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Cocooned from Crime: The Relationship Between Video Games and Crime

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Abstract

The majority of research on the relationship between video game playing behavior and crime has been conducted by psychologists, has focused only on violent videogames, and suffers from two major shortcomings. First, psychologists have adopted correlational or experimental methodologies that do not in fact assess the empirical relationship between video game playing behavior and crime. Instead, they examine the relationship between video game playing behavior and aggression, and then infer research findings have social implications related to crime. Second, when making such inferences, these studies presume that meso and macro level phenomena are nothing more than the aggregated consequences of micro level events. Recent studies, however, have raised questions surrounding these two components of psychological research, as they have identified negative relationships between video game playing behavior and crime at county and national levels. In this study, we propose that these seemingly contradictory results can be explained using routine activities theory (Cohen and Felson 1979). We contend that video game playing behavior, particularly insofar as it occurs within the home, alters the routine activities of individuals in such a way as to decrease the number of criminal opportunities present within a society. We provide an initial test of this hypothesis using UCR, CPS, and Census data. As predicted by routine activities theory, we find that rates of video game playing behavior in the home are negatively associated with both violent and property crime.

Keywords Routine activities theory · Crime · Video games · Media · Community · Public Health

With the emergence of video game arcades and home video game consoles in the 1970s, video game playing behavior has become ingrained within U.S. culture. As of 2015, the Entertainment Software Association (2015) reports that 150 million Americans, about half of the population, reported playing video games. Despite the prevalence of video game playing behavior, little research has actually directly examined the relationship between video game playing behavior and rates of crime. Psychological studies purporting to identify a possible link between video games and crime find that video game playing behavior to be positively linked to aggression in experimental or correlation studies, but never actually examine the relationship between video game playing behavior and rates of violent crime (Markey et al. 2015). Contradicting these findings, research by Ward (2011), studying counties, and Markey et al. (2015), studying national trends, find rates of video game playing behavior to be negatively associated with crime rates.

We resolve here these seemingly paradoxical findings using routine activities theory, and by focusing on videogame playing in general as opposed to violent videogames in particular (Cohen and Felson 1979; Kringen and Felson 2014). We begin by providing an overview of the research pertaining to video game playing behavior and crime. We then articulate how routine activities theory can be employed to reconcile the seemingly contradictory finding that videogame playing can increase individual aggression and frustration, while also having a negative effect on community rates of crime. Finally, we conduct an empirical test of routine activities theory using longitudinal state-level data to assess the plausibility of our routine activities approach.

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Psychological Approaches to the Study of Video Games and Crime

The study of video games, competitiveness and aggression has been developing for at least a decade, though this research has largely been in the province of experimental social psychology. Craig Anderson et al. (2007) have argued that *violent* video games, in particular, should increase aggressiveness and, subsequently, violent criminal offending. They argue, in short, that violent video games encourage players to identify with aggressive characters, and that the active participation of players as they play the games should increase their ability to mimic and/or otherwise reproduce the violent acts they see on screen. Moreover, Anderson and colleagues point out that violence in such video games tends to be continuous and that the repetitiousness of violent acts ought to increase the tendency for individuals to become desensitized. Desensitization to violence, they suggest, may lead people who play these video games to commit acts of criminal violence throughout their lives.

Critically, across studies, it is not always *violent* videogames that are hypothesized to increase aggression but, indeed, any videogame that encourages zero-sum competition between players (or between the player and a computer controlled avatar). As competition may produce zero-sum losses—in points, high scores, in-game collectibles, health of the videogame character and so on—it is also often hypothesized that videogames more generally have the potential to increase competitive aggression (Adachi and Willoughby 2011). Virtually all videogames contain elements of zero-sum competitiveness, while only a subset are explicitly or gratuitously violent in nature.

Typically, laboratory studies in the field of experimental psychology measuring the effects of video games on aggression expose participants to short sessions of violent video game play before measuring their responses to potentially hostile hypothetical situations, or simply measuring their self-reported felt sense of aggressiveness or hostility using an established scale measure (see, e.g., Craig A. Anderson et al. 2010). Perhaps the most popular research protocol in this area is to have participants play violent video games before asking them to play an unrelated competitive game with a supposed partner (actually a confederate), with the option of blasting their partner with loud bursts of white noise (a measure of hostile aggression).

There are mixed findings regarding exposure to video games and subsequent aggression. Studies have indeed demonstrated that participants high in trait aggression are more likely to identify with characters in these games, and that identification with game characters predicts subsequent aggressive behavior (Barlett et al. 2007; Engelhardt et al. 2011; Hasan et al. 2013; Konijn et al. 2007). Moreover, there is evidence that playing video games desensitizes study participants to acts of competitive aggression, especially when video games display gratuitous amounts of blood and gore (e.g., Barlett et al. 2007; Greitemeyer 2014). A recent meta-analysis that examined 98 independent studies with a total of 36,965 participants revealed that there appeared to be a small correlation linking violent video game exposure with subsequent aggression ($r = .18$) (Greitemeyer and Mügge 2014).

Other researchers, however, have identified a series of issues with the logic of assuming that violent (or competitive non-violent) video games increase aggression, and that this aggression translates into acts of criminal violence. Adachi and Willoughby (2011), for example, point out that researchers frequently fail to distinguish increases in aggression from increases in competitiveness, which any competitive game might be expected to influence. Others point to the large body of research demonstrating that the human brain is capable of distinguishing fiction (the game) from reality (actual criminal offending) beginning at very early ages (Ferguson and Dyck 2012). Other studies, more basically, fail to find a relationship at all between exposure to video games and subsequent aggression (Breuer et al. 2015). Lastly, experimental studies of videogame playing and aggression have been criticized for generalizing study findings pertaining to mild forms of aggression in laboratory settings to explain severe forms of violence, such as mass shootings, in the real world (Markey et al. 2015).

The conclusion of a recent meta-analysis conducted by a team of researchers representing the American Psychological Association (APA) was that, though violent video game playing indeed appears to increase aggressiveness, the existing literature does not employ representative samples, which leaves many open questions surrounding how this relationship pertains to various socio-demographic groups within the general population (Applebaum et al. 2015). Moreover, the authors highlighted a fundamental challenge when interpreting this literature is that its multidisciplinary nature has meant that there is a lack of precision and consistency when defining the concept of competition and aggression.

Macro Level Approaches to the Study of Video Games and Crime

Unlike the large body of social psychological research that examines the relationship between violent video game playing and aggression, little research exists that examines the relationship between violent video game playing behavior and *crime* at the macro level. In one study that adopts a macro level trend analysis approach for the entire U.S., Markey et al. (2015) found that: (1) from 1978 to 2011 there was no annual association between violent video game playing behavior and aggravated assault or homicide, even when taking into account possible lag effects; (2) between 2007 and 2011

there was a negative correlation between video game sales and aggravated assault when employing monthly data, with no lag effects being identified as significant; (3) between 2004 and 2011 there was a negative relationship between violent video game walkthrough Google searches, a proxy measure for violent video game playing behavior, and rates of aggravated assault and homicides that occurred 2 months following keyword searches; and (4) that releases of popular violent video games (e.g., Grand Theft Auto) were unrelated to aggravated assault rates and negatively related to homicide rates for up to 3–4 months after a game's release. Thus, Markey and his colleagues found no support for the hypothesis that violent video game playing behavior is positively associated with violent crime, and in fact found the opposite to be true: violent video game playing behavior tends to be negatively related to violent crime.

In another study employing analyses at the county level, Ward (2011) produced similar findings. Employing economic theory, Ward hypothesized several ways in which video game playing behavior might be related to violent crime, both positively and negatively. First, gamers might develop a penchant for violent video games and subsequently engage in violent behavior when they lack immediate access to them. Second, violent video game playing behavior might reduce violent behavior because playing violent games might reduce the appeal or marginal utility of real-world violence. Third, individuals predisposed to violence might employ violent video games as a means of sublimating violent tendencies, and therefore become voluntarily incapacitated because time spent playing violent video games cannot also be time spent committing violent crimes.

Contrary to hypotheses holding that violent game playing behavior should be positively associated with violent crime, Ward found that the number of video game stores within a county, a proxy measure for violent video game playing behavior, were negatively associated with robbery, burglary, larceny, motor vehicle theft, and arson—all of which are property-related crimes, and only one of which, robbery, necessitates the co-presence of another individual and inherently involves interpersonal violence. Curiously, he found no relationship between video game stores and violent crimes that are less likely to be associated with property, such as murder, rape, or aggravated assault. A strength of Ward's study was that he analyzed the county-level density of videogame stores—as opposed to violent videogame sales specifically—and, as such, endeavored to capture videogaming's influence on competitiveness, aggression and competitive-aggression.

Three Paradoxes

The existing research examining the relationship between video game playing and crime produces at least three paradoxes. The first paradox surrounds the question of why the growing prevalence of video games in society, particularly violent ones, is not positively related to actual violent crime rates given that violent video games have been shown to lead to aggressive behavior in experimental settings. The second paradox, pertains to why community and national level studies have actually found negative relationships between violent video games and violent crime. A third paradox stems specifically from Ward's (2011) finding that the number of videogame retail stores in a county is negatively related to numerous *property* (as opposed to violent) crimes.

First, videogame sales have soared since the early 1990s (see Markey et al. 2015). This increase in sales co-occurred precisely at the start of the "Great American Crime Decline" noted by Zimring (2007) and many other criminologists. Assuming the contestable claim that playing videogames—violent or not– necessarily increases zero-sum competitiveness, and possibly aggression, why did crime rates begin to decline in the US precisely when the most violent videogames were being released?

Second, an element common to both social psychological and econometric approaches to the study of the relationship between videogames and crime is the assumption that the properties of individuals (that is, their individual "criminality") are sufficient for making inferences about the causes of societal rates of crime. As Hirschi and Gottfredson ([1986] 2002) note, however, the individual criminality of offenders is just one component of a crime. Crimes occur not only because of the presence of a motivated offender (i.e., an individual with a sufficient level of "criminality"), but also because of the situational opportunity to commit the crime, along with the copresence of a sufficiently vulnerable victim. Crimes can, therefore, be understood as "events"—events with criminally-motivated individuals, vulnerable victims, and available opportunities for law violation.

This means that even if video games produce short-term increases in competitiveness or aggression, one cannot infer crime rates from such findings because crime rates relate to events that also require knowledge about situational factors for the accurate prediction of crime. Thus, changes in the number of opportunities or potential victims might produce declining crime rates, *even if* video game playing behavior is generating propensities within individuals to engage in competitive or aggressive behavior. In short, here we try to resolve the paradox of *why extant empirical studies show videogame playing both increases short-term individual competitiveness and/or aggression while simultaneously decreasing macro-level rates of criminal offending?*

Third, current research and theory in experimental social psychology linking videogame-playing behavior to competitiveness and/or aggression cannot account for the negative effect of videogame playing on the property crime rate found

by Ward (2011). Theoretically, *why should playing videogames reduce property crime rates?*

In order to resolve these paradoxes we propose that a theory of the criminal "event", not of "criminality" *per se*, is required. We contend that routine activities theory (Cohen and Felson 1979; Cohen et al. 1980) can sufficiently resolve all three of these paradoxes.

Routine Activities Theory

Routine Activities Theory (RAT) is an empirically validated and highly cited theory of criminal offending (see, e.g., Kringen and Felson 2014). This theoretical approach is a "criminal opportunities perspective" of offending which emphasizes the important triangulation, in time and space, of guardianship, motivated offenders, and vulnerable victims—one's risk of victimization is understood in terms of how often their habituated or routine behaviors put them into contact with motivated offenders, in locations without capable guardianship (Cohen 1981). "Capable guardianship" may be conceptualized informally as supervisory parents/teachers/community leaders or formally as police officers and other criminal justice officials. Individuals may also serve as guardians of their own property to the degree that, for example, their routine activities involve staying at home during weekend evenings. Also, depending on the context, someone who is a supervisory agent in one setting (e.g., a police officer on duty) may in other settings constitute a vulnerable victim (e.g., if this officer is off-duty with his/her family at a sporting event).

In the classical statement of Routine Activities Theory (Cohen and Felson 1979), crime is conceptualized as a symbiotic (if parasitic) relationship between offenders and victims. That is, the routine activities of potentially vulnerable victims determine their risk of interaction with both motivated offenders and capable guardians. When routine activities increase exposure to motivated offenders, without a concomitant increase in exposure to capable guardians, the risk of victimization rises. Thus, criminal offenders subsist materially (e.g., through theft) and emotionally (e.g., through acts of sexual violence or revenge) by preying on the chance interactions they experience with vulnerable victims in contexts where capable guardianship is absent. Without a supply of vulnerable victims and motivated offenders, and without a dearth of capable guardians, criminal victimization would be impossible. In biological terminology, this would be understood as an antagonistic symbiosis, or a relationship sustained between two functionally distinct entities (i.e., offenders and victims) based on the extraction of resources by one party for its own gain.

To date, Routine Activities Theory has been used to successfully predict rates of property crime (Bennett 1991; Cohen 1981; Miethe et al. 1987; Mustaine and Tewksbury 1998) and violent crime, including sexual assault (Clodfelter et al. 2010; Mustaine and Tewksbury 1999), homicide (Messner and Tardiff 1985), and robbery (Smith et al. 2000). Even understudied forms of criminal victimization, such as barroom brawls or criminal stalking, have been successfully predicted using a Routine Activities framework (e.g., Fox and Sobol 2000; Mustaine and Tewksbury 1999). Routine Activities Theory remains one of the most empirically validated theories of crime in the criminological literature.

Video Gaming as a Routine Activity

A key insight generated by early statements of Routine Activities Theory was that changing crime rates between WWII and the 1970s could best be explained utilizing an ecological model that accounted for how suburbanization increasingly separated the public and private lives of individuals in particular ways that were conducive to crime. Separations between these spheres occurred because places of employment and entertainment were located largely outside of the immediate vicinity of suburban neighborhoods, thus forcing individuals to be separated from their homes, property, and primary groups for prolonged periods of times—exposing people to a greater risk of crime victimization.

Since the 1970s, however, many have observed that the social conditions originally explored within RAT have been changing. While individuals still work and reside in separate locations, their routine activities have changed in that they are participating less in various forms of civic life and the social lives of individuals are increasingly becoming concentrated in just two locations: the workplace and home. Putnam (2000) utilizes the term 'cocooning' to describe this phenomenon, and observes a general trend toward spending more time at home, often watching television, and spending significantly less time leaving the home for entertainment purposes or meals. Putnam notes that a major indicator of cocooning is simply the growth in the number of screens (e.g., television or computer) per household, which further allows for intra-household cocooning insofar as individuals can watch desired programming alone.

The cocooning process described by Putnam represents a shift in the legitimate activities of individuals that we hypothesize alters rates of crime as a predatory a phenomenon. Whereas between WWII and the 1970s individuals were increasingly separated from their homes and more vulnerable to crime victimization as a consequence, the cocooning era from the 1970s to present is marked by privatization within the home of entertainment, which we contend potentially reduces the number of criminogenic situations by reducing the co-presence of motivated offenders and suitable targets in time and space, while increasing home guardianship as people increasingly spend times within the home.

While Putnam (2000) emphasizes television as being a central element of cocooning, he acknowledges that video games also serve as a form of entertainment located within the home that facilitate the cocooning process (see also Williams 2006). As illustrated in Fig. 1 utilizing data from the American Time Use Survey (Bureau of Labor Statistics 2015), about 10% of the US population over 15 engage in some form of gaming behavior (e.g., board gamers, card games, and computer games) on a daily basis. From 2003 to 2014, the location of where gaming occurs shifts further in the direction of occurring in one's own home and decreasingly away from occurring in the homes of others. Given that 75% of all gaming already occurred within one's home in 2003, and by 2014 83% of all gaming events occurred within one's home, there is strong evidence which suggests gaming behavior has largely become a cocooned form of leisure activity. While the internet may be facilitating this trend by allowing for gaming behavior to remain a social form of leisure that increasingly occur online, it is important to note that such behavior is still cocooned insofar as individuals are physically not co-present, which likely reduces the prevalence of predatory crimes that require the physical colocation of offenders and suitable targets for crime, while at the same time increasing rates of cybercrime that require the colocation of offender and suitable target online.

Video gaming playing as a leisure activity is theoretically relevant, therefore, to criminology in general and Routine Activities Theory in particular for three primary reasons.

First, RAT asserts that a key component of a criminal event is the presence of a motivated offender. Even if psychological studies indicating playing video games leads to aggression are correct and can be extrapolated to explain crime, video game playing behavior largely occurs within the home and therefore separates motivated offenders from suitable targets for most conventional forms of crime. Second, video gaming playing provides a form of leisure that allows potential victims to remain within the safe confines of their home, thus reducing the number of potential targets criminals can prey upon. Thus, crimes as events lack the victims needed to occur. Third, guardianship is also increased by playing video games because it occurs largely within a player's home. As Cornish and Clark ([1986] 2014) note, for example, the presence of a resident within a household can affect a burglar's decision to burgle a home. Additionally, insofar as video game playing behavior is increasingly occurring solely within a person's home as part of a general trend in cocooning, guardianship over the home increases in general and likely negatively impacts the occurrence of criminal events as a result.

If video game playing behavior is part of a general cocooning process that decreases the prevalence rates of conventional criminal events by reducing the interaction of motivated offenders and potential victims in space and time, as well as by increasing rates of guardianship, we can hypothesize that video game playing behavior, insofar

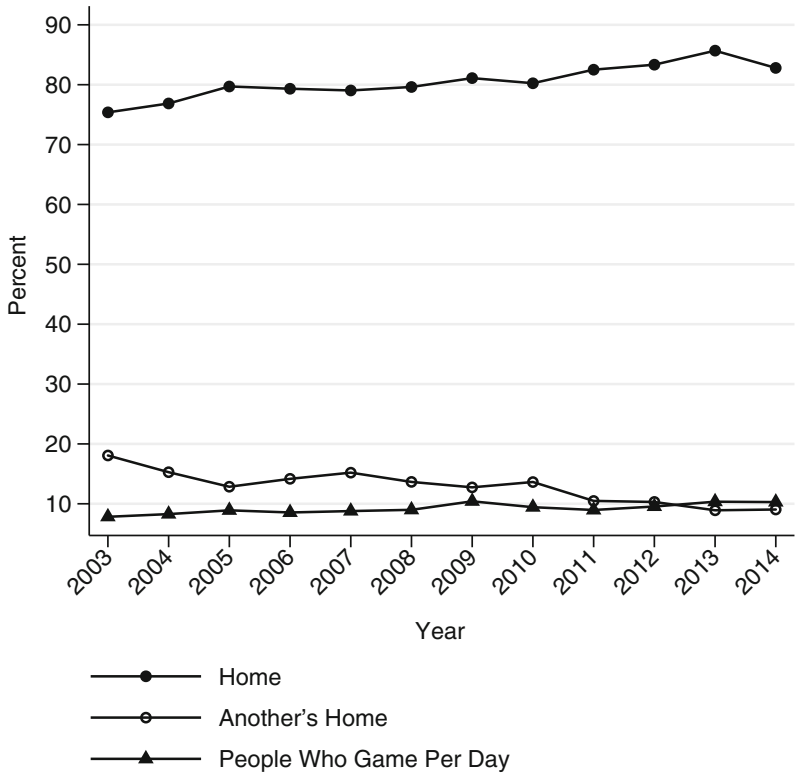

Fig. 1 Location of Gaming Events and Percent of People Who Engage in Gaming Behavior Per Day, 2003–2014. *Source*: Bureau of Labor Statistics (2015). *Notes*: The sample universe was comprised of residents within the United States fifteen or older

as it occurs within the confines of one's home, should be negatively associated with conventional violent and property crimes, net of other factors. We test this hypothesis using a panel of state-level data, and in doing so conduct the first-ever study to examine the effects of rates of video game playing behavior on crime. We focus here on video game playing in general, instead of on violent videogame playing in particular, in order to provide the widest possible test of our application of routine activities theory.

Methods

Data

The hypothesis of this study was empirically assessed using a panel dataset comprised of all 50 U.S. states for the years 1997, 2001, and 2003. Since no single dataset exists that could be used to test our hypothesis and control for other variables commonly used within macro level tests of routine activities theory, we constructed our dataset using multiple secondary data sources and standardized all data to provide state-year level measures of study variables. The resulting dataset was comprised of variables attained from the Uniform Crime Reports, Current Population Survey, Bureau of Economic Analysis, and the US Census Bureau.

Uniform Crime Reports

The first source of secondary data incorporated into our dataset was from the Uniform Crime Reports (Federal Bureau of Investigation 2010). The Uniform Crime Reports (UCR) contain data pertaining to crimes known to the police within each state for all years included within our panel. For the purposes of our study, the UCR served as our source of data for variables related to property and violent crime. Since these data were available at the state-year level of analysis, no modifications were required for their incorporation into our dataset.

IPUMS-CPS

Another source of secondary data for the study was the Integrated Public Use Microdata Series Current Population Survey (IPUMS-CPS) (Flood et al. 2015). The IPUMS-CPS contains micro (individual-level) data from the Current Population Survey (CPS), which is a stratified random sample of U.S. non-institutionalized civilians conducted monthly by the U.S. Census Bureau for the Bureau of Labor Statistics. The IPUMS-CPS is a version of the CPS that has been standardized across years by the Minnesota Population Center at the University of Minnesota to allow for easier longitudinal analysis of CPS data. Variables pertaining to video game playing behavior were collected within the CPS as part of the Computer Internet Supplement (CIS). Unlike the rest of the CPS, the CIS was not conducted on a regular monthly basis and was instead conducted only in 1 month in specific years. During the years included within our panel, the CIS was conducted in October 1997 (N = 123, 249), September 2001 (N = 143,300), and October 2003 (140,000).

Since the CPS contains micro data obtained through a stratified random sample, sampling weights were used to estimate state-level rates of video game playing behavior, variables related to household occupancy, and unemployment-related variables for each year included in our study.

Bureau of Economic Analysis

A third source of secondary data was data from the Bureau of Economic Analysis (2014), which was used to obtain estimated rates of personal consumption expenditures per capita for each state. To arrive at state-level estimates of expenditures, the Bureau of Economic Analysis (BEA) utilizes data from the Economic Census, the Quarterly Census of Employment, and other state-level expenditure data related to housing, utilities, and transportation to arrive at gross estimates of expenditures within a state. Non-resident spending is then subtracted from the gross state expenditure estimates to arrive at estimates of consumer expenditures of state residents.

U.S. Census Bureau

Lastly, data from the United States Census Bureau were incorporated into our data set to provide variables pertaining to general population estimates (United States Census Bureau 2012), population density (United States Census Bureau n.d.), and poverty rates (United States Census Bureau 2015). These data sets were combined to form a single panel data set that contained data for all 50 U.S. states for the years 1997, 2001, and 2003.

Measures

Dependent Variables

The dependent variables of our study include rates per 100,000 of larceny, burglary, motor vehicle theft, robbery, total property crime, aggravated assault, rape, murder (including non-negligent manslaughter), and total violent crime obtained from the Uniform Crime Reports.

Independent Variable

In order to test the study's hypothesized relationships between general (i.e., violent or non-violent) video game playing and crime, we construct the variable 'percentage of individuals who play computer games at home' and calculate measures of it for each state for each year within the study. This general measure of videogame playing is arguably preferable to a more specific measure of violent videogame playing, as routine activities

theory is an ecological theory of behavior, time spent, and opportunities for victimization. As such, any behavior which increases over time and which reduces the likelihood of exposure to victimization should concomitantly reduce rates of crime.

This variable is constructed using the variable CICMGAM that was present within the IPUMS-CPS data set, which measures whether or not individuals residing within a household play games on the computer at home. To arrive at state-level estimates of the percentage of individuals who play computer games at home, we use CPS supplementary data weights to calculate the number of individuals within each state who play computer games at home. We then calculate the percentage of individuals who play computer games at home by dividing the number of persons who play computer games at home by the state's population and multiply the quotient by 100 for each year in the panel.

Control Variables

We include several control variables that are consistent with tests of routine activities theory. These variables include:

1. *Percentage of individuals living in single-parent households*. Previous research within routine activities theory has noted that two-parent households provide added guardianship against crime pertaining to their children (Cohen and Felson 1979; Sampson and Wooldredge 1987). Estimates for the percentage of individuals living in single-parent households for each state were calculated using data from the IPUMS-CPS.
2. *Percentage of individuals living in single-person households*. Early research with routine activities theory observed that individuals who lived alone were more likely to become victims of crime because anytime they spent away from their homes left their homes unguarded (Cohen and Felson 1979; Cohen et al. 1980). To calculate the percentage of individuals living in single-person households, we use IPUMS-CPS data.
3. *Poverty rate*. In a standard-setting study of routine activities theory and leisure activities, Messner and Blau (1987) utilized poverty as a control variable for their analysis. We include poverty rate as a control variable for any effects poverty might have on crime that might be associated with the presence of motivated offenders or the presence of suitable targets. We obtain poverty rates for our study from the US Census.
4. *Percentage of individuals between 14 and 24*. One of the most durable predictors of crime is age. Zimring (2007), in his analysis of the 1990s crime decline, observes that changes in the age structure for individuals between the ages of 15–25 have historically influenced crime rates. To control for any effect that shifting age demographics might have on crime rates within our panel, we calculate the percentage of individuals between 14 and 24 within each state using IPUMS-CPS data.
5. *Unemployment rate*. Unemployment rates were originally conceived within routine activities theory as reducing the presence of suitable targets since unemployed individuals were seen as spending more time at home (Cohen et al. 1980). Sampson and Wooldredge (1987), however, have conceptualized unemployment rates as pertaining to the prevalence of motivated offenders. Since both conceptualizations of unemployment rates are plausible, we calculate unemployment rates for each state within our panel using IPUMS-CPS data to control for the effects of unemployment rates on crime and produce empirical findings that can clarify which interpretation is more accurate.
6. *Adjusted durable goods expenditures per capita other than automobiles*. Cohen et al. (1980) employ this measure as a proxy measure for the presence of property targets for crime in an early test of routine activities theory. We include this measure to control for the prevalence of targets within a state. Data used to calculate our measure of adjusted durable goods come from the Bureau of Economic Analysis (2014).
7. *Population density*. We control in this study for logged state population density using data from the US Census. Population density is a general measure of criminal opportunities, as greater population densities indicate greater total numbers of both motivated offenders and vulnerable victims in a given geographic region.

The summary statistics for the study's dependents, independent, and control variables pooled are pooled across the years included in the study and presented in Table 1.

Statistical Model

Since we were are interested in isolating the potential effects computer gaming behavior has on crime rates, we employ a series of fixed-effect nuisance models (Allison 1994, 2009) to evaluate our study's hypotheses, which are estimated using Stata 14.1 (StataCorp 2015). Fixed-effect models provide parameter estimates based upon the within-group variance within panel models, with groups within our models consisting of states that have been repeatedly observed. Treating states as a fixed effect allows us to control for the effects of unobserved time-invariant 'nuisance' factors which are associated with each state. By doing so, we are able to limit omitted variable bias within our results. Despite this benefit of using fixed-effect models, Allison (2009) notes fixed-effect models have at least two major shortcomings, which include their inability to estimate coefficients for time-invariant factors within groups and their tendency to have significantly larger standard errors than random-effect models. An additional shortcoming of fixed-effect models is that valid inference cannot be made to cases that lie outside of a study's sample.

Table 1 Descriptive statistics ($N = 150$)

Variables	Mean	SD	Min.	Max.
Guardianship				
% of individual living in single-parent household	13.66	2.24	8.70	20.43
% of individual living in single-person household	25.94	2.66	17.23	32.32
Motivate offenders				
% of individuals living below the poverty line	11.91	2.99	6.00	19.30
% of individuals between 14 and 24	15.58	1.57	12.74	22.76
Suitable target				
Unemployment rate	4.64	1.35	1.08	8.81
Adjusted durable good expenditures per capita	8.74	1.05	6.53	11.30
Logged population density	4.41	1.41	.07	7.06
% of individuals who play computer games at home	46.16	13.31	15.96	70.19
Crime rates per 100,000				
Larceny	2624.35	649.12	1483.10	4326.90
Burglary	764.62	256.68	309.30	1459.80
Motor vehicle theft	390.67	187.49	105.60	1021.60
Robbery	116.79	70.13	6.40	336.80
Total property crime	3779.63	980.81	2003.40	6571.30
Aggravated assault	283.30	147.55	43.00	756.90
Rape	34.76	12.04	14.90	93.30
Murder	5.10	2.84	.90	15.70
Total violent crime	439.94	208.34	79.30	1023.60

We employ fixed effect models with an awareness of their shortcoming for several reasons. First, since no literature exists surrounding the state-level effects of video game playing behavior on crime rates, we have little knowledge of how omitted variables might affect estimates. We therefore opt to reduce bias within our estimates at the expense of any efficiency we might gain by utilizing random-effect modeling strategies to arrive at conservative estimates of the effects of videogame playing behavior on crime. Second, we are interested in how changes occurring within states related to videogame behavior have influenced crime rates over time; we are not interested in how time-invariant factor might be associated with crime. Part of the causal logic within fixed-effect models is that time-invariant variables cannot cause changes in time-variant variables (see Allison 2009). By using fixed-effect models to control for the effects of unobserved time-invariant factors and focusing solely on time-variant factors, we can have some confidence our results have causal significance. Lastly, we are only interested in examining the effects of videogame playing behavior on crime rates within our sample. Since our sample is technically a census of states for the three points of time located within our panel, there are no other states to which we could generalize our findings. This means that the inability of fixed-effect models to arrive at valid inferences for cases that lie outside of a sample is of little consequence for our study.

Results

As part of analysis, we employed several regression diagnostics and modified our fixed effect models in response to their results when needed. Since the units of analysis within our study were states, we tested for cross-sectional dependence to determine if the dependent variables of neighboring states influenced one another using Pesaran's CD tests (De Hoyos and Sarafidis 2006) on all models and found no evidence of cross-sectional dependence. We additionally conducted tested for heteroskedasticity using a modified Wald test and found heteroskedasticity to be present with in all models. Since heteroskedasticity produces inconsistent and invalid standard errors within fixed-effect models, we estimated standard errors using Huber-White sandwich estimators to arrive at valid estimates. The results of our fixed effect models are presented in Tables 2 and 3.

Regarding our control variables, the percentage of individuals living in single-parent households was not related statistically significantly to any crimes within the study. The percent of individuals living in single-person households was negatively related to larceny rates ($\beta = -28.510$, $p < .05$) and total property crime rates ($\beta = -33.716$, $p < .05$), findings that run contrary to the predictions of routine activities theory. In routine activity theory, single-person households are considered more vulnerable to

Table 2 Fixed-effect models for property crime ($N = 50$; 150 State-Years)

	Larceny	Burglary	Motor vehicle theft	Robbery	Property crime
% of individual living in single-person household	−7.361	2.658	−.646	−.303	−5.354
	(12.981)	(5.157)	(5.475)	(1.147)	(20.666)
% of individual living in single-person household	−28.510*	−1.512	−3.696	−1.222	−33.716*
	(11.036)	(3.407)	(3.927)	(.963)	(14.541)
Adjusted durable good expenditures per capita	.002	−.003	−.004	−.003*	−.006
	(.007)	(.003)	(.003)	(.001)	(.011)
% of individuals living below the poverty line	71.251**	26.407**	12.976	.347	110.635***
	(25.525)	(9.467)	(9.980)	(2.200)	(37.284)
Unemployment rate	−17.685	2.148	−3.455	1.926	−18.985
	(20.302)	(4.680)	(5.336)	(2.193)	(25.544)
% of individuals between 14 and 24	36.231+	6.575	−3.992	−.304	38.812
	(19.584)	(4.909)	(4.613)	(1.559)	(25.168)
Logged population density	−3542.143***	−978.154***	346.260	−132.110	−4173.885***
	(721.907)	(216.433)	(256.931)	(93.307)	(1030.887)
% of individuals who play computer games at home	−7.464**	−3.242***	−1.522*	−.468*	−12.230***
	(2.369)	(.692)	(.654)	(.222)	(3.319)
Constant	18,067.152***	4832.924***	−989.762	777.991+	21,909.688***
	(3186.417)	(916.725)	(1140.574)	(395.002)	(4424.287)
R-squared (within)	.764	.784	.309	.545	.771
F statistic (8; 49)	30.26	35.67	5.87	7.08	30.79

Robust standard errors in parentheses

Significance levels: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed)

burglary by virtue of the lower guardianship over the property (one resident as opposed to two or more).

Likewise, adjusted durable good expenditures per capita were negatively related to robbery ($\beta = .003$, $p < .05$), and poverty rate was negatively associated with larceny rates ($\beta = -71.251$, $p < .01$) and total property crime rates ($\beta = -110.635$, $p < .01$). Unemployment rates also failed to predict property crimes. Durable good (i.e., personal technology) expenditures, poverty and unemployment should all increase rates of criminal offending in a routine activities framework. The prevalence of durable goods owned by members of the population will increase the potential available targets for theft, whereas poverty and unemployment ought to increase the motivation of potential offenders. In short, the control variables included in our models were not associated with crime rates in a manner consistent with routine activities theory. Our measure of time spent playing videogames, however, provided very interesting results both empirically and theoretically.

Recall that the hypothesis of our study is that video game playing behavior is negatively related to rates of property and violent crime. Results for our models pertaining to property crimes are presented in Table 2. As shown in the table, the percentage of individuals who play computer games at home was negatively associated with larceny rates ($\beta = -7.464$, $p < .01$), state burglary rates ($\beta = -3.242$, $p < .001$, two-tailed), motor vehicle theft rates ($\beta = -1.522$, $p < .05$), robbery rates ($\beta = -.468$, $p < .05$), and total property crime rates ($B = -12.230$, $p < .001$), meaning that for every one-percent change in the proportion of individuals who play computer games at home within states, the larceny rates decreased by approximately 7 crimes per 100,000 residents, the burglary rate decreased by about 3 burglaries per 100,000 people, the motor vehicle theft rates decreased by about 1–2 vehicle thefts per 100,000, and the total property crime rate decreased by about 10 crimes per 100,000 people. These results hold controlling for other variables associated with the routine activities approach and unobserved time-invariant factors that are present within states within our panel. These finding support the routine activities theory's conception that crime is a sustaining behavior and our hypothesis that videogame playing behavior potentially cocoons individuals from criminal events.

Table 3 contains the results for a fixed-effect model predicting violent crimes. Overall, the percentage of individuals who play computer games at home was not significantly related to violent crimes, with the exception of murder ($\beta = -.035$, $p < .001$). The effect of time spent playing computer games on the overall murder rate was indeed small, but still highly statistically significant. Given these results, researchers may want to focus their attention on how and why time spent playing videogames may have a stronger suppressing effect on property crimes, as opposed to violent crimes. Indeed, previous studies (e.g., Ward 2011) have found concordant evidence that videogames may be suppressing

Table 3 Fixed-effect models for violent crime (N = 50; 150 State-Years)

	Agg. Assault	Rape	Murder	Violent crime
% of individual living in single-person household	−.484	.028	.009	−.748
	(3.172)	(.251)	(.071)	(3.285)
% of individual living in single-person household	−2.022	.383	−.047	−2.902
	(2.191)	(.333)	(.071)	(2.709)
Adjusted durable good expenditures per capita	−.006***	.000	.000	−.009**
	(.001)	(.000)	(.000)	(.002)
% of individuals living below the poverty line	−2.234	.279	.000	−1.604
	(5.740)	(.497)	(.137)	(6.895)
Unemployment rate	−10.506*	−.357	.006	−8.931
	(4.818)	(.637)	(.069)	(5.692)
% of individuals between 14 and 24	6.382+	.848	.038	6.967+
	(3.268)	(.561)	(.083)	(3.803)
Logged population density	−224.419	−41.849+	−2.428	−400.545+
	(138.468)	(23.606)	(3.559)	(207.284)
% of individuals who play computer games at home	−.510	−.009	−.035***	−1.021
	(.556)	(.049)	(.010)	(.697)
Constant	1390.242*	195.607+	17.963	2380.370**
	(602.202)	(109.519)	(15.595)	(883.248)
R-squared (within)	.498	.263	.422	.599
F statistic (8; 49)	10.97	4.41	10..03	11.86

Robust standard errors in parentheses

Significance levels: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed)

property crime more so than violent crime, but the reason(s) for this remain unknown.

Discussion and Conclusion

The vast majority of research that has examined the relationship between videogames and violence has consisted of laboratory studies in experimental psychology. This research has produced conflicting results, and has used outcome measures such as competitiveness and/or aggression, which have questionable external validity with rates of violent (and property) crime. We have argued here that sociological, as opposed to psychological, research into the relationship between videogame playing and violent aggression is best framed using routine activities theory. This theory provides several reasons why general indoor videogame playing behaviors should produce lower rates of crime in society—playing videogames may distract or preoccupy potential offenders while keeping them indoors and off the street, and videogames may also keep potential victims off the streets and in their homes (with this tendency to stay at home providing an added deterrent effect to potential burglars).

In this study, the effect of time spent playing videogames at home was more closely related to reductions in property crime rates, than it was related to reductions in violent crime rates. In fact, the only violent crimes that were reduced by our measure of at-home videogame playing were murder and robbery. Robbery is not uncommonly classified as a property crime, though the legal definition of robbery includes the commission of an assault with the intent to steal one's property. Nevertheless, whether or not at-home videogame playing has consistent differential effects on property, as opposed to violent, crimes remains to be determined.

The results of our longitudinal empirical analyses of crime trends and videogame playing behaviors provides overwhelming support for our hypotheses. Still, this study has grappled with several data limitations and drawbacks. For one, our key independent variable is a very conservative measure of videogame playing, which asked respondents only about games they play on their computers. An analysis that included not only time spent playing computer videogames, but that also included time spent playing handheld and console videogames would have no doubt found larger effects. A second drawback of the present study is that the data are for the years 1997–2003 and, as such, it remains to be seen whether or not our proposed mechanisms are operating similarly in more recent years. A third caveat, not so much a drawback as an opportunity for future inquiry, is that we endeavored to analyze general videogame playing behavior on crime rates instead of non-violent or violent videogame playing specifically.

This research provides insight into the possible theoretical mechanisms by which laboratory studies of videogames and aggression might be connected to more sociological studies. It

may be the case that videogame (especially violent videogame) playing increases short-term competitiveness and aggression in individuals, but that this increase in potentially negative emotion is essentially "caged" or "cocooned" inside of the home. It is not just important to determine whether or not videogames increase competitiveness or aggression, it is also important to consider the context wherein videogames are often played (the home). A focus on the criminal event, as opposed to criminality, demonstrates that, in some cases, crime rates may drop even if individual criminality increases. Put another way, videogame playing *may* increase competitiveness and/or aggression and thus "motivate" the committing of violent or property crimes (though no solid evidence for this exists). Yet, if these offenders, as well as potential victims, are "cocooned" in their homes, the overall crime rate may actually, and paradoxically, drop.

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