EVOLUTIONARY PSYCHOLOGICAL PREDICTORS OF HOMICIDE IN THE UNITED STATES

A dissertation submitted

by

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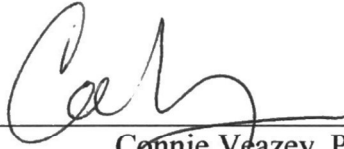
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Abstract

Violence is a prominent part of human history as well as modern society. In this study, literature describing social, cognitive, and evolutionary psychological models of aggression is discussed. Based on this discussion, it is suggested that evolutionary psychology provides an encompassing framework for explaining and predicting violent behavior. Public data on homicide rates throughout the United States are used along with census data to support an evolutionary psychological explanation of violence. Specifically, a negative binomial regression model was applied to determine if sex ratio, marriage rates, male age trends, police presence, poverty level, and population density are correlated with homicide rates across United States Metropolitan Statistical Areas. It was found that marriage rates, poverty, and population density were correlated with homicide rates in the predicted directions. Male age trends were correlated with homicide rates in an unexpected direction, while sex ratio and police presence were not significantly associated with homicide rates.

Keywords: aggression, homicide, reproduction, violence, evolutionary psychology

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CHAPTER ONE: INTRODUCTION

Human aggression and violence are in the news every day. From individual murders to mass killings and bombings, modern society is filled with aggressive human behavior. Many explanations of aggression tend to emphasize modern social issues such as access to guns and exposure to violent television (Buss & Shackelford, 1997), but violence is not a new phenomenon for the human species. In fact, there is evidence that aggression was common more than 25,000 years ago when warfare and interpersonal violence were seen in the ancient Greek, Roman, and Egyptian societies. It is interesting that so many parallels can be drawn between modern day and antiquity, including the current popularity of violence in the media and the Roman practice of watching gladiators fight to the death in the arena (DeWall & Anderson, 2010). The human tendency toward aggression can be driven by anger, ranging from agitation to rage or fury. The resulting aggression has traditionally been considered to be a violation of social standards (Berkowitz, 2012); however, anger and aggression fit into modern and historical social norms and expectations.

In 2015, there were 15,696 murders recorded in the United States, making up 1.3% of the estimated 1,197,704 violent crimes (FBI, 2016). These statistics do little to represent the true cost of violent crime, considering that each occurrence impacts numerous lives and costs substantial resources to investigate and adjudicate. Contrary to popular belief, murderers are usually normal people with no significant psychological disorders, and most violent crime occurs while the perpetrator is sober (Buss, 2005; Daly & Wilson, 1988). Despite media focus, serial killers only make up one to two percent of homicides in the United States (Buss, 2005).

While violence seems omnipresent in today's media, Pinker (2011) presents an argument that violence in today's society is much less prevalent than it was in our historical past. He suggests that eras of human history are similar to the differences in culture between countries of the modern world, with violence condoned and accepted at different levels and in different ways. It has been much less acceptable to act in violent ways in recent decades, and the exposure of children to violence through punishment and media has become unacceptable in many cultures (Pinker, 2011).

Naturally, there has been much study of violence and homicide, and many factors have been associated with this behavior. For example, increased police presence has been associated with less violent crime (Fajnzylber, Lederman, & Loayza, 2002; Levitt, 2004), and income inequality has been linked to increased homicide rates (Daly, 2016; Fajnzylber et al., 2002). In fact, there is substantial evidence that economic inequality is a major contributing factor to violence in the modern world, and this evidence points to the competition created and exaggerated when some have an abundance of resources and others have little (Buss, 2005; Daly, 2016). Identifying factors such as these, while useful, does little to help prevent violence and provide ways to treat those most at risk. For example, Daly (2016) suggests that economic conditions cannot be changed as long as it is defended by the minority in power. From this perspective, the study of psychology is primed to offer productive insights into what leads to violent behavior. These insights can then lead to methods and interventions designed to reduce violence and aggression.

There have been many psychological theories and approaches to the problem of human violence. One such approach is that of social psychology, which has demonstrated that certain situations tend to promote violent action. Perhaps the most well-known of these

studies is Milgram's demonstration that 65% of participants were willing to give a seemingly innocent individual a lethal shock under the direction of an authority figure (Milgram, 1963; Russell, 2011). In 1973, Zimbardo (2007) demonstrated a similar effect by placing college students in the roles of prisoners and prison guards. These randomly assigned roles quickly led to aggressive behaviors from both groups and ended in the early termination of the experiment. From this viewpoint, violence is a behavioral reaction to certain situational variables.

While a social psychological perspective focuses on the impact of variables in a situation, there are also psychological models that consider the role of cognition in violent behavior. The cognitive neoassociation model, for example, suggests that individuals develop mental scripts based on life experiences, and these scripts activate aggressive behaviors when triggered by the environment (Berkowitz, 2012). Similarly, the general aggression model suggests that an aggressive state is created by a combination of personal factors, such as personality traits and attitudes, and situational factors, such as the presence of weapons (Anderson & Bushman, 2002). These ideas acknowledge the impact of situational variables and add the role of individual cognitive processes.

These psychological approaches to anger and violence have yielded informative results. However, the field of evolutionary psychology adds the influence of evolutionary history and uses this viewpoint to inform a model that incorporates both the social and cognitive views of violent behavior. In this model, situational variables can be linked to situations in evolutionary history which required adaptive behaviors to achieve genetic survival. The cognitive models, then, are the evolved mental mechanisms that link the behavior to the triggering situation (Buss & Shackelford, 1997).

The modern approach in Darwinism is to consider similarities among individuals and groups, not differences. The goal in evolutionary psychology is to identify mental mechanisms that evolved in the common historical environment of humanity (Wright, 1994). This approach can be applied to the psychological study of violence to help discover the mechanisms that evolved in the ancestral environment and cause problematic aggression in the modern world.

In this dissertation, literature on the factors associated with behavior and psychological theories of aggression and violent behavior are reviewed. The argument is then made that these factors and theories support the idea that violent behavior has a basis in evolution, and aggression has historically led to increased chances of survival and reproduction in some situations. Because men and women have different reproductive strategies, it is argued that there is a difference in aggressive behavior between men and women, and the case is made that violent behavior in men is influenced by the availability of resources and reproductive opportunities in the environment. Further, it is proposed that aggression arises from evolved mental mechanisms as suggested by an evolutionary psychological model. Based on this model, a study is conducted using census and crime data gathered by the United States government to test the impact of evolutionarily significant environmental variables on homicide rates across the country.

CHAPTER TWO: LITERATURE REVIEW

It is common to consider crime and violence in relation to social conditions, such as incarceration rates, drug problems, gun control, poverty, and oppression. In fact, an increase in violence and gang membership is associated with poverty, hopelessness, racism, inequity, and similar environmental influences (Wrangham & Wilson, 2004). It is natural to assume that an increase in these negative variables leads to an increase in violent behavior. However, direct causal relationships remain elusive (Wrangham & Wilson, 2004). Unemployment rates, for example, have been consistently linked with property crime, but violent crime has not been associated with unemployment (Levitt, 2004). Similarly, overall crime rates have been linked to unemployment rates as well as income inequality in a given area (Fajnzylber et al., 2002). This suggests that criminals focus on practical crimes when faced with financial difficulties instead of becoming unnecessarily violent to gain resources.

In terms of the ability to commit violent crime, it has been found that rates of handgun ownership are associated with violent crime rates (Levitt, 2004). However, studies involving the banning of handguns showed no association between violent crime and the legality of handgun ownership (Levitt, 2004). There is also controversial evidence for and against the impact of concealed-carry laws and the theory that armed victims effectively reduce violent crime rates (Levitt, 2004). Relatedly, the deterrent effects of the death penalty have been debated for many years, with evidence both for and against its deterrent effectiveness (Levitt, 2004). For example, Fajnzylber et al. (2002) included the death penalty in a regression analysis designed to explain international homicide rates, and they found that the presence of the death penalty had a negative impact on homicide rates. Armed

victims and the death penalty both represent attempts to reduce violent crime by increasing the risks involved in engaging in this behavior.

Along these lines, there is also evidence that an increase in the number of police patrolling in an area is inversely related to the amount of crime in that area (Fajnzylber et al., 2002; Levitt, 2004), further supporting the idea that violent actions are less likely if the negative consequences of those actions are more likely. From an economic point of view, a strong threat of punishment from law enforcement increases the chances of suffering costs for violent behavior while decreasing the possibility of a large payoff (Fajnzylber et al., 2002).

Incarceration rates have been studied in relation to crime rates, and the number of inmates in the United States has fluctuated greatly in recent history. For example, there were about four times as many American inmates in 2000 than there were in 1972 (Levitt, 2004). However, rates of incarceration are impacted by many factors outside of crime rates, such as the penalty for certain types of crimes. This is most visible in the current debates over mandatory minimum sentences for certain offenses. Incarceration rates are thought to impact crime rates by both removing offenders from society, rendering them unable to commit crimes during their incarceration, and providing a deterrent of harsh punishment for criminal behavior. Interestingly, there is evidence that this deterrence effect impacts violent crime more than property crime (Levitt, 2004).

Because of the negative impact that violence has on economic activity, it is a natural topic of research for economists. As mentioned above, an economic view of criminal behavior, including acts of violence, suggests that it is the result of a logical cost/benefit analysis in which the benefits are expected to outweigh the costs. Fajnzylber et al. (2002)

conducted a regression analysis to determine the influence of several variables on violent crime in different countries using the United Nations World Crime Surveys. These variables included measures of how much of the population was previously convicted of a crime, the average income in the population, income inequality, and educational levels. This model was extended to consider the impact of police presence, capital punishment, and the production and possession of illegal drugs.

Findings suggest that homicide rates are linked to how much of the population has been convicted of prior criminal activity. There are several proposed mechanisms for this effect, including the idea that those convicted of a crime are less likely to be hired due to their convict status and turn to crime for access to resources. It is also suggested that criminals learn by committing crimes, which makes the costs of recurring crimes decrease as the offender gets better at the behavior (Fajnzylber et al., 2002). Results also show that gross domestic product (GDP) growth has a negative impact on homicide rates, indicating that less poverty is connected to less homicide. Income inequality demonstrated a positive correlation with homicide rates, suggesting that less income inequality is related to lower rates of homicide. Two economic explanations are presented for this finding. One possibility is that income gaps provide a criminal with a higher payoff which helps to increase the benefits relative to the costs of violent crime. Another possible explanation is that those in the lower income-earning groups have little expectation of improving their lives, decreasing the costs of violent behavior (Fajnzylber et al., 2002).

Psychological Theories of Violence and Aggression

These data lead to the conclusion that environmental factors, such as the poverty level and presence of law enforcement, have some impact on violent behavior. However,

the individual psychology leading to violent action is not addressed. Incidentally, several of psychology's most well-publicized and controversial studies have been laboratory investigations attempting to pinpoint which factors are most able to provoke violent behavior despite negative consequences imposed by society. Social psychology, focusing primarily on the impact of the environment on behavior, has been primed to study this question.

Situational Influences. Social learning theory suggests that motives fueling behavior are developed through exposure to situational influences, such as the behavior of parents and exposure to media (Archer, 2009). Supporting this line of thinking, there is evidence that exposure to violence in one's culture increases one's tendency to behave violently. Guerra, Huesmann, and Spindler (2003) utilized data from 4,458 children from first to sixth grade throughout the Chicago area. The children's aggressive behavior, exposure to neighborhood violence, and social cognitions were measured through interviews with the children, interviews with the parents, and self-report measures. It was found that more aggressive children reported more exposure to violence, more fantasizing about violence, and more beliefs supporting the use of violence. These findings support the idea that encountering violence within society leads to more aggressive thoughts and actions. If one is raised in an environment where violence is the norm, it is essential that one learn to defend oneself against this violence or else become a victim.

Perhaps one of the most well-known psychological studies of aggressive behavior was the Stanford Prison Experiment undertaken by Philip Zimbardo. This study was originally intended to complement Stanley Milgram's work on the impact of authority figures and obedience, and together these two studies demonstrate the strong psychological power of a situation (Slavich, 2009). The Stanford Prison Experiment was focused on investigating

how the correctional environment impacts the behavior of inmates and officers. This includes the factors of deindividuation and power dynamics.

With help from multiple students, Zimbardo turned the basement of the Stanford psychology building into a makeshift prison. He selected participants from the local community using advertisements for paid participation, and these participants were randomly assigned to become either inmates or guards in the model prison. Those selected as inmates were then arrested in their homes by local police on false charges without explanation. The participants who were assigned as guards were assigned to a shift and allowed to design a list of rules for the prison. The guards were given uniforms as well as dark sunglasses, while the prisoners were issued standard clothing and assigned a number. It was a rule that inmate names were not to be used; each prisoner was referred to only by his number (Zimbardo, 2007).

Once these roles were in place and the experiment began, it did not take long for prisoners to begin disobeying and for officers to begin coming up with ways to creatively punish disobedience. These punishments included being locked in a dark closet referred to as the "hole" and covering inmate blankets with burrs so they had to laboriously remove them before they could use them to sleep. There were even attempts to escape despite the fact that participants were told in the beginning that they could leave at any time. A rumor quickly spread that prisoners were not allowed to leave, and stress and tension among the inmates and guards quickly rose. Several disturbances resulted from prisoners revolting against the guards' control. In the end, the study had to be prematurely terminated after multiple prisoners experienced emotional breakdowns (Zimbardo, 2007).

This study appears all the more powerful because it used community participants as opposed to a more homogeneous group of college undergraduates. Once in the situation, these individuals acted the part of rebellious inmates and overly harsh guards. It dramatically demonstrated that average individuals are capable of inhumane behavior given the right circumstances, such as being de-identified and given authority over a "lesser" population. In fact, Zimbardo himself stated that his role as the superintendent clouded his judgement and caused him to let the experiment go forward beyond what an ethical and objective experimenter would have done (Drury Hutchens, Shuttlesworth, & White, 2012).

As mentioned above, Stanley Milgram also carried out a famous study demonstrating the powerful impact of situational variables on violent human behavior. After several pilot studies, Milgram created conditions in which 65% of participants would administer what they believed to be a lethal shock to another participant in a different room (Milgram, 1963; Russell, 2011). He did this by convincing the participants that they were taking part in a study on the relationship between learning and punishment. A stern and authoritative experimenter told each participant to issue a shock to a confederate each time the confederate missed an answer to a question. After each shock, the experimenter increased the voltage on a prop electrical box, indicating to the participant that more and more powerful shocks were being administered. In the end, most of the participants issued what they believed was a 450-volt electrical shock to the confederate under the direction of the experimenter. In this way, Milgram was able to show that individuals would commit destructive and lethal acts at the request of an authority figure (Blass, 2002; Milgram, 1963).

These two landmark studies make a strong case that violent and socially problematic behaviors are influenced by environmental stimuli. The social roles that individuals were

placed in, whether as a correctional officer or a study participant, seemed to dictate much of their behavior. In both cases, the consequences of violent behavior were lessened by the assigned social role. Social roles may also play a part in explaining why prior criminal activity is a predictor of violent crime (Fajnzylber et al., 2002). This idea is in line with the findings that the presence of police officers and the reminders of negative consequences reduces criminal behavior. In addition, this gives some credit to the leviathan idea that government rule can serve to reduce violence by preventing an every-man-for-himself mentality. There is substantial evidence from historical records and anthropological studies that also support this idea (Pinker, 2011).

Overall, this line of research indicates that the environment has an influence on violent behavior. These results lead to the question of whether certain environmental variables make violence more likely due to evolved mental processes. For example, these findings may support the idea that violence becomes more likely when there is less chance of suffering negative consequences. In this case, an individual may act violently to gain resources and/or status while avoiding punishment. Over evolutionary history, a mental mechanism may have evolved to make this scenario more likely.

Cognitive Ideas of Aggression and Violence. While the two social psychology studies presented above are well-known and present evidence for the power of the environment, there is also support for the impact of cognition on violent and criminal behavior (Anderson, Benjamin, & Barthalow, 1998; Bartholow, Anderson, Carnagey, & Benjamin, 2005; Berkowitz, 2012; DeWall & Anderson, 2010). As presented below, considering the role of thought in aggressive behavior does not conflict with the impact of the situation. In fact, cognition may serve as a bridge that links environmental variables to

violent behavior. There are several theories that describe such a role for cognition, including the cognitive neoassociation model and the general aggression model (GAM).

The cognitive neoassociation model suggests that mental scripts are activated by exposure to stimuli in the environment. This model is particularly apt at explaining the mechanisms behind hostile forms of aggression, in which an individual acts violently on impulse and without forethought and planning. An example of this may be striking a partner when perceiving an insult or yelling profanities when being cut off on the highway. In this type of situation, Berkowitz (2012) suggests that anger may elicit automatic reactions that are below the conscious level. These automatic reactions are thought to be responsible for a heightened awareness of anger-provoking events or sensations. Mental scripts are used to explain how one learns to automatically associate specific aggression-related cognitions and actions to anger-provoking stimuli. Essentially, observing and experiencing aggressive situations activates aggressive scripts which become primed for activation the more often they are activated. An example of this type of reaction can be seen experimentally when testing the weapons effect.

Anderson, Benjamin, and Bartholow (1998) tested the weapons effect with two experiments. In the first, 35 participants were exposed to six weapon words, such as shotgun and grenade, and six animal names, such as dog and bird. After each of these priming words, participants were then asked to read aloud a target word. Target words were either aggressive, such as *assault*, or nonaggressive, such as *bloom*. Participants were timed in regard to how long it took them to read the target word after being presented with a weapon word or an animal word. Results indicated that participants primed by animal words were slower to read aggressive target words than nonaggressive target words. However,

when participants were primed with weapon words, they were faster at reading aggressive words than nonaggressive words. In a second experiment, participants were primed with drawings instead of words, and the neutral drawings were of plants instead of animals. The results replicated the findings of the first experiment by indicating that participants were faster to name aggressive target words when primed with drawings of weapons.

These results provide support of an association between objects, such as weapons, and aggression. Due to the use of response times in this study, the results provide support for an automatic association as opposed to a conscious association between aggressive stimuli and aggressive target words. Specifically, this can be seen as supporting the idea that cues like weapons or other aggression-related stimuli activate aggressive scripts which unconsciously increase one's tendency to recognize other aggression-related cues. This, in turn, is likely to increase the chances of aggressive behavior. These results also support the idea of a flexible mental mechanism that is activated by the presence of aggression-related stimuli. This activation then causes an individual to quickly identify other threatening stimuli in the environment.

Bartholow et al. (2005) provide further evidence for script activation through the weapons effect. They did this by identifying groups of hunters, who have likely created scripts that associate specific types of guns with specific activities, and nonhunters, who have likely created a more general script in which all types of guns are associated with human violence. In the first of three experiments, 48 undergraduates were classified as either hunters or nonhunters based on an Activities Questionnaire. Photographs of six hunting guns, six assault-style guns, and six flowers were split into binders containing one assault-style weapon, one hunting weapon, and two flowers on separate pages. After each

photograph, a page asked participants to write as much as they knew about the photograph and list ways in which the object is used. An analysis of these data revealed that hunters viewed guns less negatively than nonhunters, and hunters described the hunting guns more favorably than nonhunters. Hunters also listed more details about both types of guns than nonhunters.

A second experiment tested to see if participants' different gun knowledge structures were associated with a difference in reactions to aggressive stimuli. One hundred eighty-eight undergraduates viewed photos of assault-style guns, hunting guns, and neutral images followed by target words. The participants were asked to read the target word aloud as soon as they recognized it. Response times between aggressive and nonaggressive target words were measured. The results indicated an interaction in which aggressive thoughts were read faster by hunters after viewing assault guns. However, nonhunters had faster reaction times after viewing both assault and hunting guns (Bartholow et al., 2005).

In a third experiment, Bartholow et al. (2005) asked participants to complete a response time test in which they were exposed to either assault guns or hunting guns. This was done by displaying eight images on a computer screen and asking participants to name the object as fast as they could. The last image displayed was either a hunting or assault gun, and it remained on the screen during the remainder of the experiment to serve as a visual prime. The next task asked each participant to compete with an opponent to press a button as quickly as possible. The participant who was slowest in pressing the button was exposed to a loud noise as punishment. The volume and length of this punishment noise was determined by the winning (unpunished) participant. Aggression was then measured by a participant's choice of noise level and duration when punishing an opponent. An interaction

revealed that hunters displayed more aggression when primed with an assault gun than a hunting gun. In contrast, nonhunters showed no difference in aggression between the assault and hunting gun prime.

Overall, this series of experiments provides support for the notion that scripts can be automatically activated and cause an increase in aggressive behavior. Specifically, the cognitive effects of script activation were shown by increased accessibility to aggressive target words, and behavior was shown to be affected by increasing participant's punishment on an opponent. Further, scripts were shown to be specific to an individual's experience with an object, such as a hunter's association with hunting guns for sport and not aggressive violence. These results also demonstrate that general aggressive primes, such as the presence of assault weapons, are related to aggression. Again, these results and ideas support the evolutionary idea that there are flexible mental mechanisms associated with violent action that are primed by situational stimuli.

Another theory that includes the role of cognition in aggressive behavior is the general aggression model (GAM). This model suggests that aggressive behavior is the result of an internal state, and this state is created by the interaction between person factors and a given situation. Person factors include everything a person brings to a situation, such as personality traits, current attitudes, genes, and knowledge structures (Anderson & Bushman, 2002). Several situational factors such as uncomfortable temperatures (Anderson, 1987) and the presence of weapons (Bartholow et al., 2005; Anderson, Benjamin, & Bartholow, 1998) promote aggressive behavior. A common situational factor in aggressive situations is the presence of provocation. In many cases, the aggression that results from frustration is targeted toward someone who is not responsible for the frustration (Anderson &

Bushman, 2002). For example, Anderson (1987) found that hot temperatures were associated with an increase in violent crime, but the victims of this crime were not the cause of hot temperatures (or presumably the negative effects) that were associated with the crime increase.

According to the GAM, it is one's internal state that determines how one reacts to a situation. These internal states are made up of the interaction between the affect, arousal, and cognition of an individual in a given situation (DeWall & Anderson, 2010). These states are what determine which type of reaction process is activated in a given situation. Automatic processes are called "immediate appraisal," while controlled processes are called "reappraisal" (Anderson & Bushman, 2002). Immediate appraisals require little mental effort or conscious thought, and the resulting action may be an immediate reaction in which no real appraisal occurred (DeWall & Anderson, 2010). This is an explanation that aligns with the automatic activation scripts causing hostile aggression.

Arendt (2015) tested this idea by exposing an experimental group to crime articles in which dark-skinned individuals were associated with crime. The control group read crime articles that did not refer to skin color. Participants were then exposed to faces on a computer screen for 300 milliseconds. After exposure to the faces, participants were asked to quickly indicate if the facial expressions were neutral or angry. The speed of this decision was meant to cause the participants to act on impulse, which GAM refers to as immediate appraisal. The results indicated that, after exposure to the crime articles that associated dark-skinned individuals with crime, participants were more likely to indicate that dark-skinned ambiguous faces were angry as opposed to neutral. Because this study measured participants' impulses, it supports the idea that, during immediate appraisal, a person uses

available knowledge structures to make quick decisions without spending the mental time and effort to thoroughly investigate a situation.

These cognitive models demonstrate that violence is not only the result of situational influences, but is also influenced by individual thought. Whether modeled as mental scripts or personal factors, humans are not simple reaction machines that act violently in the presence of universal aggression-provoking cues. However, the research in social psychology also suggests that some situations have the power to cause many individuals from diverse backgrounds to act in uncharacteristically violent ways. A model suited to explaining violent behavior and providing ways to treat it should account for all of these findings.

An Evolutionary Psychological Model of Violence

While psychologists have searched for causes of human violence in situations and cognitive systems, relatively few have studied violent behavior in the broader context of life and evolutionary history. This may be partially due to a negative view of evolutionary thought caused by the misuse of these ideas to justify racism and declare certain cultures superior to others. Social Darwinism took advantage of a common misunderstanding of evolutionary ideas to justify the classification of groups of people as more intelligent or more cultured than others (Wright, 1994). However, this was a clear distortion of Darwinian thought. These ideas show a lack of understanding that phrases such as "survival of the fittest" apply to individuals within a species, and not groups of individuals, such as races, within a species. It is unfortunate that a productive path of scientific thought was hijacked to spread messages of hate and segregation, while evolutionary thought promotes unity as a species that survived and evolved through the same harsh environments.

Modern evolutionary thought considers human behavior in terms of the evolutionary history shared by the entire human species, and this requires the examination of commonalities between cultures. Differences between cultures are much less important than recurring patterns that can be seen across the globe, such as a concern about social status. These patterns reflect the operation of common adaptations evolved throughout a shared evolutionary history (Wright, 1994). From this viewpoint, the classification of cultures and the idea that some races or groups are superior to others is nonsensical. If anything, modern Darwinian thought would lead to the conclusion that a population of people who commit crimes of violence should be evenly distributed between cultural and racial groups if these crimes were committed in similar situations. Because of this, race and ethnicity are not considered causal factors in the present study, and they are not included in the analysis.

Another objection to the application of evolutionary thought to human behavior is that it ignores conscious thought and treats humans as instinct-driven animals. While the Darwinian viewpoint acknowledges the influences of genes and the transmission of heritable characteristics that make up human nature, humans are not viewed as reaction machines programed by genes. Instead, human nature is thought to play a role in an individual's development. Wright (1994) describes this view of human nature in terms of knobs that are turned by one's environment. In addition, human nature provides a set of universals, such as common emotions that are activated in similar situations all over the world (Wright, 1994). These evolutionary considerations add to our current understanding of behavior, and do not contradict or discount ideas of individual agency and free will. Just as certain situations have been shown to influence behavior, so too can inherited factors that evolved in the ancestral environment.

Evolutionary psychology encompasses the theories presented above and places them within the framework of evolved psychological mechanisms that are triggered by environmental stimuli. From this point of view, the findings of social psychology can be explained as environmental triggers formed through evolution. The cognitive models, then, are descriptions of mental mechanisms triggered by the environment. Over the course of evolutionary history, selection pressures in the environment caused mental mechanisms to evolve (Sell, 2005). In other words, behavior results from evolved ways of processing and reacting to specific types of information (Buss & Shackelford, 1997).

The mental mechanisms proposed by evolutionary psychology do not operate at a conscious level. Much like the automatic scripts suggested by cognitive theories, evolved mental mechanisms create feelings that push an individual toward a strategy that has served survival and reproduction in the past (Wright, 1994). For example, a man does not choose to fight over a woman because he thinks she is a valuable reproductive resource that will help increase his chances of passing on his genes to the next generation. Instead, he may fight because of his feelings of affection toward her or because of his anger when another man damages his reputation by hitting on his girlfriend in front of others. The cost-benefit analysis designed to promote genetic survival creates feelings which are then interpreted and acted upon (or not) through conscious thought.

Feelings of anger and aggression can therefore be viewed as the result of psychological mechanisms that evolved to promote survival and reproduction. These mechanisms are triggered in specific contexts where the benefits of aggressive behavior were likely to outweigh the costs in evolutionary history. These elements create a flexible view of aggression that considers violent behavior to be an instinct, and violence is viewed as a

strategic solution that has been effective throughout evolutionary history (Buss &

Shackelford, 1997). It is important to note that the idea of aggression and violence as an

evolved mechanism does not endorse the behavior as moral or acceptable in modern society.

Instead, it implies that it is one of many mental mechanisms that evolved due to historical

environmental pressures and causes significant harm in modern life (Buss, 2005; Daly, 2016;

Pinker, 2011).

        The Evolution of Violence. Violence against conspecific rivals is not unique to

humans, and it has also been found in wolves, lions, and chimpanzees among other animals

(Wrangham & Wilson, 2004). In addition, human violence was much more prevalent in

earlier human societies, as can be seen in accounts of mass murders and creative tortures

well before the invention of modern weapons and strategies (Pinker, 2011). The facts that

human violence predates modern history and that intraspecies violence occurs in other

animals suggests that human violence cannot be attributed to modern situations, such as

cultural influences and media exposure. In fact, Pinker (2011) argues that modern culture

and institutions have significantly reduced violence in the human world. The existence of

violence in other species also suggests that it provides some type of universal advantage for

the survival of an individual's genes. A clear example of this would be the murder of a rival

for food. Without considering the possible costs of this situation, the advantage to survival

is the acquisition of food and the continued survival of the individual and his or her

offspring.

        Buss (2008) suggests several evolutionary theories for the development of aggression

in human psychology. The first is that physical force has been used throughout history to

gain resources from others, and these resources have aided in the survival of the aggressor.

This type of action can be seen in modern crimes such as muggings, burglary, and theft, and this behavior can take place in individuals and in groups. Unemployed men are more likely to engage in violence, and men are more likely to seek violent revenge when losing their jobs compared to women (Buss, 2005). Men are particularly prone to forming aggressive groups to gain resources, suggesting that this trait may have been selected for in men based on its success in gaining resources at little cost (Buss, 2008; Wright, 1994). In fact, there are no examples of women forming groups and engaging in tribal warfare (Buss & Shackelford, 1997).

Another proposed evolutionary mental mechanism for aggression is the defense of oneself to prevent valuable resources from being taken by others (Buss & Shackelford, 1997; Buss, 2008). Exposure to the threat of violence is all but inevitable in modern day and throughout most of known evolutionary history. Chimpanzee groups use violence to defend their territory and maintain access to food (Pinker, 2011; Wrangham & Wilson, 2004). In this way, aggression may cause more aggression. In fact, one of the most consistent findings in research on aggression is that an act of aggression is likely to result in retaliatory aggression (Buss & Shackelford, 1997). Daly (2016) suggests that violent action is used primarily to either gain resources from others or to protect resources when they are threatened. Passivity in the face of aggression is unlikely to be endorsed by natural selection. However, it is also noteworthy that only about 10% of homicides are carried out with the intent of practical gain (Pinker, 2011).

A third suggestion for the evolution of violent mental mechanisms is that aggression may have aided in the competition for sexual partners in the past, which would have the effect of the survival of aggressive individuals (Buss, 2008; Daly, 2016; Pinker, 2011;

Wright, 1994). Buss (2005) provides numerous examples of homicide cases based on reproductive competition. Data supporting this idea suggest that murder victims who are post-pubescent are more likely to be the same sex as the murderer than pre-pubescent victims (Daly & Wilson, 1988). In other words, murders are more likely to occur within a single sex after the victim becomes reproductive competition. This behavior can be understood by considering that a cost inflicted on a rival for reproductive opportunities represents a benefit for the individual inflicting the cost.

Relatedly, aggression may also be seen as a strategy to prevent infidelity by long-term mates (Buss & Shackelford, 1997). Aggressive males may prevent their mate from infidelity by threatening to inflict a cost through aggression. This may be the adaptive function of violence fueled by male jealousy. In fact, men have been shown to aggress against women most often when the women are suspected of cheating or leaving the relationship (Buss & Shackelford, 1997). In addition, young women, who are more reproductively valuable, are more likely to be murdered than older women (Buss & Shackelford, 1997).

Finally, mental mechanisms supporting aggression may cause increased status, improved reputation, and a higher social standing in society. This then leads to increased chances of survival and reproduction (Buss, 2005, 2008; Wright, 1994). Relatedly, violence can also be used to prevent sinking to the lowest levels of society and avoid the reproductive costs associated with this status (Daly & Wilson, 1988). This explains why Buss (2005) found that being made to look bad in front of others was a common trigger to thoughts about committing homicide. Generally, low status individuals are taken advantage of by those higher in the social hierarchy, and they ultimately lose most of their resources and

reproductive opportunities (Buss, 2005). In many pre-state societies, the act of murder improved one's status in society, and dueling was common among prominent figures in early American history (Buss, 2005; Daly & Wilson, 1988).

Social status may be considered a primary drive in cases of overt aggression because the display of masculine traits is related to an ability to defend one's territory and honor. Daly and Wilson (1988) make the case that murders involving honor and status are the most common type of murder, and these murders usually result from a trivial argument or disagreement that escalates to a status-threatening situation. Once an argument starts, no matter how trivial, backing down in public can deal a blow to status and social standing. Violence is likely to occur when one is facing marginalization from society, exaggerating the need to defend one's reputation and abilities (Buss, 2008). When an individual is threatened with being excluded from mating opportunities, he or she is willing to risk the high cost of violence for the potential gain (Daly & Wilson, 1988). In these cases, the reproductive cost of not acting outweighs the potential costs of acting violently.

Beyond considering the specific benefits of violence in evolutionary history, an evolutionary explanation of aggression suggests a general cost-benefit analysis shaped by natural selection and aimed at increasing the chances of survival and reproduction (Archer, 2009). Violence carries a heavy potential cost, including the reciprocation of violence leading to injury or death. For violent action to be justified it must carry a higher potential for successful survival and reproduction to outweigh the cost. An example of this is the tendency for the males of some species to kill the offspring of a new mate. This act eliminates the cost of caring for another male's children and allows the male to contribute more resources toward his own offspring (Daly, 2016; Dawkins, 1989).

When this line of thinking was applied to humans, it was found that children being raised with a step-parent in the home were much more likely to be abused and killed than children living with their biological parents. In fact, the chances of a child being fatally abused increased one hundred fold when the child is a step-child (Buss, 2005; Daly & Wilson, 1988; Daly, 2016). In terms of evolutionary history, the cost of this behavior for the step-parent is low, because the offspring are unlikely to be able to defend themselves.

When aggression occurs between members of the same sex, it is suggested that they are likely competing for the same resources that are needed to survive and reproduce (Archer, 2009). In this case, gaining these resources is worth the risk of engaging in violence. The asymmetric war of attrition solidifies these ideas by suggesting that selection benefits those who compete for resources that provide more potential benefits than costs (Sell, 2005). For example, violence becomes more likely when there is more violence in a given area, making the costs of nonviolence greater (Daly & Wilson, 1988). Determining the benefits of a resource requires the consideration of an individual's current situation. For example, a starving person will gain more benefit from a loaf of bread than an individual who has just finished a three-course meal. Likewise, the potential cost is determined by the fighting ability of both competitors as well as the value that one's rival places on the resource. These considerations lead to an equation that determines if an individual will enter a conflict based on the relative benefits versus the costs (Sell, 2005). Again, it is important to stress that mental mechanisms such as this do not occur at a conscious level (Wright, 1994), but instead create feelings that push an individual to create or avoid conflict. It is also important to note that costs and benefits are calculated based on what an individual can approximate, which does not correspond exactly with reality (Sell, 2005).

Unlike other animals, humans have the mental capacity to understand and act on abstract concepts. In addition, humans have thrived in communities for much of evolutionary history, prompting the evolution of mental machinery for dealing and competing with others in a complex society (Sell, 2005). As mentioned above, humans often engage in conflict over abstract concepts such as honor and respect instead of directly competing over mates and food as might be expected in the nonhuman animal kingdom. This adds complications to the relatively straightforward economic analysis of weighing the immediate costs and benefits of engaging in conflict over an immediate and tangible resource with one opponent.   Instead, complex social interactions must be taken into account and considered by a mental process that promotes conflict when conflict promotes survival. Sell (2005) refers to this as the Welfare Tradeoff Ratio (WTR), which is used by humans to determine how much cost can be borne to benefit others and how much cost can be imposed on others to benefit oneself.

An evolutionary theory of violence suggests that there should be evolved mechanisms that are activated when violence is likely to improve the chances of survival and reproduction. In other words, when conflict becomes more likely there should be physical mechanisms to prepare the body for a fight and make gaining benefits more likely than paying costs. These mechanisms include adopting a fight posture as well as changes in pain sensitivity and blood flow (Daly, 2016).

There is evidence for a link between aggressive behavior and biological variables, such as hormone levels. It has been recognized for decades that castration reduces masculine behavior in males (Daly, 2016). In one study, testosterone levels in male chimpanzees were found to increase in the presence of females who had successfully given birth (Wrangham &

Wilson, 2004). In humans, it has been found across multiple studies that interactions with attractive women tend to increase testosterone levels in adult men (Archer, 2006; van der Meij, Buunk, van de Sande, & Salvador, 2008). When men's testosterone levels were artificially increased, it was found that they engaged in more punitive activities than their counterparts who were given a placebo (Daly, 2016). Additionally, testosterone levels have been found to be higher in men who are not sexually active when compared to men that are (van der Meij et al., 2008), suggesting that increased testosterone may be linked to an increased need to mate.

Increased testosterone levels have also been linked with antisocial activities (Archer, 2006), including acts of violence. The challenge hypothesis theorizes that testosterone is directly linked to violent behavior, and this hypothesis is based on the finding that aggressive behavior in monogamous birds has been associated with an increase in testosterone. This increase in testosterone has also been associated with situations involving threats to survival and reproduction (Archer, 2006). These findings lead to the conclusion that evolved biological processes are partially responsible for aggressive behavior, and these processes are linked to mental mechanisms that promote aggression when it paid off in evolutionary history.

Group-Based Conflict. As our global society demonstrates, humans are one of several species who have adapted to the environment by living in groups. Cooperation among group members increases the chances of survival for all group members by allowing specialization and the pooling of resources. In this context, conflict as a group member may have increased chances of benefits with lower costs (Spisak, Dekker, Kruger, & van Vaugt, 2012). In fact, a study involving street gangs in the United States revealed that men in these

gangs had mating opportunities that were above average (van Vugt, De Cremer, & Janssen, 2007), demonstrating a clear evolutionary advantage to group living that extends to conflict-based groups in modern society. This also applies to family groups. Daly and Wilson (1988) provide evidence that those who commit homicide together are more likely to be related than the victim and offender. Genetic similarities seem to allow family members to find common causes for violent action. It has also been found that those who kill close family members are more likely to be considered insane, supporting the evolutionary idea that those with similar genes will be more inclined to work together than to harm each other (Daly & Wilson, 1988).

Brain imaging research has shown that scenarios involving competition and cooperation among groups activate distinct neurological mechanisms, giving biological support to the idea of evolved mental mechanisms associated with group conflict (Spisak et al., 2012). Research in social psychology has also suggested that people tend to make quick emotional attachments to group members, even when they are placed into groups without justification (van Vugt, De Cremer, & Janssen, 2007). The Stanford Prison Experiment, reviewed above, is a prime example of this. During this study, alliances were formed within groups of inmates and guards, and aggression including acts of violence occurred between groups that were randomly assigned (Zimbardo, 2007).

A study conducted by Wrangham and Wilson (2004) solidifies the connection between evolutionary development and group-based conflict. This study involved the comparison between violence in youth gangs and in chimpanzees. It is important to note that an evolutionary model does not consider human thought and behavior to be equal to that of chimpanzees or any other animal. Because of the genetic similarity between humans and these phylogenetic relatives, similarities in behavior suggest a shared evolve drive.

However, this does not discount the human ability to suppress these drives and use conscious thought and decision making to act in accordance with moral beliefs. This particular study examined two populations of different species that engage in similar behavior to find commonalities that may have evolved in a shared evolutionary past.

In this study, youth gangs are defined as groups of adolescents who form a group in a specific context and commit criminal acts. The groups tend to form in urban areas low in socioeconomic status, and members of these gangs tend to group up together. The great majority of group members are male. Gang membership may start at 12 years old or younger, and the groups establish their own territory that is defended from rival gangs. The safety and security of group members may depend on the tough and intimidating reputation of the group, making the defense of the reputation necessary (Wrangham & Wilson, 2004).

Wrangham and Wilson (2004) suggest that, like gangs, chimpanzee violence also occurs between rival groups which may result in gaining territory or preventing territory loss. The amount of territory controlled by a chimpanzee group has been linked to increased food, reproduction, and infant survival, suggesting evolutionary benefits for intergroup violence. Eliminating nearby males and lowering the status of nearby groups also serves to increase the chances of successful reproduction for male members of the aggressive group. Consideration of the risks versus the benefits can also be seen in chimpanzee behavior. For example, a group is more likely to engage in intergroup violence if it contains more males than a rival group, suggesting a preference for maximizing chances of payoffs versus the chances of injury and death. In other words, chimpanzees tend to act violently when the odds are in their favor (Wrangham & Wilson, 2004).

The similarity between gang violence and violence committed by chimpanzees further supports the argument that violence evolved. This is especially relevant considering that chimpanzees are one of two species most genetically similar to humans (Wrangham & Wilson, 2004). The situational factors and the potential benefits from acts of violence are similar when considering street gangs, tribal warfare, political groups, and groups of chimpanzees. Specifically, the importance of status, both within and between groups, is a dominant concern for individuals who engage in conflict. It is also notable that the exposure to violence and its benefits is inevitable in both the human and chimpanzee group experiences. It is likely that evolution has selected for males with a tendency to become violent and reap the benefits of increased status during adolescence, when they are most physically able to succeed using this strategy (Wrangham & Wilson, 2004).

Group violence has been known to occur within as well as between groups. As discussed above, status and social standing within a group likely led to increased chances of survival and reproduction in evolutionary history (Buss, 2008; Pinker, 2011), and aggression may be a means to increase status within a group and create a hierarchy in an otherwise chaotic environment (Wrangham & Wilson, 2004). Because of the importance of one's status within a group, violence may be the result of perceived insults to one's honor or dignity. This may include a personal insult or a violation of culturally accepted behaviors (Wrangham & Wilson, 2004).

Cohen and Leung (2010) describe a culture of honor in which honor is both given and claimed by other members of society. Because of this, honor is based on a reputation for paying others back for both positive and negative occurrences. In this context, an honorable person is one that will respond to a good deed with a good deed and will respond to harm

with harm. It is easy to see how aggression plays a part in this culture, mostly in the form of defending oneself from aggression by showing that such behavior will be reciprocated. This implies that, within a group subscribing to an honor culture, failure to reciprocate an aggressive act will lead to a loss in status and a loss in survival-based resources within the group. Conversely, those who have embraced the idea of honor have been shown to feel a moral obligation to repay someone who does something good for them (Cohen & Leung, 2010).

Cohen and Leung (2010) also describe a face culture, which is based on a hierarchy and one's ability to fill a particular role in society. Over the course of evolutionary history, these roles include behaviors necessary for survival (Pinker, 2011). Because face is an external quality, other members of this culture decide where an individual stands in the hierarchy. Aggression makes sense in this culture from the prospective of gaining social status by "saving face" through a display of aggressive behavior when wronged (Cohen & Leung, 2010; Pinker, 2011).

Age and Sex. An evolutionary explanation of violence also has implications for mental mechanisms associated with age and sex. To this end, research has associated specific age ranges with violent crime. A pattern known as the age-crime curve suggests that violence peaks in young adulthood (Buss, 2005; Daly, 2016). In fact, violent crime rates have been linked with an increase in the proportion of a population in their 20s (Fox, 2009). In a decade-long analysis of homicides committed by gang members in Chicago, it was calculated that the median age of gang-related homicide perpetrators was 19 years (Wrangham & Wilson, 2004). In addition, people over the age of 65 years have low association with crime, either as perpetrators or as victims (Levitt, 2004). Even in the

context of gang memberships, older gang members have been shown to engage in more non-violent strategies for achieving group status when compared to younger members (Wrangham & Wilson, 2004).

Relatedly, there is a substantial rise in violent behavior after puberty, when reproduction becomes possible and testosterone begins to take action in the male body (Archer, 2009; Daly & Wilson, 1988). It is also notable that men tend to grow into a more masculine form around this time, and this psychological change is coupled with entry into reproductive competition (Archer, 2009; Pinker, 2011). From an evolutionary standpoint, aggressive thought and behavior is likely adapted to take place in the age range when individuals are most capable of gaining the benefits and minimizing the costs of violence. To solidify this idea, it has been found that same-sex homicides occur most often with individuals ranging in age from 18 to 30 years, the prime human reproductive years (Archer, 2009).

Sex has also been shown to have a substantial impact on violent activity during these age ranges. In fact, the ratio of male to female mortality was highest for individuals between the ages of 20 and 24 years (Archer, 2009). It has also been shown that violent crime rates tend to rise when the number of males in their early 20s increases in a population. This was demonstrated in the violent crimes of the 1960s and 1970s when regional demographics underwent major changes (Fox, 2009). Even disregarding age, males have been identified as the more aggressive sex. Data from self-reports across 13 nations showed a large effect size in the male direction in physically violent behavior (Archer, 2009).

Research has demonstrated that men are much more likely to be murderers than women, and the victims of their violence are much more likely to be other men than women

(Daly, 2016; Pinker 2011). In fact, there is no known society where women commit more violence than men (Daly & Wilson, 1988). In the United States, approximately 88.8% of homicides between 1980 and 2008 were carried out by men (Cooper & Smith, 2011). This trend is also supported by evidence from the recent and distant past (Pinker, 2011). Male-on-male violence is the leading cause of injury and death among men. This is true across cultures (Buss & Shackelford, 1997), and it can be viewed in the context of sex differences in reproduction and evolution. In terms of evolutionary history, it has been estimated that up to 40% of the male population were involved in warfare between non-state societies, resulting in the death of about 30% of the young male population (Archer, 2009). In modern society, many murders occur when two men are trying to impress a woman, leading to violent conflict (Daly & Wilson, 1988). While women do occasionally act out aggressively, female aggression tends to be less violent and overt (Buss & Shackelford, 1997). It is thought that less direct aggression is less costly as it is less likely to cause immediate retaliation (Archer, 2009). In short, the most physically able and violent demographic group are young adult males (Daly, 2016).

Sex selection theory has been proposed to explain these data from an evolutionary standpoint. This theory suggests that natural selection has produced a more aggressive male sex in humans because females provide the more limited reproductive resources (Archer, 2009). In other words, women are required to invest more in the reproductive process than men, given the 9-month gestation period and limited number of eggs that may be fertilized in a lifetime (Daly & Wilson, 1988). Women also have more to lose in the selection of a mate, as mating with someone who is unable to provide healthy offspring and parental investment could have a heavy and long-term cost.

Men, on the other hand, do not have these biological limits to their reproductive abilities, and they are seemingly unlimited in the number of offspring they can produce (Archer, 2009; Buss & Shackelford, 1997). The average number of offspring between an equal number of men and women is likely to be similar, but the variance will be much wider in men than in women. This is because some men may sire many children by multiple women, while others are unable to sire any. Women, on the other hand, have more equality in the number of children they are able to produce (Daly, 2016). This makes women a more valuable reproductive resource, and this is thought to cause a higher level of competition among men as well as a tendency among women to be more selective in their mate.

The combination of these factors has created conditions where high-risk strategies among men, such as risking injury or death through aggression, have paid off in evolutionary history by allowing access to members of the more reproductively valuable sex (Buss & Shackelford, 1997; Pinker, 2011). In other words, the benefits of violent competition are much higher for males than females, producing mental mechanisms that promote these behaviors. The influence of social status on aggression, discussed above, adds evidence for these ideas.

This idea of violence used for survival and mating is supported by the results of recent research in which it was found that violence in prisons was more likely when there was a higher percentage of female staff and officers (Lucas & Hawkins, 2015). In this case, male prison inmates are housed with other male inmates for years on end with virtually no reproductive opportunities. Inmates are only allowed limited contact with females through visitation and encounters with female staff members. Considering the scenario of over 100 male inmates living in a housing unit, it is hypothesized that a woman entering in any role

would create a competitive environment in which the inmates increase in aggression and testosterone to gain an extremely rare opportunity for reproduction.

There are many other examples where the presence of females has been shown to change male behavior. For example, Ronay and von Hippel (2010) found that male skateboarders took greater risks and attempted more difficult maneuvers when a female was present compared to a male. As mentioned, it has been shown in multiple studies that short interactions with attractive women increase testosterone levels in adult men (Archer, 2006; van der Meij et al., 2008). These findings suggest that there is an aggression-related mental and physical reaction to the presence of a mating opportunity, especially since the presence or absence of testosterone cannot be consciously controlled. It is also suggested that differences in body size between men and women, known as sexual dimorphism, are also a result of men's tendency and ability to act aggressively. Men, who must compete to gain access to females, have developed a body style focused more on size and strength. Women, on the other hand, must bear children and cope less with same-sex physical competition, which led to the development of a body type less suited for physically aggressive competition (Archer, 2009; Daly, 2016; Pinker, 2011). One analysis of 112 studies estimated that the average strength of women is 61% the average for men, supporting the development of greater strength in men (Archer, 2009).

The ability of men to control access to mates is also thought to have an impact on aggressive behavior. In support of this idea, it has been found that married men are less likely to behave aggressively, and those with less economic resources are more likely to engage in violence (Archer, 2009; Buss & Shackelford, 1997). Societies and species in which monogamy is prominent and men are less likely to hoard resources will theoretically

lead to less homicide (Daly, 2016). In fact, marriage is recognized and enforced in most modern and historic societies. Cross-cultural and historical studies suggest that, when wives cheat on their husbands, the husband is usually considered the victim and deserving of compensation (Daly & Wilson, 1988). This suggests that monogamy has been historically enforced for men in order to prevent a husband from losing reproductive rights to his wife. On the other hand, there were no documented legal prohibitions of men cheating on their wives with unmarried women until 1810 (Daly & Wilson, 1988), demonstrating the increased value placed on female reproductive behavior. Another example of the power of marriage comes from gibbons, a type of ape that are known for their monogamy and lack of violent behavior (Daly, 2016; Pinker, 2011). Considering the mix of monogamous marriage and other sexual practices, modern human behavior may be viewed as mildly polygynous (Daly, 2016).

These ideas suggest that men with secure access to a mate have less reason and get less payoff from aggressive behavior. These ideas give rise to the operational sex ratio, which is the number of males and females able to reproduce in a given time and place (Archer, 2009). The fewer the females in this ratio, the fewer the men with secure access to females and the more payoff there will be for successful aggressive behaviors. This idea also extends to resources needed to attract a mate, incorporating environmental influences. In short, the operational sex ratio predicts that mental mechanisms will promote aggressive behavior more often when the ratio is high and there are fewer females to males in an environment of scarce resources. The opposite is also predicted, with a low operational sex ratio predicting less male overt aggression. This is consistent with the cross-cultural finding that those with less to lose are more likely to engage in violent behavior (Archer, 2009).

Weir, Grant, and Hutchings (2011) conducted a meta-analysis that tested the influence of the operational sex ratio on aggression across species. They found that aggression increased along with competition as the operational sex ratio became more biased. However, when the operational sex ratio reached 1.99, aggression decreased, presumably due to an increase in the cost of aggressive behavior. Barber (2003) tested the impact of the operational sex ratio on violent crime across several countries. He used a regression analysis to examine data from England and Wales between the years of 1856 and 1980, Scotland between the years of 1871 and 1980, and the United States between 1900 and 1988. Findings included an increase of violent crime in England, Wales, and the United States when there were more males in the male-to-female ratio. Interestingly, this study also found that marital opportunities for women were inversely related to violent crime across the countries and time periods studied. This result coincides with a longitudinal study carried out with Bostonians that found that marriage and employment reduce the chances of criminal behavior (Pinker, 2011). This suggests that violence increases when there is less opportunity to marry, suggesting an increase in male competition for marriage.

CHAPTER THREE: STATEMENT OF THE PROBLEM

Human violence is a major problem throughout modern society. Compared to other Western developed nations, the United States leads in the number of homicides and is more aligned with numbers seen in less developed nations (Pinker, 2011). Research has linked many factors to violent behavior, and several psychological theories have been developed to explain why people act violently. Despite these insights, violence is still a daily occurrence in modern society, and the cost of preventable violence on modern civilization is tremendous. To treat those at risk for acting violently, clinical psychology needs a working model that is able to explain why people act violently in modern settings. This model may then be used to create effective treatments and successfully reduce needless acts of human violence.

Evolutionary psychology is poised to provide this model, as it encompasses modern psychological theories and research findings and places them in the context of ancestral history. This model suggests that aggressive feelings are prompted by underlying cost-benefit analyses that evolved throughout a pre-industrialized society. These mental mechanisms are likely triggered in present-day situations and cause violent behavior that is maladapted to the modern environment. The goal of this study is to provide evidence for or against the ability of an evolutionary psychological model to explain acts of violence that occur in today's society.

An evolutionary psychological explanation for violence makes several predictions for variables that activate the mental mechanisms leading to aggression. Many of these variables have received substantial research support, as reviewed above. This support includes studies addressing historical violence as well as violent crimes that occur in modern society.

However, much of this research has not taken advantage of the ability to collect and compile large amounts of data on crime rates and environmental variables in modern day. Research that utilizes these data may contribute to knowledge concerning the impact of environmental factors on violent behavior, which may lead to better methods of violence prevention and treatments for aggressive behavior.

Research Questions

Based on the cost-benefit framework suggested by an evolutionary model, there are many modern-day environmental predictions regarding violence. These predictions can now be tested using crime and census data collection from throughout the United States. The outcome variable for all predictions will be the count of homicides committed across the country. One variable that is predicted to increase the number of homicides is the operational sex ratio. According to an evolutionary psychological model, the more men in a population compared to women would present an increase in the benefits for men who successfully compete over female mates. The scarcity of females is predicted to activate the mental mechanism for competition in males, which includes physically aggressive behavior.

In a similar vein, the higher percentage of a population that is married is predicted to correspond with a lower number of homicides. From an evolutionary standpoint, married men will receive less benefit from violent behavior and risk paying a higher cost when competing for other mates. Married men often have a secure relationship with their wives and successfully engaging in another relationship adds marginal benefit in terms of genetic survival. In contrast, unmarried men may not have such a secure mate and stand to gain more from engaging in conflict over women. Married men also run the additional cost of damaging their marriage when pursuing extramarital relationships. As a result, a higher rate

of marriage is thought to decrease the activation of mental mechanisms that drive violent conflict.

It is also predicted that a greater number of males between the ages of 15 and 39 will be correlated with an increase in homicides. Members of this age group stand to gain the most from mating, and this increases the possible benefits from violent competition. In addition, male physical abilities tend to become primed for physical conflict at this age, and it is proposed that a mental mechanism has evolved that promotes increased violent conflict over mating opportunities during this time. This increase in violent conflict is predicted to correspond with an increase in homicides.

Higher poverty rates are also predicted to be associated with increased homicides. In this case, the lack of general resources is likely to cause increased competition due to the increase in benefits from attaining resources and the high cost of losing them. In addition, those at the lower end of the socioeconomic curve are less likely to be protected by law enforcement (Daly, 2016; Pinker, 2011). Successful procurement of resources through male physical violence in evolutionary history likely lead to the development of a mental mechanism designed to activate aggression when scarce resources related to status and survival are available. The increase in benefits that can be gained from monetary resources in an environment of poverty is predicted to outweigh the cost of physical violence in many cases, leading to an overall increase in homicide. It is recognized that a measure of income inequality would better reflect the evolutionary idea that men compete for resources in the local environment when they do not possess them themselves (Daly, 2016). However, measures such as the Gini index are not available for the small areas that will serve as the sample in this study. In addition, all areas are inside the United States, and modern media

exposes most of the population to a common standard of living. This may lead to an increased correlation between the poverty level and income inequality in terms of homicide.

From an evolutionary standpoint, the amount of police in a given area is thought to represent additional costs for engaging in violent conflict. This is because a stronger police presence presumably leads to a greater chance of being punished for violent behavior. In these cases, the greater cost represented by the increased chances of getting caught likely outweighs the potential benefit of engaging in physical conflict more often. This would cause an evolved mental mechanism to avoid violence and avoid paying a heavy price. As a result, it is predicted that an increase in police per capita will lead to a decrease in homicide rates.

Higher population density is also predicted to increase homicide rates. More people in a limited area leads to more competition over fewer resources, such as housing and employment. Because there are fewer resources, mental mechanisms that lead to violent competition are likely to be activated in order to gain valuable resources and social status. This activation is predicted to lead to an increase in homicides in regions with higher population densities.

As mentioned above, evolutionary psychology searches for commonalities between cultures, races, and ethnicities (Wright, 1994). Mental mechanisms are thought to have evolved over a history shared by all humans, and differences in mechanisms may be explained by different environmental triggers and individual genetic differences. While differences in homicide rates may be detected between races and ethnicities, race and ethnicity are not considered to be a cause in these differences. Instead, differences in homicide rates between races and ethnicities should be explained by environmental

differences between these groups. Because of this, race and ethnicity were not considered in

this analysis.

CHAPTER FOUR: METHODS

Data Sources

In this study, data collected by the FBI Uniform Crime Reporting Program were used to determine the number of murders and non-negligent homicides in 341 Metropolitan Statistical Areas (MSAs) across the United States in 2010 (United States Department of Justice, 2011b). Some MSAs were excluded due to the lack of availability of one or more of the predictor variables. The Office of Management and Budget sets federal standards that determine what constitutes an MSA, and these standards are followed by the Census Bureau and the FBI. An MSA is defined as an area with a large central population surrounded by communities that are integrated with that population (Office of Management and Budget, 2010).

Data on murder and non-negligent homicide are made available by the reporting of local, state, and federal police forces across the county. The FBI's reporting program is known for minimal underreporting and consistent quality (Fox, 2009). The FBI considers the crimes of murder, non-negligent manslaughter, forcible rape, robbery, and aggravated assault to be violent crime (United States Department of Justice, 2011a). This definition is standardized across the country for the FBI's reporting program. For the purposes of this study, the count of murders and non-negligent manslaughters in MSAs across the United States during 2010 serves as the outcome variable. The FBI defines murder and non-negligent manslaughter as "The willful (nonnegligent) killing of one human being by another" (United States Department of Justice, 2013b, p.1). Deaths that are related to injuries caused by fights or arguments are reported as murder and non-negligent manslaughter, even if the offender is charged with a lesser offense (United States Department of Justice, 2013b).

When multiple deaths result from a single act, each death is reported as a separate instance (United States Department of Justice, 2013b).

Because measurement error is a known problem with many measures of violence and criminal activity, murder and non-negligent manslaughter was selected as the outcome variable. Homicide is considered the most accurately measured and the most serious violent crime (Daly, 2016; Fajnzylber et al., 2002; Levitt, 2004). Other violent crimes, such as assault or rape, may go underreported more often, but homicide is likely to be detected even when it is not directly reported. When the deceased are found in developed countries, it is very likely to be reported and an investigation is bound to follow. This makes records of homicides much more reliable that other crimes (Daly, 2016). This study is limited to the United States because underreporting is a known widespread problem in countries with problematic judicial systems and uneducated populations (Fajnzylber et al., 2002). In addition, this study used MSAs to make comparisons between multiple individual populations across a country with a uniform criminal justice system.

Data collected by the United States Census Bureau were used to calculate the number of males per 100 females in each of the MSAs in the United States in 2010. In addition, data from the Census Bureau were used to calculate the number of men between the ages of 15 and 39 per 1,000 people in each MSA. Census data were also used to determine the number of individuals below the poverty line per 1,000 people in the MSAs. The poverty level was used to indicate how much of the population struggled to obtain resources. The number of married people per 1,000 in 2010 was also used as a predictor variable to estimate how much of a MSAs population represent available mates. The rate of married people only included those in the population over 15 years of age, and this rate did not include those who were

classified as separated. Data on the law enforcement workers in the MSAs were used as a measure of the police force. The number of law enforcement officers per 1,000 people in each MSA was included in the analysis. However, these data were only available and included for 187 MSAs, which resulted in a separate analysis. The population density, measured as the number of people per square mile of land area within an MSA, was also included as a predictor variable. In addition, the population of each MSA, recorded as thousands, was used as an offset variable to control for the impact that population has on homicides. This also allows for the outcome variable to be interpreted as homicide rates per thousand.

Hypotheses

Based on the evolutionary psychological model outlined above, it was predicted that a higher rate of males per 100 females and a higher number of males in the population between the ages of 15 and 39 would result in a higher rate of murder and non-negligent manslaughters. In addition, higher poverty rates were predicted to be associated with a higher rate of murder and non-negligent manslaughter driven by resource competition, and a higher rate of married people was predicted to be associated with a lower incidence of murder and non-negligent manslaughter due to an increased number of stable non-competitive relationships. It was also predicted that higher police presence would increase the potential cost of violent crime and coincide with a lower rate of murder and non-negligent manslaughter. Higher population density, on the other hand, was predicted to coincide with increased homicides due to an increase in competition in a limited geographic area with limited resources and mates.

Analysis

Using these data and the R Software Environment for Statistical Computing, a regression analysis was performed to determine if there is a relationship between these variables and homicide in the MSAs. However, the analysis of count data causes problems with traditional parametric statistical analysis, including regression models. Specifically, crime counts are impacted by population size, and the difference in population between units of the dependent variable violates the assumption of homogeneity of variance. This is because errors in prediction are expected to be higher in smaller populations than in larger ones (Osgood, 2000). In other words, a single event, such as a murder, will have a much larger impact on the homicide count of an MSA with a population of 100,000 than it will have on an MSA with a population of several million.

According to Osgood (2000), populations of several hundred thousand per unit are needed to address this issue. There are several MSAs with a population of less than 100,000, and over 100 MSAs had a population of less than 200,000 in 2010 (United States Census Bureau, 2017). Because of this, the counts of murder and non-negligent homicide in the MSAs are not likely to meet the assumption of homogeneity of variance. In addition, distributions of rare event rates cannot be assumed to have a normal distribution, as there are likely to be a high number of zeros which results in a significant skew (Osgood, 2000).

The Poisson-based regression models do not assume homogeneity of variance, and they were designed to counter these problems and allow for explanatory variables to predict rare event data as an outcome variable. These techniques are common in criminology when analyzing criminal careers, and they have recently been applied when dealing with rare crime events such as shootings in a specific area (Osgood, 2000; Piza, 2012). However, this model does assume that the explanatory variables account for all variation in the outcome

variable, and it is assumed that each event is independent and not impacted by other occurrences of the events (Osgood, 2000).

As reviewed above, there is evidence that violent events do impact the occurrence of future violence, whether in retaliation or as a defense. For example, one homicide committed by a gang member is likely to produce one or more additional homicides from a rival gang. In addition, each victim of a murder or non-negligent homicide is counted as a separate event in the FBI Uniform Crime Reporting Program, even when the deaths occur together and are the result of a single person's actions (United States Department of Justice, 2013a). As a result, the assumption of independence is likely to be violated by homicide. In addition, the variables included in this study may not fully account for homicides, as many other variables impacting violent behavior are likely. This will likely result in a phenomenon known as *overdispersion* which occurs when the residual variance is greater than the mean of the outcome variable. The negative binomial regression model is the most widely used Poisson-based regression analysis when overdispersion is detected (Osgood, 2000; Piza, 2012).

Osgood (2000) demonstrates the use of Poisson-based regression using rates of violence among juveniles across counties in four states. The rates used as the outcome variable in this study were the number of juveniles per 100,000 arrested for robbery in each county over 5 years. Census data were used for the explanatory variables of residential instability, ethnic heterogeneity, family disruption, poverty, unemployment rate, and proximity to metropolitan counties. A dummy variable representing four states was used to control for the difference in juvenile violence accounted for by the state. The use of negative

binomial regression allowed Osgood (2000) to determine how much of an increase in the outcome variable was accounted for by each explanatory variable.

In the current study, the counts of murders and non-negligent manslaughters in each of the MSAs were used as the outcome variable. The predictor variables included the number of males per 100 females, number of people in poverty per 1,000, number of married people per 1,000, law enforcement workers per 1,000 people, number of men in the population between the ages of 15 and 39 per 1,000, and the number of people per square mile of land area. Three hundred forty-one MSAs in the United States served as the sample with the exception of law enforcement workers in which a sample of 187 was used. These sample sizes allowed for detection of significance if these variables are associated with murder and non-negligent manslaughter. In addition, the population of each MSA measured in the thousands was used as an offset to account for the impact of the number of people in each MSA on homicide.

CHARTER FIVE: RESULTS

Prior to completing the negative binomial regression, the characteristics of each variable were examined. The measurement method for each variable is defined in Table 1 below.

Table 1

Unit of Measurement for All Variables

Variable	Unit of Measurement (per MSA)
Homicide	Number of homicides
Sex	Number of men for every 100 women
Men	Number of men between the ages of 15 and 39 per 1,000 people
Poverty	Number of people below the poverty line per 1,000 people
Marriage	Number of married unseparated people per 1,000 people over the age of 15
Police	Number of law enforcement workers per 1,000 people
Density	Number of people per square mile of land area
Population	Thousands of people

Because the sample size examined in this study is large, violations of normality were not predicted to cause major problems. Specifically, for sample sizes above 100, the distribution of sample means can be assumed to be approximately normal, regardless of the shape of the sample data (Ghasemi & Zahediasl, 2012). As a result, skew and kurtosis were not included in the preliminary analysis of the variables. A summary table of descriptive statistics for each variable is included in Table 2. Of note, marriage data were not available for one MSA in the analysis, resulting in a sample of 340 MSAs. Similarly, data on law

enforcement workers were only available for 187 MSAs. All other variables included data for 341 MSAs.

Table 2

Descriptive Statistics of All Variables

Variable	*n*	*M*	SD
Homicide	341	34.36	85.14
Sex	341	97.16	4.15
Men	341	350.99	44.89
Poverty	341	163.83	48.29
Marriage	340	491.34	42.75
Police	187	4.67	2.91
Density	341	239.99	332.8
Population	341	688.52	1543.50

There were several outliers noted when examining the predictor variables, and these outliers are identified in Table 3. Because of the possible impact of these values on the analyses, each analysis was run with and without these values. It was shown that the inclusion of these values did not have a substantial influence on the results.

Table 3

Outliers

MSA	Variable	Value
Albany GA	Police	30.40
Hanford-Corcoran	Sex	125.80
San Franciso-San Mateo	Poverty	535
McAllen-Edinburgh	Poverty	333.6
Brownsville-Harlington	Poverty	363

In addition to examining the characteristics of each variable, the correlations between variables were also examined. A pairwise matrix correlation table is presented in Table 4. It is notable that several correlations between variables are significant. Because of this, one analysis was used to determine if each variable is significantly associated with homicide rates while accounting for the impact of all other variables. However, the police variable was not included in this overall analysis because it only included 187 samples. A separate analysis, using all variables for 187 MSAs, was used to determine the impact of police presence on homicide rates.

Table 4

Correlations Between Variables

Variable	Homicide	Sex	Males	Poverty	Marriage	Police	Density
Gender	-.12*						
Men	.02	.41**					
Poverty	-.07	-.08	.24**				
Marriage	-.15**	.10	-.42**	-.45**			
Police	-.05	-.04	-.02	.26**	-.19**		
Density	.70**	-.20**	-.09	-.18**	-.13*	-.16*	
Population	.94**	-.10*	.03	-.11*	-.10	-.07	.73**

Note. * indicates $p < .05$, ** indicates $p < .01$

As mentioned above, it was predicted that overdispersion would be present when using a Poisson-based regression analysis, leading to the use of negative binomial regression. In order to confirm this assumption, the analyses were first run as Poisson regression equations. These analyses included the log of the population as an offset variable. The equations were then analyzed for overdispersion using a test developed by Cameron and Trivedi (1990). These results indicated that overdispersion occurred in both the overall model (alpha = 7.37, $z = 3.87$, $p < .01$) and the police model (alpha = 10.48, $z = 3.70$, $p < .01$). The option of using a zero-inflated Poisson analysis was rejected because there was no theoretical reason why the zeros in this sample would be artificially inflated. In other words, there is no reason to think that homicide could not have occurred in every MSA during 2010. As a result, negative binomial regression was used to analyze the relationship between the predictor variables and homicide.

The results of the negative binomial regression analyses performed for the overall model are shown in Table 5. This model tested the relationship between homicide and the gender, men, poverty, marriage, and density variables. The log of the population of each MSA was used as an offset variable. Because this offset was used, the results may be interpreted as the impact of each variable on homicide rates per 1,000 people. An incidence rate ratio (IRR) was calculated to describe the impact of each predictor variable on homicide and nonnegligent manslaughter.

Table 5

Negative Binomial Regression: Overall Results

Variable	IRR	SE	z-value	p-value
Sex	0.991	0.01	-0.90	.37
Men	0.996	<0.00	-3.58	<.01**
Poverty	1.002	<0.00	3.32	<.01**
Marriage	0.993	<0.00	-6.69	<.01**
Density	1.000	<0.00	1.99	.046*

Note. * indicates $p < .05$, ** indicates $p < .01$

The results presented in Table 5 suggests that the sex ratio did not have a significant impact on homicide. However, the number of men between the ages of 15 and 39 was significantly associated with homicide rates. This impact was not in the predicted direction, with more men in this age range associated with a decrease in homicides. Interpretation of the IRR suggests that homicide rates decreased by 0.4% for each unit increase in men. Poverty had a significant effect on homicide in the predicted direction, with an increase in poverty associated with an increase in homicide rate. The IRR indicates a 0.2% increase in

homicide rates is associated with each unit increase in poverty. The number of people married in each MSA produced a significant decrease in the homicide rate, as predicted. The IRR suggests that homicide rates were reduced by 0.7% for each unit increase in marriage. Population density was positively associated with homicide rates; however, the IRR results suggest a very small effect size (<0.01%).

Because data on law enforcement personnel were only available for 187 MSAs, a separate negative binomial regression was performed. This analysis also used the log of population as an offset variable and tested the impact of law enforcement on homicide rates. Because the police variable was significantly associated with the marriage and density variables, all variables used in the overall analysis were used in the police analysis. All variables only included the 187 MSAs for which law enforcement data were available. The results of the police analysis suggest that the number of law enforcement workers in an MSA was not significantly associated with homicide rates when all variables were considered (IRR = 1.02, z = 1.37, p = .17).

CHARTER SIX: DISCUSSION

Evolutionary psychology encompasses several psychological theories of human violence and places them in the framework of evolved mental mechanisms. Social psychology has found that there are environmental triggers that lead to violent behavior (Archer, 2009; Guerra et al., 2003; Milgram, 1963; Zimbardo, 2007) and cognitive psychology describes mental processes that lead to violent behavior (Anderson et al., 1998; Bartholow et al., 2005; Berkowitz, 2012; DeWall & Anderson, 2010). Evolutionary psychology embraces both viewpoints and places them in the context of evolutionary history in which mental mechanisms were developed as a result of environmental selection pressures. This process created flexible cognitive processes, triggered by certain environmental stimuli, that lead to violent human behavior (Buss & Shackelford, 1997; Sell, 2005).

This study used a large dataset collected by government agencies in order to test the predictions of evolutionary psychology in modern-day United States. Specifically, predictions regarding the environmental influences on homicidal behavior were tested. As reviewed above, previous research supports the prediction that gender ratio, number of competitive men, poverty, population density, and marriage impact rates of violence. However much of this research utilized smaller datasets or only considered each variable alone. In addition, this study used homicide as an outcome variable, which is more accurately measured than other forms of violence (Daly, 2016; Fajnzylber et al., 2002; Levitt, 2004). While the power of this study was decreased by the use of homicide alone, the reliability of the findings was improved.

The goal of this research was to improve the understanding of modern-day homicide and work toward more effective prevention methods. While Pinker (2011) demonstrated that violence has declined over the course of human history, recent news of frequent mass shootings, continued gang violence, and teenage violence suggests that homicide is still a monumental problem in modern society. As Buss (2005) suggests, a better understanding of the triggers and mental processes that lead to homicide can lead to better violence prevention. This includes environmental changes based on known triggers to violent mental mechanisms and psychological treatments designed to target dangerous thought processes.

Examination of Results

Because homicide is a relatively rare event, a large amount of power was given up in order to improve the reliability of the outcome variable. All of the results from this study produced IRRs that were very close to one, indicating a relatively small effect size. However, it should be noted that these results are based only on homicides that were completed and documented, and for each completed murder there are about three attempted murders in which the victim does not die (Buss, 2005). Homicide is the most extreme violent act, and it occurs much less frequently than other violent crimes. In 2015, homicides accounted for 1.3% of report violent crimes (FBI, 2016), and this statistic does not include all incidence that were not reported to the government. It is likely violent acts, such as bar fights and other assaults, commonly go unreported to avoid legal consequences.

From an evolutionary psychology standpoint, the triggers and mental mechanisms that lead to homicide may also lead to other violent crimes. Competition may be eliminated by causing a rival physical harm or harming a rival's reputation, and homicide may be avoided. Because of this, the effect sizes that resulted from this study should be considered

extremely conservative, and a significant finding on the outcome variable of homicide can be considered a powerful finding in terms of violence more generally.

Sex Ratio. Despite previous findings, sex ratio was not significantly associated with homicide in this analysis. This suggests that, when considering all other variables examined, the number of men per 100 women in a given MSA did not significantly impact the rate of homicides. However, it is noteworthy that the mean of this variable was 97.2 men per 100 women with a relatively small standard deviation. It is clear that this sample did not include populations with a wide variety of sex ratios, leading to a lack of effect.

It is also possible that the sex ratio may exhibit a curvilinear effect, in which competition among men is only impacted by sex ratios at the far ends of a distribution. For example, male violence may be associated with the sex ratio in male prisons, where the male-to-female ratio is extreme compared to other environments. At the other end of the curve, an extreme abundance of females may cause a significant reduction in violence for males. This study would fail to detect such an effect because there were no examples of extreme sex ratios in this sample.

Competitive Men. The results of this study suggest that an increase in the number of men between the ages of 15 and 39 was associated with a decrease in homicide rates. This finding is counter to the predicted outcome, which claimed that violence would increase with the number of males in this age group because these individuals are most physically competitive. Violent crime as a whole has been linked to young adulthood and puberty, when competition among men peaks (Archer, 2009; Daly, 2016; Fox, 2009; Pinker, 2011). Pinker (2011) argues that violence as a whole has declined throughout human history; this trend is also found in the United States in recent years. The FBI reported that violent crime

in 2010 dropped 6% from 2009 and 13.4% since 2001 (United States Department of Justice, 2011a). It is possible that strategies to decrease violence have affected young men more than other groups, and these results could represent a trend of decreasing violence by men in this competitive age group. Further research is needed to determine if violence among this group has declined to the point where men of reproductive age are less likely to be involved in homicide than are other age groups.

The costs of committing homicide may also be highest at this age group, with the possible loss of all reproductive opportunity for the remainder of life. It could be that violence is highest among this age group because the benefits of winning a violent conflict are outweighed by the costs of a loss. However, the act of homicide in modern society puts one at risk for being killed or jailed for life, which is a much higher cost than losing a fight. Further research is needed to clarify the impact that this age group has on homicide and generally violence in modern life.

When comparing the initial correlations, it is noteworthy that this variable was not significantly associated with homicides. This initial finding suggests that, without considering the other predictor variables and controlling for population, the number of men in this age group in an area does not have a sizable impact on homicide. The number of men in between 15 and 39 is also negatively correlated with marriage. In other words, an increase in marriage was associated with a decrease in men in this age range. As discussed below, marriage demonstrated a negative correlation with homicide rates, so an increase in marriage was found to be associated with a decrease in homicides. There may be an interesting interaction between these two variables leading to a combined effect on homicide rates. There was also a significant positive correlation between this variable and poverty,

suggesting that men in this age group are more likely to be poor, and increased poverty is linked to increased homicide. This moderating effect may explain the unexpected findings, and it can be explored in future research.

Poverty. As predicted, poverty was significantly and positively correlated with homicides across the United States. This suggests that a lack of resources not only increases violent behavior, but also homicidal behavior. Daly (2016) further suggests that it is not poverty alone, but income inequality that has the true impact on violence and homicide. Because MSAs were used, it can be assumed that economic inequality in these areas was relatively high when compared to more rural homogeneous areas. However, further research is needed to determine the relative impact of poverty compared to economic inequality.

Poverty is also likely to be correlated with social status, and the evolutionary psychological model suggests that social status has an impact on violent behavior. Specifically, poverty may be correlated with lower social status, which may cause a drop in reproductive opportunities and resources. This effect may partially explain the positive correlation between poverty and homicide, and this may be the subject of future research.

Marriage. The rate of marriage was significantly negatively correlated with homicide rates, as predicted. This result suggests that monogamous marriage reduces homicide rates, presumably because married men pay greater costs and get fewer rewards from competing for other women. While violent mental mechanisms may still be activated to defend a wife from a potential mate poacher (Buss, 2005), a married man seems less likely violently compete for other women because he has a stable reproductive relationship. The costs of competing for other women may increase in this situation because the married man could lose his marriage on top of other potential costs. In addition, his potential gains

are marginal given his current relationship. Men without a stable relationship are more likely to compete violently for reproductive opportunities because the potential payoff is higher and the relative cost is lower.

Police. Contrary to predictions, homicide rates were not significantly impacted by police presence. It is possible that this is because this study only included metropolitan areas in the United States. This provided a relatively homogeneous sample, and the standard deviation for this variable was the lowest of all variables used. The effect of police presence might be better studied using a sample with more diverse numbers of police, such as from different countries. In addition, the data were only available for the police variable in 187 MSAs compared to 341 MSAs for most other variables. This reduced the power of the study, and a significant impact of police presence may have gone undetected.

Population Density. The density of the populations in the MSAs had a significant impact in the predicted direction, with more people in less space correlating with increased homicide rates. Essentially, there are fewer resources, such as housing, when there are more people in a limited space. This likely leads to increased competition for these resources, leading to increased homicides. There is also an increase in opportunity for homicide when population density is higher. It seems that areas with higher population densities are less likely to share a sense of community that can be experienced in less populated areas. A high volume of people makes it difficult to know the people that surround you on a daily basis. This may allow for criminals, including murderers, to commit their crimes without the notice and interference of bystanders.

Study Limitations

Like all studies that rely on regression and do not occur in controlled environments, causal relationships between the predictor and outcome variables cannot be drawn. While evolutionary psychological theory provides a model that can explain why the predictors impact homicide, these data cannot be used to conclude that the predictors are the cause of changes in homicide rate. As discussed above, there is the possibility that other variables impacted homicide rates while interacting with and mediating the predictors used in this study. This study was designed to determine if the evolutionary ideas of homicide can be supported in modern life, but it cannot be used to conclude that any variable actually causes an increase or decrease in homicide rates.

This study was also limited by the amount and quality of public data available. Most notable was the availability of police data for only 187 MSAs and the unavailability of a reliable statistic to measure economic inequality in the MSAs. Marriage was also used as an inexact measurement for the number of available women in an area because it is unrealistic to collect detailed data on the relationship status of individuals across the United States.

While using large samples collected by government agencies allows for increased power and the application of theory to society at large, it also limits what can be accurately measured and adds a degree of uncertainty to everything that is measured. While the FBI's crime database is known for its accuracy (Fox, 2009), it still relies on the reporting of local, state, and federal agencies across the country. This naturally leads to some degree of reporting error, as with any large-scale data collection involving numerous agencies all containing numerous people.

Future Directions

Research Directions. Future research may aim to solidify the relationship between the variables used in this study and homicide. Police presence, for example, can be measured using a larger and more diverse sample to see if it has the predicted negative impact on homicide rates and violence in general. In addition, sex ratio, or operational sex ratio, can be investigated to see if it exhibits a curvilinear effect in which extreme ratios impact homicide rates. Specifically, it is suggested that when men largely outnumber women, homicide rates will increase. At the other end of the spectrum, when women largely outnumber men, homicide rates should decrease.

The direction of the results found for men in the reproductive age group may also drive future research. It would be interesting to investigate the possible impact an interaction between the number of men in this age group and marriage rates has on homicides. In addition, the question of whether modern society leads men in this age group to be associated with increased violence but decreased homicide seems primed for investigation. This research can be fueled by the idea that competitive men are driven to violent conflict by the reward of reproductive resources but shy away from homicide because of the extreme modern-day costs of possible death and life imprisonment.

Treating Violence. Because an evolutionary theory of violence suggests that mental mechanisms trigger angry feelings, it is necessary to create a psychological treatment for coping with these triggers. Each individual has a unique set of genes and experiences, so each individual will likely have different tolerances for coping with violence-provoking triggers. From this viewpoint, those who need treatment for dealing effectively with anger and violent tendencies are those with a combination of genes, experiences, and situations that make their evolved mental mechanisms for violence more easily and frequently

activated. While some environments, such as inpatient mental health treatment and prisons, may be able to control and limit triggering stimuli, it is unlikely that these controls can be imposed on society more generally. Because triggers are inevitable when living in a large social society, a treatment should be developed to help individuals and groups to recognize these triggers and use higher cognitive skills to prevent costly violent behavior.

The practice of mindfulness may be viewed as an anti-evolutionary practice that helps an individual become aware of the activation of evolved mental mechanisms and accept them without allowing them to influence behavior (Wright, 2017). The practice of mindfulness uses the connection between the breath and the body in order to develop an awareness of the mind in the present moment and recognize mental activities that have previously been automatic. Through this mechanism, clients may learn that thoughts and feelings are simply events that do not reflect the truth of a situation, which allows relief from the negative emotional states (Kazemeini, Ghanbari-e-Heshem-Abadi, & Safarzadeh, 2013). This process may prevent the triggered mental mechanisms from causing violent behavior.

Mindfulness has been incorporated into several different therapy programs. These programs typically include the personal practice of meditation, behavioral practices encouraging love, kindness, and compassion, and cognitive strategies such as reflecting on the present (Singh, Lancioni, Wahler, Winton & Singh, 2008). Based on this view of mindfulness and the idea of violence as the result of evolved mental mechanisms, a mindfulness-based treatment protocol for those prone to violence may prove effective. Essentially, mindfulness can be used to help clients expect and accept the activation of violent mental mechanisms without acting on them.

Conclusion

Violence is a prominent part of human history, and violent behavior continues to cause substantial problems in modern society. While violence has decreased over the course of human civilization (Pinker, 2011), murder and violence continue to dominate the daily news and keep law enforcement constantly active. While modern issues are often blamed for modern violent behavior (Buss & Shackelford, 1997), it is clear that human psychology plays a primary role in violence and murder. Several psychological models have been proposed to account for this tendency to act violently, including social and cognitive approaches. Evolutionary psychology encompasses these viewpoints and places them in the context of evolved psychological mechanisms.

This study built on established research by attempting to apply evolutionary psychological ideas to the modern United States. The goal was to determine how these ideas can be applied to modern psychology in order to develop treatment and preventative measures to reduce violent behavior. Homicide was chosen as an outcome variable because it appeared to be the most accurately measured violence data. However, this greatly underestimated the amount of general violence that occurred in the sample areas. Poverty, marriage, and population density impacted homicide rates in the expected directions, while gender ratios and police presence did not show a significant impact. The number of men in the reproductive age group showed an effect opposite of what was expected, leading to several interesting questions inspiring future research.

Overall, this study aimed to increase the understanding of human violence in modern society. This understanding is intended to improve violence prevention efforts, and to develop a treatment for those who are prone to violent thoughts and behavior.

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