IMPACT OF VIOLENCE EXPOSURE ON HOSTILITY, PHYSIOLOGICAL AROUSAL, AND HEALTH IN YOUTH

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Submitted to the Graduate Faculty of

Arts and Sciences in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Pittsburgh

2005

UNIVERSITY OF PITTSBURGH

FACULTY OF ARTS AND SCIENCES

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May 9, 2005

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This study examined the joint effects of lifetime exposure to violence within the home and community and acute exposure to media violence on hostility, physiological arousal, and attitudes toward health risk behaviors. One hundred male undergraduates aged 18-21 who had previously reported low or high lifetime amounts of violence were randomly assigned to play a videogame low (The Simpsons: Hit and Run) or high (Grand Theft Auto III; GTA III) in violent content. Participants randomly assigned to GTA III exhibited greater changes in systolic (SBP) and diastolic blood pressure from the initial rest period to game play, and greater negative affect subsequent to game play, in comparison to adolescents randomly assigned to The Simpsons. Participants randomly assigned to GTA III also exhibited more permissive attitudes toward drinking alcohol and using marijuana and were more competitive during a subsequent task. Greater lifetime violence exposure was associated with greater changes in SBP and pulse rate from the initial rest period to game play and with more permissive attitudes towards violence and drinking alcohol. Two interactions between lifetime violence exposure and laboratory media violence condition were found. Within the low lifetime violence exposure group, videogame condition was not associated with change in SBP from the initial rest period to game play, while within the high lifetime violence exposure group, play of Grand Theft Auto III predicted greater changes in SBP. Lifetime community violence exposure interacted with laboratory media violence condition in predicting hostile attributions. Within the high community violence exposure group, play of GTA III was associated with greater likelihood that participants would think a teacher would accuse them of cheating. The present study is the first experimental study to show that media violence is associated with permissive attitudes towards health risk behaviors that do not directly involve hostility or aggression, such as alcohol and marijuana use. Media violence effects observed in the laboratory may be representative of how *any* type of violence exposure influences youth, including real-world violence within homes and communities. One consequence of acute or chronic violence exposure among young men may be a greater willingness to engage in generally risky behavior.

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PREFACE

I would like to acknowledge the Pittsburgh Mind-Body Center (HL65112) and the University of Pittsburgh Provost's Office for their support of my research. I would also like to express my gratitude for the guidance provided to me by my dissertation committee members: Andrew Baum, Lorah Dorn, Karen Matthews, Edward Mulvey, Michael Pogue-Geile, and Daniel Shaw. I am especially grateful to Karen Matthews for her mentorship throughout my years of graduate study and for her encouragement of my development as an independent researcher. Karen amplified my early excitement about my dissertation topic with her own enthusiasm. Her generosity in time, wisdom, and resources, and her confidence in my ability to manage my project from start to finish, helped to make my dissertation the most rewarding experience of my graduate study. I would also like to thank the many members of Karen's laboratory for their encouragement and assistance during my years of graduate study and during the collection of my dissertation data.

I am indebted to my past teachers, family, and friends for their unwavering support of my education. I would particularly like to thank my mother, Kathy Brady, and my grandparents, William and Betty Zelina, for encouraging me in my earliest academic endeavors and for making it known that my efforts would always earn their warm approval, regardless of the outcome. Many doors to the imagination are opened by having one's first teachers provide a safe, supportive environment for learning. I felt that I could reach any of my dreams then, and I still feel this way.

1. INTRODUCTION

Youth enter adolescence and mature into young adulthood with considerable exposure to violence. Roughly half of high school youth report being threatened, slapped, hit, or punched in the home, school, or neighborhood (Singer, Anglin, Song, & Lunghofer, 1995). Additionally, up to a third of high school youth indicate being beaten or mugged in the school or neighborhood, attacked with a knife or stabbed, or shot at by another person. The percentage of youth witnessing specific acts of violence is higher, with adolescents from low-income urban settings typically reporting the most violence overall. Even if youth manage to avoid violence exposure in their homes or communities, they have little chance of doing so when viewing or interacting with media. For example, Huston et al. (1992) estimate that the average American child has witnessed more than 8,000 murders and 100,000 other assorted acts of violence on network television alone by the time he or she graduates from elementary school.

In July, 2000, six major professional societies – the American Academy of Pediatrics, American Academy of Child & Adolescent Psychiatry, American Psychological Association, American Medical Association, American Academy of Family Physicians, and American Psychiatric Association – issued a joint statement based on over 1,000 studies warning that exposure to media violence can lead to increases in aggressive attitudes, values, and behavior in youth (Cook, Kestenbaum, Honaker, & Anderson, 2000). Listed effects include viewing violence as an effective way of settling conflicts, emotional desensitization towards real life violence, increased fear of becoming a victim of violence with a resultant increase in self-protective behavior and mistrust of others, and a higher tendency for exhibiting aggressive behavior later in life. Meta-analytic reviews of experimental studies consistently demonstrate a significant positive association between media violence exposure and hostile or aggressive outcomes (Anderson & Bushman, 2001; Wood, Wong, & Chachere, 1991).

Despite evidence of an association between media violence exposure and negative outcomes, the majority of youths are exposed to considerable amounts of media violence without exhibiting clinically significant externalizing or internalizing symptoms. Researchers who warn that media violence exposure

may be detrimental to youth concede that media violence is not a necessary or sufficient cause of maladjustment (Bushman & Anderson, 2001). In a review of media violence effects on the development of antisocial behavior, Huesmann, Moise, and Podolski (1997) criticize the scarcity of existing research addressing the question of who may be most adversely impacted by media violence. One potentially important moderator that Huesmann et al. identify is an existing societal "culture of violence." Although their work focuses on differences in media violence effects across different countries and cultures, Huesmann et al. also theorize that youth living in violent homes and neighborhoods are at particular risk for being negatively influenced by media violence. Violent media representations may appear more realistic and appropriate to youth living within violent settings, as they are more likely to be sanctioned by family and the surrounding community. Violent media representations may not only reinforce messages that violence is appropriate, but also limit exploration of more appropriate ways of interacting with others.

Figure 1 depicts the potentially interacting effects of media and home/community violence exposure on health related outcomes. The solid line in Figure 1 shows potential effects of high home/community violence exposure, while the dashed line shows effects of low home/community violence exposure. Greater exposure to home/community violence is depicted as being associated with more hostile social information processing, more permissive attitudes towards violence and other harmful health behaviors (e.g. illegal substance use), more competitive behavior, more negative affect, and greater physiological arousal during the context of media violence exposure. The positive direction of the slope of each line shows that increasing levels of media violence exposure should be associated with outcomes in a similar fashion. Consistent with the theory of Huesmann et al. (1997), Figure 1 shows that media violence exposure should have a greater impact on cognitive-behavioral, affective, and physiological health outcomes among adolescents exposed to greater amounts of violence within their homes and/or communities (see steeper slope of the solid line in Figure 1, indicating an interaction between media violence and home/community violence exposure). Figure 2 shows that affect and physiological arousal may mediate the effects of violence exposure on cognitive-behavioral outcomes. Specifically, violence exposure may increase angry/negative affect, blood pressure, and pulse rate, which may in turn make it more likely that individuals engage in hostile social information processing, form

Figure 1. Hypothesized Interaction between Media Violence and Home/Community Violence Exposure

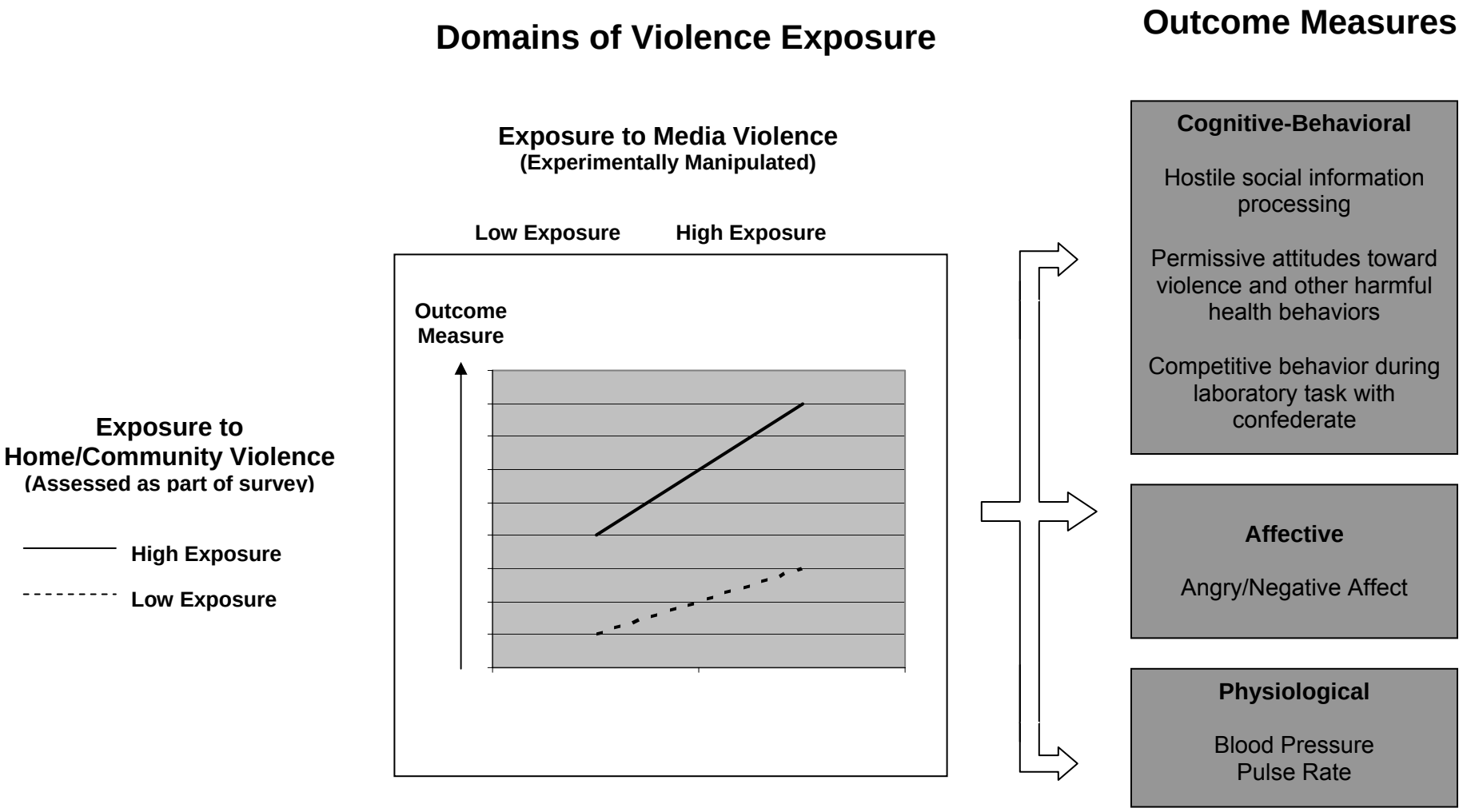
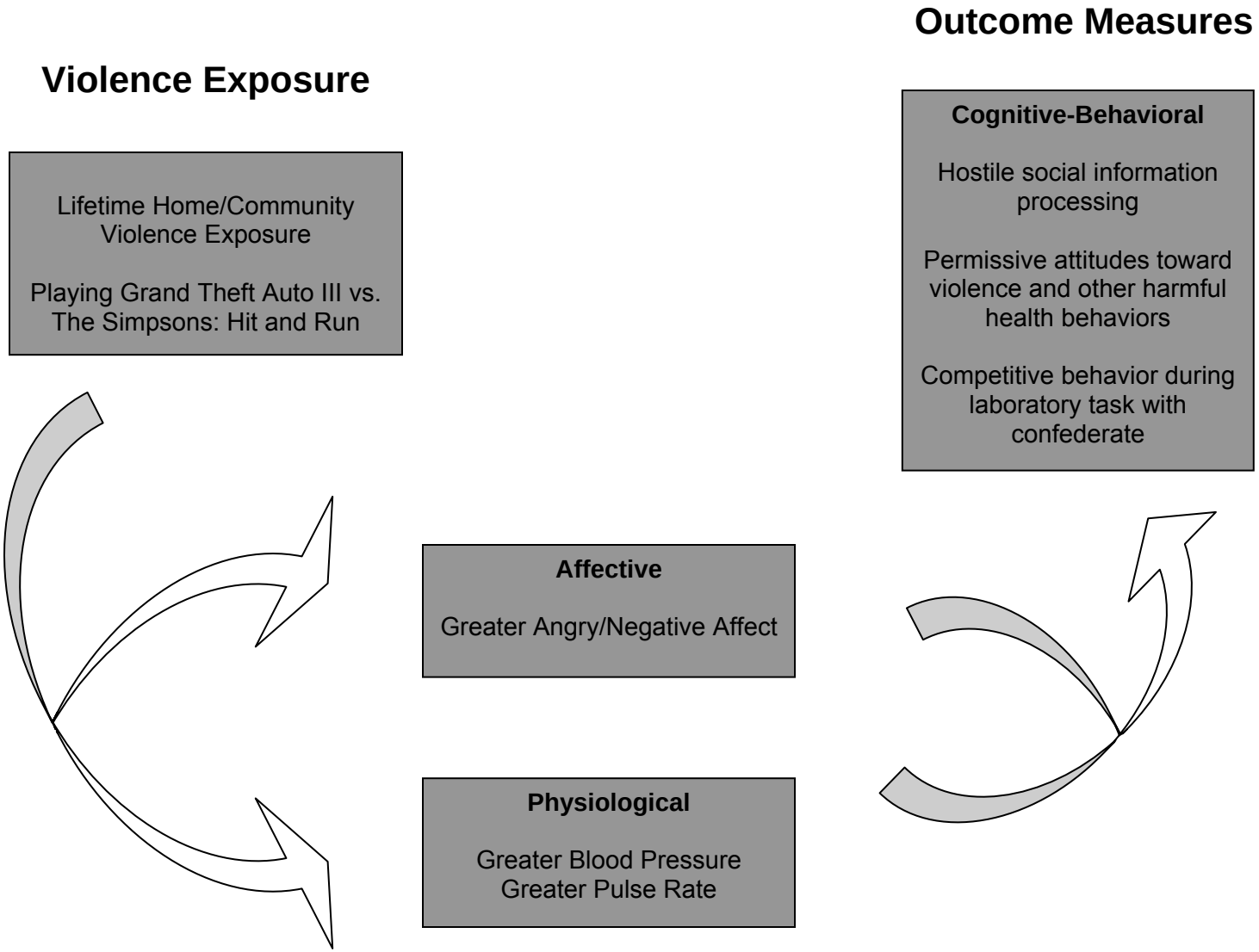


Figure 2. Mediational Tests for Laboratory Outcome Measures



permissive attitudes towards violence and other harmful health behaviors, and engage in competitive behavior or other types of aggressive behavior.

Prior to outlining the hypotheses and methodology of the present study, the following topics are briefly reviewed: (1) domains and prevalence of violence exposure among youth, (2) health related effects of violence exposure within the home and community, (3) health related effects of media violence exposure, (4) developmental consequences of violence exposure, including the potentially mediating roles of negative affect and physiological arousal in explaining associations between violence exposure and cognitive-behavioral health outcomes, (5) contextual correlates of violence exposure.

1.1. Domains and Prevalence of Violence Exposure among Youth

Exposure to violence in childhood and adolescence is common and may occur within different environmental contexts or domains. The most pervasive exposure to violence occurs through the domain of media. Media may be conceptualized as conveying cultural and societal norms regarding violence, especially to young members of the population, who are at more impressionable stages of development. Entertainment media contains high amounts of violence. The National Television Violence Study (NTVS; 1998) found that 61% of general programming on American broadcast and cable television contains violence, excluding sports and news. Of evaluated genres, movies (91%), drama series (75%), children's programming (69%), and music videos (53%) contained the highest rates of violence. In surveys of the most popular-selling videogames, Provenzo (1991) found 85% to be violent and Dietz (1998) found 80% to be violent. Today the most heavily marketed and consumed videogames are violent (Walsh, 2000). Adolescents spend an average of 20 hours per week viewing television (Nielsen Media Research, 1998) and attend movie theaters more than any other segment of the population (Huntemann & Morgan, 2001). In a survey of college freshmen and sophomores, retrospective recall of time spent playing videogames was 5.5 hours per week in junior high and 3 hours per week in high school (Anderson & Dill, 2000).

A second, more proximal, domain of violence exposure is through one's community. Although estimates of violence exposure in this domain vary widely according to socioeconomic status and geographic location, there is no question that alarmingly high percentages of youth are exposed to violence within their schools and larger communities. In a national probability sample of over 1,000 youth aged 10-16, 6% of females and 18% of males reported that they had experienced a physical assault by a

non-family member involving either the use of a weapon or a resultant injury (Boney-McCoy & Finkelhor, 1995). Singer and colleagues (1995) conducted a survey of 3,735 high school adolescents in central city, small city, and suburban high schools. The percentage of students reporting victimization by or witnessing of violence varied by school site, with the lowest percentages usually occurring among students attending the suburban school. The range of percentages for being victimized by specific acts of violence were as follows: threatened in the school or neighborhood, 12% to 39% for females, 32% to 48% for males; slapped/hit/punched in the school or neighborhood, 13% to 27% for females, 32% to 44% for males; beaten or mugged in the school or neighborhood, 0.5% to 9% for females, 1% to 22% for males; sexual abuse or assault, 12% to 17% for females, 2% to 7% for males; knife attack or stabbing, 0% to 9% for females, 6% to 16% for males; shot at or shot, 0.5% to 12% for females, 3% to 33% for males. The percentage of students who witnessed specific acts of violence was much higher in nearly every case.

The third, most proximal, domain of violence exposure is within the home. In Singer et al.'s (1995) survey of high school students, the percentage of students reporting victimization by or witnessing of violence in the home again varied by school site, with the lowest percentages occurring among students attending the suburban school. The range of percentages for being victimized by specific acts of violence were as follows: threatened in the home, 14% to 32% for females, 17% to 29% for males; slapped/hit/punched in the home, 34% to 56% for females, 26% to 40% for males; beaten or mugged in the home, 4% to 10% for females, 3% to 9% for males. The percentage of students who witnessed specific acts of violence in the home was higher in most cases. In Boney-McCoy and Finkelhor's (1995) national probability sample of adolescents, 3% of females and 2% of males reported being physically assaulted by a parent, while 6% of females and 5% of males reported being physically assaulted by a family member other than a parent. Straus (1992) has estimated that more than 10 million children in the United States witness physical aggression between their parents each year.

There are high rates of co-occurrence between exposure to violence within the home and larger community (Bell & Jenkins, 1993; Garbarino, Dubrow, Kostelny, & Pardo, 1992; Lynch & Cicchetti, 1998). Although research suggests that violent victimization has a greater negative impact on the development of youth than does witnessed violence (Martinez & Richters, 1993), the potential negative impact of witnessed violence should not be dismissed. For example, data from the National Survey of Adolescents

demonstrate that witnessing violence triples the risk of alcohol, marijuana, and hard drug abuse/dependence after the effects of demographics, familial substance use, and victimization are controlled (Kilpatrick, Acierno, Saunders, Resnick, Best, & Schnurr, 2000).

1.2. Health Related Effects of Exposure to Home and Community Violence

Greater exposure to community violence is prospectively associated with greater aggression (Gorman-Smith & Tolan, 1998), antisocial behavior (Miller, Wasserman, Neugebauer, Gorman-Smith, & Kamboukos, 1999), and self-reported violent behavior (Farrell & Bruce, 1997) among youth, even after controlling for earlier externalizing behaviors (see Margolin & Gordis, 2000 for a review). In a review of the adolescent literature, Champion and Durant (2001) conclude that exposure to home and community violence and victimization by violence predict the use of violence and carrying a gun. Flannery, Singer, and Wester (2001) selected a sub-sample of dangerously violent adolescents (i.e. those who endorsed attacking/stabbing someone with a knife or shooting at someone with a gun within the past year) and non-violent matched controls from Singer et al.'s (1995) sample of high-school adolescents. Dangerously violent adolescents were more likely than matched controls to have witnessed and been victimized by violence in the neighborhood and school, witnessed or been victimized by violence in the home, and been the victim of a shooting or knife attack.

For the past decade, researchers have documented associations between violence exposure and health behaviors more varied than aggression in adolescents. A longitudinal study of over 1,200 6th grade rural youth found that those children who had witnessed violence by the middle of the year were more likely to have had initiated cigarette, beer/wine, liquor, or advanced alcohol use by the end of the year (Sullivan, Kung, & Farrell, 2004). In a nationally representative sample of over 4,000 adolescents aged 12-17, current cigarette use was independently predicted by physical assault and witnessed violence among males and females, and by sexual assault among females (Acierno et al., 2000). In the same sample, alcohol, marijuana, and hard drug abuse/dependence were each independently predicted by physical assault, sexual assault, and witnessed violence (Kilpatrick et al., 2000). Among those adolescents with substance abuse/dependence, assault history was associated with earlier age of marijuana use (significant) and earlier age of alcohol use (marginally significant). All but one adolescent with hard drug abuse/dependence reported a history of assault.

In addition to substance use, violence exposure is associated with sexual risk taking among adolescents. In a sample of over 2,000 urban 6th, 8th, and 10th grade adolescents, greater frequency of witnessing shootings and stabbings was associated with greater frequency of alcohol use and diminished perception of risk from engaging in potentially harmful behaviors (e.g. substance use, gun carrying, fighting, sexual intercourse without a condom; Schwab-Stone et al., 1995). Youth Risk Behavior Survey (YRBS) data based on over 2,000 Massachusetts female students reveal that physical and/or sexual dating violence are associated with greater (1) engagement in heavy smoking, binge drinking, and cocaine use, (2) engagement in unhealthy weight control practices (e.g. diet pills, laxatives), (3) engagement in sexual health risk behavior (e.g. early age of intercourse, greater numbers of partners, no condom use), (4) likelihood of having been pregnant, and (5) likelihood of having seriously considered or attempted suicide (Silverman, Raj, Mucci, & Hathaway, 2001). In a sample of over 500 adolescent females presenting at a family planning clinic for contraceptive care, females who had witnessed violence (i.e. robbery, physical attack, threatened or completed rape, threats against life) were 2-3 times more likely than females who had never witnessed violence to report using tobacco and marijuana, drinking alcohol or using drugs before sex, and having intercourse with a partner who had multiple partners (Berenson, Wiemann, & McCombs, 2001). Females who had experienced but not witnessed violence were at increased risk of the same behaviors and were also 2-4 times more likely than females who had never witnessed or experienced violence to report early initiation of intercourse, intercourse with strangers, multiple partners, and a positive test result for a sexually transmitted disease. Females who had both witnessed and experienced violence reported the greatest involvement in harmful health behaviors and were 3-6 times more likely than females who had never witnessed or experienced violence to report suicidal ideation, suicide attempts, and self injury.

Associations between violence and health risk behavior appear to be bidirectional. Longitudinal bidirectional associations have been observed between aggressive behavior and substance use among male adolescents (White, Loeber, Stouthamer-Loeber, & Farrington, 1999), and between victimization by violence and substance use among adult women (Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997). In a cross-sectional study of 167 adolescents aged 14-20, substance use and sexual risk taking were statistical predictors of greater likelihood of witnessing violence and being victimized by violence,

respectively (Albus, Weist, & Perez-Smith, 2004). These associations were independent of age, sex, ethnicity, and aggressive behavior.

1.3. Health Related Effects of Media Violence Exposure

Results from longitudinal studies suggest that media violence exposure increases the occurrence of meaningful aggression-related outcomes over an extended period of time. In a sample of over 700 New York State youth, greater television viewing at mean age 14 was associated with greater report of the following indices of aggression at mean age 16 or 22: assaults or physical fights resulting in injury; robbery, threats to injure someone, or weapons used to commit a crime; any aggressive act against another person (Johnson, Cohen, Smailes, Kasen, & Brook, 2002). In all analyses, the following potential confounds were statistically controlled: childhood neglect, low family income, low parental education, being raised in a dangerous community, past psychiatric disorder, and previously reported aggressive behavior. Aggressive behaviors at mean age 14 were not associated with subsequent television viewing after controlling for confounds. Eron, Lefkowitz, Huesmann, and Walder (1972) followed a different sample of over 400 New York youth and found that preference for violent television in the third grade predicted peer rated aggression 10 years later among males, but not females, controlling for third grade peer rated aggression. In contrast, third grade aggression was not associated with preference for violent television 10 years later among males, controlling for third grade viewing preferences. In a follow-up study of his original sample of youths, Huesmann (1986) found that that preference for violent television in the third grade predicted seriousness of criminal convictions by age 30.

Longitudinal field studies are necessary in order to adequately test the hypothesis that media violence exposure influences the development of health related outcomes. However, they do not eliminate the need for experimental research (Bushman & Huesmann, 2001). The level of control obtained over the environment in experimental studies cannot be replicated within the context of other study designs. Experimental studies consistently show that media violence exposure increases aggressive behavior in the immediate aftermath of exposure, including physical assault (hitting, kicking, choking, wrestling) in samples of children and younger adolescents, and willingness to inflict electric shock or loud aversive noises on a peer in samples of older adolescents and young adults (see Anderson et al., 2003 for a review).

Only one study has examined the association between media violence exposure and harmful health behaviors that do not directly involve hostility or aggression. Kremar and Greene (2000) surveyed adolescents aged 11-18 and college students aged 18-25 about their television viewing habits and engagement in seven risk behaviors: smoking, alcohol use, other drug use, delinquency, risky sexual behavior, and risky driving, with drinking and driving assessed as a separate category. In a factor analysis of risk behaviors, all loaded above the criterion of .65 except for risky sexual behavior (.59) and smoking (.59); these risk behaviors were not considered in analyses. For males, exposure to contact sports and realistic crime (e.g. COPS) was associated with greater engagement in risk behaviors, while exposure to violent drama (e.g. NYPD Blue) was associated with lesser engagement in risk behaviors. Independent of sex and total time viewing TV, realistic crime was positively associated and violent drama negatively associated with risk behaviors. Kremar and Greene suggested that violent drama may not have been violent or vivid enough to provide the same meaning for adolescents as contact sports and realistic crime shows. Another explanation is that violent drama may elicit cognitive and affective processes that discourage impulsive, destructive behaviors (e.g. consideration of long term negative consequences of violence, pity for victims of violence). Additional research is necessary to determine whether media violence exposure is associated with attitudes towards harmful health behaviors other than aggression.

1.4. Developmental Consequences of Violence Exposure

Cognitive consequences of violence exposure. Building upon the work of Berkowitz (1984, 1990) and Bandura (1986), Dodge and Schwartz (1997) have outlined and provided evidence for a series of social information processing mechanisms that can contribute to aggressive behavior in youth. Exposure to violence may influence social information processing at each of the stages described by Dodge and Schwartz. Violence exposure may shape attention by modeling hypervigilance for threatening cues, shape encoding and interpretation of social cues by modeling hostile attributions, shape goal construction by modeling the placement of value on aggression-related outcomes, and shape response construction, evaluation, and enactment by modeling aggressive behavior. Exposure to violence within several environmental contexts (e.g. home, community, media) may increase the likelihood of hostile bias

in social information processing, as modeled violence is common and pervasive while modeled alternatives to violence are relatively infrequent.

Research on media violence exposure supports the social information processing model of Dodge and Schwartz (1997). In an experimental study, Kirsh and Olczak (2000) randomly assigned undergraduate students to read a comic book low or high in violent content and to subsequently read ambiguous provocation stories, in which one child causes a negative event to happen to another child with unclear intent. In comparison to males who read the less violent comic book, males who read the more violent comic attributed more hostile intent and a more negative emotional state to the child who caused harm; in addition, they suggested more aggressive retaliation towards the child who caused harm. A special report on the influence of media violence on youth concluded that short-term exposure to media violence increases the likelihood of aggressive thoughts by priming existing aggressive scripts and cognitions, and that long-term exposure to media violence increases the likelihood of acquiring lasting aggressive scripts, interpretational schemas, and aggression-supporting beliefs about social behavior (Anderson et al., 2003).

In their review of the literature on adolescents, Champion and Durant (2001) found that witnessed home and community violence and victimization by violence predicted accepting attitudes towards the use of aggressive behavior to resolve conflict, intentions to use violence, gun carrying, and the use of violence. Both witnessing and victimization by violence appear to result in aggressive outcomes through cognitive mechanisms. Schwartz and Proctor (2000) hypothesized that witnessed violence is likely to result in aggressive/hostile social-cognitive styles due to the formation of schemas supporting positive evaluation of violent behavior. Consistent with their conceptualization, they found that hostile social information processing mediated an association between witnessed violence and aggressive behavior in a sample of 285 urban 4^{th}-6^{th} grade youth. Shahinfar, Kupersmidt, and Matza (2001) hypothesized that higher levels of victimization by violence would be associated with aggressive behavior development through hostile attribution bias, maladaptive social goals (e.g. dominance, revenge), greater approval of violent tactics, and perceived positive outcomes to aggression. In a sample of 110 highly aggressive, incarcerated adolescent boys, victimization by severe violence (i.e. shooting, stabbing, assault with weapon) was associated with hostile attribution bias, maladaptive social goals, and greater approval of

violent tactics, while witnessing of severe violence was associated with perceived positive outcomes to aggression.

The developmental consequences of violence exposure are likely to be broader than formation of a hostile bias and aggressive patterns of interaction. Lerner's (1987) life span perspective of development emphasizes reciprocally dependent domains of behavior. Hostile social information processing may be indicative of a general deficiency in ability to consider alternative interpretations of an event, while aggressive behavior may be indicative of a general disregard for the well being of oneself and others. The impulsive quality of many violent behaviors may appear as a sanction to act primarily based on emotion rather than contemplation, to fail to consider or to disregard the potential negative consequences of actions, and to place value on short term rather than long term gains. Adolescents exposed to large amounts of violence throughout their development may thus exhibit little self-control across a range of behaviors and may act to enhance their own short term gratification to the detriment of their own and others' long term well being. In support of this possibility, Jessor (1984) and colleagues (Donovan & Jessor, 1985; Donovan, Jessor, & Costa, 1991; Jessor, Donovan, & Costa, 1996) have observed that harmful problem and health behaviors (e.g. delinquency, cigarette smoking, alcohol use, other drug use, sexual risk taking) co-vary systematically in adolescence and appear to constitute a syndrome.

One developmental consequence of violence exposure may be a greater willingness to engage in risk behaviors that may compromise one's own health and the health of others. Dodge and Schwartz (1997) find that aggressive youth encode a relatively small number of social cues and seek additional information less frequently. If domains of behavior are reciprocally dependent, one might also expect aggressive youth to attend less to messages about the harmful effects of smoking, drinking, unprotected sexual activity, etc. Youth who are impulsive in their review, evaluation, and selection of responses (e.g. a quick decision to aggress) may also be more likely to engage in harmful health behaviors with little forethought. Observed effects of home and community violence include the undermining of a future orientation (i.e. "terminal thinking"; Garbarino, 1997; Shahinfar & Fox, 1997), characterized by failure to set goals for the future. Low future orientation may also increase the likelihood that youth act to enhance short term gratification to the detriment of long term well being.

Affective consequences of violence exposure. Youth exposed to greater amounts of violence may experience greater negative affect, including anger, depression, and anxiety. In Singer et al.'s (1995) sample of high school adolescents, the following types of violence exposure were associated with greater anger: being a witness or victim of violence at home, being threatened, slapped/hit/punched, and/or beaten or mugged in the past, being the victim of sexual abuse/assault, being a witness or victim to a shooting or knife attack, and being a witness to past violence. All but the latter two forms of violence were additionally associated with greater depression and anxiety. In Flannery et al.'s (2001) sample of dangerously violent adolescents, females endorsed more symptoms of anger, anxiety, depression, dissociation, and posttraumatic stress in comparison to matched controls, while males endorsed more symptoms of anger and dissociation. Reviews of the literature also show that exposure to media violence can increase fears and anxieties in youth as a result of greater perception of danger (Cantor, 2001), and increase hostile affect as well (Anderson & Bushman, 2001). The long-term effects of media violence exposure may include a reduction in negative emotional responses to violence (i.e. desensitization; Anderson et al., 2003).

Physiological consequences of violence exposure. The experience of strong negative affect (e.g. anxiety, anger) triggers a chain of neuroendocrine events within the body (Frankenhaeuser, 1986; Lovallo, 1997). Neural stimulation of the adrenal medulla through sympathetic innervation results in the release of epinephrine into the bloodstream, while neurons in the sympathetic nervous system release norepinephrine into the bloodstream. Under the influence of these catecholamines, the rate and strength of heart contractions increase, resulting in increased heart rate and cardiac output. The generalized vasoconstrictor effects of sympathetic activation can also increase total peripheral resistance. Together, these effects result in increased blood pressure (Sherwood, 1997).

A limited number of studies have examined whether exposure to media and home/community violence is associated with physiological arousal. Youth exposed to violent media exhibit greater systolic blood pressure (SBP; Ballard & Wiest, 1996; Bushman & Geen, 1990; Gerra et al., 1996) and heart rate (HR; Ballard & Wiest, 1996; Calvert & Tan, 1994; Gröer & Howell, 1990) in comparison to youth exposed to non-violent or less violent media, both when media presentation is passive (viewing television) or active (playing a videogame). Some studies show that youth exposed to high amounts of community

violence exhibit lower physiological arousal at rest. Cooley-Quille, Boyd, Frantz, and Walsh (2001) selected a sample of adolescents exposed to high (n=17) or low (n=16) amounts of community violence and found no difference in HR from baseline to a video montage of fictional community violence clips. However, high exposure to community violence was significantly associated with lower resting HR. In a different study, Cooley-Quille and Lorion (1999) found that greater exposure to community violence was associated with lower resting SBP and HR in a sample of 25 predominately African American high school youth (findings were marginally significant). In contrast, exposure to community violence was not associated with resting HR among a sample of 54 college undergraduates screened for high or low community violence exposure (Scarpa, Fikretoglu, & Luscher, 2000).

Interestingly, greater resting heart rate has been identified as a protective factor against aggressive behavior and engagement in criminal activity in longitudinal studies of youth (Raine, 1997; Raine, Venables, & Mednick, 1997; Raine, Venables, and Williams, 1995, 1996). For the youth in these studies, greater resting heart rate may be indicative of greater levels of anxiety and a greater likelihood of inhibiting behaviors that have potential negative consequences. Reduced autonomic activity may only be a risk factor for aggressive and criminal behavior when other risk factors are present (e.g. genetic predisposition, hostile or neglectful environment; Brennan et al., 1997; Raine et al., 1995, 1996). It may be that an unusually high level of physiological arousal, particularly during times of stress, is a marker of hostility or other intense negative affect, while an unusually low level of physiological arousal, particularly at rest, is a marker of behavioral inhibition deficits. Both types of physiological dysregulation may confer greater risk for engagement in aggression and other harmful health behaviors.

Negative affect and physiological arousal as mediators of the association between violence exposure and cognitive-behavioral outcomes. Negative affect is one potential mediator of associations between violence exposure and greater aggression, hostility, and permissive attitudes towards risk behaviors. Exposure to violence is associated with an inability to modulate emotional arousal using cognitive skills, perhaps resulting in a tendency to cope with negative affect in dysfunctional ways (e.g. drug use; Finkelhor & Kendall-Tackett, 1997; Streeck-Fischer & van der Kolk, 2000). In support of this model, use of alcohol or drugs to cope with stress mediated the association between childhood abuse and symptoms of alcohol abuse or dependence in adult women (Schuck & Widom,

2001). Schwartz and Proctor (2000) found that impaired emotion regulation (e.g. inappropriate negative emotions in response to intrusive acts by peers) mediated the association between violent victimization and aggressive behavior in their sample of 285 urban 4th-6th grade youth. Similarly, physiological arousal may be a mediator of associations between violence and maladaptive cognitive-behavioral outcomes. In studies of youths and adults, greater anger and hostility is associated with greater resting values and stress-related increases in heart rate and blood pressure (Davis, Matthews, & McGrath, 2000; Gump, Matthews, & Räikkönen, 1999; Räikkönen, Matthews, Flory, & Owens, 1999; Räikkönen, Matthews, & Kuller, 2001). Moreover, greater physiological arousal during exposure to violent versus non-violent media is associated with subsequent endorsement of hostile and aggressive thoughts (Ballard & Wiest, 1996; Bushman & Geen, 1990; Calvert & Tan, 1994).

1.5. Contextual Correlates of Violence Exposure

Virtually all youth are exposed to large amounts of media violence throughout their development (Huston et al., 1992; Johnson, 1996). Gender is one correlate of media violence exposure, as males exhibit a greater preference for violent media than do females (Anderson & Dill, 2000; Bushman, 1995). Although patterns of media use also appear to vary by socioeconomic status (SES; e.g. youth of lower SES families spend more time watching television and less time reading; Anderson, Huston, Schmitt, Lindbarger, & Wright, 2001), it is unclear whether exposure to violent media, per se, varies by SES. Violence within the home and community is associated with other adversities such as poverty, poor nutrition, overcrowding, substance abuse, lack of adequate medical care, parental unemployment, and parental psychopathology (see Margolin & Gordis, 2000, for a review). Many parents and communities may thus lack the resources to ameliorate the negative effects of violence exposure. Association with deviant peers may also increase the likelihood that youth will witness, be victimized by, or engage in violence. Among an inner-city sample, greater perceived neighborhood affiliation was associated with greater exposure to violence after controlling for age, sex, length of residence in one's neighborhood, and concurrent behavioral and emotional problems (finding was marginally significant; Perez-Smith, Albus, & Weist, 2001). Effects attributed to violence exposure may thus partially reflect contextual correlates of exposure.

1.6. Study Contributions and Hypotheses

The present study examines the effects of media and home/community violence exposure on cognitive-behavioral, affective, and physiological health outcomes within the context of a quasi-experimental study design (see Figure 1 and Figure 2). Adolescents exposed to high or low amounts of violence within their homes and/or communities were randomly assigned to play a videogame high or low in violent content within the context of a laboratory study.

Study Contributions. The present study contributes to the body of literature on violence exposure in at least three ways. First, exposure to violence was examined within the contexts of home and community as well as media. At the time of this writing, literature searches of peer-reviewed, published articles contained in Medline and PsychInfo databases did not yield any empirical studies that have examined the relative and potentially interacting effects of exposure to media violence and home/community violence on youth's adjustment. Experimental studies of media violence that control for exposure to home/community violence through random assignment do not address the issue of whether media violence exerts the greatest influence among those youth exposed to violence at home and in their larger communities, nor do they compare the relative main effects of media and home/community violence exposure. It is important to distinguish between different domains of violence exposure because different numbers and populations of youth are exposed to violence within each domain, particularly when comparing media violence exposure to home and community violence exposure. The present study aids in the identification of youth whose violence exposure may place them at risk for adverse behavioral health outcomes.

Second, the present study adds to the literature testing whether violence exposure is associated with potentially negative health outcomes that may not directly involve hostility or aggression, such as illegal substance use and sexual risk taking. A growing body of literature links home and community violence exposure with greater engagement in harmful health behaviors (Acierno et al., 2000; Berenson et al., 2001; Kilpatrick et al., 2000; Schwab-Stone et al., 1995; Silverman et al., 2001), but a similar link between media violence exposure and harmful health behaviors has only been examined and reported by one study (Kremar & Greene, 2000).

A third contribution that the present study makes to the literature on violence exposure is the examination of potential mediators between violence exposure and harmful health behaviors. Experimental studies provide an optimal setting for testing potential mediators. The findings of experimental studies can inform the design of later longitudinal studies and interventions. The present study includes a measure of attitudes towards harmful health behaviors (e.g. illegal substance use) that was administered after laboratory manipulated media violence exposure. It was possible to test whether physiological arousal measured during violence exposure and negative affect measured immediately after exposure mediated associations between violence exposure and attitudes toward harmful health behaviors. Such mediational models have not been explicitly tested by other experimental studies.

Hypothesis 1: Greater levels of media violence exposure will be associated with more hostile social information processing, more permissive attitudes towards violence and other harmful health behaviors (e.g. illegal substance use), more competitive behavior, more angry/negative affect, and greater physiological arousal during the context of violence exposure. As reviewed above, associations between media violence exposure and aggression are well documented (Anderson et al., 2003; Eron et al., 1972; Huesmann, 1986; Johnson et al., 2002). Studies also consistently show that greater levels of media violence exposure are associated with more hostile social information processing (see Anderson et al., 2003, for a review), more angry affect (e.g. Anderson & Bushman, 2001), and greater physiological arousal during violence exposure (e.g. Ballard & Wiest, 1996). Although one study has tested and shown that greater media violence exposure is associated with greater engagement in health risk behaviors other than aggression (e.g. substance use), this study did not manipulate violence exposure or control for potential confounds. However, a model in which media violence exposure broadly affects health risk behavior is consistent with reciprocally dependent domains of behavior described by Lerner (1987) as part of his life span perspective of development.

Hypothesis 2: Greater levels of home/community violence exposure will be associated with more hostile social information processing, more permissive attitudes towards violence and other harmful health behaviors (e.g. illegal substance use), more competitive behavior, more angry/negative affect, and greater physiological arousal during the context of media violence exposure. In addition, greater levels of home/community violence exposure will be associated

with lower physiological arousal at rest. As reviewed above, greater exposure to home/community violence exposure is associated with greater aggression and greater engagement in other types of health risk behaviors (Gorman-Smith & Tolan, 1998; Kilpatrick et al., 2000; Silverman et al., 2001). Additionally, greater exposure to home/community violence is associated with more hostile social information processing (e.g. Shahinfar et al., 2001) and more negative affect (e.g. Singer et al., 1995). Some data suggest that greater exposure to home/community violence is associated with lower physiological arousal at rest (e.g. Cooley-Quille et al., 2001). Cooley-Quille and colleagues found no difference in physiological arousal from a resting baseline period to a video montage of fictional community violence between the adolescents in their study who were exposed to high or low amounts of community violence. However, the passive presentation of their laboratory media violence condition may not have been engaging enough to elicit differences in physiological arousal. To the extent that violent media representations may appear more realistic to youth having prior experience living within violent settings, one might expect an interactive media violence condition to elicit greater physiological arousal. By virtue of its larger sample size, the present study should also have greater power to detect differences in physiological reactivity to media violence than previous studies of home/community violence exposure.

Hypothesis 3: Laboratory media violence condition and home/community violence exposure will interact, such that the effects of media violence condition will be greater among those adolescents high in lifetime exposure to home/community violence than among those low in lifetime exposure (see Figure 1). Because the majority of youths are exposed to considerable amounts of media violence without exhibiting clearly significant externalizing or internalizing symptoms, it is important to identify subgroups of youth who are most likely to experience detrimental effects of media violence exposure. Huesmann and colleagues (1997) have conceptualized societal "cultures of violence" as a potentially moderating variable of media violence effects. Previous studies have not tested whether exposure to media violence and home/community violence interact to influence outcomes.

Hypothesis 4: Predicted associations between laboratory media violence exposure and cognitive-behavioral outcomes will be mediated by greater physiological arousal during game play and greater angry/negative affect subsequent to game play (see Figure 2). As reviewed above, exposure to media violence is associated with an increase in hostile affect (Anderson & Bushman, 2001).

Angry, negative affect is associated with greater physiological arousal (e.g. Räikkönen, Matthews, & Kuller, 2001), and greater physiological arousal during exposure to violent versus non-violent media is associated with subsequent endorsement of hostile and aggressive thoughts (Ballard & Wiest, 1996; Bushman & Geen, 1990; Calvert & Tan, 1994). Others have not tested whether negative affect and physiological arousal mediate associations between media violence exposure and health related outcomes other than aggression. Jessor (1984) and colleagues (Donovan & Jessor, 1985; Donovan et al., 1991; Jessor et al., 1996) have observed that harmful problem and health behaviors (e.g. delinquency, cigarette smoking, alcohol use, other drug use, sexual risk taking) co-vary systematically in adolescence and appear to constitute a syndrome. Thus, affect and physiological arousal may mediate associations between violence and reciprocally dependent domains of health behavior.

Hypothesis 5: Predicted associations between lifetime home/community violence exposure and cognitive-behavioral outcomes will be mediated by greater physiological arousal during game play and greater angry/negative affect subsequent to game play (see Figure 2). Little research has explicitly examined the pathways through which lifetime violence exposure may influence maladaptive cognitive-behavioral health outcomes. However, an inability to modulate emotional arousal during stress has been implicated as a mediating variable (Finkelhor & Kendall-Tackett, 1997; Streeck-Fischer & van der Kolk, 2000). For example, Schwartz and Proctor (2000) found that impaired emotion regulation mediated the association between violent victimization and aggressive behavior in their sample of 285 urban 4^{th}-6^{th} grade youth. Negative affect is associated with greater physiological arousal (e.g. Räikkönen, Matthews, & Kuller, 2001), and both negative affect and physiological arousal may be indicative of perceived stress (Lovallo, 1997). Individuals exposed to greater amounts of home/community violence in their lifetime may be more likely to perceive events as stressful and may be less skilled in coping with the negative affect and physiological arousal that occurs as part of perceived stressful experiences. Negative affect and physiological arousal may in turn make it more difficult to process social information and choose adaptive courses of action.

2. METHOD

2.1. Study Design and Procedure

The purpose of the present study is to examine the effects of media and home/community violence exposure on hostile cognitions, attitudes towards violence and other harmful health behaviors (e.g. illegal substance use), competitive behavior, negative affect, and physiological indices of arousal within the context of a quasi-experimental study design (see Figure 1 and Figure 2). The University of Pittsburgh Institutional Review Board approved all parts of the study protocol. One hundred male undergraduate students aged 18-21 were recruited from a pool of 180 males completing a survey of violence exposure and engagement in harmful health behaviors (see Table 1 for a summary of sample characteristics). Participants were recruited to represent low, medium, and high amounts of lifetime violence exposure within their homes and communities. Males from the extremes of the violence exposure distribution were overrepresented, such that 36% of study participants were in the low violence exposure group based on the distribution of 180 males completing the survey, 23% of participants were in the medium violence exposure group, and 41% of participants were in the high violence exposure group. The decision to conduct the present laboratory experiment on males was based on a desire to test the relative and potentially interacting effects of media and home/community violence exposure within a population known to have greater exposure to violent media (Funk, 1993) and to behave more aggressively (Huesmann, Eron, Lefkowitz, & Walder, 1984). Pairs of males were matched on ethnicity and lifetime home/community violence exposure group and randomly assigned to play a videogame high or low in violent content within the context of the present laboratory experiment. Participants in the present study were expected to have some familiarity with playing videogames, as the college freshmen and sophomores in Anderson and Dill's study (2000) nearly all played videogames at some point in their youth.

The majority of study participants identified themselves as being of White/Caucasian ethnicity (83%), while 10 participants reported being Black/African American, 4 participants reported being Asian, 2 participants reported being Hispanic, and 1 participant declined to provide his ethnicity. In some studies, individuals of Black ethnicity have reported greater hostility (Allen, Markovitz, Jacob, & Knox, 2001) and have exhibited greater resting values or stress-related increases in blood pressure and heart rate (Dysart,

Table 1. Sample characteristics.

Number of Participants	100 (all male sample)			
Age Range	18-21			
Self-Identified Ethnicity	White/Caucasian: 83 Black/African American: 10 Asian/Asian American: 4 Hispanic/Latino: 2 Declined to Identify: 1			
Lifetime Home/Community Violence Exposure Group (based on survey sample of 180 males)	Low (score≤17): 36% (18% within non-Whites) Medium (17<score ≤28): 23% (18% within non-Whites) High (score>28) : 41% (65% within non-Whites)			
Parental Years of Education [1]	M = 16.6	SD = 3.1	Minimum = 11	Maximum = 24
Average Hours per Week Spent Playing Video Games				
Grades 7-9 [1]	M = 11.0	SD = 11.9	Minimum = 0	Maximum = 70
Grades 10-12 [1]	M = 10.1	SD = 10.1	Minimum = 0	Maximum = 50
College [1]	M = 6.6	SD = 7.3	Minimum = 0	Maximum = 43
Association with Deviant Peers [1]	M = 35.6	SD = 14.0	Minimum = 6	Maximum = 73

[1] M = mean; SD = standard deviation

Treiber, Pflieger, Davis & Strong, 1994; Murphy, Alpert, Moes, & Somes, 1986; Treiber et al., 1993; Shapiro, Goldstein, & Jamner, 1996) in comparison to individuals of White ethnicity. All but one of the Black participants in the present study were from the high home/community violence exposure group, raising the possibility that effects of lifetime violence exposure would be confounded with ethnicity. For this reason, a dichotomous ethnicity variable (White/Caucasian or minority) was included as a covariate in supplemental analyses.

All participants began their laboratory visit by watching a relaxing video about Hawaii for 10 minutes while baseline measures of blood pressure and pulse rate were made. Participants then viewed 4 minutes of videotaped game play of a videogame high or low in violent content, depending on the condition to which they were randomly assigned. The purpose of the 4-minute viewing period was to allow participants to learn the rules and features of the game they were about to play. After the 4-minute viewing period, participants engaged in 10 minutes of videogame play. Following game play, participants completed an affective checklist and a measure of attitudes towards engagement in potentially harmful health behaviors, including violence. Following completion of these measures, participants participated in two additional laboratory tasks administered in counterbalanced order. In one task, participants viewed two videotaped social scenarios and were administered a structured clinical interview designed to measure hostile cognitive bias in evaluating the scenarios. In the other task, participants engaged in a "mixed-motive" game with a confederate, during which they could cooperate or compete with the confederate to earn points exchangeable for money at the completion of the study. The compete option, which deprived the confederate of points and money, was operationalized as laboratory aggression.

Blood pressure and pulse rate readings were made at minutes 5, 3, and 1 of the 10-minute resting baseline period, and at minutes 3 and 1 of 10-minute intertask rest periods. Readings were made at minutes 4 and 2 while participants viewed videotaped game play, and at minutes 10, 7.5, 5, and 2.5 during game play. Each social scenario clip was 3 ½ minutes in length; blood pressure and pulse rate readings were made at minutes 3 and 1 while participants viewed the clips and every two minutes while participants were interviewed (5 readings maximum). Readings were made at minutes 5, 3, and 1 of the mixed motive game and at minutes 10, 7.5, 5, and 2.5 of the 10-minute final rest period.

At the end of the study, participants completed a paper and pencil measure asking them to rate features of the videogame on a 7-point Likert scale (e.g. How violent, exciting, difficult was the game?). This measure served as a manipulation check to ensure that the violent and non-violent games differed from one another in violence and not in other important aspects that may have influenced cognitions, behavior, affect, and physiological arousal. Participants were reimbursed for their participation.

2.2. Measures

Previous violence exposure. The Community Experiences Questionnaire (CEQ; Schwartz & Proctor, 2000) was administered during the survey to measure participants' lifetime exposure to violence. Schwartz and Proctor developed items based on a review of existing measures, including Richters and Saltzman's (1990) Survey of Exposure to Community Violence. The CEQ consists of two subscales: exposure to violence through direct victimization (11 items) and witnessing (14 items). In Schwartz and Proctor's sample of 285 inner-city children, internal consistencies for the direct victimization and witnessing subscales were .81 and .89, respectively, while the correlation between the two subscales was .54. In the present study participants were asked to indicate whether they had experienced each item within the domain of home as well as school/work/community. Consistent with Schwartz and Proctor, participants were asked to indicate whether each item had occurred never (coded 0), once (coded 1), a few times (coded 2), or lots of times (coded 3). A violence exposure score was summed by tallying across all items within a specific domain and type of violence exposure (e.g. direct victimization within the home). A separate question was attached to each item to assess recency of violence exposure, coded 0 for not applicable, 1 for within the past month, 2 for within the past year, and 3 for over a year ago. Recency of violence exposure is not analyzed in the present study.

The Community Experiences Questionnaire (CEQ) yielded four subscales representing different types and domains of violence exposure: witnessed violence and victimization by violence within the community and within the home. Table 2 presents the distribution of each subscale, as well as the distribution of total violence exposure within the community and home, and total overall violence exposure. Mean scores of witnessed violence and victimization by violence within the community were higher than in Schwartz and Proctor's (2000) sample of inner-city children in grades 4-6, although this is not surprising given the older age of the present sample. Participants were more likely to witness or be

Table 2. Distribution of lifetime violence exposure variables by domain and type of exposure.

Scale [1]	Mean Score (*SD*)	Skew	Min.	Max.	Highest Possible Score	Internal Consistency [2]
Total Overall Violence Exposure	26.2 (14.8)	.62	2	73	150	.90
Total Community Violence Exposure	19.2 (10.6)	.66	0	51	75	.89
Witnessed	12.1 (7.0)	.80	0	32	42	.85
Victimization	7.0 (4.4)	.61	0	19	33	.75
Total Home Violence Exposure	7.1 (7.1)	1.23	0	33	75	.82
Witnessed	3.8 (4.1)	1.22	0	19	42	.69
Victimization	3.3 (3.6)	1.40	0	18	33	.72

[1] *SD* = standard deviation; Min. = minimum; Max. = maximum

[2] Two items were dropped from scale reliability analyses due to zero variance. The items were: "How many times have you seen somebody get robbed or have something stolen from them by force, *in your home*," and "How many times have you seen somebody get killed, *in your home*."

victimized by violence within the larger community than within the home (paired sample t=11.6 for the difference between total community and home violence exposure, p<.001). Variables representing violence exposure within the home were slightly positively skewed; these variables were transformed by taking the square root of the original variable.

Table 2 also presents internal consistencies for the violence exposure subscales and total scores. High internal consistencies for total overall violence (.90), total community violence (.89), and total family violence (.82) support the use of the violence composite scores as an indicator of an individual's overall experience of violence in their lifetime. Table 3 presents inter-correlations between the four violence exposure subscales (i.e. witnessed violence and victimization by violence within the community and home). Although all correlations were significant, correlations were highest within a specific domain of violence exposure (i.e. community or home). Principle component analysis with Varimax rotation of the four violence exposure subscales yielded two factors, each explaining 43% of variance in response. Witnessed violence and victimization by violence within the home loaded on the first factor (loadings .90 and .91, respectively), while witnessed violence and victimization by violence within the community loaded on the second factor (loadings .93 and .89, respectively). The pattern of data thus support examining total overall violence exposure, total community violence exposure, and total home violence exposure as separate variables in analyses and collapsing across type of exposure (e.g. witnessed violence or victimization by violence).

Prior experience playing videogames was assessed during the survey and analyzed as a covariate in supplemental analyses involving videogame condition. Participants estimated the typical number of hours per week they spent playing videogames during grades 7-9, grades 10-12, and college (see Table 1). Estimated hours were weighted according to time period (weight of 1 assigned to grades 7-9, weight of 2 to grades 10-12, weight of 3 to college) and summed across all three time periods. Due to slight positive skew (1.90), this composite score was transformed by taking the square root of the original variable.

Videogames and manipulation check. Participants were randomly assigned to play a videogame high in violence, Grand Theft Auto III, or a videogame comparatively low in violence, The Simpsons: Hit and Run. Both games involve driving through a virtual city to complete various missions.

Table 3. Inter-correlations among lifetime violence exposure variables.

	Community, Witnessed	Community, Victimization	Home, Witnessed [1]
Community, Victimization	.72 ***		
Home, Witnessed [1]	.30 **	.39 ***	
Home, Victimization [1]	.27 **	.37 ***	.72 ***

[1] To reduce positive skew, variables representing violence exposure within the home were transformed by taking the square root of the original variable.

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

The Simpsons: Hit and Run was designed to mimic the highly popular Grand Theft Auto series. In Grand Theft Auto III, the game player is a petty criminal trying to work his way up the gangland hierarchy in order to obtain better jobs. The creators of Grand Theft Auto promote the game player's ability to "take out" another character in over two dozen ways, including use of fist fighting (punch, kick, and head butt), baseball bat, handgun, Uzi, machine gun, M-16, rocket launcher, grenade, Molotov cocktail, and flame thrower. In the present study, participants randomly assigned to play Grand Theft Auto III were instructed by a member of the mafia to "introduce a bat" to the face of a drug dealer who was supplying drugs to prostitutes employed by the mafia. Participants randomly assigned to play The Simpsons: Hit and Run played the role of Homer Simpson and were instructed by Homer's wife, Marge, to deliver daughter Lisa's science project to school before Principal Skinner arrived and Lisa's science project would be marked late. Both characters in the games drove through a virtual city and interacted with other characters in order to complete their missions.

Seven male undergraduates from the pool of 180 males completing the survey were recruited as pilot participants to test whether Grand Theft Auto III and The Simpsons: Hit and Run were perceived as differing in violence. Pilot participants played each game in random order and completed a paper and pencil 'Videogame Rating Sheet' allowing them to rate features of the game on a 7-point Likert scale. This measure has been used by other researchers as a manipulation check that violent and non-violent game conditions are perceived by players as differing on violent content and graphics (Anderson & Dill, 2000; Anderson & Ford, 1986). Paired sample t-tests showed that pilot participants in the present study perceived Grand Theft Auto III to be more violent in content (M=6.7 vs. M=2.4, t=10.2, p<.0001) and graphics (M=6.3 vs. M=1.4, t=9.6, p<.0001) in comparison to The Simpsons: Hit and Run. Ratings of game difficulty (M=3.1) and frustration (M=2.4) did not differ between Grand Theft Auto III and The Simpsons: Hit and Run. However, pilot participants perceived Grand Theft Auto to be more enjoyable (M=6.1 vs. M=5.1, t=3.2, p<.05) and exciting (M=6.1 vs. M=4.3, t=4.0, p<.01) than The Simpsons: Hit and Run, and to have faster action (M=5.7 vs. M=4.4, t=2.0, p<.10). Differences in ratings of enjoyability, excitement, and fast action were not as large as differences in ratings of violence. For this reason, along with the games' similarity in genre and design, the decision was made to use the games within the full sample of participants.

In the present laboratory experiment, participants completed the Videogame Rating Sheet at the end of the study as a manipulation check. Independent samples t-tests showed that participants perceived Grand Theft Auto III to be more violent in content (M=6.0 vs. M=3.1, t=10.8, p<.001) and graphics (M=5.6 vs. M=2.4, t=12.8, p<.001) in comparison to The Simpsons: Hit and Run (also see Table 4). Ratings of difficulty, enjoyability, and frustration did not differ between Grand Theft Auto III and The Simpsons: Hit and Run. However, participants perceived Grand Theft Auto III to be slightly more exciting and faster in action than The Simpsons: Hit and Run (mean differences were less than 1 scale point). Table 5 presents inter-correlations among videogame rating sheet items, by videogame condition. The correlation between ratings of excitement and fast action was .50, both within participants who played Grand Theft Auto III and participants who played The Simpsons: Hit and Run. Ratings of excitement and fast action were summed to create a composite score. This composite score was included as a covariate in supplemental analyses to ensure that differences in outcomes by videogame condition were attributable to violence, and not other features perceived as differing between the games.

Hostile social information processing. Participants were shown two videotaped social scenarios (Chen & Matthews, 2003) and administered a structured clinical interview designed by Chen and Matthews and modified by the author to measure hostile cognitive bias in evaluating the scenarios (see Appendix A). Each social scenario depicted an ambiguous situation in which the main character could make hostile, neutral, or benign attributions for others' behavior. In the first scenario, a high school student, Billy, is sitting in class while his teacher hands back graded tests. The teacher alerts the class to his suspicion that some students have cheated, and dwells at length on his disappointment in students who have cheated and his pride in students who have earned their test scores. The teacher hands back a high test score to Billy and asks to speak with him at the end of class, leaving Billy to wonder why the teacher wants to speak with him (e.g. to accuse Billy of cheating, to ask if Billy saw anything during the test, to congratulate Billy on his test score). In the second social scenario, a teen is shopping with her friend. A sales associate follows the teen closely and asks if she can help the teen several times while the teen is browsing and trying on clothing in the dressing room. At the end of the scenario, the sales associate asks a security guard the direction in which the teen has gone. Based on the entire scenario, participants can make several attributions for the sales associate's behavior (e.g. thinking the teen has

Table 4. Means and standard deviations of items on video game rating sheet, by video game condition.

Item	Grand Theft Auto III	The Simpsons: Hit and Run	Independent Samples *t*
Difficulty	2.6 (1.6)	2.2 (1.2)	1.2
Enjoyability	5.6 (1.1)	5.7 (1.1)	-.5
Frustration	2.4 (1.5)	1.9 (1.2)	1.8
Excitement	5.1 (1.4)	4.6 (1.2)	2.0 *
Fast Action	5.0 (1.3)	4.2 (1.4)	3.0 **
Violent Content	6.0 (1.0)	3.1 (1.6)	10.8 ***
Violent Graphics	5.6 (1.3)	2.4 (1.3)	12.8 ***

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

Table 5. Inter-correlations among video game rating sheet items, by video game condition.

Items [1]	Difficulty	Enjoyability	Frustration	Excitement	Fast Action	Violent Content	Violent Graphics
Difficulty	…	-.01	.66 ***	.24	.19	.17	.01
Enjoyability	-.00	…	-.01	.58 ***	.39 **	.18	.08
Frustration	.69 ***	.09	…	.33 *	.23	-.02	-.09
Excitement	.11	.52 ***	.18	…	.50 ***	-.00	-.11
Fast Action	.14	.29 *	.21	.50 ***	…	.46 **	.24
Violent Content	.46 **	.15	.41 **	.34 *	.38 **	…	.68 ***
Violent Graphics	.27	.20	.33*	.25	.28 *	.61 ***	…

[1] Correlations above the diagonal correspond to Grand Theft Auto III, while correlations below the diagonal correspond to The Simpsons: Hit and Run.

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

stolen something, wanting to make a sale, wanting to help the teen or return a bag the teen has left by the dressing room).

Participants were instructed to imagine that they were the youth in each of the social scenarios, and to imagine how the teacher and sales associate would respond to them. After viewing each social scenario, participants rated the likelihood of a benign, neutral, and hostile motivation for the other person's ambiguous behavior on a 5-point Likert scale. After viewing the "Billy" scenario, participants rated the likelihood that the teacher would complement them for doing well on a test, ask them if they saw anything suspicious during the test, or accuse them of cheating. After viewing the "Shopping" scenario, participants rated the likelihood that the saleswoman was trying to help them, trying to make a sale, or trying to find them because she suspected them of stealing an article of clothing. In addition, a trained laboratory research assistant listened to participants' audiotaped responses to the interview and rated participants' hostile social information processing using a 5-point rating scale developed by Edith Chen and Karen Matthews. The laboratory research assistant was blind to participants' laboratory videogame condition and lifetime history of violence exposure. A second laboratory research assistant rated a subset of participants' responses to allow for reliability testing. The correlation between research assistants across 23 randomly selected and hard-to-code cases was r=.63 (p<.01). Within the 15 randomly selected interviews that were not identified as hard-to-code by the primary coder, the correlation between research assistants was r=.73 (p<.01).

Table 6 presents inter-correlations among participants' attributions and the laboratory research assistant's ratings of participants' hostile social information processing, within social scenario. All correlations were significant. Principle component analyses with Varimax rotation of the four social information processing outcomes yielded a single factor, explaining 49% and 57% of variance within the "Billy" and "Shopping" social scenarios, respectively. Factor loadings for "Billy" ranged between .64 and .76, while factor loadings for "Shopping" ranged between .66 and .80. In both cases, benign and neutral attributions loaded negatively onto the factors. A hostile social information processing composite score was formed by summing across the attributions and hostile social information processing rating within each scenario, using reverse scoring for the benign and neutral attributions. The correlation between the "Billy" and "Shopping" hostile social information processing composites was .27 (p<.01). An overall

Table 6. Inter-correlations among social information processing variables.

Variable [1]	Hostile Attribution	Neutral Attribution	Benign Attribution	Hostile SIP
Hostile Attribution (Accusation of Cheating/Stealing)	…	-.24 *	-.31 **	.43 ***
Neutral Attribution (Asking if anything was seen during test/ Trying to make a sale)	-.35 ***	…	.33 **	-.41 ***
Benign Attribution (Complement on high test score/Trying to help)	-.28 **	.64 ***	…	-.22 *
Independent Rating of Hostile Social Information Processing (SIP)	.46 ***	-.38 ***	-.43 ***	…

[1] Correlations above the diagonal correspond to "Billy," while correlations below the diagonal correspond to "Shopping."

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

hostile social information processing composite score was formed by summing across the "Billy" and "Shopping" hostile social information processing composites. This score was normally distributed with a mean of 25.5 (total possible score of 40), and standard deviation of 5.3.

Permissive attitudes towards violence and other harmful health behaviors. Post videogame play, Funk et al.'s 15-item Attitudes Towards Violence Scale (Funk, Elliott, Urman, Flores, & Mock, 1999) was administered to measure attitudes towards interpersonal violence. The scale yields two factors: Reactive Violence (response to immediate threat, including having violent behaviors in one's repertoire, being willing to act in a violent manner, and endorsing violent responses) and Culture of Violence (conviction that the world is a dangerous place and that the best way to ensure survival is to be vigilant and ever prepared to take the offensive). In Funk et al.'s sample of 1,266 junior and senior high school students, internal consistencies for the Reactive Violence and Culture of Violence subscales were .75 and .80, respectively. A correlation between the two subscales was not reported, but the internal consistency for the entire scale (Total Pro-Violence Attitudes) was .86. Self report of victimization by violence was positively correlated with both subscales and the Total Pro-Violence Attitudes composite.

In the present sample, internal consistencies for the Reactive Violence and Culture of Violence subscales were .77 and .49, respectively, while the correlation between the two subscales was r=.57 (p<.001). The internal consistency for the Culture of Violence subscale was much lower than that obtained by Funk et al. (1999) in their sample of high school students. The internal consistency for the entire Total Pro-Violence Attitudes scale was .76. Total Pro-Violence Attitudes was thus examined as the indicator of a participant's attitudes towards violence. This scale was normally distributed with a mean of 2.0 (total possible score of 5), and standard deviation of .45 (see Table 7).

To measure attitudes towards harmful health behaviors, participants completed a Perceived Risk Questionnaire developed for this study by the author (see Appendix B). Participants used a 7-point Likert scale to indicate the perceived health benefit or risk of engaging in 15 behaviors assessed within the 2001 Youth Risk Behavior Survey (Brener, Collins, Kann, Warren, & Williams, 1995; Brener et al., 2002; also see http://www.cdc.gov/HealthyYouth/yrbs/index.htm), including alcohol, tobacco, and other drug use, sexual risk taking, and driving risks. Five other behaviors viewed as beneficial to health were included in the measure (e.g. exercising, eating vegetables) to minimize response bias, but are not

Table 7. Distribution of variables assessing attitudes towards violence and other health risk behaviors.

Scale	Mean Score (*SD*) [1]	Skew	Minimum	Maximum	Internal Consistency
Total Pro-Violence Attitudes [2]	2.0 (.4)	.43	1.1	3.5	.76
Attitudes toward 15 Health Risk Behaviors [2]	-2.2 (.4)	.80	-3.0	-0.5	.80
Alcohol use	-1.1 (.9)	.29	-3	2	…
Marijuana use	-1.6 (1.2)	.36	-3	1	…
Sex with > 1 partner in 3 month period	-.9 (1.1)	-.43	-3	2	…
Sex without condom use	-1.8 (1.0)	.39	-3	1	…
Drinking alcohol/using drugs before sex	-1.5 (1.2)	.46	-3	2	…
Driving ≥ 20 mph over speed limit	-1.4 (1.0)	.09	-3	1	…

[1] *SD* = standard deviation

[2] The highest possible score for Total Pro-Violence Attitudes was 5, while possible scores for attitudes toward individual health risk behaviors and the 15-behavior composite ranged between -3 (very harmful) and 3 (very helpful).

analyzed. Attitudes towards the 15 health risk items of the Perceived Risk Questionnaire were averaged to create on overall composite score for permissive attitudes towards health risk behavior. The internal consistency for this scale was .80. The risk behaviors eliciting the most variance in attitudes (standard deviation close to 1 scale point or above) were alcohol use, marijuana use, having sex with more than one partner in a 3-month period, having sex without use of a condom, drinking alcohol or using drugs before having sex, and driving more than 20 mph over the speed limit. Attitudes towards these risk behaviors were examined separately as outcomes when an overall effect for the composite score was found. Table 7 presents the distribution of the overall composite score for permissive attitudes towards health risk behavior, as well as the distribution for those risk behaviors eliciting the most variance in attitudes. All variables were normally distributed.

Aggressive behavior. Participants engaged in a "mixed-motive" game (Van Egeren, Fabrega, & Thornton, 1983) with a confederate, during which they could cooperate or compete with the confederate to earn points exchangeable for money at the completion of the study. A game consisted of 30 trials. On each trial the participant chose to divide points worth money with his "partner" (in actuality, a pre-programmed computer), either equally by clicking on the COOPERATE box on the computer screen, or unequally by clicking on the COMPETE box. If both the participant and partner choose to cooperate, each earned two points. If one cooperated while the other competed, the cooperative response earned one point while the competitive response earned three points. If both the participant and partner choose to compete, both lost two points. Each point gained or lost was worth 5 cents, and participants were told they would be reimbursed for any points earned above zero (in actuality, all participants were given $5). The consequences to self and partner of various combinations of cooperate and compete responses were explained to participants prior to the game. Participants heard a tape recorded voice of a male confederate, who was ostensibly in the next room, prior to and during the game. The "partner" cooperated only 30% of the time, creating a situation that could be construed by the participant as provocation, while also providing an economical incentive for the participant to cooperate overall. The compete option, which deprived the confederate of points and money, was operationalized as laboratory aggression. "Compete" responses were tallied across the 30 trials of the mixed-motive task. The competition composite score was normally distributed (M=13.6, SD= 4.4, minimum score=2, maximum

score=24). A competition composite score could not be derived for three participants due to computer error; two of the participants had been randomly assigned to Grand Theft Auto III, while the remaining participant had been randomly assigned to The Simpsons: Hit and Run.

Laboratory assessed negative affect. Negative affect post videogame play was measured with the Reduced Profile of Mood States (Reduced POMS), which yields a total negative affect score as well as three affective sub-scores (anxiety, depression, anger), derived by summing across three items for each sub-score. Participants indicated how strongly they felt each mood item using a 5-point scale, ranging from "not at all," to "extremely." Usala and Hertzog (1989) developed the Reduced POMS based on a factor analysis of moods drawn from the original Profile of Mood States (POMS; McNair, Lorr & Droppleman, 1992). Internal consistencies for the Reduced POMS scales in Usala and Hertzog's two samples ranged between .76 and .92.

In the present study, negative affect post videogame play yielded the following internal consistencies: total negative affect (.79), anxiety (.70), depression (.68), anger (.68). Total negative affect and anger post videogame play were examined as outcomes and as potential mediators between violence exposure and cognitive-behavioral outcomes. Both variables were positively skewed: negative affect (*M*=12.9, *SD*=3.9, skew=1.2, minimum score=9, maximum score=25); anger (*M*=4.0, *SD*=1.6, skew=2.2, minimum score=3, maximum score=12). Negative affect was transformed by computing the square root of the original variable, while anger was transformed by computing the negative inverse of the original variable. Transformed variables were analyzed in subsequent analyses.

Physiological measures. Systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate (PR) were monitored using an IBS Model SD-700A automated blood pressure monitor (IBS Corp., Waltham, MA) with a standard occluding cuff placed on the participant's nondominant arm. Table 8 presents the distributions of SBP, DBP, and PR during the initial resting period, as well as changes in physiological variables from the initial rest period to watching and playing the videogame. Variables were computed by averaging all measures taken during a particular period. All variables were normally distributed. Increases in physiological parameters from the initial rest period to watching or playing the videogame were all significantly different from zero. Change scores from the initial rest period to watching or playing the videogame were regressed on the initial rest measure to control for potential

Table 8. Distribution of physiological variables.

Variable [1]	Initial Rest			Change from Initial Rest to Watching Video Game			Change from Initial Rest to Playing Video Game		
	Mean (*SD*)	Min.	Max.	Mean (*SD*)	Min.	Max.	Mean (*SD*)	Min.	Max.
SBP	113.2 (8.9)	95.7	136.0	4.3 (4.8)	-7.0	18.7	7.4 (8.4)	-11.5	33.4
DBP	60.7 (9.0)	41.3	84.3	3.2 (6.0)	-16.8	19.3	5.0 (7.6)	-17.3	24.5
PR	71.9 (9.7)	52.3	97.3	24.1 (7.9)	7.7	47.2	15.0 (10.2)	-8.6	47.2

[1] *SD* = standard deviation; Min. = minimum; Max. = maximum; SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate

"ceiling effects" (see Endnote). These residualized change scores, also normally distributed, were analyzed in subsequent analyses.

Arm movement during videogame play. During videogame play, participants wore a non-invasive band on their upper arm that was designed to measure movement. The Body Media Sense Wear ® Pro Armband contains an accelerometer which measures motion forces exerted on the body in a single plane. Static and dynamic forces are measured in two perpendicular axes: longitudinal, or parallel to the arm, and transverse, or perpendicular to the arm. In the present study, a composite score created from average longitudinal movement and transverse movement during game play was analyzed as a covariate in supplemental analyses of physiological measures. No studies of videogame violence have previously measured or controlled for arm movement.

Average longitudinal movement and transverse movement during game play were multiplied by 100 and distributed as follows: longitudinal (*M*=39.2, *SD*=11.8, minimum score=6.0, maximum score=75.6), transverse (*M*=-19.5, *SD*=30.5, minimum score=-92.8, maximum score=62.6). The absolute value of the transverse movement score was standardized and averaged with the standardized longitudinal movement score to create an overall movement composite (*M*=0, *SD*=.7, minimum score=-1.39, maximum score=1.84). This overall movement composite score was normally distributed and was analyzed as a covariate in supplemental analyses of physiological measures.

Parental socioeconomic status. When completing the survey, participants estimated the years of education achieved by each parent in their primary household. The highest years of education achieved by any parent ranged between 11 and 24 years, with a mean of 16.5 (see Table 1). This variable was included as a covariate in supplemental analyses.

Association with deviant peers. When completing the survey, participants completed a 13-item questionnaire to indicate their association with deviant peers (Metzler, Noell, Biglan, Ary, & Smolkowski, 1994). Among Metzler et al.'s sample of 99 urban adolescents aged 15-18, the internal consistency of this scale was .83. Participants in the present study completed the questionnaire both for their current set of friends (alpha=.83) and their set of friends in high school (alpha=.84). The correlation between the two scores was *r*=.65 (*p*<.001). Principle component analysis with Varimax rotation of the two scores (high school and college friends' deviance) yielded a single factor, explaining 82% of variance in response

(loading .91 for each score). The two scores were thus summed to create an overall composite for association with deviant peers that was normally distributed (see Table 1). A score of 0 would indicate that none of a participant's friends had ever engaged in any deviant behavior (e.g. smoking cigarettes, hitting other people, cheating on tests), while a score of 104 would indicate that almost all of a participant's friends had engaged in every assessed deviant behavior. Scores ranged between 6 and 73, and were analyzed as a covariate in supplemental analyses.

2.3. Power Analyses

Prior to collecting data, the statistical software SamplePower was used to perform power analyses to determine a suggested sample size for the present laboratory experiment. A priori power analyses utilized previously reported effect sizes for the association between media violence exposure and both physiological and aggression-related outcomes in undergraduate students. Ballard and Wiest (1996) randomly assigned 20 undergraduates to play either Level 1 or Level 2 of Mortal Kombat™ for 10 minutes. In both versions combatants kick, punch, and electrocute one another until one has been killed. In Level 2 aggressive motions are accompanied by spurting blood and gore. Ballard and Wiest found the average systolic blood pressure during game play, adjusted for baseline values, to be 126.0 (SD=9.9) in the Level 1 group and 132.2 (SD=5.2) in the Level 2 group. A priori power analyses using these means and standard deviations with α=.05 and power=.80 recommended a total sample size of 27 participants per laboratory media violence condition. Ballard and Wiest administered the Buss-Durkee Hostility Inventory (Buss, 1957) to participants after videogame play and found that the Level 1 Mortal Kombat™ group had a mean score of 59.3 (SD=7.4) while the Level 2 group had a mean score of 73.8 (SD=10.6). A priori power analyses using these means and standard deviations with α=.05 and power=.80 recommended a total sample size of only 8 participants per group. Anderson and Bushman (2001) conducted a meta-analytic review of the association between playing violent videogames and aggression-related outcomes, including both published and unpublished studies to provide a more conservative estimate of the association. Most of the studies included in Anderson and Bushman's analysis of aggressive cognitions were experimental. The pooled correlation coefficient across studies for the association between exposure to videogame violence and aggressive cognitions was .27. A priori power analyses using an effect size of r=.27 with α=.05 and power=.80 recommended a total sample size of 100

participants. One hundred participants (50 per laboratory media violence condition) were thus planned for the present experiment in the event that associations between media violence and hostility-related outcomes were more modest than those found by Ballard and Wiest and to provide 25 participants per cell for tests of moderation (the effects of media violence were expected to be strongest in those participants exposed to high levels of home/community violence).

2.4. Detailed Hypotheses and Plan of Analyses

Hypothesis 1: Predicted main effects of laboratory media violence condition. In comparison to adolescents randomly assigned to play The Simpsons: Hit and Run, adolescents randomly assigned to play Grand Theft Auto III were expected to exhibit greater physiological arousal (change scores from baseline to game play, residualized for resting physiology; see Endnote for a rationale on the choice of residualized change scores). Post game play, adolescents randomly assigned to play Grand Theft Auto III were expected to exhibit greater angry/negative affect, more hostile social information processing in response to Chen and Matthews' social scenarios, more permissive attitudes towards violence and other harmful health behaviors, and a greater number of competitive responses during the "mixed-motive" game with the laboratory confederate.

Univariate and multivariate general linear modeling (GLM) were used to test the above predicted associations. Univariate GLM was used in analyses of competitive behavior with the confederate and angry/negative affect. Multivariate GLM was used in analyses of the three cognitive outcomes (hostile social information processing, permissive attitudes towards violence, permissive attitudes towards other harmful health behaviors) and three physiological outcomes (change scores for SBP, DBP, and PR from baseline to game play, residualized for resting physiology). When findings were significant, analyses were performed again with inclusion of covariates, including prior experience with videogames, ethnicity, parental SES, and association with deviant peers. Arm movement during videogame play was included as an additional covariate in analyses of physiological arousal during game play.

Hypothesis 2: Predicted main effects of home/community violence exposure. In comparison to adolescents low in lifetime exposure to home/community violence, adolescents high in lifetime exposure were expected to exhibit elevations in each of the indices outlined in Hypothesis 1. In addition, adolescents high in lifetime exposure to home/community violence were expected to exhibit

lower physiological arousal during the laboratory baseline period. The same plan of analyses described above was utilized, with home/community violence examined as a continuous variable.

Hypothesis 3: Predicted interactions between laboratory media violence condition and home/community violence exposure. Laboratory media violence condition (Grand Theft Auto III vs. The Simpsons: Hit and Run) and home/community violence exposure were expected to interact, such that the effects of media violence condition would be greater among those high in lifetime exposure to home/community violence than among those low in overall exposure (see Figure 1). The same plan of analyses described above was utilized, with the inclusion of both laboratory media violence condition and home/community violence exposure as potential main effects in a first model, and the addition of an interaction term in a second model. When an interaction term was significant, simple effects tests were utilized to determine whether media violence condition was associated with an outcome within high and low home/community violence exposure groups (these groups were created by a median split of the continuous lifetime violence exposure variable). Effect sizes within each group were compared using partial eta squared. Analyses were performed with inclusion of covariates when significant main effects or interaction effects were observed.

Hypothesis 4: Tests of mediation between laboratory media violence condition and cognitive-behavioral outcomes. The predicted associations between laboratory media violence condition (Grand Theft Auto III vs. The Simpsons: Hit and Run) and cognitive-behavioral outcome measures were expected to be mediated by both greater angry/negative affect and physiological arousal during game play (see Figure 2). Cognitive-behavioral outcome measures include hostile social information processing of Chen and Matthews' ambiguous social scenarios, permissive attitudes towards violence and other harmful health behaviors, and competitive behavior during the laboratory task with a confederate.

A mediational test was performed only when the violence exposure variable was significantly associated with both the hypothesized mediating variable and the outcome variable, and the hypothesized mediating variable was also associated with the outcome variable. Stepwise linear regressions were used to test all mediational hypotheses, examining a single potential mediating variable and a single outcome variable at a time. Violence exposure was entered on the first step, while the

potential mediator was entered on the second step. Level of mediation was assessed by comparing the unstandardized regression coefficient for the violence exposure variable in models with and without inclusion of the mediator. Mediation was inferred when the unstandardized regression coefficient was reduced by at least 1.65 of its original standard error, the criterion recommended for smaller samples (e.g. Wills, DuHamel, & Vaccaro, 1995; Wills, McNamara, & Vaccaro, 1995). Analyses were performed with and without the inclusion of covariates.

Hypothesis 5: Tests of mediation between lifetime home/community violence exposure and cognitive-behavioral outcomes. The predicted associations between lifetime home/community violence exposure and cognitive-behavioral outcome measures were expected to be mediated by both greater angry/negative affect and physiological arousal during game play (see Figure 2). The same plan of analyses described above was utilized.

3. RESULTS

3.1. Preliminary Analyses

Task order subsequent to videogame play did not vary by laboratory videogame condition or by home/community violence exposure. Planned covariates included prior experience with videogames, ethnicity, parental SES, association with deviant peers, and arm movement during videogame play. Laboratory videogame condition was not associated with any of these covariates or with lifetime violence exposure variables, confirming that random assignment evenly distributed participant characteristics across the two conditions. As reported in the Measures section, participants randomly assigned to play Grand Theft Auto III perceived the game as more exciting and fast in action than participants randomly assigned to play The Simpsons: Hit and Run. Thus, the composite rating of videogame excitement/fast action was included as an additional covariate in analyses involving videogame condition.

Some associations emerged between covariates, lifetime violence exposure variables, and outcome measures. Greater experience playing videogames was associated with lower likelihood of finding the laboratory videogame to be difficult (r=-.34, p<.01) or frustrating (r=-.40, p<.001). Greater experience playing videogames was also associated with less hostile attributions subsequent to viewing the social scenarios (r=-.27, p<.01) and with lower likelihood of thinking that marijuana is harmful to one's health (r=.20, p<.05).

Ethnic minority participants, the majority of whom self-identified as African-American/Black, reported greater exposure to overall lifetime violence (M=33.3 vs. M=24.8, p<.05), community violence (M=23.5 vs. M=18.3, p=.06), and family violence (M=8.4 vs. M=4.0, p<.05) in comparison to Caucasian/White participants. Ethnic minority status was also associated with lower scores on the hostile social information processing composite (M=23.2 vs. M=26.0, p<.05).

Greater years of parental education was associated with lower total family violence exposure (r=-.20, p<.05) and lower participant SBP during game play (p=-.20, p<.05). Greater years of parental education was also associated with *lower* likelihood of thinking that having sex without use of a condom is harmful to one's health (r=.30, p<.01; higher scores indicate thinking a behavior is less harmful).

Greater association with deviant peers was associated with greater total violence exposure (r=.49, p<001), community violence exposure (r=.48, p<001), and family violence exposure (r=.32, p<01). Association with deviant peers was also associated with more permissive attitudes towards violence (r=.30, p<.01) and all 15 health risk behaviors, combined (r=.43, p<.001). Specifically, association with deviant peers was associated with more permissive attitudes towards drinking alcohol, using marijuana, having sex with more than one person in a 3-month period, and drinking alcohol or using drugs before sex (r's between .29 and .37, p's<.01). Notably, association with deviant peers was not associated with attitudes towards having sex without use of a condom. Finally, association with deviant peers was associated with more competitive responses during the mixed-motive game (r=.24, p<.05) and with greater pulse rate during videogame play (r=.26, p<.01).

Arm movement during game play was not associated with violence exposure or any outcome measures. However, the composite rating of videogame excitement/fast action was associated with greater angry affect (r=.21, p<.05) and total negative affect (r=.25, p<.05) subsequent to game play.

3.2. Main Analyses

Hypothesis 1. In comparison to adolescents randomly assigned to play The Simpsons: Hit and Run, adolescents randomly assigned to play Grand Theft Auto III were expected to exhibit greater physiological arousal (change scores from baseline to game play, residualized for resting physiology) during game play. Post game play, adolescents randomly assigned to play Grand Theft Auto III were expected to exhibit greater angry/negative affect, more hostile social information processing in response

to Chen and Matthews' social scenarios, more permissive attitudes towards violence and other harmful health behaviors, and a greater number of competitive responses during the "mixed-motive" game with the laboratory confederate.

As hypothesized, adolescents randomly assigned to play Grand Theft Auto III exhibited greater changes in SBP and DBP from the initial rest period to game play than adolescents randomly assigned to play The Simpsons: Hit in Run (see Table 9). There was no difference in PR from the initial rest period to game play by videogame condition, although supplementary analyses revealed that adolescents assigned to play Grand Theft Auto III exhibited greater changes in PR from the initial rest period to watching the videogame segment prior to game play (F=4.8, p<.05; not shown in table). Consistent with hypothesis, adolescents randomly assigned to play Grand Theft Auto III expressed greater total negative affect (significant) and angry affect (marginally significant) in comparison to adolescents randomly assigned to play The Simpsons: Hit and Run (see Table 9). Contrary to hypothesis, videogame condition was not associated with the hostile social information processing composite score or permissive attitudes towards violence. However, participants randomly assigned to play Grand Theft Auto III exhibited more permissive attitudes toward all 15 health risk behaviors, combined (marginally significant; see Table 9). Supplementary analyses of the health risk behaviors eliciting the most variance in response revealed that play of Grand Theft Auto III was associated with more permissive attitudes toward drinking alcohol (F=6.2, p<.05) and using marijuana (F=7.7, p<.01), but was not associated with variables related to sexual risk taking or driving over the speed limit. Finally, consistent with hypothesis, participants randomly assigned to play Grand Theft Auto III chose a greater number of competitive responses during the mixed-motive game than participants randomly assigned to play The Simpsons: Hit and Run (see Table 9).

Additional analyses tested whether the findings above remained after controlling for the composite rating of videogame excitement/fast action, prior experience playing videogames, ethnicity, parental SES, and association with deviant peers. Arm movement during videogame play was included as an additional covariate in analyses of blood pressure. Inclusion of covariates did not alter the significance of associations between videogame condition and physiological outcomes, permissive attitudes towards all health risk behaviors, combined, and permissive attitudes towards the individual risk

Table 9. Means and standard deviations of outcome variables by videogame condition.

Variable [1]	Mean (*SD*) The Simpsons	Grand Theft Auto III	*F*	*p*-value [4]
Change in SBP to Game Play [2]	5.9 (7.4)	9.0 (9.0)	5.0 *	.03 (.03)
Change in DBP to Game Play [2]	3.7 (7.4)	6.3 (7.7)	4.9 *	.03 (.03)
Change in PR to Game Play [2]	15.1 (10.3)	14.8 (10.1)	.14	.71
Angry Affect post Game Play [3]	3.8 (1.4)	4.3 (1.8)	3.4	.07 (.37)
Total Negative Affect post Game Play [3]	12.0 (3.1)	13.9 (4.4)	5.7	.02 (.17)
Hostile Social Information Processing Composite Score	24.8 (6.0)	26.2 (4.4)	1.8	.19
Permissive Attitudes toward Violence	2.0 (.4)	2.0 (.5)	.02	.89
Permissive Attitudes toward 15 Health Risk Behaviors	-2.3 (.4)	-2.1 (.4)	3.6 *	.06 (.03)
Competitive Responses with Confederate	12.7 (4.5)	14.6 (4.3)	4.5	.04 (.05)

[1] *SD* = standard deviation; SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate

[2] Means and standard deviations are presented using change scores from the initial rest to videogame play. Residualized change scores are used in analyses (see Endnote).

[3] Means and standard deviations are presented using the original mood rating scale, ranging from a possible 0-15 for angry affect and 0-45 for total negative affect. The negative inverse of the angry affect score and square root of the total negative affect score are used in analyses.

[4] *p*-values in parentheses indicate significance of effect with inclusion of covariates.

* Finding remained significant after inclusion of covariates: composite rating of videogame excitement/fast action, prior experience playing videogames, ethnic minority status, parental socioeconomic status, and association with deviant peers. For physiological outcomes during game play, arm movement was included as an additional covariate.

behaviors of drinking alcohol and using marijuana (see Table 9). However, the association between videogame condition and competitive responses toward the confederate was reduced to marginal significance after inclusion of covariates (F=3.9, p=.05). When covariates were entered individually into analyses, videogame condition remained a significant predictor of competitive responses. Other analyses showed that videogame condition was no longer associated with angry affect and total negative affect after inclusion of covariates. No single covariate appeared to solely account for the elimination of videogame condition's marginally significant effect on angry affect and significant effect on total negative affect, although the composite rating of videogame excitement/fast action appeared to account for the reduction in significance to a greater degree than other covariates. When videogame excitement/fast action was entered individually as a covariate, the association between videogame condition and angry affect became non-significant, while the association between videogame condition and total negative affect became marginally significant. In both cases, the unstandardized regression coefficient for videogame condition was not reduced by at least 1.65 of its original standard error, implying that videogame excitement/fast action was not a statistical mediator of the associations between videogame violence and angry or negative affect.

Hypothesis 2. In comparison to adolescents low in lifetime exposure to home/community violence, adolescents high in lifetime exposure were expected to exhibit greater physiological arousal (change scores from baseline to game play, residualized for resting physiology) during videogame play. Post game play, adolescents with greater lifetime violence exposure were expected to exhibit greater angry/negative affect, more hostile social information processing in response to Chen and Matthews' social scenarios, more permissive attitudes towards violence and other harmful health behaviors, and a greater number of competitive responses during the "mixed-motive" game with the laboratory confederate. In addition, adolescents high in lifetime exposure to home/community violence were expected to exhibit lower physiological arousal during the laboratory baseline resting period.

Table 10 shows the association between different lifetime violence exposure variables (total violence exposure, community violence exposure, home violence exposure) and outcome measures. Contrary to hypothesis, lifetime violence exposure was not associated with physiological variables during the initial rest period, angry affect and total negative affect post game play, hostile social information

Table 10. Association between lifetime violence exposure variables and outcome variables.

Variable [1] [2]	Total Overall Violence Exposure			Total Community Violence Exposure			Total Home Violence Exposure		
	B (SE)	*F*	*p*-value [4]	B (SE)	*F*	*p*-value [4]	B (SE)	*F*	*p*-value [4]
Initial rest SBP	-.07 (.06)	1.3	.27	-.11 (.08)	1.6	.21	-.48 (.59)	.65	.42
Initial rest DBP	-.07 (.06)	1.3	.25	-.06 (.08)	.51	.48	-.92 (.59)	2.4	.12
Initial rest PR	-.05 (.07)	.54	.46	-.02 (.09)	.04	.84	-.66 (.64)	1.1	.30
Change in SBP to Game Play [3]	.12 (.05)	4.9	.03 (.73)	.15 (.08)	4.1	.047 (.51)	.70 (.53)	1.7	.19
Change in DBP to Game Play [3]	.01 (.04)	.02	.88	.02 (.06)	.07	.79	-.28 (.43)	.42	.52
Change in PR to Game Play [3]	.18 (.06)	8.1	.01 (.25)	.16 (.09)	3.3	.07 (.78)	1.9 (.59)	10.7 *	.002 (.03)
Angry Affect post Game Play	.00 (.001)	.01	.94	.00 (.001)	.002	.97	.002 (.005)	.10	.74
Total Negative Affect post Game Play	.001 (.004)	.05	.82	.002 (.005)	.11	.75	.01 (.03)	.15	.70
Hostile SIP Composite Score	-.002 (.04)	.002	.96	-.02 (.05)	.23	.63	-.07 (.35)	.04	.85
Permissive Attitudes toward Violence	.01 (.003)	11.7 *	.001 (.047)	.01 (.004)	12.0	.001 (.06)	.07 (.03)	5.1	.02 (.11)
Permissive Attitudes toward 15 Health Risk Behaviors	.01 (.003)	5.5	.02 (.95)	.01 (.004)	7.5	.007 (.55)	.01 (.03)	.14	.72
Competitive Responses with Confederate	-.01 (.03)	.03	.86	.02 (.04)	.12	.73	-.36 (.30)	1.5	.22

[1] B = unstandardized regression coefficient; SE = standard error; SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate; SIP = social information processing

[2] Lifetime violence exposure variables were examined separately in analyses.

[3] Residualized change scores from the initial rest period to game play are used in analyses (see Endnote).

[4] *p*-values in parentheses indicate significance of effect with inclusion of covariates.

* Finding remained significant after inclusion of covariates: prior experience playing videogames, ethnic minority status, parental SES, and association with deviant peers. For physiological outcomes during game play, arm movement was included as an additional covariate.

processing subsequent to the social scenarios, and competitive responses during the mixed-motive game. Consistent with hypothesis, however, greater total violence exposure was associated with greater changes in SBP and PR from the initial rest period to game play. Different types of violence exposure appeared to contribute to increases in each physiological index of arousal. Greater exposure to community violence was associated with greater changes in SBP, while greater exposure to home violence was associated with greater changes in PR. Consistent with hypothesis, greater lifetime exposure to each type of violence (total, community, home) was associated with more permissive attitudes towards violence. In addition, greater total violence and community violence exposure were associated with more permissive attitudes towards all 15 health risk behaviors, combined. Supplementary analyses of the health risk behaviors eliciting the most variance in response revealed that greater exposure to each type of violence was associated with more permissive attitudes towards drinking alcohol: total violence (F=6.0, p<.05), community violence (F=3.6, p<.10), home violence (F=4.1, p<.05). Greater exposure to both total violence (F=4.9, p<.05) and community violence (F=6.0, p<.05) were associated with more permissive attitudes towards drinking alcohol or using drugs before having sex. Additionally, greater exposure to community violence was associated with more permissive attitudes towards having sex without use of a condom (marginally significant; F=2.9, p<.10).

Additional analyses tested whether the findings above remained significant after controlling for prior experience playing videogames, ethnicity, parental SES, and association with deviant peers. Arm movement during videogame play was included as an additional covariate in analyses of physiological indices during game play. Inclusion of covariates did not alter the significance of the association between greater home violence exposure and greater changes in PR from the initial rest period to game play. Inclusion of covariates eliminated the associations between both total overall violence exposure and community violence exposure and changes in SBP and PR from the initial rest period to game play. When covariates were entered individually into analyses, the only covariate to consistently reduce the significance of findings was association with deviant peers. However, the unstandardized regression coefficients for the violence exposure variables were not reduced by at least 1.65 of their original standard errors, implying that association with deviant peers was not a statistical mediator of associations between violence exposure and physiological arousal during videogame play.

The association between total lifetime violence exposure and more permissive attitudes towards violence remained significant after inclusion of covariates. However, inclusion of covariates reduced the association between community violence exposure and permissive attitudes towards violence to marginal significance, and eliminated the association between home violence exposure and permissive attitudes towards violence. When covariates were entered individually into analyses, community violence exposure remained a significant predictor of permissive attitudes towards violence. Although association with deviant peers eliminated the significant association between home violence exposure and permissive attitudes towards violence, the unstandardized regression coefficient for home violence exposure was not reduced by 1.65 of its original standard error, implying that association with deviant peers was not a statistical mediator.

Inclusion of covariates eliminated associations between both total violence exposure and community violence exposure and permissive attitudes towards the 15 health risk behaviors, combined. When covariates were entered individually into analyses, association with deviant peers eliminated significant relations between the violence exposure variables and permissive attitudes towards health risk behavior. More importantly, the unstandardized regression coefficients for the violence exposure variables were reduced by over 1.65 of their original standard errors, implying that association with deviant peers mediated the association between violence exposure and more permissive attitudes towards health risk behavior.

Hypothesis 3. Laboratory media violence condition (Grand Theft Auto III vs. The Simpsons: Hit and Run) and home/community violence exposure were expected to interact, such that the effects of media violence condition would be greater among those high in lifetime exposure to home/community violence than among those low in lifetime exposure (see Figure 1).

Significant interactions between lifetime violence exposure and the laboratory media violence condition were found only for physiological variables (see Table 11). To determine the meaning of a significant interaction, the continuous lifetime violence exposure variable was recoded into a dichotomous variable by median split, and simple effects tests were performed to determine whether media violence condition was associated with a physiological outcome within high and low lifetime violence exposure groups. Effect sizes within each group were compared using partial eta squared. Table 11 shows that

Table 11. Means and standard deviations of outcome variables by total lifetime violence exposure and videogame condition.

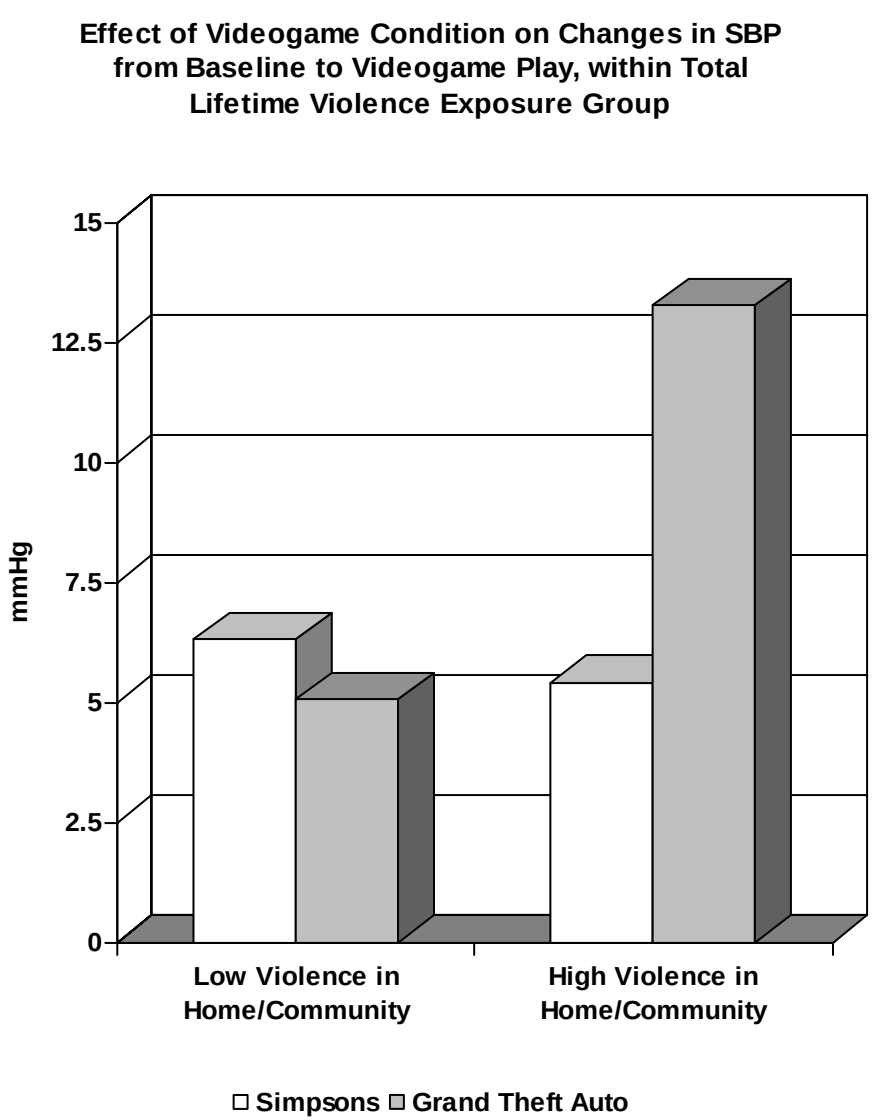
Variable [1]	Low Lifetime Violence		High Lifetime Violence		*F* (*p*-value) [4]		
	GTA III	Simpsons	GTA III	Simpsons	Life Violence	Videogame	Interaction
Change in SBP to Watching Game [2]	3.2 (5.0)	4.2 (4.6)	6.2 (4.6)	3.7 (4.7)	3.0 (.09)	.92 (.34)	5.2 (.02)
Change in DBP to Watching Game [2]	2.1 (5.9)	3.5 (5.2)	3.8 (6.3)	3.3 (6.7)	.001 (.98)	.10 (.75)	4.5 (.04)
Change in PR to Watching Game [2]	25.7 (7.5)	21.5 (6.5)	24.3 (9.3)	24.8 (7.9)	1.2 (.28)	4.9 (.03) *	.04 (.84)
Change in SBP to Game Play [2]	5.0 (6.5)	6.3 (7.7)	13.3 (9.6)	5.4 (7.3)	5.2 (.02)	5.4 (.02) *	11.3 (.001) *
Change in DBP to Game Play [2]	6.5 (7.1)	3.2 (7.2)	6.2 (8.6)	4.2 (7.7)	.03 (.86)	4.9 (.03) *	.46 (.50)
Change in PR to Game Play [2]	14.0 (8.6)	11.9 (9.0)	15.8 (11.7)	18.1 (10.7)	8.1 (.006)	.17 (.68)	.03 (.87)
Angry Affect post Game Play [3]	4.1 (1.4)	3.8 (1.6)	4.5 (2.2)	3.8 (1.2)	.01 (.92)	3.4 (.07)	.001 (.98)
Total Negative Affect post Game Play [3]	13.4 (3.6)	11.8 (3.6)	14.3 (5.2)	12.2 (2.7)	.06 (.80)	5.7 (.02)	.001 (.97)
Hostile Social Information Processing	26.5 (4.3)	24.5 (6.2)	25.8 (4.7)	25.1 (5.9)	.001 (.98)	1.7 (.19)	.05 (.82)
Permissive Attitudes toward Violence	1.8 (.33)	2.0 (.50)	2.3 (.48)	2.1 (.38)	11.5 (.001) *	.01 (.92)	2.4 (.12)
Permissive Attitudes toward Health Risks	-2.2 (.32)	-2.4 (.42)	-2.0 (.46)	-2.2 (.37)	5.8 (.02)	3.9 (.05) *	.26 (.61)
Competitive Responses with Confederate	15.2 (3.8)	11.4 (4.2)	14.0 (4.6)	13.8 (4.5)	.03 (.87)	4.5 (.04)	3.2 (.08)

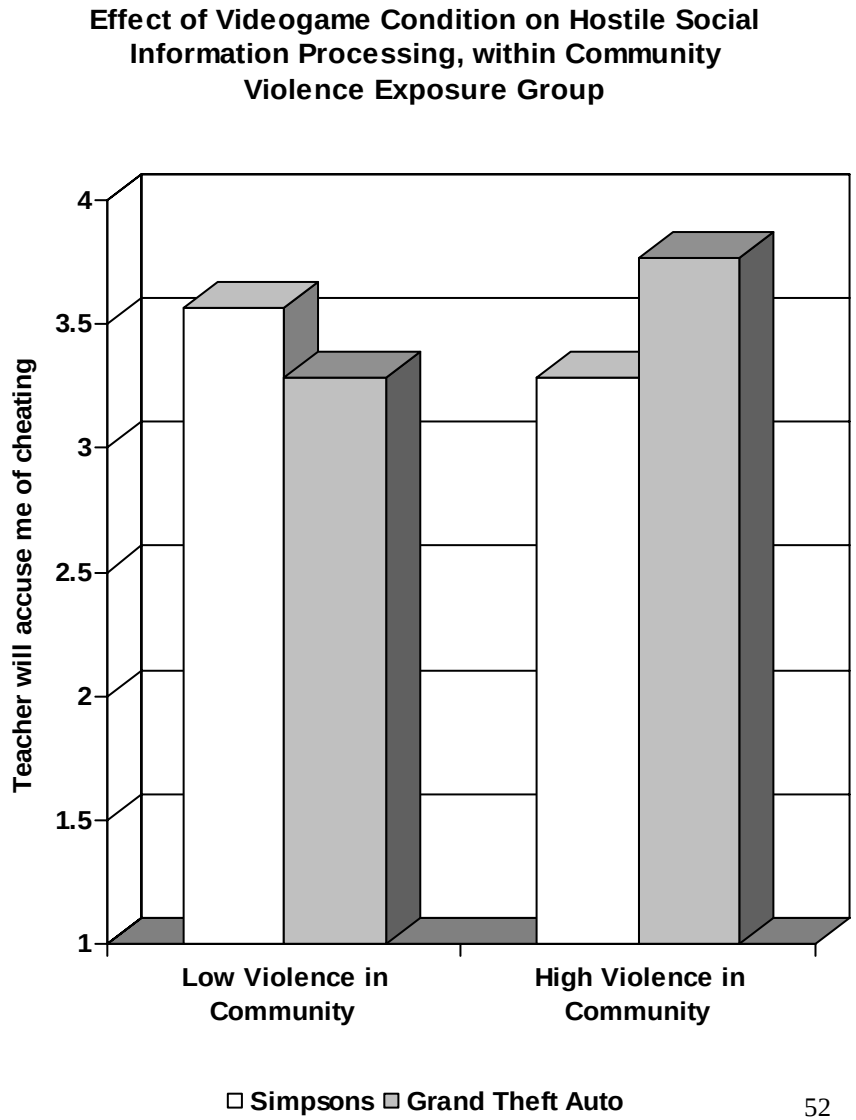
[1] GTA III = Grand Theft Auto III; SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate
[2] Residualized change scores from the initial rest period to watching the game or to game play are used in analyses (see Endnote).
[3] Means and standard deviations are presented using the original mood rating scale, ranging from a possible 0-15 for angry affect and 0-45 for total negative affect. The negative inverse of the angry affect score and square root of the total negative affect score are used in analyses.
[4] *F* and *p*-values for main effects were obtained from analyses *without* inclusion of the interaction term.
* Finding remained significant after inclusion of covariates: composite rating of videogame excitement/fast action, prior experience playing videogames, ethnic minority status, parental socioeconomic status, and association with deviant peers. For physiological outcomes during game play, arm movement was included as an additional covariate.

total lifetime violence exposure interacted with laboratory media violence condition to predict change in SBP from the initial rest period to playing the videogame. Within the low total violence exposure group, videogame condition was not associated with change in SBP from the initial rest period to game play (F=.16, partial eta squared=.003), while within the high total violence exposure group, there was a significant association (F=12.5, p=.001, partial eta squared=.207) in which play of Grand Theft Auto III predicted greater changes in SBP. A comparison of partial eta squared between the two violence exposure groups shows that roughly 21% of the variance in SBP within the high total violence exposure group could be explained by videogame violence condition, while virtually none of the variance in SBP within the low total violence exposure group could be explained by videogame violence condition (also see Figure 3). Significant interactions between videogame condition and both community and home violence exposure emerged, such that Grand Theft Auto III was associated with greater changes in SBP within the high violence exposure groups (not shown in table). Specifically, videogame condition was not associated with change in SBP from the initial rest period to game play within the low community violence exposure group (F=.02, partial eta squared=.000), but was significantly associated with greater changes in SBP within the high community violence exposure group (F=11.8, p=.001, partial eta squared=.198). Similarly, videogame condition was not associated with change in SBP from the initial rest period to game play within the low home violence exposure group (F=.26, partial eta squared=.005), but was significantly associated with greater changes in SBP within the high home violence exposure group (F=17.9, p<.001, partial eta squared=.280). In this case, roughly 28% of the variance in SBP within the high home violence exposure group could be explained by videogame violence condition, while almost none of the variance in SBP within the low home violence exposure group could be explained by videogame violence condition.

No hypotheses were made about the effects of violence exposure on physiological arousal while watching the segment of the videogame participants were about to play. However, supplemental analyses were performed to determine whether violence-related increases in physiological arousal could be observed during the passive viewing of violence (see Table 11). Total lifetime violence exposure interacted with laboratory media violence condition to predict change in both SBP and DBP from the initial rest period to watching the videogame segment prior to game play. Within the low total violence exposure group, videogame condition was not associated with change in SBP from the initial rest period

Figure 3. Significant Interactions





to watching the videotaped segment of game play (*F*=.44, partial eta squared=.009), while within the high total violence exposure group, there was a marginally significant association (*F*=4.1, *p*=.05, partial eta squared=.078) in which play of Grand Theft Auto III predicted greater changes in SBP. A comparison of partial eta squared between the two violence exposure groups shows that roughly 8% of the variance in SBP within the high total violence exposure group could be explained by videogame violence condition, while roughly 1% of the variance in SBP within the low total violence exposure group could be explained by videogame violence condition. Although the interaction effect for DBP was significant, simple effects tests showed that videogame violence condition was not associated with changes in DBP from the initial rest period to watching the videotaped segment both within the low total violence exposure group (*F*=1.6, partial eta squared=.032) and the high total violence exposure group (*F*=.39, partial eta squared=.008). A significant interaction effect between videogame violence condition and community violence exposure in predicting change in SBP from the initial rest period to watching the videogame segment also emerged (not shown in table). Within the low community violence exposure group, videogame condition was not associated with change in SBP (*F*=.66, partial eta squared=.014), while within the high community violence exposure group, there was a marginally significant association (*F*=4.0, *p*=.05, partial eta squared=.077). Thus, roughly 8% of the variance in SBP within the high community violence exposure group could be explained by videogame violence condition, compared to only 1% of the variance in SBP within the low community violence exposure group.

Table 11 indicates which interaction effects remained significant after controlling for covariates (prior experience playing videogames, ethnic minority status, parental SES, association with deviant peers, videogame excitement/fast action composite, arm movement composite for physiological outcomes during game play). Grand Theft Auto III remained a significant predictor of greater changes in SBP from the initial rest period to videogame play within the high total violence exposure group. Grand Theft Auto III also remained a significant predictor of greater changes in SBP when the interaction between videogame violence condition and either community or home violence exposure was examined (not shown in table). After controlling for covariates, interactions between videogame violence condition and total violence exposure or community violence exposure in predicting BP changes from the initial rest

period to watching the videogame segment were reduced to marginal significance. When entered individually into analyses, no one covariate could explain the reduction in significance.

In addition to interaction effects, Table 11 demonstrates the independent effects of media violence and total lifetime violence exposure on physiological, affective, cognitive, and behavioral outcomes. Results are identical to analyses performed on individual types of violence exposure (laboratory media violence condition or lifetime violence exposure) and reported in Tables 9 and 10. Effects that remained significant after inclusion of covariates are indicated by an asterisk in Table 11. These findings are also identical to those reported in Tables 9 and 10. Results involving the separate effects of community or home violence exposure are not reported in Table 11, but are identical to analyses presented in Table 10. To summarize, community violence exposure was a significant predictor of greater changes in SBP from the initial rest period to videogame play when videogame violence condition was included in the model, but this effect was eliminated after control of covariates. Home violence exposure was a significant predictor of greater changes in PR from the initial rest period to videogame play when videogame violence condition was included in the model, and this effect remained significant after control of covariates. Community violence exposure was a significant predictor of more permissive attitudes towards violence and all 15 health risk behaviors, combined, when videogame violence condition was included in the model; after control of covariates, the effect on attitudes towards violence became marginally significant, while the effect on attitudes towards health risk behaviors became non-significant. Finally, home violence exposure was a significant predictor of more permissive attitudes towards violence when videogame violence condition was included in the model, and this effect became nonsignificant after control of covariates.

Preliminary analyses for Hypothesis 4 and Hypothesis 5. Hypotheses 4 and 5 involve tests for mediation. A mediational test was performed only when the violence exposure variable was significantly associated with both the hypothesized mediating variable and the outcome variable, and the hypothesized mediating variable was also associated with the outcome variable. Table 12 shows correlations between the four cognitive-behavioral outcomes and the affective and physiological variables that could potentially mediate the association between violence exposure and cognitive-behavioral outcomes. Participants' physiological arousal while watching the segment of the videogame they were

Table 12. Correlations between cognitive-behavioral outcomes and potential mediating variables.

Variable [1]	Hostile Social Information Processing	Permissive Attitudes toward Violence	Permissive Attitudes toward 15 Health Risk Behaviors	Competitive Responses with Confederate
Angry Affect post Game Play	.15	.17 [* 3]	.09	-.01
Total Negative Affect post Game Play	.14	.22 [** 2]	.04	-.07
Change in SBP to Watching Game	-.16	.04	.14	.13
Change in DBP to Watching Game	.002	.02	.23 [** 2]	.20 [* 3]
Change in PR to Watching Game	-.13	.03	.21 [** 3]	.18 [* 2]
Change in SBP to Game Play	-.09	.02	.06	.16
Change in DBP to Game Play	-.005	-.03	.08	.12
Change in PR to Game Play	-.01	.06	.04	.24 [** 2]

[*] $p<.10$
[**] $p<.05$

[1] SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate
[2] Finding significant after inclusion of covariates: composite rating of videogame excitement/fast action, prior experience playing videogames, ethnic minority status, parental socioeconomic status, and association with deviant peers. For physiological outcomes during game play, arm movement was included as an additional covariate.
[3] Finding marginally significant after inclusion of covariates listed above.

about to play was not hypothesized to be a mediator a priori. However, supplemental analyses were performed examining these variables as mediators given the significant associations reported in Table 11. Hostile social information processing was not associated with affective and physiological variables. However, greater angry affect and total negative affect post game play were associated with more permissive attitudes towards violence. Greater changes in DBP and PR from the initial rest period to watching the videogame segment prior to game play were associated with more permissive attitudes towards all 15 health risk behaviors, combined, and with more competitive responses toward the confederate. Finally, greater changes in PR from the initial rest period to videogame play were associated with more competitive responses toward the confederate.

Hypothesis 4. The predicted associations between laboratory media violence condition (Grand Theft Auto III vs. The Simpsons: Hit and Run) and cognitive-behavioral outcome measures were expected to be mediated by both greater angry/negative affect and physiological arousal during game play (see Figure 2). Cognitive-behavioral outcome measures include hostile social information processing of Chen and Matthews' ambiguous social scenarios, permissive attitudes towards violence and other harmful health behaviors, and competitive behavior during the laboratory task with a confederate. Videogame condition was associated with the following potential mediators: change in PR from the initial rest period to watching the videogame segment, change in SBP and DBP from the initial rest period to videogame play, and angry and total negative affect post videogame play (see Table 11). Although both angry and total negative affect post videogame play were associated with more permissive attitudes towards violence (see Table 12), videogame condition was *not* associated with permissive attitudes towards violence. Thus, mediation could not be tested in this case. Change in SBP and DBP from the initial rest period to videogame play were not associated with any of the cognitive-behavioral outcomes (see Table 12), also not allowing for mediation to be tested. However, change in PR from the initial rest period to watching the videogame segment was associated with more permissive attitudes towards all 15 health risk behaviors, combined, and with more competitive responses toward the confederate. Because laboratory videogame condition was also associated with these cognitive-behavioral outcomes, mediation could be tested.

Tables 13 and 14 show the results from stepwise linear regressions of permissive attitudes towards all 15 health risk behaviors, combined, and competitive responses toward the confederate, respectively, on laboratory media violence condition. Level of mediation was assessed by comparing the unstandardized regression coefficient for laboratory media violence condition in models with and without inclusion of the PR mediator. Mediation could be inferred when the unstandardized regression coefficient was reduced by at least 1.65 of its original standard error. None of the changes in magnitude for the unstandardized regression coefficients reached 1.65 of the original standard error, either with or without inclusion of covariates. Thus, changes in PR from the initial rest period to watching the videogame segment failed to mediate associations between laboratory videogame condition and both permissive attitudes towards all 15 health risk behaviors, combined, and competitive responses toward the confederate.

Hypothesis 5. The predicted associations between lifetime home/community violence exposure and cognitive-behavioral outcome measures were expected to be mediated by both greater angry/negative affect and physiological arousal during game play (see Figure 2). Lifetime total violence exposure was associated with the following potential mediators: change in SBP and PR from the initial rest period to videogame play (see Table 11). Change in SBP from the initial rest period to videogame play was not associated with cognitive-behavioral outcomes, but change in PR was associated with more competitive responses toward the confederate (see Table 12). Because lifetime total violence exposure was not associated with competitive responses toward the confederate (see Table 11), mediation could not be tested in this case. Both community and home violence exposure were also not associated with competitive responses toward the confederate (see Table 11), preventing tests for mediation within domain of violence exposure.

3.3. Additional Analyses on Hostile Social Information Processing Outcomes

Additional analyses were performed after media violence condition and lifetime violence exposure variables both failed to predict the hostile social information processing composite score. Analyses investigated the association between violence variables and hostile attributions for each social scenario separately (i.e. attribution that the teacher would accuse participants of cheating in the “Billy”

Table 13. Stepwise linear regression of permissive attitudes towards all 15 health risk behaviors, combined, on videogame violence condition, with and without covariates in model.

	Without Covariates [1]		With Covariates [1]	
	B (SE) without Δ PR	B (SE) with Δ PR	B (SE) without Δ PR	B (SE) with Δ PR
1. Videogame violence condition (Grand Theft Auto=1) [2]	-.15 (.08) *	-.12 (.08)	-.16 (.08) **	-.14 (.08) *
2. Covariates:				
– Prior experience playing videogames			.02 (.01) **	.02 (.01) *
– Ethnic Minority Status			-.13 (.10)	-.14 (.10)
– Parental Education			.01 (.01)	.01 (.01)
– Association with Deviant Peers			.01 (.003) ***	.01 (.003) ***
– Game Excitement/Fast Action			-.02 (.02)	-.02 (.02)
3. Change in PR from initial rest period to watching the videogame segment		.01 (.006) *		.008 (.006)

[1] B = unstandardized regression coefficient; SE = standard error; Δ PR = change in pulse rate
[2] Grand Theft Auto III is coded as 1 for videogame violence condition, while The Simpsons: Hit and Run is coded as 0.

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

Table 14. Stepwise linear regression of competitive responses with the confederate on videogame violence condition, with and without covariates in model.

	Without Covariates [1]		With Covariates [1]	
	B (SE) without Δ PR	B (SE) with Δ PR	B (SE) without Δ PR	B (SE) with Δ PR
1. Videogame violence condition (Grand Theft Auto=1) [2]	-1.89 (.89) **	-1.63 (.90) *	-1.83 (.92) *	-1.47 (.94)
2. Covariates:				
– Prior experience playing videogames			-.14 (.14)	-.16 (.14)
– Ethnic Minority Status			-1.09 (1.18)	-1.18 (1.16)
– Parental Education			-.03 (.15)	-.005 (.15)
– Association with Deviant Peers			.06 (.03) *	.06 (.03) *
– Game Excitement/Fast Action			-.12 (.19)	-.11 (.19)
3. Change in PR from initial rest period to watching the videogame segment		.09 (.07)		.11 (.07)

[1] B = unstandardized regression coefficient; SE = standard error; Δ PR = change in pulse rate
[2] Grand Theft Auto III is coded as 1 for videogame violence condition, while The Simpsons: Hit and Run is coded as 0.

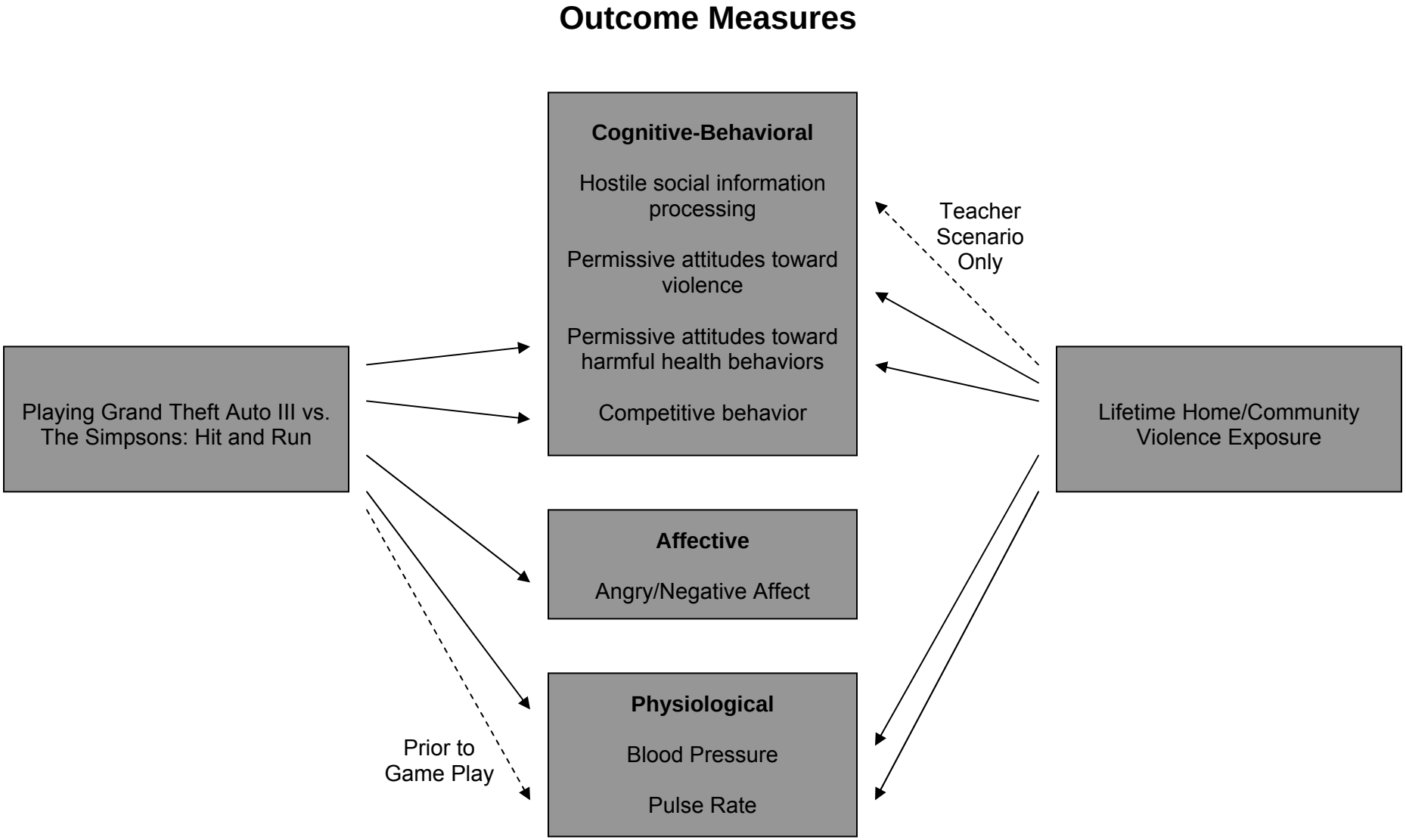
* $p<.10$
** $p<.05$

scenario, attribution that the sales associate would accuse participants of stealing in the "shopping" scenario). Main effects of laboratory videogame condition on the hostile social information processing outcomes were not observed. However, greater family violence exposure was associated with greater likelihood that participants would think the teacher was going to accuse them of cheating, both with (t=2.57, p<.05) and without (t=2.86, p<.01) inclusion of covariates (prior experience playing videogames, ethnicity, parental SES, association with deviant peers). A significant interaction between community violence exposure and laboratory videogame condition in predicting hostile attributions during the teacher scenario also emerged, both with (t=2.01, p<.05) and without (t=2.14, p<.05) inclusion of covariates. Simple effects tests showed that within the high community violence exposure group, play of Grand Theft Auto III was associated with greater likelihood that participants would think the teacher would accuse them of cheating (t=1.74, p<.10; see Figure 3). A significant interaction between home violence exposure and laboratory videogame condition in predicting hostile attributions during the shopping scenario emerged (t=-2.25, p<.05), but this interaction effect became marginally significant after inclusion of covariates (t=-1.71, p<.10). Simple effects tests showed that videogame violence condition was not associated with hostile attributions within either the high or low home violence exposure group, preventing interpretation of the interaction. Neither angry/negative affect post videogame play nor physiological variables prior to and during videogame play were associated with hostile attributions, preventing tests of mediation between lifetime violence exposure variables and hostile attributions.

4. DISCUSSION

Figure 4 summarizes significant findings that emerged from the present study. Consistent with hypotheses, males randomly assigned to play Grand Theft Auto III exhibited greater blood pressure during game play, greater angry and total negative affect post game play, more competitive responses during the "mixed-motive" game task, and more permissive attitudes towards health risk behaviors in comparison to males randomly assigned to play The Simpsons: Hit and Run (see left half of Figure 4). Supplemental analyses showed that participants randomly assigned to play Grand Theft Auto III also exhibited greater pulse rate while watching the videogame segment prior to game play. These findings replicate the results of other experimental media violence studies involving samples of youth (Anderson & Dill, 2000; Ballard & Wiest, 1996; also see Anderson & Bushman, 2001 for a review).

Figure 4. Summary of Significant Main Effects



One objective of the present study was to test whether media violence exposure is associated with potentially negative health outcomes that may not directly involve hostility or aggression. Play of Grand Theft Auto III predicted more permissive attitudes toward general health risk behavior, and toward alcohol and marijuana use, specifically, post game play. Only one published study has previously tested the association between media violence exposure and behavioral health outcomes other than aggression; Kremar and Greene (2000) found that greater exposure to televised contact sports and realistic crime (e.g. COPS) was associated with greater engagement in health risk behavior (i.e. alcohol and other drug use, delinquency, risky driving, drinking and driving) among youth. Because Kremar and Greene's study employed a survey design and did not control for other variables that may influence risk behavior, it is possible that underlying personality characteristics or environmental factors may have accounted for the association between media violence and health risk behavior. The present study featured an experimental design in which adolescents were randomly assigned to a high or low media violence condition, distributing features that may influence health related outcomes evenly across media violence conditions. Confirming the effectiveness of random assignment, media violence condition was not associated with lifetime violence exposure or any planned covariates, including arm movement during game play, prior experience playing videogames, ethnicity, parental SES, and association with deviant peers.

Despite the lack of association between media violence condition and planned covariates, analyses were performed with and without inclusion of covariates to provide a conservative test of the association between media violence and outcomes. A composite score based on adolescents' ratings of videogame excitement and fast action was also included as a covariate, as Grand Theft Auto III was perceived to be more exciting and fast in action in comparison to The Simpsons: Hit and Run. Play of Grand Theft Auto III remained a significant predictor of greater physiological arousal during viewing of the videogame segment and during game play, and of more permissive attitudes toward health risk behavior post game play, independent of covariates. Media violence thus appears to influence health related outcomes over and above the influence of sociodemographic variables, prior experience with violent media, and association with deviant peers, as well as other factors (e.g. personality characteristics) that would have been evenly distributed across experimental conditions. The association between play of

Grand Theft Auto III and more competitive responses during the mixed-motive task became non-significant with joint inclusion of covariates, but remained significant when covariates were included individually. This suggests that media violence exposure increased the likelihood of competitive behavior, but that this effect was not as strong as media violence effects on physiological arousal and attitudes towards health risk behavior. The association between play of Grand Theft Auto III and both angry and total negative affect post game play was reduced when the composite rating of videogame excitement and fast action was included in statistical models, but videogame excitement/fast action did not appear to be a statistical mediator. The violence participants were asked to engage in as part of their play of Grand Theft Auto III (striking a person with a baseball bat) may have been perceived as fast paced and exciting, accounting for associations between play of Grand Theft Auto III and game excitement and fast action. Striking another person, even within a virtual context, could have caused participants to feel angry and negative. This interpretation is consistent with previous findings in the literature. A meta-analytic review of 13 studies showed that play of violent videogames increased angry/hostile affect (Anderson & Bushman, 2001).

Contrary to hypothesis, videogame violence condition was not associated with hostile social information processing or with permissive attitudes towards violence in the present study (see left half of Figure 4). This is somewhat surprising given that Anderson and Bushman (2001) found violent videogame play to be more strongly linked with aggressive cognitions than with aggressive behavior, angry/hostile affect, and physiological arousal in their meta-analytic review of the literature. Albert Bandura's (1986) social cognitive theory emphasizes the importance of observing and modeling the behaviors and attitudes of others, and Bandura called attention to the increasingly powerful role of media in influencing thought patterns, values, attitudes, and styles of behavior. Thus, both theory and empirical evidence support links between media violence exposure and hostile social information processing and pro-violent attitudes. The failure of the present study to replicate these specific findings may be due to the relative sophistication of the sample. It is possible that male undergraduates randomly assigned to play the violent videogame guessed that the experimenter was investigating the effects of violence exposure on aggression-related outcomes. They may have resisted report of pro-violent attitudes and hostile attributions because they did not want to appear susceptible to media violence (i.e. masking a

genuine association between media violence exposure and aggressive cognitions). Alternatively, some participants' awareness of the potential effects of media violence may have made them more thoughtful in their judgment of the appropriateness of violence and in their evaluation of others' ambiguous behavior (i.e. genuine non-association between media violence condition and aggressive cognitions). During post-experiment interviews, 27 of the 50 participants randomly assigned to play Grand Theft Auto III, and 18 of the 50 participants randomly assigned to play The Simpsons: Hit and Run, mentioned violence when asked to guess or share their ideas about what the study was investigating. One participant randomly assigned to play Grand Theft Auto III wondered if "competition was like being aggressive," and stated that he did not want to compete against someone he did not know. Participants randomly assigned to play Grand Theft Auto III also were more likely to guess that the confederate they played the mixed-motive game against was a computer rather than a person (M=2.4 vs. M=1.9, t=2.1, p<.05). Stronger belief that the confederate was a computer (rated on a 1-5 Likert scale after the experiment) was associated with a lower number of competitive responses (t=-2.3, p<.05), independent of play of Grand Theft Auto III's association with a greater number of competitive responses (t=2.7, p<.01). Thus, participants randomly assigned to play the violent videogame did appear to be more evaluative of the tasks in which they were asked to engage. Participants randomly assigned to play Grand Theft Auto III may have been less conscious of monitoring and/or altering their affect and attitudes towards health risk behavior, and they may have been unable to alter their physiological response to violence exposure.

Another explanation for the lack of an association between media violence condition and hostile cognitions is that the social scenarios designed to measure hostile social information processing (potential accusations of cheating and stealing) may not have been ideal for the present, all-male sample. A scenario in which an ambiguous *physical* provocation occurred may have yielded results consistent with hypothesis. Additionally, Berkowitz (1984) has noted that individuals are more likely to adopt pro-violent attitudes after being exposed to media violence if they believe the violence they experienced was justified. Participants in the present study may not have perceived the violence in Grand Theft Auto III as justified. A different media violence condition (e.g. videogames allowing the game player to attack terrorists) may have yielded effects on pro-violent attitudes and hostile social information processing that were consistent with hypotheses.

Consistent with hypotheses, total lifetime violence exposure was associated with greater physiological arousal during game play and with more permissive attitudes towards violence and health risk behavior post game play (see right half of Figure 4). Both home and community violence exposure were associated with more permissive attitudes towards violence, while community violence exposure was associated with more permissive attitudes towards varied health risk behaviors, including alcohol use, use of alcohol/drugs before having sex, and having sex without use of a condom. Additionally, exposure to violence within the home was associated with more hostile social information processing during a specific situation in which a teacher's motives were unclear, both with and without controlling for covariates (prior experience playing videogames, ethnicity, parental SES, and association with deviant peers). The association between lifetime violence exposure and permissive attitudes towards violence also remained significant after controlling for covariates. Significant associations between total violence and community violence exposure and physiological arousal during game play were eliminated after controlling for association with deviant peers, but association with deviant peers did not appear to be a statistical mediator. It is possible that unmeasured factors (e.g. sensation seeking personality) could have been responsible for a tendency to associate with deviant peers, to be exposed to community violence, and to exhibit elevated physiological arousal in response to a violent, exciting game.

Association with deviant peers *was* a statistical mediator of associations between both total lifetime violence and community violence exposure and permissive attitudes towards health risk behavior among the male participants in the present sample. Deviant peers may model health risk behaviors and encourage the perception of health risk behaviors as normative, leading to more permissive attitudes among youth. Notably, total lifetime violence exposure ($t=5.0$, $p<.001$) and permissive attitudes towards health risk behavior ($t=3.9$, $p<.001$) were independently related to association with deviant peers in the present sample. Thus, even if adolescents exposed to large amounts of home and community violence do not initially have permissive attitudes towards health risk behaviors, association with deviant peers may cause more permissive attitudes to develop. Similarly, even if adolescents who have permissive attitudes towards health risk behavior have not been exposed to violence, association with deviant peers may lead to greater likelihood of violence exposure. It is unclear whether patterns of violence exposure and health risk behavior are strongly tied to association with deviant peers among female youth.

Longitudinal data show that associations between violence and health risk behavior are bidirectional in samples of male adolescents (White et al., 1999) and in women (Kilpatrick et al., 1997), although women's violence exposure may be more likely to involve victimization within the context of relationships (Howard & Wang, 2003). Additional longitudinal data within male and female samples is necessary to establish causal directions between violence exposure, association with deviant peers, and the development of permissive attitudes towards health risk behavior. The significant association between media violence condition and permissive attitudes towards health risk behavior in the present study, independent of association with deviant peers and other covariates, implies that violence exposure relaxes attitudes towards harmful health behaviors in the immediate aftermath of exposure among males.

Contrary to hypothesis, lifetime exposure to home/community violence was not associated with more angry, negative affect post videogame play and more competitive behavior (see right half of Figure 4). It had been hypothesized that individuals exposed to greater amounts of lifetime violence would perceive events as more stressful in the laboratory and thus exhibit increased negative affect. Lifetime violence exposure was expected to increase competitive, aggressive behavior due, in part, to increased negative affect in the laboratory. It is possible that that violence exposure must be relatively recent in order to observe effects on affect and behavior. In comparison to violent homes and communities, the laboratory is an environment relatively free of violent cues. When violence *was* introduced into the laboratory environment, via play of Grand Theft Auto III, effects on both angry, negative affect and competitive behavior were observed. As noted above, effects of lifetime violence exposure on hostile social information processing, permissive attitudes towards violence and other health risk behaviors, and greater physiological arousal were observed within the laboratory independent of media violence condition. Past violence exposure may thus influence cognitions and physiological responses to challenging tasks to a larger degree than it may influence state affect and behavior.

Although it was predicted that lifetime violence exposure would interact with media violence condition to predict physiological, cognitive, affective, and behavioral outcomes, interaction effects emerged only for physiological outcomes and one cognitive outcome. Play of Grand Theft Auto III predicted greater changes in SBP from the initial rest period to game play only within participants exposed to high amounts of total violence and community violence exposure, both with and without

inclusion of covariates (see Figure 3). Supplemental analyses showed that play of Grand Theft Auto III also predicted greater changes in SBP from the initial rest period to viewing the videogame segment within participants exposed to high amounts of total violence and community violence exposure, although these effects were weaker and were reduced to marginal significance with inclusion of covariates. It is possible that the mission participants were asked to complete in Grand Theft Auto III (i.e. striking another person on the head with a baseball bat) appeared more realistic to adolescents exposed to high amounts of violence throughout their lifetime, leading to heightened physiological arousal during passive viewing of violence and to even more pronounced elevations during game play.

Because of the heightened physiological arousal exhibited by individuals from high violence backgrounds during play of the violent videogame, one might expect associations between media violence exposure and cognitive, affective, and behavioral outcomes to also be stronger among those exposed to high amounts of lifetime violence. In support of this hypothesis, play of Grand Theft Auto III was associated with more hostile social information processing during the "Billy," or teacher scenario, among those participants exposed to high amounts of community violence in their lifetime (see Figure 3). However, there were no other interactions between lifetime violence exposure variables and media violence condition in predicting non-physiological outcomes in the present sample. One explanation for this lack of association may be the composition of the sample. All participants had functioned well enough in their schools and larger communities to gain admittance into a University. Thus, despite coming from a disadvantaged background, University youth with high lifetime amounts of violence exposure may have been no more likely to judge potentially harmful behaviors as low risk and behave competitively after exposure to a violent videogame stimulus than University youth with low lifetime amounts of violence exposure. A different pattern of associations may have been observed in general population or high risk (e.g. inner-city low socioeconomic) samples of youth. However, main effects of both lifetime violence and media violence exposure on health-related outcomes in the present sample of young adults underscore the point that violence can impact youth of all backgrounds.

Lifetime violence exposure was not associated with resting physiological indices, contrary to previous studies that have found associations with lower resting physiology (e.g. Cooley-Quille et al., 2001; Cooley-Quille & Lorion, 1999). It may be that previous findings were idiosyncratic to the samples

utilized by Cooley-Quille and colleagues, or that such associations are less likely to be observed in University samples of youth. Scarpa et al. (2000) did not observe an association between community violence exposure and resting physiology in their University sample of youth.

Media violence condition and lifetime violence exposure were associated with outcomes independently from one another in the present study, as indicated by analyses in which both variables and their potential interaction were included stepwise in analyses. Media violence effects observed in the laboratory may be interpreted in different ways. First, effects of laboratory media violence condition may reflect the effects of media violence exposure outside of the laboratory. Repeated exposure to media violence may be associated with more permissive attitudes toward health risk behavior and with more competitive responses in interactions with others. A second and broader interpretation of laboratory media violence effects is that they are representative of how *any* type of violence exposure influences youth, including real-world violence within homes and communities. This interpretation is supported by the similarity of effects between media violence condition and lifetime violence exposure on outcomes in the present study, particularly on permissive attitudes toward health risk behavior.

Research shows that lifetime violence exposure is associated with greater aggression (Gorman-Smith & Tolan, 1998; see Margolin & Gordis, 2000 for a review), substance use (Acierno et al., 2000; Albus et al., 2004; Berenson et al., 2001; Kilpatrick et al., 2000; Schwab-Stone et al., 1995; Sullivan et al., 2004), and sexual risk taking (Albus et al., 2004; Berenson et al., 2001; Silverman et al., 2001) among male and female samples of youth. One objective of the present study was to test *how* violence exposure may lead to such outcomes. This study is unique in its attempt to establish mechanisms linking violence exposure to health risk behavior through an experimental design. An advantage of experimental research is that participants can be randomly assigned to violence condition, controlling for other factors that may also be associated with outcomes of interest. A trade-off is that real-world negative outcomes cannot easily be measured; in the present study, permissive attitudes towards health risk behavior were examined instead of actual risk behavior, and competitive behavior in the laboratory was examined as a proxy for aggression. Although competitive behavior within the laboratory may not generalize to real-world aggression, the similarity of media violence effects observed across experimental and longitudinal field studies (Anderson et al., 2003) suggests that the same processes may operate in producing

competitive and aggressive behavior. Analyses in the present study identified change in pulse rate from the initial rest period to viewing the videogame segment as a potential mediator of associations between videogame violence condition and both permissive attitudes toward health risk behavior and competitive responses with the confederate. Results did not support the interpretation of mediation, however. It may be that physiological arousal does not mediate associations between violence exposure and risk behavior, although additional research is necessary to draw this conclusion.

4.1. Limitations

Limitations of the present study include the selection of a sample that may not be representative of non-university males or female young adults. Although the range of lifetime violence exposure was broad in the present study sample, non-university or at-risk samples of youth may experience greater rates and degrees of violence exposure. Lifetime violence exposure may also have a different impact on aggression-related outcomes and health risk behavior among non-university and at-risk samples. A second and related limitation involves demand characteristics that may be particularly apparent among University samples of youth. Participants may have been evaluative of experimental tasks and may have guessed that the study was investigating associations between violence exposure and risk behavior. Participants may have responded in a manner consistent with what they perceived the experimenter would predict, regardless of their natural inclination toward aggression and health risk behavior. Conversely, some participants may have guessed study hypotheses, disagreed with the premise that violence exposure increases risk behavior, and suppressed aggressive impulses and permissive attitudes toward health risk behavior. A third limitation of the present study involves the ecological validity of experimental measures. Competitive behavior in the laboratory was measured as a proxy for aggression, and attitudes towards risk behavior were measured as a proxy for actual risk behavior. It is not clear whether increases in competitive behavior and permissive attitudes towards risk would translate into actual aggression or other health risk behavior. The competitive behavior observed in the present study may be viewed as more punitive and resentful in nature than aggressive (i.e. not allowing another person to earn points, even if it means earning fewer points for yourself). A fourth limitation is the large number of statistical analyses performed in the present study. Although all analyses were informed by theory, the

likelihood of committing a Type I error (i.e. interpreting significance when, in fact, two variables are unrelated) across all tests increases as the number of statistical tests increases.

4.2. Future Directions

The interactional model depicted in Figure 1 may perhaps be better tested by obtaining a younger, more at risk sample who may be less likely to guess the study's purpose and potentially evaluate/alter their impulses. The model might also be more fully supported if social scenarios were expanded to include ambiguous physical provocation, and if media violence stimuli appeared to depict socially sanctioned types of violence. However, the majority of hypothesized main effects were supported by findings of the present study (see Figure 4). The finding with the greatest potential to add to current thinking about violence exposure effects is the link between media violence and more permissive attitudes towards health risk behavior. Future studies may be designed to test whether experimentally manipulated media violence exposure influences actual use of licit substances within a laboratory setting (e.g. cigarettes, alcohol). Previous studies have utilized a laboratory paradigm to test self-administration of legal substances (Abrams, Kushner, Medina, & Voight, 2002; Perkins et al., 2004). Laboratory paradigms have also been used to test decision making regarding other types of health risk behaviors (e.g. vignettes assessing perceived risk of engaging in sexual activity without condom use; Abbey, Saenz, & Buck, 2005).

A remaining question is *how* violence exposure may influence attitudes towards and actual engagement in health risk behavior. Non-experimental research has begun to examine mechanisms linking real-world violence exposure and health risk behavior. For example, numerous researchers have conceptualized substance use as a strategy to reduce negative affect (Brown, 1989; Levenson, Oyama, & Meek, 1987; Stasiewicz & Maisto, 1993; Stewart, 1996), and many have identified violence as a precipitating stressor (Bean, 1992; Dembo et al, 1987; Ireland & Widom, 1994; Kilpatrick et al., 1997; Lindberg & Distad, 1985). In support of this linkage, use of alcohol or drugs to cope with stress mediated the association between childhood abuse and symptoms of alcohol abuse or dependence in adult women (Schuck & Widom, 2001). Exposure to violence may also affect attitudes towards long term health (e.g. life is short - why plan for the future?). Fick and Thomas (1995) found that exposure to community violence was associated with youths' diminished belief in the ability of health professionals, teachers, and

parents to positively impact their health. Violence exposure may also impact developing personality characteristics in youth that are associated with risk taking behavior, or alternatively, personality characteristics may increase the likelihood of both violence exposure and engagement in multiple types of risk behavior. For example, Brady and Donenberg (2005) found that sensation seeking personality accounted for the clustering of violence exposure, substance use, and sexual risk taking among a sample of inner-city male adolescents. Both experimental research and field research can be designed to test whether distress and maladaptive attempts to cope, disengagement from a future orientation, low faith in family and community leaders, and placement of value on sensation seeking activities mediate associations between violence exposure and harmful health behaviors. Supported links would suggest areas for intervention.

It is also important to gain a better understanding of how violence exposure is linked to health related outcomes among female youth. The health risk behaviors that female youth may engage in as a potential means of coping with violence exposure may be more varied than those employed by male youth and may be internalizing in nature as well as externalizing (e.g. unhealthy weight control practices, self injury; Silverman et al., 2001; Berenson et al., 2001). Aggression and other types of health risk behavior (e.g. substance use, sexual risk taking) also appear to place adolescent females at risk for dating violence (Howard & Wang, 2003), potentially leading to cycles in which levels of violence exposure and risk behavior escalate (Kilpatrick et al., 1997).

Results of the present study suggest that both media violence and real-world violence exposure may influence attitudes towards health risk behavior among male youth. Media education campaigns targeted towards youth and parents typically emphasize the link between media violence and aggressive thoughts, feelings, and behavior (Anderson et al., 2003; Hogan, 2001). Present findings suggest that links between media violence and more permissive attitudes toward health risk behavior should also be highlighted. Many researchers agree that interventions to promote health in youth may be most effective by addressing the broader context in which risk occurs, including adolescent exposure to violence and engagement in multiple forms of health risk behavior (Albus et al., 2004; Kilpatrick et al., 1997; Sullivan et al., 2004). Jessor (1984) has argued that risk behaviors are purposeful, goal-directed, and capable of fulfilling multiple goals central to adolescent life, including expressing opposition to authority, identifying

with the youth subculture, confirming important attributes of personal identity such as being “cool” or mature, and gaining pleasure. Health-compromising behaviors may also provide a way of coping with personal, social, and environmental events that are a source of stress (Jessor, 1984; Wills, Sandy, Yaeger, Cleary, & Shinar, 2001). A better understanding of the mechanisms linking violence and health risk behavior may inform clinical and health promotion interventions, as well as broader policies targeted toward curbing adolescent engagement in health risk behavior (e.g. “zero tolerance” policies of schools and federal education funding programs). In conclusion, all types of violence exposure appear to confer risk with respect to youth engagement in harmful health behaviors. Understanding the mechanisms linking violence and health is key to ensuring that the youth of today remain healthy enough to realize their full potential tomorrow.

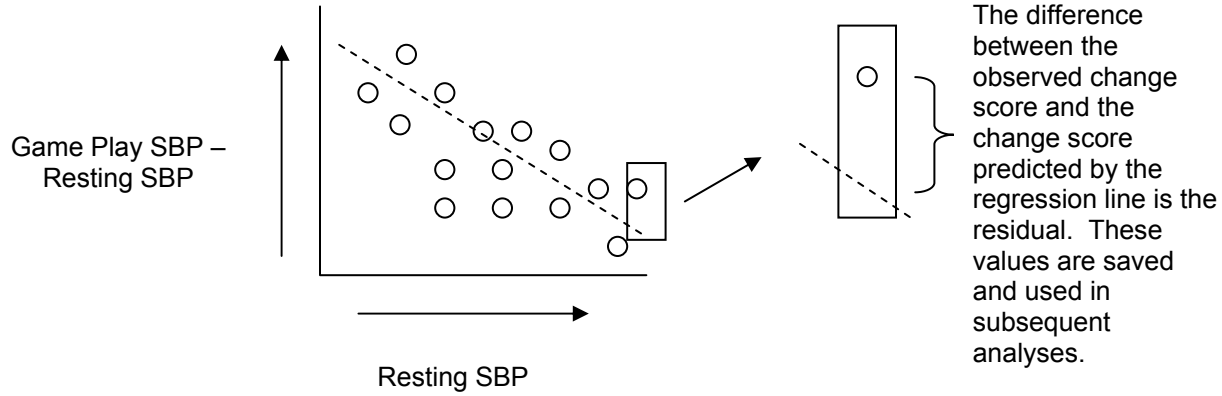
ENDNOTE

Change scores from baseline to game play, residualized for baseline levels, were used as the measures of physiological arousal for systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate (PR). To create residualized change scores, the change in a physiological index from baseline to game play was regressed on the physiological index during baseline, and the residuals from the regression were saved and used in analyses.

To illustrate:

Regression $Y = a + b X$

(Game Play SBP – Resting SBP) = a + b (Resting SBP)



Individuals with greater resting SBP may not exhibit as great a change in SBP from baseline to game play (i.e. a ceiling effect). Regressing the change score on the baseline level provides a "purer" measure of reactivity, especially in cases where other variables of interest (e.g. violence exposure) may be associated with resting physiology.

It was predicted that greater exposure to home/community violence would be associated with lower resting physiology. Because it was also predicted that greater exposure to home/community violence would be associated with greater physiological arousal during game play (change scores from baseline to game play), a more conservative test would use change scores residualized for resting physiology. This addresses the potential confound that any association between violence exposure and physiological arousal during game play may be due to differences in resting physiology rather than differential exposure to violence, per se.

APPENDIX A

Video Interview Questions

BILLY GETS HIS GRADE

At end of video:

"Now close your eyes and imagine that this situation has just happened to you. Picture the teacher talking to you. Picture his face and expression. Think about how you would feel, what you would think, and what you would do. Take a few seconds to really feel yourself reacting to this situation."

Give the participant a couple of seconds to imagine their reactions.

Press RECORD and PLAY on tape player.

- **"Ok, open your eyes. Now pretending that this situation has just happened to you, tell me why do you think the teacher wants to talk with you?"**
- **"What will the teacher say to you?"**
- **"How would he sound?"**
- **"What would you say to the teacher?"**
- **"How do you think the teacher will respond to what you tell him?"**

  If teacher is suspicious:

  "Will it change his opinion of you or the situation?"

    If no:

    "Why not?"

- **"Do you think he was planning to talk with some of the other students too, or just you?" "Why?"**
- If they endorsed suspicion:

  "Why do you think the teacher was suspicious of you?"

GIVE CARD TO PARTICIPANTS – NOT AT ALL TO VERY, 1-5

- **"How nervous or uncomfortable would you feel in this situation, on a 1-5 scale, 1 being not at all nervous or uncomfortable, and 5 being very nervous or uncomfortable?"**

- **"How annoyed would you feel in this situation, 1 being not at all annoyed, and 5 being very annoyed?"**

- **"How likely do you think it is that the teacher will accuse you of cheating, 1 being not at all likely, and 5 being very likely?"**

- **"How angry would you be if the teacher accused you of cheating, 1 being not at all angry, and 5 being very angry?"**

- **"How likely do you think it is that the teacher wanted to praise you for doing well on his test, 1 being not at all likely, and 5 being very likely?"**

- **"How likely do you think it is that the teacher wanted to ask you if you saw anything going on during the test, 1 being not at all likely, and 5 being very likely?"**

Press STOP on tape player.

SHOPPING

At end of video:

"Now close your eyes and imagine that this situation has just happened to you. Picture the saleswoman talking to you. Picture her face and expression. Think about how you would feel, what you would think, and what you would do. Take a few seconds to really feel yourself reacting to this situation."

Give the subject a couple of seconds to imagine their reactions.

Press RECORD and PLAY on tape player.

- **"Ok, open your eyes. Now pretending that this situation has just happened to you, tell me why do you think the saleswoman is looking for you?"**

- **"What will the saleswoman say to you?"**

- **"How would she sound?"**

- **"What would you say to the saleswoman?"**

- **"How do you think the saleswoman will respond to what you tell her?"**

  If saleswoman is suspicious:

  "Will it change her opinion of you or the situation?"

    If no: **"Why not?"**

- **"Why do you think the saleswoman was paying attention to you while you were browsing?**

- **"Does it seem like the saleswoman would act this way toward all young adults, or do you think she treated you differently?" "Why?"**

- Only if talking about suspicion:

"Why would the saleswoman be suspicious of you?"

"At what point did the saleswoman become suspicious?"

For everyone:

- **"What about the security guard- why do you think he was by the dressing room at the end?"**

- If guard is suspicious:

  "Why would the guard be suspicious of you?"

  "At what point did the guard become suspicious?"

- If saleswoman was suspicious, but not the guard:

  "Did you feel like the security guard had his own suspicions about you?"

  If yes: **"Why?"**

GIVE CARD TO PARTICIPANTS – NOT AT ALL TO VERY, 1-5

- **"How nervous or uncomfortable would you feel across this whole situation, on a 1-5 scale, 1 being not at all nervous or uncomfortable, and 5 being very nervous or uncomfortable?"**

- **"How annoyed would you feel across the situation, 1 being not at all annoyed, and 5 being very annoyed?"**

- **"How likely do you think it is that the saleswoman or security guard would accuse you of stealing, 1 being not at all likely, and 5 being very likely?"**

- **"How angry would you be if they accused you of stealing, 1 being not at all angry, and 5 being very angry?"**

- **"Thinking across the whole situation, how likely do you think it is that the saleswoman paid attention to you because she wanted to be helpful, 1 being not at all likely, and 5 being very likely?"**

- **"How likely do you think it is that the saleswoman paid attention to you because she was trying to make a sale, 1 being not at all likely, and 5 being very likely?"**

Press STOP on tape player.

APPENDIX B

Behavioral Attitudes Scale

Instructions: Please indicate how harmful or helpful you believe each of the behaviors below are. Circle one number to reflect what you think. There are no right or wrong responses.

How harmful or helpful to your health do you think it is to…

		Very Harmful						Very Helpful
1.	**Drink alcohol?**	-3	-2	-1	0	1	2	3
2.	**Smoke cigarettes?**	-3	-2	-1	0	1	2	3
3.	**Lift weights on a weekly basis?**	-3	-2	-1	0	1	2	3
4.	**Engage in cardiovascular exercise (e.g. running, biking) on a weekly basis?**	-3	-2	-1	0	1	2	3
5.	**Use marijuana?**	-3	-2	-1	0	1	2	3
6.	**Use cocaine?**	-3	-2	-1	0	1	2	3
7.	**Use hallucinogenic drugs, such as LSD, acid, PCP, angel dust, ecstasy, mescaline, or mushrooms?**	-3	-2	-1	0	1	2	3
8.	**Use methamphetamines (also called speed, crystal, crank, or ice)?**	-3	-2	-1	0	1	2	3
9.	**Use heroin?**	-3	-2	-1	0	1	2	3
10.	**Breathe the contents of aerosol spray cans, or inhale paints or sprays to get high?**	-3	-2	-1	0	1	2	3
11.	**Take steroid pills or shots without a doctor's prescription?**	-3	-2	-1	0	1	2	3
12.	**Inject an illegal drug into your body?**	-3	-2	-1	0	1	2	3
13.	**Eat 3-5 servings of vegetables a day?**	-3	-2	-1	0	1	2	3

14. Eat 2-4 servings of fruit a day?	-3	-2	-1	0	1	2	3
15. Eat 6-11 servings of bread, cereal, rice, and pasta a day?	-3	-2	-1	0	1	2	3
16. Have sexual intercourse with more than one partner within a 3 month time period?	-3	-2	-1	0	1	2	3
17. Have sexual intercourse without using a condom?	-3	-2	-1	0	1	2	3
18. Drink alcohol or use drugs before having sexual intercourse?	-3	-2	-1	0	1	2	3
19. Drive after drinking alcohol or using other drugs?	-3	-2	-1	0	1	2	3
20. Speed 20 mph or more above the speed limit?	-3	-2	-1	0	1	2	3

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