptoms.

Further, the 166 participants in the study were composed of 114 women and 51 men. ADHD is typically considered a male-dominant disorder, with a typical clinic sample male to female ratio of 9:1 (APA, 1994). The disproportionate number of women in the present study may have affected the results by minimizing the actual relationship among the tested variables. Of the 12 participants who indicated having been diagnosed with ADHD, 3 were men and 9 were women. These demographic findings might suggest a gender imbalance regarding the ability to use coping strategies and gain entrance into college. Future research examining gender differences in college students with ADHD can identify which coping strategies are the most effective for each gender. Establishing clear coping strategies for each gender will assist with skill development to ensure that both genders receive an equal advantage in overcoming the problems associated with symptoms of ADHD.

To summarize, the findings of the study provide support for the existing correlation between boredom proneness, sleep disturbances, self-esteem, and symptoms of ADHD. They suggest that boredom proneness, in particular, is negatively associated with academic achievement (as measured by GPA). These results expand current knowledge about young adults with symptoms of ADHD, specifically regarding the population of college students. Further research should establish whether the findings can be generalized from the sample of college students with ADHD symptoms to the general population of adults with ADHD. This will allow for improved assistance, counseling, and skill development in the classroom, home, and workplace for adults exhibiting symptoms of ADHD.

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Social Relationships Mediate the Relation Between Emotional Intelligence and Meaning in Life

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*Emotional intelligence has been consistently associated with higher quality social relationships (Rivers, Brackett, Salovey, & Mayer, 2007). Social relationships have been deemed a vital source of meaning and purpose in life (DeBats, 1999; Kraus, 2007; Settersten, 2002). This study examined the role of meaningful social relationships in the association between emotional intelligence and meaning in life. Participants (*N = 50*) completed the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Salovey, & Caruso, 2002), the Personal Meaning Profile (PMP; Wong, 1998), and the Purpose in Life test (PIL; Crumbaugh & Maholick, 1964). Results indicated that the relation between emotion management (branch 4 of emotional intelligence) and meaning in life was mediated by the quality of social relationships.*

Emotional intelligence has been defined as the ability to accurately perceive emotions and emotional content, to use emotions to facilitate intellectual processing, to understand emotions and emotional knowledge, and to regulate and manage emotions (Mayer & Salovey, 1997). Research has suggested a relationship between emotional intelligence and meaning in life (Brackett & Mayer, 2003; David, 2002). Emotional intelligence was related to five dimensions of Ryff's (1989) psychological well-being measure, including the "purpose in life" dimension, which focuses on an individual's sense of direction and meaning in life (Brackett & Mayer, 2003).

A specific branch of emotional intelligence, emotion management (branch 4), may be especially important for constructs like meaning and purpose in life. This branch of emotional intelligence has been described as "the conscious regulation of emotions to enhance emotional and intellectual growth" (Mayer & Salovey, 1997, p.14). Emotion literature corroborates the proposed benefits of emotion management and regulation, demonstrating that the use of positive emotional states can act as a buffer against stress (Folkman & Moskowitz, 2000) and can lead to psychological resilience (Tugade & Fredrickson, 2004).

The present research attempts to elucidate the potential relationship between emotional intelligence and meaning in life by introducing a third variable: social relationships. Quality social relationships may play an important role in this link, given their strong correlations with emotional intelligence (Brackett, Warner, & Bosco, 2005) and meaning in life (DeBats, 1999; Krause, 2007; Setterson, 2002). Consequently, it is necessary to delineate the role of emotional intelligence in social relationships and subsequently the role of social relationships in a meaningful and purposeful life.

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The Role of Emotional Intelligence in Social Relationships

The ability of emotional intelligence has been consistently and unequivocally related to many aspects of social interaction. There is basic information-processing evidence, both neurological and behavioral, that emotional intelligence is related to successful social exchange reasoning (Reis et al., 2007). This type of social reasoning involves the reciprocal understanding between individuals when mutually beneficial goods or services are exchanged (Reis et al.). Research examining interpersonal relationships demonstrated that in men, lower emotional intelligence scores predicted destructive responses (e.g., engagement in a heated argument or complete avoidance) to both relationship conflict (e.g., a disagreement with a friend) and to reports of positive events (e.g., a friend shares his/her good news; Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006). Additionally, men scoring high in emotional intelligence were judged to be more socially engaging and competent (Brackett et al., 2006) and to have more positive relations with friends (Brackett, Mayer, & Warner, 2004), while men scoring low in emotional intelligence were found to have more negative relations with friends (Brackett, Mayer, & Warner, 2004).

More specific links have appeared between various measures of social relationships and the *managing emotions* subscale (branch 4) of emotional intelligence (Lopes, Salovey, & Straus, 2003; Lopes et al., 2004; Yip & Martin, 2006). Of the four branches of emotional intelligence, this branch consists of the most advanced, integrated emotional processes (Mayer & Salovey, 1997). Higher scores on the managing emotions subscale—with its emphasis on moderating negative emotion and enhancing positive emotion in interpersonal situations—are thought to be more indicative of quality social relationships than any other branch of emotional intelligence (Lopes et al., 2004). Specifically, the managing emotions subscale was positively correlated with measures of conflict management, emotional support, the initiation of relationships, and overall interpersonal competence (Yip & Martin, 2006). In further work, the managing emotion subscale was positively correlated with participants' self-reports of positive interactions with two friends (Lopes et al., 2004). This study also found that participants' emotion management score was positively correlated with a friend's ratings of their positive interactions and their tendency to provide emotional support.

The Role of Social Relationships in a Meaningful and Purposeful Life

The aforementioned research demonstrates emotional intelligence's role in social relationships. Social relationships, while not the sole factor, are considered a prominent source of meaning and purpose in individuals' lives (Pohlmann, Gruss, & Joraschky, 2006; Simpson & Tran, 2006; Wong, 1998). Numerous studies have provided evidence that intimate personal relationships are among the most frequently-cited source of meaning in life—across age, gender, and culture (DeBats, 1999; Kraus, 2007; Pohlmann, Gruss, & Joraschky, 2006; Settersten, 2002). These types of relationships include romantic relationships, family relationships, and relationships with close friends (Setterson, 2002). Although not as prevalent in extant literature, an individual's broader social relations with her or his surrounding community can also provide a sense of meaning and purpose in life (Bar-Tur & Prager, 1996; Bar-Tur & Savaya, 2001; Wong, 1998). These relationships are often operationally defined as "community service-altruism" (Bar-Tur & Prager, 1996), "communal activity" (Bar-Tur & Savaya, 2001), and "community relationships" (Wong, 1998).

Goals and Hypotheses

The primary goal of this research was to examine the role of social relationships in the relation between emotional intelligence (specifically the emotion management branch) and meaning in life. Emotional intelligence was measured with the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer et al., 2002). Two instruments were used to measure meaning in life: the Personal Meaning Profile (PMP; Wong, 1998) and the Purpose in Life test (PIL; Crumbaugh & Maholick, 1964). The PMP measures overall meaning in life and also has 7 subscales that each measure a specific source of meaning. Two of the subscales were of primary interest in this research because of their focus on social relationships. The *intimacy* subscale indicates the amount of meaning derived from romantic partners and close friends and family. The *relationship* subscale employs a broader approach, evaluating meaning in life through general community relations and more expansive peer networks. The PIL served as the primary meaning in life measure and was also used to validate the newer, less thoroughly researched PMP (Schulenberg, 2004).

The following hypotheses were proposed:

1. The PMP and PIL total scores will be positively correlated.
2. The relationship scales (relation and intimacy) of the PMP will be positively correlated (given that the scales are significantly correlated, a composite social relationships variable will be calculated).
3. The social relationships variable will mediate the

relation between emotion management (MSCEIT branch 4) and meaning in life (PIL). Several criteria will be met to satisfy this: (a) Emotion management will be related to meaning in life; (b) emotion management will be related to social relationships; (c) controlling for emotion management, social relationships will be related to meaning in life.

Method

Participants

Undergraduate students enrolled in introductory psychology courses were recruited for participation via the online research database Sona Systems. Participants consisted of 50 students (14 men; 36 women) ranging in age from 18 years to 24 years ($M = 19.94$, $SD = 1.25$). All participants received course extra credit.

Measures

Personal Meaning Profile. The Personal Meaning Profile (PMP) is a 57-item, self-report measure of personal meaning that employs a 1–7 Likert scale (Wong, 1998). The PMP yields an overall score and is also composed of 7 subscales (*achievement, fair-treatment, intimacy, relationship, religion, self-acceptance, self-transcendence*), each of which measures a prominent source of personal meaning. Although participants completed each of the 7 subscales, the intimacy and relationship subscales were of primary interest in this study as they indicate quality of both intimate and community relations. For example, the intimacy subscale asks questions like "I have a loving relationship with someone in my life," while the relationship subscale asks questions like "I feel a sense of belonging with my community." For each question, participants marked a 1 if the statement did not apply at all to them and a 7 if the statement applied exactly to them. The intimacy and relationship subscales were related, thus a composite score was calculated to indicate overall quality of social relationships, where higher scores indicated greater quality. This score was created for the current study to more adequately reflect the variable of interest, social relationships by combining both intimate relationships and community relationships. The composite score was calculated by summing the scores from both subscales and dividing by two.

Purpose in Life Test. The Purpose in Life Test (PIL) is a three-part questionnaire designed to measure the amount of meaning a person has discovered in life (Crumbaugh & Maholick, 1964). Part A is composed of 20 items, each using a Likert scale ranging from 1 to 7. Questions in this part begin with statements like, "My life is…" A Likert scale then follows each statement. One end of the scale contains a negative response (*boring and dull*) while the opposite end contains a positive response (*fulfilling and worthwhile*). A total score was calculated, with higher scores representing more purpose in life (Crumbaugh & Maholick, 1964; Schulenberg, 2004). Parts B and C are intended for clinical use and were not employed in this study.

Mayer-Salovey-Caruso Emotional Intelligence Test. The ability of emotional intelligence was measured with the online version of the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer et al., 2002). The MSCEIT is a 141-item questionnaire which offers a total score and four branch scores: perception of emotion, use of emotion to facilitate thought, understanding of emotion, and management of emotion. Each of these branches is measured by two tasks. The fourth branch, managing emotions, was of primary interest in the current study and is measured by presenting respondents with multiple scenarios and asking them to identify (a) the most adaptive way to handle their feelings and (b) the feelings of others (Mayer et al., 2002).

MSCEIT scores can be based on expert or consensus scoring methods. In expert scoring, if the respondent answers "C–ashamed" and 55% of the expert sample (comprised of 21 internationally renowned emotion researchers) answer "C–ashamed," then the person receives a raw score of .55 for that question. Consensus scoring follows the same principle, except that answers are based on replies from a normative sample of over 5,000 respondents. The present study used expert scoring because experts have been deemed more reliable judges of emotion (Mayer, Salovey, Caruso, & Sitarenios, 2003). Correlations between expert and consensus scoring methods have been quite high, usually above .90 (Mayer, Salovey, Caruso, & Sitarenios, 2001, 2003).

Procedure

Participants reported individually to the research office where a research assistant met them. They were greeted and their course information was collected so their extra credit could be processed. Participants then completed a consent form, the computerized MSCEIT, the PMP, and the PIL one at a time in a research cubicle. The MSCEIT and PMP tasks were counterbalanced using a Latin-square design (Campbell & Stanley, 1963). A test administrator was available outside the cubicle to answer questions for each participant as necessary. Participants were instructed to alert the test administrator upon completion of each questionnaire. The administrator then explained the next questionnaire, asked if there were questions, and left the cubicle. This procedure continued until all questionnaires had been completed.

Results

Complete data were available for 48 participants (14 men, 34 women). Two outliers with significantly low MSCEIT scores (less than 2.5 *SD* below the mean) were excluded from all analyses because they completed the test in a fraction of the time other participants did and were suspected of filling in answers blindly. Due to the disproportionate ratio of women to men, as well as the moderate sample size, gender comparison analyses were not conducted.

Hypothesis 1

The PMP total score and the PIL total score were significantly correlated, $r\,(48) = .75$, $p < .01$. The PIL was also positively correlated with each of the 7 subscales of the PMP (see Table 1). As predicted, participants scoring higher on the PMP scored higher on the PIL, indicating that personal meaning and purpose in life were significantly positively correlated.

Hypothesis 2

The PMP relationship subscale and the PMP intimacy subscale were significantly correlated, $r\,(48) = .44$, $p < .01$.

Hypothesis 3

MSCEIT scores ($M = 97.61$, $SD = 12.26$) were similar to previous studies (Mayer et al., 2003). Tests for mediation were conducted to examine the role of social relationships as a mediator of the relationship between emotion management and meaning in life. Regression analyses satisfied the necessary mediation conditions: (a) Emotion management significantly accounted for variance in meaning in life, $\beta = .43$, $p = .002$; (b) emotion management significantly accounted for variance in social relationships (intimacy and community combined), $\beta = .40$, $p = .005$; c) controlling for emotion management, social relationships significantly accounted for variance in meaning in life, $\beta = .52$, $p < .001$. The relationship between emotion management and meaning in life, however, was not significant when analyses controlled for social relationships.

TABLE 1

Correlations Between Personal Meaning Profile (PMP) Subscales and the Purpose in Life (PIL) Test

	PIL
PMP fair treatment	.52*
PMP intimacy	.53**
PMP self acceptance	.45**
PMP transcendence	.65**
PMP religion	.45**
PMP achievement	.64**
PMP relationship	.51**

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

Discussion

The data supported each of our hypotheses. A specific facet of emotional intelligence, emotion management, was related to meaning in life and meaningful social relationships. Further analyses investigated the relationships between these three variables (emotion management, social relationships, and meaning in life) and the potential influences and indirect effects each exerts on the other. As hypothesized, meaningful social relationships were found to mediate the connection between emotion management and meaning in life.

One goal of this study was to examine the relationship between a specific subset of meaning in life factors (i.e., intimate, personal relationships and community relationships) and emotion management abilities. To accomplish this goal, we used a meaning in life scale, the Personal Meaning Profile (Wong, 1998), that consisted of subscales measuring these dimensions (i.e., the *intimacy* and *relationship* scales). An experimentally-validated measure of meaning of life, the Purpose in Life test (Crumbaugh & Maholick, 1964), then served as the primary meaning in life measure and also provided additional validation for the Personal Meaning Profile. Indeed, the overall score and each subscale of the Personal Meaning Profile was correlated with the Purpose in Life test, seemingly providing researchers an instrument with identifiable factors to descry various avenues for meaning in life.

The mediation analyses carried out were based on the premise that social relationships were related to the two variables of primary interest: emotion management and meaning in life. In reference to the latter, and similar to previous research (DeBats, 1999; Krause, 2007; Setterson, 2002), the present results found that social relationships are a vital source of meaning and purpose in life for many individuals. This study included both intimate relationships and broader community relationships in the overall conceptualization of social relationships. Prior research has shown that quality social relationships are also related to the successful management of emotion (Lopes et al., 2003; Lopes et al., 2004). The current research verified that the ability to manage emotions is associated with meaningful social relationships.

Although, ostensibly, there seem to be clear relationships between emotion management, social relationships, and meaning in life, the present results demonstrate added complexity. Past research has indicated that individuals with greater emotional intelligence have shown greater meaning in life (Brackett & Mayer, 2003; David, 2002). Greater meaning in life is related to numerous positive outcomes (Wong, 1998.). Because individuals derive meaning in life in a number of ways, it is important to understand how these different avenues may be fostered. The current study examined how valuing social relationships, in particular, explained the relationship between emotion management and meaning in life. Specifically, meaningful social relationships were found to mediate the association between emotion management and meaning in life. In other words, the successful management of emotion contributed to meaning in life in part through quality social relationships. It is likely that individuals with better emotion management skills foster more meaningful intimate relationships (e.g., close friendships and romantic relationships) and community relationships (e.g., a neighborhood watch group), which lead to a greater sense of meaning and purpose in life.

The present study yielded a number of significant findings. It supports the previously established association between emotion management (branch 4 of emotional intelligence) and social relationships. In accordance with past work on meaning in life, this research indicated that social relationships are an essential source of meaning and purpose in life. Most importantly, the results demonstrate that the relation between emotion management and meaning in life is mediated by social relationships. Future theoretical and empirical work is needed to identify how the particular abilities of emotion management influence social relationships. Additional research could also focus more extensively on the types of social relationships that are important in influencing meaning in life and emotion management. For example, are intimate relationships or community relationships more important? Or, are there other types of social relationships that could mediate the relation between emotion management and meaning in life? Using a questionnaire designed solely to measure different types of social relationships could accomplish this task and could also avoid any potential issues that arise with using the combined subscales of a larger questionnaire (i.e., the Personal Meaning Profile) as the social relationship variable. Further research could also examine whether the relationship between other aspects of emotional intelligence may be related to meaning in life through different mechanisms of deriving meaning, not only social relationships.

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Perceiving Mood in Color: The Effects of Mood States on Reaction Times

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This study examined the effects of a musical mood induction procedure on the reaction time required to perceive the colors yellow and blue. Thirty-six undergraduates listened to 5 min of happy music, sad music, or white noise. The participants then completed the Multiple Affect Adjective Checklist-Revised to assess their current mood, and reaction times to yellow and blue stimuli of varying intensities were recorded. Results showed that participants who listened to happy music felt happier, and participants who listened to sad music felt sadder. Significant differences were not found between the happiness and sadness groups for reaction times to yellow and blue stimuli. Surprisingly, the white noise group was significantly slower in reaction times to yellow and blue stimuli.

The normal human visual system is capable of perceiving color in every visual stimulus in the environment. In fact, color is such a dominant theme in the human experience that we have been known to associate our emotions with colors. The well-known sayings, "I feel blue," "I was so angry I saw red," and "I was green with envy" clearly demonstrate these associations. One may wonder why we tend to associate our moods with colors. More specifically, do our brains make this connection innately, or is this tendency purely learned?

Previous research has attempted to define these color-mood relationships by examining the type of emotional response that color induces (Gao & Xin, 2006; Hemphill, 1996; Kaya & Epps, 2004; Peretti, 1974a; Peretti, 1974b; Wexner, 1954; Xin, Cheng, Taylor, Sato, & Hansuebsai, 2002). For example, Kaya & Epps (2004) asked college students to indicate their emotional responses to different hues and found that yellow was related to happiness, and blue was linked to feelings of loneliness and sadness. In a similar study, the researcher investigated the color-emotion associations of 40 undergraduate students and reported that 61% of the responses to bright colors (such as white, pink, red, yellow, blue, purple, and green) were positive, compared with only 21% for dark colors such as brown, black, and gray (Hemphill, 1996). By examining how color affects one's emotional state, these studies showed that people can connect mood states to colors.

Xin et. al. (2002) reported that some researchers have suggested that color directly affects the parts of the human nervous system responsible for emotional arousal. If color can affect one's emotional arousal, then it is possible for one's emotional arousal to affect one's perception of color. For instance, being in a particular emotional state, such as sadness, could potentially affect the way one perceives a particular color, such as blue. If this is true, then it could indicate that these color-mood associations are not simply learned but have a neurological basis. Perhaps we say we "feel blue" because when we are sad, we perceive blue in a different way than when we are not sad.

Though few studies have attempted to address this question, Zeims and Christman (1998) did examine the effects of mood states on discrimination of colors that differed on valence (or pleasantness) and arousal. Valdez and Mehrabian (1994) had previously indicated that some colors possess properties of both pleasantness and arousal (e.g., the color blue-green was determined by the researchers to be high in pleasantness and high in arousal, and the color purple-blue was considered to be high in pleasantness and low in arousal). Zeims

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and Christman used these colors in their 1998 study and found that the emotional state of the observer affected the speed with which colors differing on the dimension of arousal were discriminated. More specifically, observers in a happy state were faster at discriminating high-arousal colors, and observers in a sad state were faster at discriminating low-arousal colors. These findings suggested that participants were faster at processing certain colors when in different mood states; therefore, emotional arousal affects perception of color.

Kunzendorf (2001) also investigated whether emotional state affects perception of color by attempting to test the validity of the sayings that angry people "see red" and sad people "feel blue." The researcher first split the participants into two conditions: anger and sadness. In the anger condition, participants were instructed to generate feelings of anger; while in the sadness condition, they were asked to generate feelings of sadness. The participants were then asked to rank the similarity of eight paired colors consisting of reds (such as red-orange and maroon) and blues (such as blue-violet and blue-green). The participants were shown eight pairs of such colors and were asked to rank the similarity of the pairs by writing the pair number of the most similar pair first, then the second most similar, and so on. The logic behind this test was if anger adds redness to colors and sadness adds blueness, then reddish hues should shift closer together in similarity to pure red, and bluish hues should shift closer in similarity to pure blue. An analysis of variance showed the average red pair was more similar for the anger group, and the average blue pair was more similar for the sadness group. Kunzendorf proposed that these results suggest that the observer's surroundings are subjectively perceived as redder during anger and bluer during sadness.

In his second experiment, Kunzendorf (2001) investigated the mechanism behind this phenomenon. He proposed the neural threshold for red and blue sensations may be lowered when people experience anger and sadness, respectively. To test this, Kunzendorf split the participants into the same two groups, anger and sadness. He then flashed a series of slides containing either an angry or a sad face that was colored reddish-black or bluish-black and that was placed above or below a midline. The participants were then given 10 sec to determine whether the face was above or below the midline. The results showed that participants were more accurate at localizing red faces during anger and blue faces during sadness, but that the emotion expressed by the face had no effect on accuracy. Kunzendorf suggested that the feeling of anger may increase the detectability of red signals, and likewise that the feeling of sadness may increase the detectability of blue signals. These findings suggest the neural thresholds for triggering sensations of red and blue may be lowered during anger and sadness, respectively.

The current study aimed to further investigate the effects of emotional state on the perception of color. More specifically, the effects of happiness and sadness on the perceptions of yellow and blue were examined. It was hypothesized that participants in the happiness condition would have decreased reaction times to yellow stimuli, and that participants in the sadness condition would have decreased reaction times to blue stimuli. Additionally, a group of participants not exposed to any mood induction procedures served as a control group.

If the neural threshold for detecting colored stimuli is lowered during certain moods, as suggested by Kunzendorf (2001), then this would mean that the minimum degree of intensity needed to perceive that color would be lowered when a person is in the corresponding mood. Therefore, participants should be faster at reacting to that color because they would perceive it sooner. Consequently, the colors used in this study were manipulated by intensity (low, medium and high brightness) and reaction time required to perceive these colors was recorded. If reaction times to yellow and blue stimuli are found to be faster when a person is in a happy and sad mood respectively, then this would provide support for Kunzendorf's speculation that neural thresholds for perception of colored stimuli are lowered when a person is an associated mood state.

Method

Participants

Thirty-six students (34 women and 2 men) from a small New England college participated in this study. Participants were recruited from the college psychology department subject pool, and received one credit toward a research requirement in their General Psychology class. Participants were at least 18 years of age *(M* = 18.86 years old). Although vision was not tested, all subjects reported normal or corrected-to-normal vision, and no known color vision deficiencies.

Materials

Three different CD recordings were used: Mozart's Clarinet Concerto in A Major, Barber's Adagio pour Cortes, and white noise. The white noise was a continuous static sound. The music and white noise was played from a compact disk (CD) and captured via a Telex M-560 Super-Directional USB Digital Microphone. The music and white noise was then recorded onto a computer using the program Cool Edit Pro (v2.0) and was played back to participants using

Koss UR20 headphones.

This study also made use of the Multiple Affect Adjective Checklist-Revised, short form (MAACL-R). The MAACL-R is a mood assessment instrument used in research and clinical practice that contains multiple subscales such as depression, hostility, anxiety, sensation seeking, and positive affect subscales (Lubin, Whitlock, Reddy, & Petren, 2001). The instrument measures present (state) moods by requesting that participants check which adjectives in a set of 132 describe, "How you feel today, right now." Sufficient reliability (internal consistency and test-retest reliability) and validity (convergent, predictive, discriminant, and diagnostic) have been reported for the checklist. Specifically, in a community college population, Cronbach's alpha was reported to be .94 for the positive affect subscale and .84 for the depression subscale (Lubin & Zuckerman, 1999).

Participants also completed a two-alternative, forced-choice task that was constructed to measure reaction time following exposure to yellow and blue stimuli. The stimulus color of yellow was chosen based on Kaya and Epps (2004) and Wexner's (1954) results that showed that yellow is the color most associated with happiness, and the stimulus color of blue was chosen and based on the Kaya and Epps (2004) and Kunzendorf's (2001) studies that indicated that blue was associated with sadness and loneliness. This was a computer-generated task that was created using E-Prime software, a product of Psychology Software Tools, Inc. The colored stimuli were made using Microsoft Paint and varied at three intensities: low, medium, and high. Three blocks consisted of the hue 40 (yellow) with a saturation level of 240 pixels. These yellow blocks varied in intensity at 120 pixels (high), 210 pixels (medium), and 230 pixels (low). The hue 160 (blue) had the same saturation value as hue 40, but varied at the following three intensity values: 120 pixels (high), 215 pixels (medium), and 235 pixels (low). These intensity values were slightly different between colors so that the colors displayed the same *perceived* intensity, which varied slightly from the *physical* intensity. Prior to any testing of participants, the researcher evaluated perceived intensity by comparing the physical intensity values of each level of color and adjusting any colors that were too dissimilar from one another (e.g., adjusted *physical* intensity of low blue to match the same *perceived* intensity of low yellow). A second observer confirmed the researcher's final color choices, and the resulting color stimuli were used for all participants.

Design and Procedure

During the experiment, the 36 participants were randomly assigned to three conditions: happiness, sadness, and control. The 12 participants in the happiness group listened to 5 min of Mozart's Clarinet Concerto in A Major, the 12 participants in the sadness group listened to 5 min of Barber's Adagio pour Cortes, and the 12 participants in the control group listened to 5 min of white noise. All participants then completed the MAACL-R and the two-alternative, forced-choice task. Participants completed the musical MIP, MAACL-R, and the two-alternative, forced-choice task in isolation in order to prevent a possible Hawthorne Effect, which occurs when participants act differently simply because they are being observed, not because of an experimental manipulation (Adair, 1984). These procedures were carried out in a lab room that was furnished with a table, a chair, and a computer.

The Human Subjects Review Board of the campus approved the study and all participants provided written informed consent prior to initiation of study procedures. After consent was obtained and questions were answered, the participants were asked to complete the musical MIP. In the musical MIP, participants listen to a mood-suggestive piece of classical music after being instructed to try to get into the mood expressed by the music, without explicitly stating that mood. The type of mood induction procedure and the specific pieces of classical music that were used in this study were selected because they have been shown to be successful in inducing happy and sad moods in previous research on mood dependent memory (de I'Etoile, 2002), and on the effects of mood on color perception (Ziems & Christman, 1998). The participants were told, "You are going to listen to something play for 5 minutes. You want to try to determine if what you hear expresses a certain mood. If you think that it does, you want to try to get into that mood. Put on the headphones and hit the play button when you are ready. After the recording stops, please read the instructions and fill out this check list as quickly as possible. The checklist asks you to check the items that pertain to how you feel today, right now. I will also leave you this list for reference. Do you have any questions? I will be right outside; come and get me when you are finished." The list left for participants stated (a) put on the headphones and click play when ready; (b) try to determine if what you hear expresses a mood; (c) If it does, try to get into that mood; (d) when the music stops, read the instructions and quickly fill out the checklist; and (e) get researcher when finished.

Following completion of the checklist, which was utilized to perform a manipulation check regarding what mood was actually induced by the musical MIP, participants were asked to complete the two-alternative, forced-choice task. In this task, the participants were instructed to stare at a fixation point that consisted of

cross bars (+) in the middle of the screen. The screen then changed and consisted of a block of color placed above or below a midline. The midline was a grey line separating the top half of the screen from the bottom half of the screen. Each of the six stimuli was placed at six different locations: three locations above the midline, and three locations below the midline. This design resulted in 36 different trials, which were shown twice, in random order, to each participant for a total of 72 trials. Participants were asked to hit the number 1 if they saw the stimulus above the midline, and to hit the number 2 if they saw the stimulus below the midline. Participants were told, "You are going to see a block of color either above or below a line that divides the screen in half. All you have to do is hit the number 1 if you see the block of color above the line, and hit the number 2 if you see the block of color below the line." These instructions were also shown on the screen before the trials were run, and the instructions informed participants to hit the enter button when ready to begin. To aid accuracy, a number 1 was placed on the top of the computer screen and a number 2 was placed on the bottom of the computer screen. Upon completion of the experiment, participants were debriefed and provided contact information to address study concerns and/or to access study results should they wish to learn the outcome of the study.

Results

The aim of this study was to determine if participants in a happy mood react faster to yellow stimuli, and if participants in a sad mood react faster to blue stimuli. To determine if the musical MIP was successful in altering mood, comparisons between groups on the MAACL-R scores were analyzed using a one-way analysis of variance (ANOVA). If a significant main effect was found, a Least Significant Difference (LSD) post hoc test was performed to determine which of the three groups differed significantly from each other. To determine if differences existed between mood groups on their reaction time to colored stimuli, a one-way ANOVA was performed. If a significant main effect was found, a LSD post hoc test was used to determine which of the three groups differed significantly from each other.

Data analyses using a one-way ANOVA showed that the musical MIP was successful in inducing the appropriate mood. A significant difference was found between groups on the positive affect subscale of the MAACL-R, $df = 2$, $F(2,33) = 16.66$, $p < .01$; and a LSD post hoc test revealed a significant difference between the happiness and sadness groups ($p < .01$) and also between the happiness group and the control group ($p < .01$). On the positive affect subscale, a higher score indicates a stronger feeling of happiness by the test taker. The participants who listened to the happy music scored significantly higher on the positive affect subscale ($M = 10.00$, $SD = 5.38$) than participants who listened to the sad music ($M = 3.00$, $SD = 3.46$) and significantly higher than those in the control group ($M = 1.17$, $SD = 2.44$); thereby demonstrating that the individuals who listened to the happy music felt happier than those who listened to the sad music and those in the control group (see Figure 1).

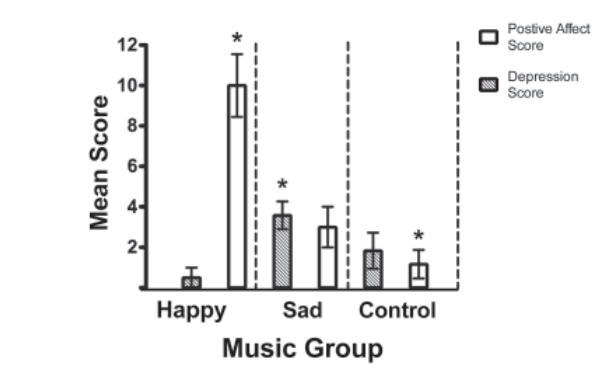
A significant difference was also found between groups on the depression subscale of the MAACL-R, $df = 2$, $F(2,33) = 4.74$, $p < .05$, and a LSD post hoc test revealed a significant difference between the happiness and sadness groups ($p < .01$) on the depression subscale, but no difference between the sadness and the control groups. On the depression subscale, a higher score indicates a stronger feeling of sadness by the test taker. The participants who listened to the sad music scored significantly higher on the depression subscale ($M = 3.58$, $SD = 2.35$) than participants who listened to the happy music ($M = 0.50$, $SD = 1.73$); thereby demonstrating that the individuals who listened to the sad music felt sadder than those who listened to the happy music (see Figure 1).

A one way ANOVA confirmed a significant difference between groups in their reaction times to yellow and blue stimuli, $df = 10$, $F(10, 165) = 2.20$, $p < .02$. A LSD post hoc test revealed unexpected significant differences between the control group and the happiness group ($p < .05$), and between the control group and the sadness group ($p < .05$), such that the control group exhibited significantly slower reaction times to yellow ($M = 1{,}117.48$ ms, $SD = 676.61$ ms) and blue

FIGURE 1

Mean scores of happiness, sadness, and control groups on the positive affect and depression subscales of the MAACL-R.

***Denotes a significant difference.**



(M = 918.68 ms, SD = 328.71 ms) stimuli (see Figure 2). Reaction times to yellow stimuli did not differ significantly between the happiness group (M = 777.86 ms, SD = 180.33 ms) and the sadness group (M = 801.84 ms, SD = 209.25 ms). Additionally, there was no significant difference in reaction times to blue stimuli between the happiness (M = 809.60 ms, SD = 195.49 ms) and sadness (M = 730.79 ms, SD = 131.50 ms) groups. Therefore, the participants who listened to the happy music did not react faster to the yellow stimuli, and the participants who listened to the sad music did not react faster to the blue stimuli (p = .81).

Consequently, the hypotheses that participants in a happy mood would react faster to yellow stimuli and participants in a sad mood would react faster to blue stimuli were not supported by these data. Additionally, a post hoc power analysis confirmed that the sample size (n = 36) had 91% power for detecting a medium-sized effect when employing the .05 criterion of statistical significance, and the effect size proved to be small (η_{p^2} = .05).

Discussion

The aim of this study was to determine if participants in a happy mood react faster to yellow stimuli, and if participants in a sad mood react faster to blue stimuli. The results showed that participants who listened to the happy music felt happier and participants who listened to the sad music felt sadder, indicating that the musical MIP was effective in altering mood. Surprisingly, the participants in the control group who listened to white noise were significantly less happy than the happy group and exhibited a trend to score lower on the positive affect subscale than the sad group, although not significantly lower. This discovery indicates that white noise may not be a neutral sound and may have the ability to alter mood states. These participants may have been in a different mood than the ones for which they were tested.

This study suggests that listening to white noise delays reaction time to colored stimuli. An alternative explanation for this result may be that it is suggestive of the Yerkes-Dodson Law (1908), which states that the relationship between arousal and performance is an inverted-U function. This implies that performance will be low if arousal is low. Participants who listened to the white noise may have found the task repetitive and boring and may have been less stimulated than the participants who listened to the music, consequently hindering performance on the two-alternative, forced-choice task. If white noise does in fact produce a low arousal state, then this study supports the Yerkes-Dodson theory.

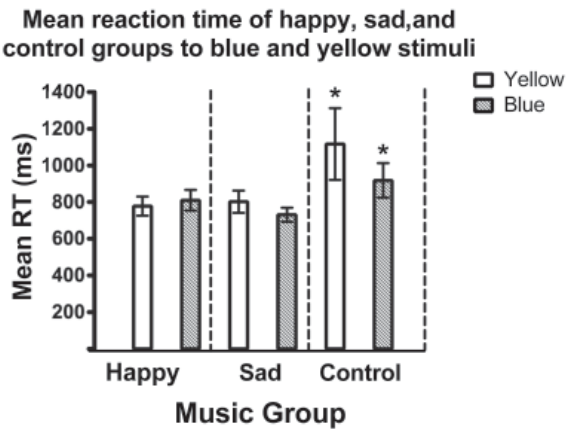
If a faster reaction time to colored stimuli had been observed, it would have suggested a lowered perceptual threshold for that color. The results failed to support this hypothesis. Although the MAACL-R was effective in inducing the appropriate mood, participants in the happiness group did not have faster reaction times to yellow stimuli, and participants in the sadness group did not have faster reaction times to blue stimuli. Unexpectedly, the control group was significantly slower at reacting to both colored stimuli than the happiness and sadness groups. These results are somewhat contrary to previous studies, which showed that being in a sad mood increases the ability to detect blue stimuli (Kunzendorf, 2001). This discrepancy between findings may be due to limitations of this study, methodological differences between Kunzendorf's study and the current study, or may be a truly contradictory finding.

A methodological difference between the present study and Kunzendorf's (2001) study is the choice of the mood induction procedure; the present study used music to induce mood while Kunzendorf instructed participants to self-generate feelings of anger and sadness. The instructions for the musical MIP used in this study asked the participants to determine themselves if the piece of music conveyed a particular mood without explicitly stating the desired mood. This procedure has been shown to control for demand characteristics (Westermann, Spies, Stahl & Hesse, 1996) and to be successful in altering mood (de l'Etoile, 2002; Etzel, Johnsen, Dickerson, Tranel, & Adolphs, 2006; Ferraro, King, Ronning, Pekarski, Risan, 2003; Lewis, Dember, Schefft, & Radenhausen, 1995; Westermann et al., 1996). Moreover, it has been previously shown that happy and sad music are significantly discriminated

FIGURE 2

Mean reaction times of happiness, sadness, and control groups to yellow and blue stimuli.

***Denotes a significant difference.**



by diastolic blood pressure, electrodermal activity, and zygomatic muscle activity involved in the smile response (Khalfa, Roy, Rainville, Dalla, & Bella, 2008) which suggests that happy and sad music cause physiological changes in the listener that could potentially be attributable to changes in affect. Kunzendorf's mood-induction procedures consisted of instructing the participants to "generate feelings of anger and sadness." By explicitly stating the mood to be achieved, demand characteristics may have been present and could account for the differences in results. Participants may have falsely reported feelings of anger and sadness in order to comply with experimental demands, and/or they may have deduced the purpose of the study, making it possible that this effect could account for the differences in results. Although research has found explicitly stating the desired mood is more successful in inducing the desired mood (Westermann et al.), it could be argued that the operational definition of "successful" typically relies on self-reports that again, may be attributable to demand characteristics.

Another methodological difference between Kunzendorf's (2001) study and the present study is the choice of the dependent variable. The present study examined reaction time required to perceive a colored stimulus, while Kunzendorf examined accuracy of locating a colored stimulus with an angry or sad face. One interpretation of the differences in results could be that sad people may be more accurate at indicating the location of blue stimuli because they are more apt to notice the color, but that they perceptually need the same degree of intensity in order to perceive it. The present study suggests that the mechanism proposed by Kunzendorf (2001) in order to explain the findings of his study (i.e., the neural threshold of perception of blue stimuli is lowered during feelings of sadness) may not be the mechanism at work.

Another possibility for the difference in results may be attributable to the music itself and not related to the mood induced by the music. In 1993, Rauscher, Shaw, and Ky found that exposure to a Mozart sonata enhanced performance on visuospatial tasks and they coined this phenomenon the "Mozart Effect." Similar studies have also found support for an effect of classical music on performance (Nantais & Schellenberg, 1999; Rideout, Dougherty & Wernert, 1998; Wilson & Brown, 1997). However, there are also many studies (Carstens, Huskins, & Hounshell, 1995; Hui, 2006; Kenealy & Monsef, 1994; McCutcheon, 2000; Newman, Rosenbach, Burns, Latimer, Matocha & Vogt, 1995; Steele, Bass & Crook, 1999) that failed to show support for the so-called Mozart Effect. Meta-analyses have provided contradictory support for this effect, as weak support has been found (Chabris, 1999) and stronger support has been found (Hetland, 2000). It could be argued that the present study shows support for Rauscher, et al. (1993) Mozart Effect as participants who listened to the classical music responded faster to the colored stimuli than participants who listened to the white noise. However, due to the conflicting findings of previous studies investigating the effects of classical music on performance, it is not possible to make any strong conclusions regarding the present study as being suggestive of a Mozart Effect.

One limitation of the current study was that the participants comprised a small convenience sample of nearly all women (34 women and 2 men). Previous literature regarding gender differences in color-mood associations has been conflicting. While no gender differences in color-mood relationships have been reported (Wexner, 1954), others have found that women are more likely than men to relate blue to sadness and yellow to happiness (Peretti, 1974a; Peretti, 1974b). Based on Peretti's results (1974a; 1974b) one could assume that because this study consisted of mainly female participants, any effect of mood on the perception of yellow and blue stimuli may have been exaggerated. However, because significant effects were not detected, it is reasonable to assert that a difference between the reaction times of the happiness and sadness groups to yellow and blue stimuli may not exist. Conversely, due to the limitations of the sample size and makeup, it is impossible to evaluate gender differences or to generalize the results.

Another potential limitation of the current study was that color vision deficiencies were not tested. Although none of the participants reported known color vision defects, there is the potential that some participants suffered from color vision problems outside of their awareness. Any future research in this area should test color vision by administrating the Ishihara Test for Color Blindness (1917), or a comparable test of this nature, to ensure that color deficiencies do not confound the data.

In examining the effects of mood on color perception, future researchers could employ different techniques to measure perceptual threshold of color after administering a mood induction procedure. Reaction time has been reported to be one of the most common measures of neurological function (Crabtree & Antrim, 1988), and some researchers have found that cognizant intention to act appears only after a delay of approximately 350–400 ms from the onset of cerebral activity that precedes a voluntary act (Libet, 1993). In contrast, Hanes and Schall (1996) state that humans' reaction times tend to be long and variable relative to neural transduction and transmission times because decision processes interfere. Therefore, the use of reaction time

to measure neural threshold has its limitations. Other procedures, however, may be more useful in measuring threshold values, such as the method of constant stimuli, the method of adjustment, the method of limits, or the staircase procedure. These procedures would allow one to determine an average absolute threshold value for each group (happy, sad, and control) and to compare those values to see if there are significant differences between them. Future researchers should avoid using a white noise stimulus for the control group because it has been shown to cause significant effects on reaction times to colored stimuli. Alternatively, one could use a "no-music" group or "no mood induction" group as a control group. Data gained from such research would be an informative addition to the study of color and emotion.

A second direction future research could take would be to investigate the effects of white noise on visual threshold. Past research in this area has been scarce and discordant. In one study, perceived intensity of red, green, and blue lights was increased under white noise conditions at 100 db (Chason & Berry, 1971). Another study found large individual differences in the effect of white noise on visual threshold (Ince, 1968). It is suggested that future research examine the effect of white noise using different threshold-measuring procedures such as the method of constant stimuli, in order to provide evidence for a possible visual threshold-altering mechanism.

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The Generation Effect in the Context of Lyrical Censorship

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When peope are actively involved in generating information (e.g., solving a word fragment), they tend to remember that information better than when they process the information more passively (e.g., hearing a word). This phenomenon—the generation effect—has been applied to numerous settings including the field of education (e.g., teaching, learning, mathematics) and marketing (e.g., advertising). The current study reviewed the applied generation effect literature and then explored this effect within a new applied setting—lyrical censorship. Participants listened to and shadowed an original song which contained a mixture of partially or completely censored nouns. Participants were asked to repeat every word and generate the censored words throughout the song. Results showed an ironic effect of censorship: censored items were remembered significantly better than heard items. Results and implications are discussed.

One of the classic benchmark phenomena in the human memory literature is the generation effect (Hirshman & Bjork, 1988; Mulligan & Duke, 2002; Serra & Nairne, 1993; Slamecka & Graf, 1978). The generation effect refers to the finding that people remember information better when they are actively involved in generating that information such as the word fragment *f_otball*, than when they simply read the complete word *football*. Although using word fragments is a common manipulation in the generation effect literature, researchers have employed a variety of methods, including letter transposition, word stem completion, paired-associate generation, and picture fragment completion, to name but a few (Kinjo & Snodgrass, 2000; Mulligan, 2002; Mulligan & Duke, 2002). Moreover, researchers have demonstrated robust generation effects with a range of testing procedures including explicit free recall and recognition (Burns, 1990), explicit serial recall and reconstruction of order (Kelley & Nairne, 2001; Nairne & Kelley, 2004), and implicit memory tests (Mulligan, 2002; Nicolas, Ehrlich, & Facci, 1996).

On the Generality of the Generation Effect

In an attempt to assess the generality of the generation effect, many studies have explored the influence of generation across the lifespan, from childhood through adulthood and into old age (e.g., Nicholas et al., 1996; Pesta, Sanders, & Nemec, 1996). For instance, McFarland, Duncan, and Bruno (1983) asked children aged 7, 9, 11, and 13 to generate or read words from semantic or phonetic categories for a subsequent test (free recall, recognition, or rhyme recognition). They reported that generation ability increased substantially from age 7 to 13, with older children able to generate both semantic and phonemic categories. Clearly, children must attain a certain level of cognitive maturity before they can fully benefit from the generation effect (McFarland et al., 1983).

The majority of research on the generation effect has involved college-aged participants and has shown robust memory enhancement for generated materials (e.g., Hirshman & Bjork, 1988). However, some studies have directly manipulated the ages of adults and have shown that the generation effect is present across the

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lifespan, although its size is often reduced in old age (e.g., Taconnat et al., 2006; Troyer, Häfliger, Cadieux, & Craik, 2006). For example, Taconnat, Froger, Sacher, and Isingrini (2008) compared generation abilities for younger adults (20-36 yrs) and older adults (60-81 yrs). Participants were asked to generate or read lists of strong- or weak-associate pairs and then complete a cued-recall test. They showed that the magnitude of the generation effect did not differ between younger and older adults with strong-associate lists; however, younger adults exhibited a stronger generation effect for the weak-associate lists. Despite a reduction in magnitude, generation remains a useful mnemonic device throughout the lifespan.

Importantly, the act of generation also has been shown to benefit people with a variety of physical and cognitive impairments, including sufferers of multiple sclerosis (Basso, Lowery, Ghormley, Combs, & Johnson, 2006), traumatic brain injury (Lengenfelder, Chiarvalloti, & DeLuca, 2007), dementia of the Alzheimer's type (DAT; Barrett, Crucian, Schwartz, & Heilman, 2000), as well as other memory impairments (Tailby & Haslam, 2003). For instance, Multhaup and Balota (1997) examined healthy older adults (mean age 77), very mild DAT adults (mean age 76.7), and mild DAT adults (mean age 76.1). Using a counterbalanced within-subjects design, participants completed sentence fragments in an experimenter-participant task (half of the endings were completed by the experimenter; half by the participant) and a generate-read task (half required generation; half did not). The subsequent recognition test also employed a source judgment (experimenter- or participant-generated?; read or generated?). Multhaup and Balota reported significant generation effects for all three groups of participants (11% and 15% advantages for the experimenter-participant and generate-read tasks, respectively). Although reliable for each group, the magnitude of the generation effect declined with DAT severity. Furthermore, source monitoring accuracy declined as dementia increased across the groups.

Applications of the Generation Effect

Unlike many benchmark phenomena in the memory literature, the generation effect has clear applications to everyday life outside the laboratory. In particular, the mnemonic benefits of self-generation have been studied extensively in educational settings (e.g., Boyle & Weishaar, 1997), in the marketplace (e.g., Thompson & Barnett, 1981), and in other common, real-world situations (Kelley, Goldman, Briggs, & Chambers, 2009).

Learning. Research suggests that the generation effect can facilitate student learning (e.g., DeWinstanley & Bjork, 2004). That is, when attempting to learn new information, the act of generating the material has a strong memory advantage over simply reading the material. For instance, Foos, Mora, and Tkacz (1994) compared student-generated questions and outlines with experimenter-generated questions and outlines. On an exam conducted 2 days after receiving/generating the outline and questions, the groups that generated their own study material scored significantly higher than the groups that received the experimenter-generated study material. Clearly, students can take advantage of this mnemonic benefit in an educational setting.

Mathematics. Along with learning and teaching, the generation effect has been shown to facilitate memory for mathematics problems. For instance, McNamara and Healy (2000) explored the influence of generation with simple and difficult multiplication problems. Participants were asked to generate half of the math problems (both simple and difficult) and read the remaining half. Although a generation effect was found in both conditions, a stronger generation effect was found with the simple math problems compared to the difficult math problems (for similar results with small versus large product-size problems, see Pesta et al., 1996).

Marketing and advertising. The generation effect has also been demonstrated successfully in marketing settings. For instance, Reardon and Moore (1996) created 19-min audio segments that contained 10 advertisements, three public service announcements, and three songs. The target advertisement was for an Optimax 35-mm camera, whose brand name was presented five times to each participant. The generation opportunity came at the end of the advertisement when a voice asked, "Hey, what was the name of that new camera again?"; this line was not included in the control advertisement. Following a short distractor task, participants were given a surprise cued recall test with 56 product names, including the target product. Participants were also asked to rate their confidence level of actually hearing the product name during the audio clip. Results indicated a significant generation effect—participants in the generation condition remembered the camera name significantly better than participants in the control condition. Hence, Reardon and Moore (1996, see also, Thompson & Barnett, 1981) were able to use the generation effect to help increase the recall of the brand name, which presumably might influence sales of that product.

The generation effect has also been demonstrated with print advertisements. For example, Sengupta and Gorn (2002) used print advertisements with two experimental conditions (element-absent and element-present) to test subsequent recall for Olympus cameras. The element-absent condition depicted a bare-chested male displaying the outline of a camera and its strap,

while the element-present condition depicted the bare-chested male with a real camera and strap. After viewing several print media pictures, participants were asked to complete a product and brand questionnaire. In addition, participants were asked to list everything they could remember regarding the specific image in question (i.e., the Olympus camera). The results indicated a generation effect—enhanced recall in the element-absent condition.

Lyrical censorship. Recently, Kelley, Goldman, Briggs, and Chambers (2009) explored the generation effect within the context of lyrical censorship. In their study, participants listened to an original song that contained 30 nonoffensive nouns—15 of which were either completely-censored or partially-censored and 15 of which were not. In the partially-censored condition, the word's initial phoneme was audible (e.g., the *t* sound in *tree*), while in a completely censored condition, the whole word was omitted. Participants were asked to shadow the lyrics as they were presented—repeating every *heard* word and generating every *censored* word—while an experimenter recorded the shadowing/generating accuracy. After song presentation, participants received a short distractor task where the participants gave a rating for their opinion of the song and then completed a forced-choice recognition test with a source component (e.g., if item was from song, was it heard or censored). An ironic effect of censorship was found for generating lyrics. If the participant successfully generated the censored lyric during presentation, his/her memory was enhanced by almost 20% over the heard items. Unfortunately, the generation task proved difficult for participants as they generated only 46% and 31% of the items in the partial and complete conditions, respectively. Moreover, source memory generally was poor. In other words, participants were poor at determining whether they actually heard a word or if that word was censored. Participants more often recalled that they heard the word when, in fact, it had been censored. Source memory was measured by calculating the sum of both the censored and not censored items and then dividing the sum by all of the censored and not censored items that were "recognized." The current study is designed to replicate and extend the work of Kelley et al. (2009).

Present Experiment

The low generation rate reported by Kelley et al. (2009) could have been due to impoverished contextual information at the time of generation. That is, the necessary contextual information did not always precede the censored items, but often occurred within the next few lines of the song. To remedy this, participants in the current experiment were allowed to listen to the entire song once—so they could understand the complete context—before they heard it again while completing the shadowing/generating task. Following a short distractor task, participants completed a similar forced-choice recognition test as used by Kelley et al. (2009) with one exception—the source recognition task was eliminated. Specifically, participants were forced to determine whether the word was from the song (either heard or censored) or whether it was a new item (distractor). By having participants hear the entire song before shadowing/generating, we expected that (a) participants would generate a greater proportion of items than on the previous experiment and (b) that they would remember the censored items better than the heard items.

Method

Participants

Twenty-four students from an introductory psychology course at a small liberal-arts college in the Midwest earned extra-credit for their participation in this task. Participants were tested individually in sessions lasting approximately 20 minutes. Stimuli were presented and controlled in a small testing room with a desktop computer.

Materials and Design

Thirty nonoffensive, high-frequency nouns were obtained from the Kucera and Francis (1967) norms with an average frequency of 241.72 (occurrences per million written words), a range of 107-787, and an average word length of 5.38 letters with a range of 4-7. Using each of the 30 target nouns, an original song consisting of 306 words was created about the start of a beautiful relationship between a man and a woman. A male vocalist recorded this song with the use of an acoustic guitar and a keyboard. Multiple versions of the song were created, with 15 of the nouns being intact (e.g., island, hand, friend) and 15 were censored, (e.g., market, voice, family). Censoring was accomplished by erasing the word (e.g., market) so no sound occurred at that point during the song. The censored words were either completely censored (eliminated from the song leaving a silent spot), or partially censored, leaving the word's initial phoneme audible (e.g., the *t* sound in *tree*).

In order to allow each noun to be presented equally often as a censored word and as an intact word, multiple versions of the song were employed. Thus, the second version counterbalanced the 15 censored nouns with the 15 intact nouns so that each word was presented in the same quantity across the participants. Overall, 5.5% of the words in the song were censored. Another 30 nouns were matched on all of the above

characteristics (i.e., frequency and word length) to pair together the censored/noncensored nouns and to serve as distractors in the recognition test following the completion of the experiment. The average frequency for the nouns in the song was 178.72 with a range of 101-470 and an average word length of 5.81 letters with a range of 4-7.

Kelley et al. (2009) provided an item analysis which reported the generation rate and recognition accuracy for each item when censored and not censored. This analysis showed the generation effect for 24 of 30 words. Additionally, there was no effect of generation rate. In other words, both easy and hard to generate items displayed the generation effect.

A 30 s clip of the theme song from the television show *Cheers* was used in a shadowing practice session. Participants were provided with a pair of headphones in order to listen to the lyrical song.

Procedure

Participants were given a brief set of instructions (see appendix) via the computer, prior to the start of the experiment. Participants received shadowing practice prior to hearing the experimental song. In other words, each participant was asked to repeat every word aloud. After completing the 30 s shadowing practice, participants listened to the entire version of the appropriate song for their condition (about 5 min long). Following the first song presentation, participants were asked to shadow the song lyrics while an experimenter recorded their shadowing/generating accuracy. During this phase, participants were instructed to fill in the censored words to the best of their ability. After the shadowing task, participants completed a short distractor task, rating the song on various qualities (e.g., pleasantness of the music). Finally, participants completed a 60-item, forced-choice recognition test, where they were asked if the noun was an old item (i.e., heard or censored from the song) or if the noun was a new item (distractor word that was not in or censored from the song).

Results and Discussion

Overall Recognition

Overall recognition performance was analyzed with a 2 (generation type: partial vs. complete) x 3 (stimulus type: not censored, censored, distractor) mixed-factor ANOVA (see Figure 1). Only the main effect of stimulus type reached statistical significance, $F(2, 44) = 163.13$, $p < .001$ (see Table 1 for complete ANOVA information). A Newman-Keuls post-hoc analysis revealed that recognition accuracy was statistically equivalent for noncensored and censored words and performance in both conditions exceeded the false alarm rate for distractor items. The ANOVA did not reveal any other significant main effects or interactions. These results are consistent with Kelley et al. (2009)—namely, the overall data failed to produce a traditional generation effect. Kelley et al. (2009) suggested that, with the overall data, the generation effect might have been masked by the fact that not all censored words were generated. To control for this, a separate *conditional* analysis was run in which data inclusion was made conditional upon successful shadowing of noncensored items as well as successful generation and shadowing of censored items.

Conditional Recognition

After hearing the complete song once, participants successfully generated 51% ($SD = 10\%$) of the partially-censored items and 29% ($SD = 9\%$) of the completely-censored items. Recognition performance on the conditional data was analyzed with a 2 (generation type: partial vs. complete) x 3 (stimulus type: not censored, censored, distractor) mixed-factor ANOVA (see Figure 1). The ANOVA revealed a significant main effect of stimulus type, $F(2, 44) = 231.47$, $p < .001$. A Newman-Keuls post-hoc analysis revealed a *traditional generation effect*—recognition accuracy for generated censored items was significantly higher than the noncensored items and both means far exceeded the false alarm rate. Once again, neither the main effect of censorship

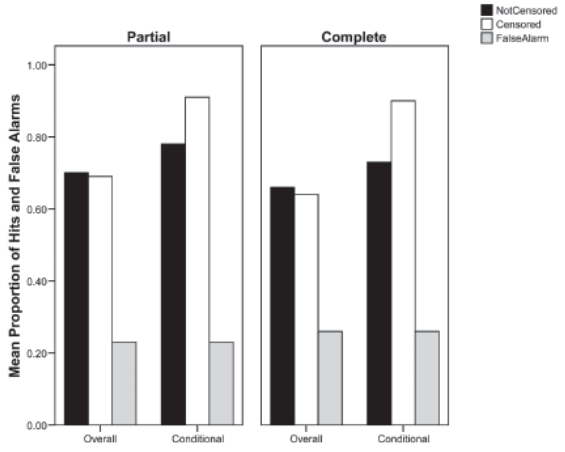
TABLE 1

ANOVA Results for Overall and Conditional Data

Overall	
Main Effect of Generation Type	$F(1, 22) = .10$; $p > .05$
Main Effect of Stimulus Type	$F(2, 44) = 163.13$; $p < .001$
Interaction	$F(2, 44) = 1.24$; $p > .05$
Conditional	
Main Effect of Generation Type	$F(1, 22) = .07$; $p > .05$
Main Effect of Stimulus Type	$F(2, 44) = 231.47$; $p < .001$
Interaction	$F(2, 44) = .82$; $p > .05$

FIGURE 1

Mean proportion of hits and false alarms as a function of stimulus type (not censored, censored, distractor), censorship type (partial, complete), and analysis type (overall, conditional).



type nor the interaction reached statistical significance. Indeed, a similar pattern of performance was apparent for both the partial (.91 > .78 > .23) and complete (.90 > .73 > .26) censorship conditions. Therefore, when censored words were generated successfully at encoding, those words were significantly more memorable than noncensored (heard) words.

The present investigation was designed to replicate and extend the findings of Kelley et al. (2009). One criticism of their original study was that generation rate was rather low (46% and 31% for the partial and complete censorship conditions, respectively). We posited that generation rate might be enhanced if participants heard the entire song because participants would understand the song's full context prior to completing the shadowing/generating task. Hearing the song twice only elicited a nominal improvement in generation rate for the partially-censored items (51% compared to 46% in previous study) and did not appear to influence generation rate for completely-censored items (29% vs. 31%). Clearly, complete censorship is a more effective technique than partial censorship. Yet, adult participants were still able to generate at least a portion of the omitted items. Despite these low generation rates, when participants successfully generated an item, they tended to remember it extremely well. Collapsed across the partial and complete conditions, generated censored items enjoyed a 15% mnemonic benefit over uncensored, heard items. Somewhat ironically, then, omitting song lyrics can actually enhance memory for words that are censored. Censoring words did not appear to increase memory for the noncensored nouns. However, this could be tested by having a condition in which the entire song was heard and comparing performance for the heard items in a song without censorship versus the heard items in a song with censorship. To date, most generation effect literature shows the benefits are specific to the generated material.

One obvious limitation of the current study is that it used a sample of college students and censorship generally is intended for a younger audience. Because children are often impressionable, future research should focus on whether the generation effect with song lyrics occurs among youths. As described earlier, McFarland et al. (1983) showed that the generation effect in children was weak at age 7 but developed steadily until age 13, when the generation effect began to appear as for adults. Hence, one would expect even lower generation rates by young children. Moreover, many of the words that are typically censored from songs may not even be known to the children—they cannot generate what they do not know.

Another direction for future research might investigate the generation effect with regard to censorship of explicit versus nonexplicit words. Within the current study, the use of nonoffensive nouns was thought to be a tougher test of the lyrical generation effect. This is because offensive censored words contain a small, known set of items, which should make retrieval easier. If offensive words were used, memory performance might show a ceiling effect—regardless of whether the word was heard or generated. On the other hand, the nouns used in this study were derived from a huge set of all-high-frequency nouns, which in turn makes for a tougher test.

The present findings suggest that memory enhancement can occur when college-aged students were able to generate censored lyrics. This was apparent when the data was made conditional. In other words, during the encoding phase, participants showed a standard generation effect when they were able to successfully generate a censored word (i.e., listening and shadowing the song). Additionally, when participants recognized a word which was either heard or censored, they were more likely to report that word as "heard." Obviously, future research with different populations and types of words is needed before the generality of the lyrical generation effect can be assessed.

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APPENDIX

General Instructions

I'd like to begin by thanking you, in advance, for your participation in this research study. A lot of research in psychology depends on the participation of individuals like yourself, so we're very grateful for your help.

That being said, I would like to remind you that participation is completely voluntary and you can stop participating at any time without the risk of any negative consequences.

Press 'c' to continue

Today's experiment consists of four brief phases.

In Phase 1, you will be asked to listen to a song. You will notice that certain words in the song have been censored or omitted. Your task will be try to understand the content of the song for a later memory test.

Press 'n' to go to next page

In Phase 2, you will hear the song again and will be asked to verbally shadow the song. "Shadowing" simply means that you will say EACH word in the song ALOUD as you hear it. For instance, you might hear the lyric, "She opened the book and began to ____ the story to her child."

Try to determine the identities of these missing words and say them ALOUD while shadowing. In this example, you might guess that the missing word is "read." So, when you are shadowing you would say, "She opened the book and began to read the story to her child."

It is important the you shadow (say) EVERY word and try to identify as many of the censored words as possible. The experimenter will sit behind you and record your shadowing behavior.

Press 'c' to continue

In Phase 3, we will ask your opinion regarding certain aspects of the song. You will be given nine statements and you will be asked to choose the one option that best reflects your opinion on the statement. The options are: strongly agree, mildly agree, unsure, mildly disagree, and strongly disagree.

The first five statements will assess how pleasant, interesting, and realistic the song's music and lyrics were. The next three statements will assess whether the presence of censored items affected your enjoyment and comprehension of the song. The final statement will gather information regarding your overall enjoyment of the song.

Please press 'n' to go to next page.

In Phase 4, you will be given a short recognition memory test. You will view a series of words and you will be asked to decide whether a) the word was from the song and was either heard or censored, or b) the word was neither heard nor censored.

To recap, you will listen to a song once, then you will shadow the song while attempting to identify the censored words. The song will be followed by a brief questionnaire, which will then be followed by a short recognition memory test.

At this point, please let the experimenter know that you've finished reading the instructions. Feel free to ask any questions at this time.

Have the experimenter press 's' to move on.

Now that any questions have been answered, let's practice shadowing. In a moment, you will hear a 30 s audio clip of a popular theme song from a 1980s television show.

You may find it helpful to listen to a few words and then begin shadowing. Try your best to keep up with song, though.

Press 'p' to practice shadowing

Shadowing practice complete.

Now, it is time to listen to the song. Pay careful attention to the lyrics and try to understand the song's content. As you know, your memory for the words in the song will be tested later.

Please place the headphones on your head.

Press 'p' to play the song.

Song Presentation Complete.

Now, we will record your shadowing behavior for the song. As you hear the song again, be sure to SAY every word ALOUD and to try to IDENTIFY any of the missing words as you hear them.

You may find it helpful to listen to a few words and then begin shadowing. Try your best to keep up with song, though.

PLEASE TELL THE EXPERIMENTER THAT YOU ARE READY TO START SHADOWING.

Have the EXPERIMENTER press 's' to start the shadowing task.

Song shadowing is complete.

Please complete the following opinion questionnaire.

Press 'b' to begin.

Priscilla Miranda

Nicholas McCluskey

Benjamin J. Silber

Christian M. D. von Pohle

Charlene K. Bainum*

Pacific Union College

Effect of Adult Disapproval of Cartoon Violence on Children's Aggressive Play

Studies show that children's exposure to violent media increases aggression (Browne & Hamilton-Giachritsis, 2005). Alternatively, in some cases parental involvement suppresses aggression (Singh et al., 2006). We hypothesized that children's behavior would be less aggressive after viewing a violent cartoon with an aggression-disapproving adult (ADA) than with a silent adult (control condition). Second and third graders (6 boys, 10 girls) were randomly assigned to either the ADA or control condition to watch a violent cartoon clip. Afterwards, children played with a variety of toys while observers recorded their behaviors using a 30-second time-sampling method. Children in the ADA condition showed significantly less toy and verbal aggression than those in the control. The parental role in children's media viewing is discussed.

In the classic Bobo doll study, Bandura, Ross, and Ross (1961) demonstrated that aggressive behavior modeled by authoritative adults would elicit this same behavior from the observing children. From this study, a virtual cottage industry of research using variations on the theme of aggressive modeling emerged. For example, in a study conducted by O'Carroll, O'Neal, McDonald, and Hori (1977), children who observed a child confederate play with toys aggressively were more likely to act aggressively later in the presence of that child than in the presence of a different child. This suggests that the actual child modeling aggression contains cues for aggression over and above the modeled aggressive behavior. In some way, the presence of this aggressive model affects the amount of later aggression.

Although aggressive modeling has been the primary focus of the Bandura et al. study (1961), the often-ignored non-aggressive models in that study are central to understanding how to reduce violence. Children who observed non-aggressive models spent significantly more time sitting passively than those exposed to the aggressive models. Also noteworthy is research by Singh et al. (2006) examining autistic children and parenting style. Mothers of autistic children were given training on mindful parenting, which consisted of remaining calm and dealing with the actions and attitudes of the child in a nonjudgmental way, as well as considering alternative options for situational responses. This specialized form of intervention, implemented across an extended part of the child's day, was found to have a direct effect on reducing the children's noncompliant behavior. Most relevant to the present study, mindful parenting styles exhibited by the authoritative figures reduced prior aggressive behavior.

However, more studies note the impact parenting styles have on children's increased aggressive behavior. For example, Carroll (1977) reported that children who experienced a physically punitive environment were more likely to display the same type of physically punitive behaviors with others. Similarly, Comstock (2005), who monitored children of abusive parents, found that a major contributing factor to whether these children became abusive themselves as adults was their direct exposure to physical violence in the home. Further, Williams, Conger, and Blozis (2007) focused on adolescents and found that the amount of parental hostility predicted interpersonal aggression among siblings.

Other studies examined whether television would provide the same effect as a live model. In particular, Boyatzis, Matillo, and Nesbitt (1995) found that chil-

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dren exposed to the Power Rangers television show committed more aggressive acts per interval than children in the control group. Browne and Hamilton-Giachritsis (2005) thoroughly investigated 108 studies linking aggression and media on children and adults. Children who were exposed to violent scenes in video games, television shows, and movies, experienced aggressive and violent behavior. Browne and Hamilton-Giachritsis concluded that violent or aggressive media produced short-term effects in individuals' arousal, emotions, and thoughts, as well as their relative frequency of both aggressive and fearful behaviors. In short, numerous studies evaluating the effects of an aggressive model on the subsequent aggressive behavior of the observing child provide consistent evidence that exposure to violence, whether live or electronic media, increases violent behavior (Anderson et al., 2003; Bushman & Anderson, 2001; Huesmann, Moise-Titus, Podolski, & Eron, 2003).

Despite these established findings, television continues to provide aggressive programming and parents continue to allow their children to view these programs. Although parents are often urged to sit down and watch television with their children in order to explain what is viewed, exactly how parents help to counteract the impact of media violence and whether their efforts are effective is unclear. Who has a greater impact as a model? Will the child be more influenced by the aggressive action figure who obliterates the bad guy, or the parent who explains to the child that violence is not the best solution? If a child witnesses aggressive television, but an authority figure models disapproval of violence, how then would the child respond?

The present study sought to determine how the modeling of aggression disapproval by an adult watching a violent cartoon with a child, influences the child's later behavior during separate play activity. To this end, we examined four types of aggressive behavior as well as the incidence of neutral and prosocial play. These four aggressive behaviors included verbal aggression, physical aggression, toy aggression, and aggression toward toy. It was hypothesized that children who viewed the violent cartoon in the presence of an actively aggression-disapproving adult (ADA) would show less of all four types of aggressive behaviors in subsequent play than those who viewed the same cartoon with a silent adult. Additionally, it was hypothesized that children in the ADA condition would exhibit more prosocial play than those with the silent adult.

Method

Participants

There were 16 participants from the second and third grades (6 boys, 10 girls), attending a small private elementary school in northern California. Although all children whose parents signed parental consent forms were selected as participants, the children signaled their additional consent when asked if they would like to play with toys in another classroom.

Materials

The video clip consisted of the last 5 minutes of the *Justice League of America* episode entitled *"For the Man Who Has Everything."* The clip was downloaded onto a laptop for portability when connected to the classroom television for viewing. The toys with which the children were allowed to play in the observation room included several stuffed animals, a set of plastic dinosaurs, several dolls, and a set of Justice League of America action figures: Superman, Batman, Wonder Woman, Bizzaro, and Amazo. A pre-recorded track providing audio cues for ten 30-second time increments was downloaded onto three iPods for the time-sampling observation. Observers who were blind to the child's condition used an aggression behavior data recording sheet to mark the occurrence of six categories of behavior. The following operational definitions were used: a) verbal aggression—name calling or yelling at another person; b) physical aggression—touching another person with negative intent to hurt or humiliate; c) toy aggression—using a toy with negative intent toward another person or toy; d) aggression toward toy—inflicting violence or harm on the toy; e) prosocial play—playing with or using toys in a positive or helpful way; and, f) neutral play—playing in a way that is neither aggressive nor prosocial (see Appendix A).

Procedure

The children were randomly assigned to one of two conditions. The control group was exposed to a 5-minute video clip of the *Justice League* cartoon with a silent female adult present. This adult merely sat with the children and watched the cartoon without comment or judgment. In the experimental group, children were exposed to the identical 5-minute clip of the *Justice League* cartoon in the presence of the same female adult. However, this time, the female confederate made the following aggression-disapproving remarks after each aggressive act in the cartoon, while watching with the children: "Oh, how terrible!", "Well, that's not very nice!", "They shouldn't do that!", or "He shouldn't hit him like that." Immediately following the video clip, the children were escorted to a nearby classroom for observation while they played with toys. The toys in the room included both neutral toys, such as dolls, plastic dinosaurs, a soccer ball, a football, and stuffed animals unrelated to the cartoon, as well as toys explicitly related to the recently viewed cartoon, like plastic figures of

Bizarro, Superman, Wonderwoman, and Batman. In the classroom, four male observers recorded the occurrence of four types of aggressive behavior, as well as neutral and prosocial play, using a 30-second time sampling format.

Before live observation began, observers trained on a videotape in the laboratory using the aggression behavior data sheet until they attained a minimum of .75 inter-observer reliability. Further, inter-observer reliability of .80 was established on observations of a selected sample of children before actual data collection occurred. Although the children were in the playroom for 10 minutes, each child was only observed for 5 minutes. The order that the children entered the playroom determined which observer was assigned to observe their play. The observers were blind to which condition the children were in when in the playroom. As the children entered the playroom, the observers knew which child to observe through a previously established order (e.g., the first, fifth, ninth, and thirteenth child to enter the classroom was assigned to observer one).

Results

Initial Analyses

Descriptive statistics. Table 1 contains means, standard deviations, and comparisons among all study variables. In general, there were significantly fewer instances of aggression in all categories for the experimental group.

Primary Analyses

The first hypothesis, that children who viewed the violent cartoon in the presence of an actively aggression-disapproving adult (ADA) would show less of all four types of aggressive behaviors in subsequent play than those who viewed the same cartoon with a silent adult, was examined by using an independent samples *t*-test. An analysis of the data revealed significant differences between the ADA and control conditions in two categories. Specifically, the children in the ADA condition ($M = .25$, $SD = .46$) demonstrated significantly fewer instances of verbal aggression than those in the control condition ($M = 1.38$, $SD = 1.30$), $t(14) = -2.30$, $p = .04$. A measure of effect size also demonstrated a relationship between adult disapproval of aggression and later incidence of verbal aggression, Cohen's $d = -1.21$. Additionally, children showed less toy aggression in the ADA condition ($M = .13$, $SD = .35$), than in the control condition ($M = 1.25$, $SD = 1.04$), $t(14) = 2.01$, $p < .01$. A measure of effect size also demonstrated a relationship between adult disapproval of aggression and later incidence of toy aggression, Cohen's $d = -1.35$. Although there were no significant differences found for the other two aggression categories, children showed less physical aggression in the ADA condition ($M = .25$, $SD = .46$) compared with the control ($M = .75$, $SD = 1.17$), $t(14) = 1.13$, $p = .29$.

The second hypothesis was that children in the ADA condition would exhibit more prosocial play than those with the silent adult. When analyzed with an independent samples *t*-test, our second hypothesis was not supported. There was no difference in prosocial play between children in the ADA ($M = 1.13$, $SD = .84$) and control conditions ($M = 2.25$, $SD = 2.77$), $t(14) = 1.10$, $p = .30$.

Discussion

As predicted, less aggressive behavior was exhibited in the ADA condition than in the control condition.

TABLE 1

Means and Standard Deviations of Aggressive, Neutral, and Prosocial Incidents per 5 Minute Interval Between ADA and Control Groups

	ADA[a]		Control[a]	
Behavior	*M*	*SD*	*M*	*SD*
Verbal*	.25	.46	1.38	1.30
Physical	.25	.46	.75	1.17
Toy*	.13	.35	1.25	1.04
Towards Toy	.13	.35	.25	.71
Neutral*	9.50	1.07	7.88	.99
Prosocial	1.13	.84	2.25	2.77

[a] $n = 8$ for each condition.
* $p < .05$

In particular, verbal aggression and toy aggression occurred significantly less often. These findings are consistent with previous research by Boyatzis, Matillo, and Nesbitt (1995) showing the effects of authoritative modeling of television violence on children's aggression. By introducing an aggression-disapproving adult model into our study, we sought to create a similar condition to the home environment. In this way, our adult model would be comparable to the parent or guardian who watches an aggressive television program along with the child and remarks negatively about aggressive actions.

Consequently, if we were to generalize from these findings, even children who watch an aggressive television program with an adult present will later display more aggressive play than those children who watched the same program with an adult who actively disapproved of the aggressive actions on the screen. In our study, adult attempts to counteract the aggressive cartoon seemed successful because there was less subsequent aggression by these children and verbal agreement with the adult's disapproving statements. When the adult made aggression disapproving comments, several children audibly agreed, making such statements as "Yeah, he shouldn't do that, huh?", "Oh wow, that IS terrible!", and "He's not nice, is he?" The children's agreement could be seen as evidence that the children were aware that the adult did not approve of the cartoon violence and were influenced by the adult. In contrast, the children did not say anything while watching the cartoon violence with a silent adult.

Although the children in the ADA condition may have displayed less aggressive behavior in the short-term, we did not measure long-term effects. They may have been affected by the aggressive programming later, and especially if they experience repeated viewing of violent media, they may become desensitized to future violence. A longitudinal study by Huesmann et al. (2003) shows this effect. They found that exposure to media violence in childhood is highly correlated with young adult aggressive behavior in men and women. This behavior persists even when influences such as socioeconomic status, intellectual ability, and several parenting factors are controlled.

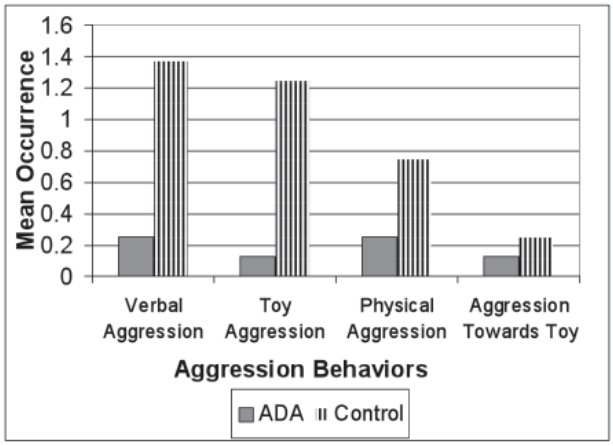
A statement released by six major professional societies declared that over 1,000 studies up to that year pointed to a causal connection between media violence and aggressive behavior among children (Joint Statement, 2000). In addition, the statement reported that based on over 30 years of research, the public health community concludes that viewing media violence can increase aggressive attitudes and behavior, mostly among children. Anderson et al. (2003) reported that violent television and films increase the likelihood of aggressive and violent behavior both in short-term (aggressive behavior, thoughts, and emotions) and long-term (physical attacks, domestic abuse) situations.

Perhaps in an ideal world, parents would restrict their children's television viewing to nonviolent educational and entertainment programming, and provide alternative activities to enrich their children's development. However, because many children are not monitored while watching violent programs on television, it is important for parents to realize that they can lessen the impact of this exposure through vigilant involvement. Although some parents may counteract the negative influence of media violence through banning violent programs, others are unaware of the negative effects of violent cartoons, or prefer to be actively involved in their child's moral development. Ceballo, Ramirez, Hearn, and Maltese (2003) found that increased parental monitoring positively affected the psychological health of children who were less exposed to actual violence; however, parental monitoring diminished as exposure to violence increased. Ceballo et al.'s findings further led Singer, Flannery, Guo, Miller, and Leibbrandt (2004) to suggest that monitoring children's television viewing is beneficial and important in reducing violent behavior, anxiety, and fear.

It is possible that an even larger effect would have been found had the observation room been a more sterile environment. For example, a number of distractions such as a piano and a whiteboard seemed to promote more neutral play in both conditions. Future studies would need to ensure a more distraction-free room. Also, the inclusion of another control group that did not watch a violent cartoon, or one with no adult

FIGURE 1

Mean occurrence of aggression behaviors observed for ADA and control conditions.



present in the room would provide a comparative baseline for aggression behavior in play.

Although the children were randomly assigned to the ADA and control conditions, the small sample size and uneven gender distribution prevented us from analyzing a gender effect. Future studies should strive for a larger sample size that is balanced for gender.

Despite the limitations of this study, it is clear that exposure to media violence leads to increased aggression in children (Joint Statement, 2000). Parents can oversee the media's exposure to their children by helping them to make wise viewing choices when living in today's socio-cultural environment. Rather than becoming censors of the media, today's parents might recognize their limitations and choose critical thinkers over V-chip robots. Parents can teach and discuss and argue as they purvey the values of critical thinking to their children. Yet parents who allow their children to watch media violence either in their home or at the neighbor's, must understand that distracted or passive adult supervision is not sufficient to counteract exposure to aggressive media content. Rather, active parental disapproval of media violence and family dialogue are needed to lessen children's subsequent aggressive behavior.

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APPENDIX

Aggressive Behavior Time Sampling Data Sheet

Check the set of behaviors as to its occurrence in a 30 second time interval. If one or more of the behaviors listed below occur during that time interval, check the box. You are not concerned with the number of times it occurs in the interval, only if it did or did not occur.

Operational definitions:

Verbal aggression—name-calling or yelling at another person
Physical aggression—touching another person with negative intent, to hurt or humiliate
Toy aggression—using toy with negative intent toward another person or toy
Aggression toward toy—inflicting violence or harm on toy
Neutral play—neither aggressive nor prosocial play
Prosocial play—playing or using toy in a positive or helpful way

Gender _____ Age/Grade _____ Condition _____

Time Interval/Behavior	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Verbal Aggression										
Physical Aggression										
Toy Aggression										
Aggression Toward Toy										
Neutral Play										
Prosocial										

Research Awards

Regional Research Awards
All Psi Chi members (undergraduate and graduate) are eligible to submit their research for the Regional Research Awards. Cash awards of $300 each are presented to students submitting the best research papers to Psi Chi sessions at regional conventions. The number of awards in each region varies based on the size of the region; a total of 78 awards of $300 each are available for the academic year. Award monies are distributed at the conventions following the presentations. Deadlines for submissions vary according to region and sometimes from year to year; check the Psi Chi website for details.

Society Annual Convention Research Awards | Dec 1
All Psi Chi members (undergraduate and graduate) are eligible to submit their research for the Society Annual Convention Research Awards. Cash awards of $300 for undergraduates and $500 for graduates are presented to students submitting the best research for Psi Chi sessions at the APA and APS national conventions. Up to 16 awards are given: 8 for the APA Convention and 8 for the APS Convention. Award monies are distributed at the conventions following the presentations.

Bandura Award | Feb 1
All psychology graduate students who are Psi Chi members and graduate student affiliates of the Association for Psychological Science (APS) are eligible to submit their research for the Psi Chi/APS Albert Bandura Graduate Research Award. The winner receives the following: (1) travel expenses to attend the APS National Convention to receive the award, (2) a three-year membership in APS, including subscriptions to all APS journals, and (3) two engraved plaques, one for the winner and one for the winner's psychology department as a permanent honor to the winner. In addition, the abstract of the winning paper, as well as a photograph and brief biography of the winner, are published in *Eye on Psi Chi*. This award is presented during the APS opening ceremony at the APS National Convention.

Newman Award | Feb 1
All psychology graduate students are eligible to submit their research for the APA/Psi Chi Society Annual Edwin B. Newman Graduate Research Award. The winner receives the following: (1) travel expenses to attend the APA/Psi Chi National Convention to receive the award, (2) a three-year subscription to an APA journal of the winner's choice, and (3) two engraved plaques, one for the winner and one for the winner's psychology department as a permanent honor to the winner. In addition, the abstract of the winning paper, as well as a photograph, and brief biography of the winner, are published in Eye on Psi Chi. This award is presented during the APA/APF Awards ceremony at the APA/Psi Chi Society Annual National Convention in August.

Allyn & Bacon Awards | May 1
The Psi Chi/Allyn & Bacon Psychology Awards, cosponsored by Allyn & Bacon Publishers, are open to all undergraduate Psi Chi members and are awarded to those who submit the best overall empirical research papers. The awards are $1,000 for first place, $650 for second place, and $350 for third place. The abstracts of the winning papers, as well as photographs and brief biographies of the top three winners, are published in *Eye on Psi Chi.*

Guilford Awards | May 1
All Psi Chi undergraduate members are eligible to submit their research for the Psi Chi/J. P. Guilford Undergraduate Research Awards. Cash awards are $1,000 for first place, $650 for second place, and $350 for third place. The abstracts of the winning papers, as well as photographs and brief biographies of the top three winners, are published in *Eye on Psi Chi.*

Research Grants

Hunt Research Grants | Oct 1
All Psi Chi student and faculty members are eligible to apply for a Thelma Hunt Research Grant. Up to three grants of up to $3,000 each are presented annually to enable members to complete empirical research that addresses a question directly related to Psi Chi. Unlike other national Psi Chi award/ grant programs, the Hunt Grants focus on research directly related to the mission of Psi Chi.

SuperLab Research Grants | Oct 1
All undergraduate and graduate Psi Chi members are eligible to apply for these research grants. The purpose of this program is to provide annual grants to aid one undergraduate and one graduate student in conducting computer-based research. Grant winners receive a copy of SuperLab experimental lab software and a response pad from Cedrus®.

Undergraduate Psychology Research Conference Grants | Oct 1
The purpose of this program is to provide funds for local/regional undergraduate psychology research conferences. Funding is intended for conferences that will invite student research presenters from at least three schools in the area and will notify all Psi Chi chapters in the geographic area of the conference. The maximum grant for each conference is $1,000.

Graduate Research Grants | Nov 1 & Feb 1
All graduate Psi Chi members are eligible to apply for these graduate research grants. The purpose of this program is to provide funds for members to defray the cost of conducting a research project. Applicants may request up to $1,500 for each project. A total of $10,000 has been allotted for this student grant program.

Undergraduate Research Grants | Nov 1 & Feb 1
All undergraduate Psi Chi members are eligible to apply for these undergraduate research grants. The purpose of this program is to provide funds for members to defray the cost of conducting a research project. Applicants may request up to $1,500 for each project. A total of $45,000 has been allotted for this student grant program.

APA Science Directorate Internship & Relocation Grant | Jan 15
All undergraduate Psi Chi members are eligible to apply for this internship. The purpose of this program is to provide one undergraduate student experience in science administration through a summer internship with APA. The Science Directoriate pays approximately $3,500 for a 10-week period, while Psi Chi awards up to an additional $3,500 for living and relocation expenses.

FBI NCAVC Internship Grants | Feb 1 & June 1
All undergraduate and graduate Psi Chi members who are accepted as FBI NCAVC interns are eligible to apply for this internship grant. The purpose of this program is to provide annual grants to aid two Psi Chi members in conducting research at the FBI NCAVC. Two grants up to $7,000 will be awarded annually for the 14-week unpaid position.

APS Summer Research Grants | March 1
All undergraduate Psi Chi members are eligible to apply for these grants (research must be conducted while still an undergraduate, not after graduation). The purpose of the program is to allow students to conduct research during the summer with a faculty sponsor who is a member of APS. This allows the student to partner with a faculty mentor who shares the same research interests and may work at a different institution than the student attends. Psi Chi awards six $5,000 grants (a stipend of $3,500 to the student plus $1,500 to the faculty sponsor).

Summer Research Grants | March 1
All undergraduate Psi Chi members are eligible to apply for these summer research grants (research must be conducted while still an undergraduate, not after graduation). The purpose of this program is to provide funds for members to conduct summer research at recognized research institutions. Psi Chi will award 14 grants of $5,000 (a stipend of $3,500 to the Psi Chi student plus $1,500 to the sponsoring faculty member at the research institution each year).

Faculty Advisor Research Grants | June 1
All current faculty advisors and coadvisors who have served an active Psi Chi chapter for at least one year are eligible to apply for these faculty advisor research grants. The purpose of this program is to provide funds for advisors to defray the direct costs of conducting a research project (no stipends included). Two grants will be awarded annually within each of Psi Chi's six regions, for a total of 12 grants. The maximum amount of each grant will be $2,000.

Chapter and Advisor Awards

Denmark Award | Dec 1
The Psi Chi/Florence L. Denmark National Faculty Advisor Award is presented annually to the one Psi Chi faculty advisor who best achieves Psi Chi's purpose. The award includes (1) travel expenses to attend the APA/Psi Chi Society Annual Convention to receive the award and (2) an engraved plaque. The award is intended to recognize Psi Chi faculty advisors for their outstanding service to the chapter and to Psi Chi.

Regional Chapter Awards | Dec 1
The Psi Chi Regional Chapter Awards provide annual recognition for up to two chapters in each region that best achieve Psi Chi's purpose. Each winning chapter receives a check for $500 and a plaque to display in the winning chapter's department. The awards are intended to perpetuate the chapters, to identify chapters as role models for others, and to promote the purposes of Psi Chi.

Regional Faculty Adv Awards | Dec 1
This award is presented annually to one Psi Chi faculty advisor from each region who best achieves Psi Chi's purpose. The award is to recognize and reward actively involved chapter advisors. The winning faculty advisor from each region will receive $500 and a plaque.

Cousins Award | Feb 1
The Psi Chi/Ruth Hubbard Cousins National Chapter Award is presented annually to the one chapter that best achieves Psi Chi's purpose. The winning chapter receives: (1) a check for $3,500, (2) travel expenses for one chapter officer to attend the APA/Psi Chi Society Annual Convention to receive the award, and (3) a plaque to display in the winning chapter's department.

Website Awards | Feb 1
These awards are presented annually to three chapters with websites that are innovative, aesthetic, and useful, and that advance or support Psi Chi's purpose. Winning chapters will receive awards of $200 each.

Kay Wilson Leadership Award | April 1
The Psi Chi/Kay Wilson Leadership Award for Outstanding Chapter Presidents is presented annually to the one chapter president who demonstrates excellence in leadership of the local chapter. The winning Psi Chi chapter officer receives: (1) a $500 cash award, (2) travel expenses for one chapter president to attend and make a short presentation at the APA/Psi Chi Society Annual Convention to receive the award, and (3) an engraved plaque commemorating the award.

Model Chapter Awards | June 30
Model Chapter Awards of $100 each are presented annually to recognize and reward Psi Chi chapters that consistently maintain outstanding records of membership inductions, chapter correspondence, service projects, and other criteria associated with being an outstanding chapter. All chapters submitting evidence of meeting these criteria are designated as winners.