EMPIRICAL TESTS OF THE HOMOLOGY ASSUMPTION IN CRIMINAL PROFILING

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Empirical Tests of the Homology Assumption in Criminal Profiling

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Abstract

A fundamental assumption in criminal profiling, known as the homology assumption, is that criminals who exhibit similar crime scene actions have similar background characteristics. The homology assumption was tested by first classifying, with a pre-existing typology, a sample of arsonists ($N = 87$) and robbers ($N = 177$) into different crime types and then comparing the similarity of their background characteristics. Study 1 tested the homology assumption with Canter and Fritzon's (1998) arson typology, and for Study 2, Alison, Rockett, Deprez and Watts' (2000) robbery typology was used. Results showed that using pre-existing typologies to classify crimes into mutually exclusive types was not easily accomplished. Notwithstanding classification difficulties, the homology assumption was *violated* in 56% of the comparisons between the different types of arsonists and in 67% of the comparisons between the different types of robbers. Overall, these two studies failed to provide empirical support for the homology assumption for typology-based profiling practices. These findings indicate that using established typologies to profile offenders might not be very useful. Future research endeavors that wish to examine the validity of the homology assumption should first seek reliability with typologies across several geographic regions.

Empirical Tests of the Homology Assumption in Criminal Profiling

Criminal profiling (CP) is a psychologically-based investigative practice that aims to inform policing agencies with information about a perpetrator based on crime scene evidence (Douglas & Burgess, 1986; Kocsis, 2006). The legitimacy of CP is predicated partially on there being strong empirical support for the assumption that criminals who exhibit similar crime scene actions have similar background characteristics (commonly, and henceforth, referred to as the *homology* assumption). Demonstrating empirical support for the homology assumption is particularly vital for typology-based approaches to profiling, such as the FBI's organized/disorganized model, in which criminals are classified according to a type of criminal and then a standard set of characteristics (i.e., characteristics associated with that type of criminal) are invoked to create a profile. For example, a profiler might predict that two criminals who are classified as "criminality-type" rapists would each have previous convictions for burglary. Without support for the homology assumption, however, typology-based profiling practices are undermined.

What is Criminal Profiling?

Blau (1994) describes CP as an arcane art in which psychodiagnostic assessment and psychobiography are combined with case evidence and probabilities from similar cases to draw a picture of a likely offender. Suspected personality traits are inferred from the available crime scene evidence and information about the victim. CP is described as the science of collecting information about an offender's actions at a crime scene for the purposes of aiding in the capture, interrogation, and prosecution of a suspect (Hicks & Sales, 2006).

The main objectives of CP are to provide the police with (a) a list of the perpetrator's potential demographic, personality, and behavioural characteristics and (b) tactical recommendations (e.g., geographical areas of interest, search and seizure procedures) (Kocsis, 2006). Criminal profilers examine crimes, and from an analysis of the crime scene, behaviors about the likely offender are generated (Kocsis, 2006). It should be noted that criminal profiles are not likely to identify the exact perpetrator of a crime, but more likely to reveal probable features of the offender (Kocsis, 2006).

Arguably, CP began in earnest in the 1970s when the FBI's Behavioral Science Unit developed a model of serial homicides organized by type and style (Douglas, Ressler, Burgess & Hartman, 1986). The 'father' of profiling, John Douglas, and his colleagues created the most widely used profiling methodology for the investigation of serial homicide - the organized-disorganized dichotomy (Ressler, Burgess, Douglas, Hartman, & D'Agostino, 1986). The premise to this method is that homicides can be classified as organized and planned versus disorganized or unplanned based on the crime scene behaviors. In general, criminals who commit organized homicides are more likely to be high functioning than ones who commits disorganized homicides (Ressler et al., 1986). The crime scene behaviors are then used to classify the criminal who was responsible for the homicide.

CP appears to be growing in use. According to Pinizotto (1984), the FBI provided assistance with profiling on 192 instances between 1971 and 1981. In addition, Douglas and Burgess (1986) claim that the FBI Behavioral Analysis Unit was providing assistance for 192 cases, and Witkin (1996) stated that CP was used in approximately1000

investigations on an annual basis. In addition, CP is being practiced in many countries, including the U.S., U.K., Sweden, Finland, the Netherlands, Germany, and Canada (Åsgard, 1998; Clark, 2002; Jackson, Herbrink, & van Koppen, 1997).

Despite the aforementioned growth in the use of CP, there is no recognized regulatory body that provides a professional CP designation and, therefore, there is no consensus of who is qualified to be a profiler (Snook, Cullen, Bennell, Taylor, & Gendreau, in press). As such, anyone who has significant investigative experience could label him or herself as a profiler (Kocsis, 2004; Hazelwood, Ressler, Depue & Douglas, 1995).

Creating a Criminal Profile

Psychological profiles contain information about a probable offender in the areas of demographics, such as age and gender, legal history, vocational background, family situation, habits or social interests, type of vehicle, and various personality characteristics (e.g., demeanor, appearance) (Kocsis, 2006). Although there are no rules guiding how specific the identification of a suspect should be based on the establishment of a criminal profile Snook et al. (2007) classified the process of profiling by profilers as being either "clinical" or "statistical." Clinical predictions are based upon the profiler's knowledge of criminal behavior, experience, training and intuition, whereas statistical predictions involve the use of probabilities about the likely offender characteristics (Snook et al. 2007).

According to Horn (1988), there are seven specific steps to a psychological profile. They are: (1) a thorough evaluation of the criminal act, (2) a comprehensive

analysis of the crime scene, (3) analysis of the victim, (4) evaluation of the preliminary reports, (5) evaluation of the medical examiner's autopsy in murder cases, (6) the development of the profile with critical offender characteristics, and, (7) the investigative suggestions based on the compilation of the profile. Alternatively, Douglas et al. (1986) stipulates five stages: (1) the profiling inputs stage, which comprises of collecting all available information from the crime scene, (2) the decision process models stage, where the profiler chooses which evidence is relevant for the profile, (3) the criminal assessment, which is the determination of a type of offender based on a typology, (4) the criminal profile completed, which comprises of the final summary of the offender characteristics, information about the likely personality and type of the offender, and last, (5) the investigation and apprehension of a suspect. Step five is how the profile is used in assisting with the investigation with the explicit goal of narrowing down a suspect. In summary, there is some disagreement among profilers about what goes into a profile, or the steps that follow, but it appears that generally there are three steps in creating a profile that best describe the process (Hicks & Sales 2006; McCann, 1992; Douglas, Ressler, Burgess, & Hartman, 1986).

The first step in creating a typical profile involves gathering and evaluating the crime scene evidence. This step includes the collection of information about when and how the crime was committed. In addition, this step may or may not involve the reconstruction of the crime. Also included this first step is to consider gathered physical forensic evidence (e.g., blood found at the scene, fingerprints, tally of items stolen, etc.). Secondly, the profiler relates the crime scene evidence to the motives and behaviors of

known offenders in an attempt to formulate why the crime may have occurred. Crime reconstruction is a process that incorporates the physical evidence while considering the behaviors of an offender. For example, if an offender brought and used rope to bind a victim, this crime scene behavior implies planning. Reconstructing the crime may be helpful here. Depending on the nature of the crime, a profiler may then evaluate the strengths and weaknesses of the crime scene before generating a profile in order to determine which characteristics are relevant in creating the profile (Hicks & Sales, 2006). Gathering and evaluating crime scene evidence and behaviors requires individual judgment and perspective of the profiler.

The third step involves inductive or deductive reasoning in creating a profile based on the gathered information. Canter (2000) stated that the creation of a profile is a form of implicit reasoning in which whatever experience or logic the profiler can draw upon is used to derive inferences about the culprit from the crime scene. Hicks and Sales (2006) stated that the offender leaves characteristics and patterns of evidence during the commission of a crime, and from that, an individual's motive, personality, and behavior can be derived. An offender's behavior is inferred based on crime scene evidence, which is directly observable and easily described in a more objective manner than motive or personality (Hicks & Sales 2006). The behaviors could include violent acts, verbal assaults, the use of weapons or tools elucidated from witness reports, or from the forensic evidence. Crime scene behaviors could be indicative of a modus operandi (i.e., behaviors that are necessary for the commission of a particular crime, such as wearing gloves in a burglary), or demonstrate signature behaviors. Signature behaviors are said to be unusual

or ritualistic actions that executes some kind of deep psychological need within the offender (Hicks & Sales, 2006). In addition, offender motives interact with the situation, which influences crime scene behaviors as well. Complex interactions between victims and offenders are also included. Particular reactions by the victim, such as refusing to follow directions which may escalate the offender's hostility are also included in the profile.

As illustrated, a criminal profile is basically constructed in three general steps. Understanding these steps is important in understanding how a profiler gathers information and how it is used to describe a probable type of offender. There are no clear guidelines or rules available that determine the relevance of specific behaviors. A criminal profiler alone decides which information is relevant. The subsequent creation of a type of offender who is likely responsible for a given crime is the crux of CP.

Empirical Validity of Criminal Profiling

The field of CP continues to grow despite the fact that there is no well-defined profiling framework (Snook, Cullen, Bennell, Taylor, & Gendreau, 2008; Snook, Eastwood, Gendreau, Goggin, & Cullen, 2007). As mentioned above, the FBI has reported that they utilize criminal profilers to assist with approximately 1000 cases per year (Witkin, 1996). Likewise, in police investigations, Bartol (1996) stated that police departments are employing profilers regularly. Therefore, in response to the growing usage and popularity of CP as an investigative and predictive tool, the practice of CP is in dire need of empirical validation.

In addition to the paucity of standardized, well-controlled research alluding to how a profile is constructed, there is little information available regarding how a profile is constructed, and who a profiler is. Without the existence of standards for the profession of CP, an individual's experience, skills, or education is unknown. Future attempts to validate the practice of CP should also include important questions such as, when profiles are used and why they are used (Snook et al., 2008).

Snook et al. (2007) conducted a meta-analysis and narrative review to summarize research conducted in the field of CP and examine the prevalence, methodology, and validity of CP. Anecdotal studies have by far dominated the field, and have contributed to the popularity of CP without providing any empirical evidence. In the review by Snook et al., (2007), they found that 60% of CP articles used anecdotal evidence as a form of support for the practice. Snook et al. (2007) concluded that anecdotal accounts of CP perpetuate the use of CP despite the lack of evidence of its effectiveness.

A survey of 46 police departments in the United States indicated that approximately 52% of officers reported that the profiling was helpful in predicting the behavior of a suspect in a crime, and 38% stated that profiling helped identify a suspect (Trager & Brewster, 2001). A recent survey of 51 Canadian Police Officers found that 92% agreed that profilers are valuable to criminal investigations, but only 59% of profilers use concrete scientific evidence (Snook, Haines, Taylor, & Bennell, 2007). There is a strong belief by police officers that CP is a valid practice, even though there is a lack of empirical evidence to support its use. One reason for the popularity of CP may

be attributed to the repetition in the media perpetuating the message that profiling works (Snook, Eastwood, Gendreau, & Cullen, 2007; Snook, Cullen, Bennell, & Taylor 2007).

Besides the common, popular belief that CP works, the field of CP lacks validity in terms of demonstrating the accuracy of its predictions. No study to date has evaluated how effective CP is in the field. Several studies tested how accurate profilers are by using an experimental scenario to assess the accuracy of criminal profilers (or other experienced investigators) by comparing predictive performance with non-profiler groups (e.g., Kocsis, 2004; Kocsis, Hayes, & Irwin, 2002; Kocsis, Middledorp, & Try, 2005; Pinizzotto & Finkel, 1990). Profilers and non-profilers were asked to review details of a crime (or a series of crimes) and make predictions about the probable offender. Participants in these experiments were asked to select their predictive choices from a prescribed list provided by the experimenters. Participant choices were then compared for accuracy in the areas of cognitive processes, physical attributes, offence behaviors, and social history/habits. It was found that criminal profilers were slightly better at predicting the physical attributes of offenders (e.g., Caucasian), but were less accurate than comparison groups in predicting an offender's thought processes, social habits, and offence behaviors (Snook et al., 2007). Snook and colleagues (2007) contended that these findings are disappointing for the field of CP since profilers are "experts" and therefore should clearly outperform non-experts.

In summary, the field of CP suffers from a lack of rigorous research, evaluation and establishment of the predictive validity of CP. Thus far, there is very little empirical evidence to date available to support or refute the practice of CP, and, in light of the little

evidence that does exist, there is a sizeable shadow casting doubt on the practice of CP as a viable practice. Thus, in order to develop a framework for CP, a logical starting point for the empirical establishment of the practice and theory of CP is to begin by testing the fundamental theoretical assumptions of CP.

Assumptions of Criminal Profiling

The practice of CP is based on two major assumptions: consistency and homology. Consistency is defined by the premise that "the way in which an offender carries out a crime on one occasion will have some characteristic similarities to the way he or she carries out crimes on other occasions" (Canter, 1994, p. 489). Consistency has two components, the degree of variation within one offender's actions (e.g., Salfati & Bateman, 2005) and the range of variation across a number of offenders (Porter & Alison, 2006; Canter, 1994). The consistency assumption is central because it explains how consistently an offender behaves from one crime scene to another, and therefore acts to discriminate him or her from other offenders. For example, in a string of robberies where an alarm was bypassed, an individual who has consistently and successfully deactivated an alarm suggests that the offender may have considerable experience with alarm systems. Or, offenders that are committing offences together as a group are more likely to demonstrate consistency in their crime scene behaviors.

Canter (2004) argued that all human activity is inherently variant; however, criminals who are consistent demonstrate a "form of career development" in terms of perfecting their crafts. Canter (2004) also stated that consistency is the central avenue for the development of the scientific basis for offender profiling. Consistency, therefore,

defines an offender by differentiating him or her from other offenders, provides a method to link to serial offences, and provides the groundwork for inferring personality characteristics (Canter, 2004). The problem remains that, to date, tests of the consistency assumption have been conducted primarily by comparing themes or typologies comprised of available crime scene behaviors, and have not tested the typologies themselves for predictive validity. Predictive validity is described here as the ability of typologies to be able to predict criminal behavior. Typologies based on crime scene behaviors remain to be evaluated to determine if they are useful in accurately predicting criminal behavior. Thus, without empirical evidence of a given typology's predictive validity, doubt remains as to the veracity of the consistency theory.

The second assumption is the homology assumption. This assumption posits that offenders who commit crimes in a similar way will have similar background characteristics (Alison, Bennell, Mokros, & Omerod, 2002). Conversely, offenders that have different styles of offending are assumed to have different background characteristics. Within the field of CP, the homology assumption allows profilers to develop offending typologies based on crime scene actions and then create a standard list of background characteristics that are associated with each type of offender comprising the typology. Then, for any new offence, an offender is classified to one of the types and the standard list of background characteristics associated with that type of offending style is provided to the police. For example, in investigating an arson offence, it is assumed that all arsonists who have been categorized into a particular type share similar psychiatric backgrounds, previous convictions, and demographic characteristics. Despite

the proliferation of criminal typologies in the literature, and the presumed use of the typologies by profilers, there are only a handful of studies testing the consistency and homology assumptions.

The homology assumption was chosen for testing due to the fact that the veracity of CP hinges on the ability to classify offenders into a specific typology. To test the homology assumption, offenders need to be grouped into typologies. No study to date has applied crime scene and background characteristics of offenders to existing typologies. The homology assumption states that individuals who are categorized into a typology will have different backgrounds. Testing the homology assumption first allows for a rigorous test of typologies, which is central to CP.

Empirical Tests of the Homology Assumption

To test the homology assumption, researchers have typically collected crime scene data and subjected it to a graphical non-metric Multidimensional Scaling (MDS) procedure to categorize crime scene behaviors. MDS is also known as perceptual mapping, or a visual factor analysis which presents data points spatially in a 3-D plot. Data are represented in the plot based on how similar or dissimilar they are to the other data points. Data in an MDS can cluster. In studies where typologies were derived using MDS procedures, the data points are crime scene behaviors. Crime scene behaviors in the plot that cluster together are termed to be part of a theme. The researcher delineates themes by visually inspecting the clusters. Based on correlational distances between data points, they fit the clusters of behaviours into types. After the types are delineated, background characteristics of the offenders from the different types are compared. To

date, most researchers have used MDS analysis plots to identify various types of offenders. The assignment of offenders to types has proven to be problematic, because offenders typically display behaviors that fit more than one dominant type of behaviour.

There have been several direct empirical tests of the homology assumption with respect to: (1) stranger rape, (Mokros & Alison, 2002), (2) homicide (Santilla, Häkkänen, Canter & Elfgren, 2003), (3) arson (Canter & Fritzon, 1998; Häkkänen, Puolakka & Santilla, 2004), and (4) robbery (Woodhams & Toye, 2007). Each of these studies will be examined in more detail to demonstrate that the homology assumption underlying CP is in need of further study.

1. Stranger Rape (Mokros and Alison, 2002)

Mokros and Alison (2002) conducted a study to test the implicit assumption of homology in a sample of 100 rapes in the UK. To test their hypothesis, the authors examined a sample of solved rape cases and subjected the cases in an Smallest Space Analysis (SSA) plot in order to test for three background characteristics, age, socio-demographic features, and previous convictions. Mokros and Alison (2002) categorized 28 offender behaviors from crime scenes and then subjected the data to a three-dimensional SSA plot in order to determine if crime scene behaviors clustered together. Clusters of behaviors, or centroids, representing small groupings should be found clustered together if there are existing similarities. Centroids, therefore, then represent a theme or style of behavior. Centroids representing a collection of similar behaviors should have a significant amount of space between the clusters. The farther apart the clusters are from one another, the less similar they are. In a test of the homology

assumption, offenders who demonstrate similar behavioral clusters, should also cluster closely together. Offenders were compared on age and employment status, and if they were of a non-European background, previously convicted, or were living alone. Results from the centroid analysis indicated that there was no relationship between offence styles in rape on any of the background characteristics. In sum, Mokros and Alison (2002) found no support for the homology assumption when testing crime scene behaviors via centroid analysis.

Mokros and Alison (2002) stated that the reason they failed to find any support for the homology assumption using SSA methodology was a product of four concerns. First, they felt that there was no theoretical framework established that empirically tests and explains why an individual's background circumstances should correspond to how an individual commits a particular crime. Without an existing established paradigm, testing the homology assumption is difficult. Second, some crime scene behaviors may simply be better predictors than others. SSA does not provide information on the extent to which each variable is representative of a particular theme. Some crime scene characteristics may carry greater predictive value than others, and without this consideration accounted for, homology is difficult to determine. The third reason provided was that crime scene information does not adequately capture the confounding nature of situational variables. For example, if an offender is drunk on one occasion, this does not mean he will be the next time he commits a crime. Situational influences such as intoxication will impact how an offender ultimately carries out an offence. Lastly, Mokros and Alison (2002) state that there are inherent problems in the use of police records as data to begin with. Police

records were not collected for research purposes, and therefore, using data that has been collected from multiple sources affects the data quality.

2. Single Homicide (Santilla, Häkkänen, Canter, & Elfgren, 2003)

Santilla et al. (2003) analyzed 502 single homicides in Finland and postulated that offenders who committed instrumental themed homicides would have backgrounds that were characterized with an antisocial lifestyle, social problems, and convictions for property offences. Alternatively, offenders who committed expressively themed homicides would demonstrate more adjusted lifestyles, but a proportion of these offenders who use illegal weapons will suggest a more antisocial background. In line with previous CP studies, Santilla et al. (2003) subjected the 502 homicides to an SSA plot to determine the expressive-instrumental themes. Based on the SSA themes, Santilla and colleagues (2003) concluded that the typical offender killed someone they knew well, lacked a background in violent or sexual crimes, and was unemployed and alcoholic. In terms of instrumental homicides, the offenders in this category were said to have a maladjusted antisocial background, and use "aggression to solve problems they encounter". Expressive-themed offenders were stated to have a higher socio-economical status, had intimate relationships with their victims, owned their own residences, and had gun permits. Santilla et al. (2003) concluded that homicidal aggression was expressive in nature, and was likely the end result of perceived injustice and provocation.

Santilla et al., (2003) tested the homology assumption by comparing their homicide themes on 21 offender background characteristics, predicting that offenders' backgrounds would differ by type; expressive versus instrumental. The expressive type

correlated negatively with "resources" (i.e., higher socio-economic status) meaning that expressive-oriented offenders had fewer resources, and a low positive correlation for the instrumental theme. These correlations are in direct opposition to the hypothesis, which postulated that expressively themed homicides are committed by offenders who murder their relatives, and therefore, typically these offenders likely have more resources. In addition, there was no correlation between owning a firearm and expressive or instrumental types as postulated either. In terms of actual differences in backgrounds of offenders, within this paper, there is no support for the homology assumption.

3. Arson (Canter & Fritzon, 1998; Häkkänen, Puolakka & Santilla, 2004)

The first study, by Canter and Fritzon (1998) divided the arson typology into four types of arson; instrumental-object (IO), instrumental-person (IP), expressive-object (EO) and expressive-person (EP) based on a SSA. According to Canter and Fritzon (1998), arson is expressed and directed towards people or objects depending on whether the target is something the offender wants (instrumental) or whether the arson is in light of some perceived provocation (expressive). The four arson types were defined by subjecting the 175 arsons to a SSA.

The authors then subjected 42 offender characteristics (e.g., presence of a psychiatric history, economic status, and previous convictions) to a second SSA to determine themes of background behaviors. From the 42 offender characteristics, the authors concluded that there were four themes; psychiatric history (PH), young offender (YO), failed relationship (FR) and the repeat arsonist (RA). To test the homology assumption, crime scene behaviors in themes were correlated with the arson types. Canter

and Fritzon (1998) had predicted that an EP arsonist is one who expresses strong personal emotional reactions and should demonstrate a history of psychiatric involvement. They found that EP arson was associated positively with psychiatric history and failed relationship arsonists, and associated negatively with being a young offender arsonist. An IO arsonist should be characterized by one who uses fire setting as part of a criminal "tool-kit" and is expected to have a wide variety of previous convictions. They found that IO arsonists were associated negatively with psychiatric history, had failed relationships and were associated positively with young offender arsonists, and not associated with repeat arsonists. This finding in particular provides some doubt as to the accuracy of the typologies, since IO arsonists should be building a repertoire of criminal methods, with arson being one of them. The view that a young person would have such a repertoire does not fit with this profile. In addition, one would also expect a relationship between repeat arsonists and IO since this type of arson is used for instrumental gain. IP arsonists were defined as one who commits the arson for instrumental reasons, and the objective of the arson is of a "personal nature". The results showed that there was a strong negative correlation between young offender arsonists, a positive correlation with failed relationship arsonists, and no relationship with either psychiatric history or repeated arsonists. The IP arsonist prediction showed a relatively good fit between crime scene characteristics and the background of the offender. Lastly, the EO arsonist should demonstrate emotional reactions, but focuses on objects instead of people. The EO arsonist demonstrated mixed results at best, since EO was found to be positively

correlated with psychiatric history and repeat arsonist, but not associated with the themes of being a young offender or having a failed relationship.

In sum, in terms of testing the homology assumption, the relationships between crime scene themes and background themes are mixed in terms of the original predictions about the arson offence themes. In addition to the mixed results, the themes as outlined are vague and it would be difficult to differentiate an expressive person type of arson or instrumental person arson, as their background characteristics have been demonstrated to have similar correlations.

Häkkänen, Puolakka and Santilla (2004) conducted a similar study in Finland using the Canter and Fritzon (1998) typology, which examined arsons in a multi-dimensional scaling procedure, and by assigning each case to a dominant type. The criteria for assigning cases to a singular, primary type was that a case had to have a score (i.e., percentage of crime scene behaviours) in one type that was greater than the score from the other three types combined (i.e., summed percentage). That is, in order for an offender to be assigned the dominant type of Expressive-Object, the highest percentage of characteristics in EO had to be greater than the totals for the three other types combined. Häkkänen and her colleagues classified offenders as having two, three, or all four types if a dominant type was not present. There were a total of 14 offenders where 65% of offenders were classified into a dominant category and 35% were mixed.

An MDS analysis of 30 background characteristics (e.g., demographic features) revealed four types: the adolescent, the serial arsonist, the self-destructive arsonist, and the criminal arsonist. Correlations between the crime scene types and the offender

characteristics found that EP arsons were characterized as having a self-destructive background. EO was the opposite: a juvenile without destructive backgrounds. IP arsons were reported to have modest positive associations with a self-destructive background, a criminal background, and were not likely to be an adolescent. IO arsons were self-destructive, and had criminal and serial arson backgrounds. In summary, the results from this study are vague in terms of being able to clearly differentiate that different types of offenders have different backgrounds. The lack of clear findings in arson provides further justification that homology assumption requires additional investigation.

4. Robbery (Woodhams & Toye, 2007)

Recently, Woodhams and Toye (2007) conducted a study in which their primary objective was to test the consistency assumption by linking offenders in commercial robberies, but also included a test of the homology assumption. Using a sample of 160 commercial robberies, 71 dichotomous crime scene behaviors were derived from police files. The data were categorized into themes according to the time of day the offence was committed, (e.g., day or night), if the crime was committed during a weekday or a weekend, what kind of premises was robbed (e.g., retail or bank), if the offender(s) used a disguise or not, how the weapon of choice was used (e.g., gun, hurt victim), and how the offender appeared to the witnesses during the robbery (e.g., calm, anxious). There were a total of 22 crime scene variables, which were entered into a cluster analysis, which revealed four general themes, or types: target selection, planning, control, and property.

Woodhams and Toye (2007) subjected the crime scene data to a hierarchical cluster analysis revealing three overall crime scene behavior clusters labeled; violent

opportunists, organized risk takers, and bladed nocturnal planners. The violent opportunist robbers' types were characterized by impulsive, low-risk attacks, using no weapon. Organized risk-takers tended to be more professional and planned their targets, usually focusing on banks or financial outlets, and carried guns. Bladed nocturnal planners attacked lower risk targets at night, used disguises, were aggressive and sometimes used knives. The three robbery types were compared for significant differences on background characteristics. The homology assumption would be supported if the three themes demonstrated differences in age, employment status, ethnicity, previous convictions and how far the offence was from the offender's home location. Unfortunately, results of the comparisons showed that none of the background characteristics differed across the three theme clusters, lending no support to the homology assumption.

The Current Research

Although CP is being used more frequently around the world to assist investigations, the extent to which CP is a valid practice remains unclear. In order for CP to be considered a valid practice, it is imperative that the homology assumption receives empirical support. The purpose of the current study is to test the homology assumption with existing typologies. As stated earlier, the use of reliable and valid typologies are fundamental for the assumptions of CP.

The current research tested the generalizability of the homology assumption and this was accomplished by examining two different data sets from the same geographic region. Crime scene behaviors and background characteristics of offenders in St. John's,

Newfoundland for the crimes of arson (N = 87) and robbery (N =177) were used. The crimes of arson and robbery were chosen only because there was enough offenders and crime scene information collected in the St. John's area to apply typologies to. Crime scene behaviours associated with each offence were used to classify offenders into types that have been published in the forensic domain.

Using the available databases, this study classified offender's crime scene behaviors into arson and robbery typologies published in the CP literature. Once offenders were classified, differences in background characteristics were compared. If the homology assumption is supported, than offenders who demonstrate similarity in crime scene behaviors will fit into a typology, and individuals classified into in a particular typology will have similar background characteristics. Based on previous tests of the homology assumption, it is expected that in this study, offender backgrounds will not differ across different types of criminals; that is, it is anticipated that there will be no support for the homology assumption.

Study 1: Arson

Method

Sample.

A dataset of arsons (N = 87) from St. John's, NL was used for Study One. The dataset is comprised of 39 variables describing the crime scene behaviors (e.g., used an accelerant, alerted authorities of the fire) and 45 offender background characteristics (e.g., prior offences, history of psychological problems, demographic information, and employment status). A complete list of both crime scene behaviors and background

information is available in Appendices A and B. All variables were dichotomously coded as either present or not present.

Procedure.

The following procedure was conducted for each arsonist in the dataset. Crime scene information was used to classify offenders according to one of four existing arson typologies proposed by Canter and Fritzon (1998; see Appendix C for the Coding Guide). Their arson types were: (1) Expressive-Object (EO) comprised of 11 variables, (2) Instrumental-Object (IO), 9 variables, (3) Instrumental-Person (IP) 12 variables, and (4) Expressive-Person (EP) 7 variables.[1] The total number crime scene variables exhibited by the offender was first derived by determining whether or not a particular variable was present or not in the dataset. After each offender had been coded, a percentage was derived by dividing the total number of variables that were present for a particular type by the total number of items that comprised a particular type. For example, a particular offender had four of the eleven items present in EO, which translated to an EO score of 36%.

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[1] There was no information in the dataset concerning which day of the week the particular arson took place or the distance between the crime scene and the offender's home; therefore, these variables were eliminated from the typologies. The "set fire" variable was also excluded since it was judged to be a factual variable that was uniform across all the cases. This variable was found to be a central event in Canter and Fritzon's SSA analysis as well, and could not be classified into any particular arson type.

The next step was to assign each offender to a dominant type. The criteria for assigning the typologies were modeled after the Canter, Bennell, Alison, and Reddy (2003) study. Canter et al. (2003) determined that a type was dominant if the percentage for a particular type was greater than the sum of the other three combined. In the event that there was no dominant percentage for a type, the case would be classified as "mixed". For example, if an offender had 9 of the 11 crime scene behaviors found in the EO typology (i.e., 81.8% of the variables) and a total of 14 present behaviours across the remaining three types (i.e., equaling 50%), then the offender would be classified as EO arsonist type. If the percentage of variables found in one type was not greater than the percentage of variable in the remaining three types, the offender was classified into a mixed typology.

Following the classification of the offender's crime scene behaviors into types, offenders were tested for differences in their background characteristics. Of the 48 background characteristics in the arson dataset, nine had enough information available for the appropriate statistical analysis to be conducted. Variables were determined to be available for testing if there were more than 40 offenders who had data for that characteristic. The χ^2 statistic was used to test for significant differences between background characteristics among the different typologies. A minimum of 40 was required to be able to run statistical analyses with some measure of confidence without inflating the possibility of Type II errors. A minimum sample size of 40 also provided the likelihood that within a 2 x 2 table, individual cells would have a minimum of 5 per cell, in approximately 80% of the cells. Therefore, a minimum of 40 was the rationale for

choosing which variables were available for testing. The following variables were tested for differences between the various types of arsons: whether the offender had (1) previous convictions, (2) was a juvenile, (3) had a history of previous psychiatric treatment, (4) had a history of previous warnings for criminal behavior but was not charged, (5) had a history of theft, (6) had a history of criminal damage to property, (7) had a history of burglary, (8) had a history of assault, and (9) had previous charges for failure to comply with court/probation orders or failed to appear in court (FTC/FTA).

Results

Typologies. Based on the classification strategy outlined above, the results of the classification of offenders into types were as follows: Expressive-Object, 0%, Instrumental-Object, 5.7% (n = 5), Instrumental-Person, 0%, Expressive-Person, 8.0% (n = 7), Expressive-Person, and Mixed, 86.2% (n = 75). Because the original criteria for classifying the crime scene behaviors into types rendered the majority of arsonists as "mixed" types, a second, more liberal, classification criterion was necessary. The second typological classification was comprised of classifying arsonists into one of the four types based on which type contained the highest percentage of crime scene behaviours. For example, an arsonist with the percentages 36% EO, 33% IO, 33% IP, and 14% EP would be classified as an EO type arsonist. Results from the second, more "relaxed" classification were: EO 9.2% (n = 8), IO 28.7% (n = 25), IP 28.7% (n = 25), EP 32.2% (n = 28), and Mixed 1.1% (n = 1) (see Table 1).

Offender Background Characteristics. The differences in background characteristics as a function of types are shown in Table 2. Six of the nine background

characteristics were found to be significantly different across the types. There were significant differences between the types of offenders with respect to previous convictions, whether or not the offenders were juvenile, had psychiatric treatment, were previously warned, had arrests for criminal damage, and FTC/FTA. However, two of the types, Expressive-Object and Mixed, did not reach the minimal limits of 5 cases per cell, which is necessary in order to calculate expected values for the chi square statistic. Subsequently, EO and Mixed types were subsequently removed from the analysis. A summary of the second comparison between the remaining three types, IO, IP and EP is shown in Table 3. The different types of arsons significantly differed on the same background characteristics – that is, their removal did not change the results.

A more detailed analysis of differences among the types of arsons was undertaken to examinewhether or not there might be differences in the background of arsonists of simpler types. Thus, arson subtypes of "instrumental versus expressive" and "person versus object" were compared in order to explore the homology assumption. That is, to determine if there were any patterns in the types in terms of whether the arson was expressive or instrumental in nature or person-oriented versus object-oriented, percentages were calculated by adding EO and EP together, and then the total was divided by the number of items (EO + EP / 17). For the instrumental versus expressive comparison, two-thirds of the arsonists were subsequently classified as instrumental, 75.9% ($n = 66$), with the remaining falling into the expressive type, 24.1% ($n = 21$).

Differences in background characteristics were found between instrumental and expressive arsonists in previous convictions χ^2 (87) 7.43, $p = .00$, age (juvenile or not), χ^2

(87) 15.38, $p = .00$, psychiatric treatment, χ^2 (87) 7.30, $p = .00$, previous warnings, χ^2(87) 3.74, $p = .05$, history of burglary, χ^2 (87) 4.52, $p = .03$, and history of FTC/FTA, χ^2 (87) 16.94, $p = .00$. The other three variables (history of theft, history of criminal damage, and history of assault) were not significant.

Unlike the instrumental versus expressive categorization, there was less clarity about whether a particular arson was object oriented or person oriented. Categorization was difficult as reflected in the small differences in percentage of arsonists classified to the person or object typology. Sixteen offenders had an equal number of crime scene behaviors that were both directed towards the person and object. Forty-five offenders (51.7%) demonstrated crime scene behaviors that were predominantly directed towards a person, and 26 (29.9%) offenders predominantly set fires that were directed towards an object.

For the person versus object comparison, there were significant differences for the characteristics of previous convictions, χ^2(87) 7.98, $p = .01$, age (juvenile or not), χ^2 (87) 28.14, $p = .00$, and history of previous warnings, χ^2(87) 8.66, $p = .01$. The other six background characteristics were not significant.

It is worth noting that more than half of the arsons in this dataset were comprised of youthful offenders (51.7%). It was, therefore, prudent that the typologies were examined to determine the typologies according to age. Whether or not a particular offender was a youthful offender was indicated either as "present" or "not present". Youthful offenders in the data were indicated by whether the person was aged 16 or under ($n = 45$). A summary of typologies by age group is shown in Table 4. As noted in

this Table, there are discernable differences in types for the two age groups. The majority of youthful offenders were classified as Instrumental Object (n = 24), whereas the majority of the adults (n = 25) were classified as Expressive Person.

The results of the background characteristics differences by type and subtypes should be interpreted with caution for two reasons. The first reason is that there were large differences between the types according to whether the offenders were juveniles or adults. Adult offenders have lived longer, and have had more opportunities to build a history of offences over time. To illustrate, offence characteristics were tallied to form a composite of criminal history as a variable in order to demonstrate that adults had a higher frequency of criminal behaviors than juveniles. Criminal history variables added together were previous convictions, history of theft, history of criminal damage, history of burglary, history of assault and history of FTC/FTA. The adults had a mean score of 2.35 (SD = 1.8, n = 42) for previous convictions, and the juveniles had a mean of 1.44 (SD = 1.85, n = 45). A t-test determined that the number of previous convictions significantly differed between adults and juveniles (t(85) 3.55, p = .00) clearly demonstrating that adult offenders had larger criminal histories. The results of the t-test is consistent with the idea that adult versus juvenile offenders have different criminal histories which accounts for the χ^2 differences in the types. The adult sample (n = 45) was too small to adequately test differences in background characteristics with the χ^2 statistic.

The second reason the significant differences in background characteristics should be interpreted with caution is also due to the fact that the categorization of offenders into types had to be relaxed substantially to even test the hypothesis that background

characteristics differ. The idea that offenders could not be easily or clearly categorized into types, or subtypes was a substantial issue in testing the homology assumption.

Study 2: Robbery

Method

Sample.

A dataset of robberies (n = 177) from St. John's, NL was used for study two. The dataset comprised of a total of 85 variables. Fifty-nine were crime scene behaviors (e.g., weapon used, threatened victim), and 26 pertained to offender characteristics (e.g., age, previous convictions). For this study, Alison, Rockett, Deprez and Watts (2000) robbery typologies were used (See Appendix D for the Alison et al., 2000 coding guide). A complete list of all variables available, and how they were coded originally in the dataset are listed in Appendix E and F. The vast majority of the variables were coded as "present", "not present", or "unknown".

Procedure.

The following procedure was conducted for each individual in the dataset. Crime scene information was used to classify offenders according to one of three existing robbery types according to Alison et al. The robbery types were Cowboy, comprised of 10 variables, Bandits, comprised of 11 variables and Robin's Men, comprised of 13 variables, for a total of 34. The robbery dataset was coded for all available information directly from Royal Newfoundland Constabulary suspect files, and many of the variables were unavailable with respect to Alison et al.'s typologies. Of the Cowboy type, only five

of the original ten variables were available for coding, nine of the eleven for Bandits, and nine of the thirteen available for Robin's Men for a total of 21 out of a possible 34.

The number of crime scene variables exhibited by each offender was first derived by checking off whether a particular item was present or not according to the coding guide. After each offender had been coded, a total for each type was calculated. Using the same procedure as study one and the arson data, percentages were calculated for each type. That is, offenders were first classified into a dominant type according to whichever type had a higher percentage of behaviors that was greater than the sum of the other two types. The total number of crime scene variables for each offender was tallied within each type (e.g., how many behaviors were present for Cowboy, Bandit and Robin's Men). After each offender had been coded, a percentage for each type was calculated. To demonstrate, a particular offender may have three behaviors present under the Cowboy type. There is a maximum of five behaviors available for Cowboys, and three out of five translates to 60%. The same offender also had three behaviors present under the Bandit type, which is three out of nine (33%) and 4 behaviors under the Robin's Men type (four out of nine, or 44%).

In Study One, modeling Canter et al.'s (2003) classification procedure, we first classified offenders into a dominant type according to whichever type had a higher percentage of behaviors that was greater than the sum of the other two. Canter et al.'s (2003) classification procedure proved to be problematic with this dataset for three reasons. First, offenders in the dataset demonstrated an average of 7 behaviors (*SD* = 2.05), with a minimum of three behaviors and a maximum of 14 out of a possible 21.

Secondly, the vast majority of offenders displayed very little variability between types. Offenders had a similar number of behaviors for each type. The third problem to classifying had to do with the unequal distribution of behaviors for the types. The Cowboy type had five available behaviors, which then translated into higher percentage proportions. For example, if an offender had three behaviors in Cowboy he was said to have 60% of behaviors present because there is a maximum of only five behaviors he could have in total. Having three behaviors in Bandits or Robin's Men equaled 33% because there were nine possibilities.

Following the classification of offender's crime scene behaviors into typologies, offender background characteristics were tested for differences between robbery types. There were 17 offender characteristic variables available for testing. Variables were determined to be available for testing if there were more than 40 offenders who had data for that characteristic. The majority of the variables were dichotomous, and were tested for differences using the non-parametric chi square statistics. Chi square analyses required a minimum of 5 values per cell to be able to adequately test nominal differences, which constrained available variables from the data set we could use. There were two continuous variables, age, and number of days since last arrest tested for differences using parametric ANOVAS.

Results

Typologies. Offenders were classified with a percentage procedure. Typologies were assigned to the type with the highest percentage. When an offender demonstrated a tie between two dominant types, offenders were assigned the category "mixed." Table 5

contains the results from the classification of offenders into typologies. As can be seen, of the 177 offenders, 132 (74.6%) offenders were classified to the Cowboy type, 39 (22.0%) were Bandits, 4 (2.3%) were Robin's Men, and 2 (1.1%) were Mixed.

Offender Background Characteristics. As stated above, from this data set of robbers in the St. John's area, only previous criminal history variables were available to test to determine if there were any differences in criminal behavior according to type of robber. The following fifteen variables were tested: 1) previous arrest, 2) property arrest history, 3) previous convictions, 4) if he had a tattoo, 5) prolific offender, 6) previously incarcerated, 7) violent arrest history, 8) other criminal arrests, 9) burglary arrest, 10) weapons arrest, 11) robbery arrest, 12) deception arrest history, 13) drug arrest, 14) sex arrest history, 15) arson arrest (see Table 6 for a list of variables and the percentage of offenders who had these characteristics "present"). Only Bandits and Cowboys were tested for differences because the other two groups did not have enough offenders in that category to test for differences (e.g., there were only 4 offenders classified as a Robin's Men, and 2 were classified as mixed).

The differences in background characteristics by type are contained in Table 7. Of the previous criminal history variables, only four variables were statistically significant indicating that there was a difference between expected and observed frequencies. Bandits were more likely to be incarcerated previously than expected compared to Cowboys, who had lower than expected histories of previous incarcerations ($\chi^2 = 8.17$, $p = .00$). Bandits were also more likely to have a violent arrest history as demonstrated by higher than expected frequencies. Cowboys, alternatively, had fewer than expected

previous violent arrests ($\chi^2 = 6.97, p = .01$). Bandits were also more likely to have previous weapons arrests, and Cowboys, fewer than expected ($\chi^2 = 11.43, p = .00$). Lastly, Cowboys had fewer than expected previous robbery arrests ($\chi^2 = 7.39, p = .01$) compared to Bandits.

Taken together, according to these statistics it appears that Bandits are more experienced criminals, with a more violent criminal history. Bandits appear more likely to have been incarcerated previously and have a violent arrest history, have previous weapons arrests, and have previous robbery arrests than Cowboys. However, given these statistical findings, it is important to remember that there was great difficulty categorizing offenders into typologies. The majority of offenders fell into the one category, Cowboys. In addition, offenders were categorized into typologies using a very liberal classification criteria based on an average of seven behaviors. Last, in this study, the homology assumption was violated in roughly 67% of the comparisons made between background characteristics and robber types. Given the problems with classification these results support previous findings that that there is little support for the homology assumption.

Discussion

The main objective of these two studies was to test the homology assumption by classifying criminal offenders by their crime scene behaviors into existing typologies and then determine if types of offenders have differences in their backgrounds. In Study One, the homology assumption was tested by using Canter and Fritzon's (2003) classification criterion to classify arsonists and then compared the types for differences in backgrounds. The results showed that 76% of the arsonists were of the mixed type, and could not be

easily or readily classified into Canter and Frtizon's (1998) arson typology. Given the size of the sample of arsonists, it was not possible to test the homology assumption because the majority of offenders fell into one category. This finding led to a second more liberal and unrealistic classification of offenders into typologies. The fact that offenders could not be classified into the typologies as identified by Canter et al.'s (2003) classification procedure provided little confidence for testing offenders with these typologies in Newfoundland. Furthermore, even after an unrealistic classification procedure was adopted an attempt to classify and test homology with the arson data, any subsequent differences between types in offender backgrounds was confounded by the ages of the offenders. Older arsonists differed in criminal history than younger arsonists. Younger offenders have had relatively less time to develop a criminal history, and therefore, any differences between the typologies on background characteristics appears to be due to differences in criminal development rather than any real psychological difference between the types of arsonists. In the end, the homology assumption was violated in roughly 56% of all comparisons made between the different types of arsonists.

This analysis suggests that classifying arsonists in Newfoundland, Canada based on a typology created using UK arsonists is not easily accomplished. The findings from this study indicate that it is not possible to classify arsonists in St. John's, Newfoundland using Canter and Frtizon's (1998) typology or Canter et al.'s (2003) classification procedure. If a profiler were to use the liberal classification criterion used herein, his or her attempts would still, in all likelihood, fail. In fact, these findings tend to support

previous conclusions that there is little support for the notion that different types of criminals have different types of backgrounds.

There was one limitation to this study that must be noted. The fact that there was no inter-rater reliability analysis performed on the arson data provides some questions regarding the reliability of the data used in these findings. Even though inter-rater reliability was not performed, and preferred, it may be argued that dichotomous data offers a high degree of reliability by its very nature, since there are only 2 mutually exclusive symmetrical outcomes. Nevertheless, when considering all the evidence here, it is therefore concluded that in for the sample of arsonists used in this research, the homology assumption is not supported.

In study 2, the homology assumption was examined by using Alison et al.'s (2000) robbery typologies and comparing background characteristics according to these types. In this sample of robbers, the findings were similar to Study 1, due to the fact that there was great difficulty in classifying offenders into typologies. The classification problems resulted in the vast majority of offenders falling into one category.

There were additional difficulties in using Canter et al.'s (2003) classification procedure, which proved to be problematic with this dataset for three reasons. First, offenders in the dataset demonstrated an average of 7 behaviors ($SD = 2.05$), with a minimum of three behaviors and a maximum of 14 out of a possible 21. Secondly, the vast majority of offenders displayed very little variability between types. Offenders had a similar number of behaviors for each type. The third problem with classifying had to do with the unequal distribution of behaviors for the types. The Cowboy type prescribed five

available behaviors compared to the other types, which translated into higher percentage proportions for that particular type. For example, if an offender had three behaviors in Cowboy he was said to have 60% of behaviors present because there is a maximum of only five behaviors he could have in total. Having three behaviors in Bandits or Robin's Men equaled 33% because there were nine possibilities. The unequal distribution of behaviors into specific typologies was central to the classification problem.

Testing the homology assumption required that once robbery typologies were determined, offender's background characteristics were tested for differences between types. In this dataset, there were 17 offender characteristic variables available for testing. The offenders' background information in the robbery data demonstrated a great range of variability in terms of how much information was available about each offender. There had to be a minimum number of offenders in a given background characteristic to be able to test it. Variables were determined to be available for testing if there were more than 40 offenders who had data for a particular characteristic. In addition, the majority of the background variables were dichotomous, and subsequently, testing for differences required using non-parametric chi square statistics. Chi square analyses required a minimum of 5 values per cell to be able to adequately test for nominal differences. The nature of the data, and the sparse amount of data in this dataset constrained the variables used in this research. There were two continuous variables, age, and number of days since last arrest tested which allowed for testing the homology assumption using parametric ANOVAS. It was concluded that in Study 2, is the dichotomous nature of the

data as well as the inconsistent information about offenders are limitations that must be acknowledged.

Over and above the noted concerns about inconsistent information about offenders and using unweighted or nominal data, an adequate test of the homology assumption still rests on the premise that offenders can be classified into typologies. For Study 2, this activity was not easily accomplished because the crime scene behaviors and background characteristics were not originally collected according to Alison et al.'s (2000) content dictionary. Instead the data was coded according to available information directly from police files, and crime scene behaviors were matched according to the typology as prescribed by Alison et al.'s (2000) content dictionary. It was discovered that when matching crime scene data to the behaviors outlined in the typologies, offenders showed very little behavioral variability between offenders. Offenders all demonstrated very similar behaviors, and so coding of offenders into types, resulted in similar percentages, and types. Without much variability, it was difficult to classify offenders confidently into clear categories. Any subsequent differences found statistically between types cannot be taken with great confidence, since any small difference detected in background characteristics likely had a high degree of error associated with it.

Regardless of these methodological drawbacks, especially the lack of inter-rater reliability, using police data directly from files instead of collecting it according to a specific typology, is ecologically valid and realistic. The information extrapolated from police files were collected blindly. Police who collect information on a crime scene do not have any a priori hypotheses about typologies, and so the information collected in

Study 2 is highly indicative of crimes as they are perpetrated in the real world. Thus, a simple explanation may be that individuals who commit armed robbery may not be displaying much variability in enacting the crime in the first place. Perhaps, there are no meaningful typological differences in crime scene behaviors, as the police data collected appears to suggest. A criminal profiler called upon to assist in a investigation in all likelihood would have to extrapolate available information from police files and subsequently apply it with the literature as was done in Study 2. Therefore, it is conceded that testing the homology assumption with robbery may demonstrate different results if the crime scene data is collected and coded according to Alison et al.'s (2000) typology.

The results from Study 1 and 2 contribute to the body of literature on criminal profiling in several ways. First, these findings clearly demonstrate the need for researchers in the area of CP to develop more rigorous methodology (Gregory, 2005). CP research methods have traditionally relied on SSA and the use of dichotomous variables to determine associations between crime scene variables and offender characteristics (Goodwill & Alison, 2007). In this study the typologies used to classify offenders were derivatives of SSA plots by Canter and Fritzon (1998) and Alison et al., (2000). SSA models do not provide discrete groupings in order to clearly and confidently group behaviors. These approaches are conceptually useful at best, and do not provide much utilitarian value for enforcement agencies. Coding crime scene behaviour using a dichotomous scheme (e.g., yes/no, or present/absent) is also problematic because all behaviors are treated as numerically equal. It is highly conceivable that some behaviors are more unique than others, and should be weighted differently. For example, an

offender who demonstrates a high degree of confidence or calmness while perpetrating a robbery may indicate that this offender is more of a specialist. This information can indicate a psychologically important variation in the offender's behavior and should be weighted differently than other behaviors (Goodwill & Alison, 2007). This may in fact distinguish offenders more clearly because not all behaviors are treated equally. The situational context in which the crime takes place is also highly important (e.g., easy entry to a building, building looks unoccupied) but is rarely considered by police agencies because it is less relevant (Alison, Snook & Stein, 2001). In fact, these specific variables may be important to the development of typologies and for subsequent tests of homology since how an offender chooses his or her target may be highly indicative of one's background and experience.

Secondly, tests of the homology assumption to date, including this study, have focused on elucidating a relationship between crime scene characteristics and offender background characteristics. The important message from this exercise is that the testing the homology assumption by using typologies based on SSA methodologies appears premature. This present research emphasizes that the field of CP needs to first develop consistent, reliable, and valid coding schemes before any tests of assumptions can take place. Crime scene and offender data should be collected consistently, in collaboration with both enforcement personnel and academics, and across different geographical locations. This can be accomplished with the development of criminal behavior databases that includes information gathered from checklists, such as crime scene variables (e.g., venue, type of weapon, evidence of signature behaviors), offender background

characteristics (e.g., psychological testing, employment, previous arrests), and victim characteristics (age, sex, location, context).

The idea that criminal behaviors can be collected into databases and used to study behavioral typologies, is already underway. Yakota, Fujita, Watanabe, Yoshimoto, and Wachi (2007) developed a computer modeling program to profile offenders based on past, unsolved crimes. The authors entered all available crime scene and offender background information into a database and used an algorithm to calculate the probability that a group of offenders will demonstrate behavioral similarity. The algorithm assigned higher frequency behaviors with more weight than a lower frequency behavior in order to be able to discriminate offenders. While Yakota et al. (2007) were focused on testing the assumption of behavioral consistency and not homology, it is not hard to imagine how the conceptual simulations and algorithms developed by these authors could be applied and replicated by other jurisdictions and used to test homology of offender behavior. Applying these mathematical models to existing datasets may yield more insight into whether offenders act alike one another in perpetrating crimes, and if so, do their backgrounds differ.

It is further suggested that profilers should not only utilize data-mining procedures to link similarities in offenders' behavior in a given crime, but to use collected biographical, motivational, sociocultural, and psychological information about offenders from other crimes as well (Strano, 2004). In addition, missing from the current typologies and profiles is information about those who are more successful or resourceful. Databases used for the development of criminal profiles should find ways to include information

about individuals who have evaded being apprehended (Strano, 2004). Strano (2004) raises a very interesting point, and presents a challenge for social psychologists and enforcement agencies with respect to developing richer more informative typologies by considering information that is unclear.

Lastly, the present test of homology highlights the need for researchers to explore whether or not behavioral variation is a function of actual differences in criminal behavior or whether it is caused by differences in data collection methods (Alison, et al., 2001). However, regardless of data collection methods, one very important point needs to be considered. According to personality psychology, the idea of using typologies to classify criminals based on their crime scene behavior may not be a useful method for CP. There is fundamental debate over whether or not people have consistent stable personality dispositions at all (Epstein, 1979). People have been found to vary in their behaviors from situation to situation calling into question how predictable behavior is in general. Even when the same behaviour is measured over multiple times, the correlations are modest at best (Mischel & Peake, 1982). Taking in the idea that people are not likely to be reliably consistent with their behavior, using typologies in CP may be problematic because typologies assume consistency in behavior.

Fortunately, with advances in technology and complex statistical techniques databases from around the world can collect vast amounts of information, and through networking, compare information across police departments. Once information has been rigorously collected, and if the sample is of a significant size, perhaps then, crime scene

behavior can be compared for similarity. When and if a high degree of similarity is accomplished, then the elucidation of typologies may be applicable.

The present study also highlights the need for a close working relationship between police departments and social scientists. Similar to the suggestion by Alison et al., (2001), the development of reliable typologies and tests of the homology assumption in criminal profiling can be best served by collaboration (Alison et al., 2001).

In conclusion, profilers, especially those who employ typologically-based approaches, assume that it is possible to classify criminals to mutually exclusive types and that different types of criminals have different backgrounds characteristics. The results from the current studies failed to find strong empirical support for either of those assumptions. Indeed, profilers using either of the typologies explored here to guide their profiling activities will have based their practices upon weak assumptions. Even after giving serious consideration to the methodological limitations of the current research, confidence in the support for the homology assumption has weakened – the probability that there is even moderate support for the homology assumption has moved slightly closer to zero.

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Table 1.

Arson Typologies: Liberal Classification

Type ($N = 87$)	Frequency	Percent
Expressive Object	8	9.2
Instrumental Object	25	28.7
Instrumental Person	25	28.7
Expressive Person	28	32.2
Mixed	1	1.1
Total	87	100

Table 2.

Comparison of Background Characteristics in Arson Typologies

Background Variables (n =87)	EO	IO	IP	EP	Mixed	χ^2	p
1. Prev. Convictions							
Yes	7	4	16	21	0	25.36*	.00
No	1	21	9	7	1		
Total	8	25	25	28	1		
2. Juvenile							
Yes	6	24	11	3	0	41.75*	.00
No	2	1	14	25	1		
Total	8	25	25	28	1		
3. Psych.Treatment							
Yes	2	2	4	14	1	14.48*	.00
No	6	23	21	14	0		
Total	8	25	25	28	1		
4. Previous Warning							
Yes	6	8	18	22	0	15.20*	.00
No	2	17	7	6	1		
Total	8	25	25	28	1		
5. Theft							
Yes	4	2	5	4	1	8.01	.09
No	4	23	20	24	0		
Total	8	25	25	28	1		
6. Criminal Damage							
Yes	6	4	15	17	0	16.83*	.00
No	2	21	10	11	1		
Total	8	25	25	28	1		
7. Burglary							
Yes	3	4	5	10	1	4.09	.39
No	5	21	20	18	0		
Total	8	25	25	28	1		
8. Assault							
Yes	5	6	13	14	0	7.44	.11
No	3	19	12	14	1		
Total	8	25	25	28	1		
9. FTC/FTA							
Yes	7	2	3	12	1	12.57*	.01
No	1	23	22	16	0		
Total	8	25	25	28	1		

Table 3.

Comparison of Background Characteristics in IO, IP and EP Arson Typologies

Background Variables (n =78)	IO	IP	EP	χ^2	p
1. Prev.Convictions					
Yes	4	16	21	20.36*	.00
No	21	9	7		
Total	25	25	28		
2. Juvenile					
Yes	24	11	2	38.78*	.00
No	1	14	25		
Total	25	25	28		
3. Psych.Treatment					
Yes	2	4	14	14.01*	.00
No	23	21	14		
Total	25	25	28		
4. Previous Warning					
Yes	8	18	22	13.80*	.00
No	17	7	6		
Total	25	25	28		
5. Theft					
Yes	2	5	4	1.48	.47
No	23	20	24		
Total	25	25	28		
6. Criminal Damage					
Yes	4	15	17	13.46*	.00
No	21	10	11		
Total	25	25	28		
7. Burglary					
Yes	4	5	10	3.16	.20
No	21	20	18		
Total	25	25	28		
8. Assault					
Yes	6	13	14	5.07	.07
No	19	12	14		
Total	25	25	28		
9. FTC/FTA					
Yes	2	3	12	11.48*	.00
No	23	22	16		
Total	25	25	28		

Table 4.

Arson Typologies: Adult Versus Juvenile

Type	Adult ($n = 42$)		Juvenile ($n = 45$)	
	Frequencies	Percentage	Frequencies	Percentage
Expressive Object	2	4.8	6	13.3
Instrumental Object	1	2.4	24	53.3
Instrumental Person	14	33.3	11	24.4
Expressive Person	25	59.5	3	6.7
Mixed	0	0	1	2.2
Total	42	100	45	100

Table 5.

Robbery Typologies

Type (N = 177)	Frequency	Percent
Cowboy	132	74.6
Bandit	39	22.0
Robin's Men	4	2.3
Mixed	2	1.1
Total	177	100

Table 6.

Robbery: Frequency and Percentage of Offender Background Characteristics

Characteristic $N = 177$	Frequency	Percentage
1. Previous Arrest	164	92.7
2. Property Arrest History	158	89.3
3. Previous Convictions	148	83.6
4. Tattoo	121	68.4
5. Prolific Offender	120	67.8
6. Previous Incarceration	116	65.5
7. Violent Arrest History	108	61.0
8. Other Criminal Arrests	105	59.3
9. Burglary Arrest	95	53.7
10. Weapons Arrest	48	27.1
11. Robbery Arrest	43	24.3
12. Deception Arrest History	41	23.2
13. Drug Arrest	20	11.3
14. Sex Arrest History	5	2.8
15. Arson Arrest	2	1.1

Table 7.

Comparison of Background Characteristics between Cowboys and Bandits.

Background Variables (N =177)	Cowboy	Bandit	χ^2	p
1. Tattoos†				
Yes	87	30		
No	6	3	*n.s.*	.11
Unknown	39	5		
Total	132	38		
2. Previous Arrests				
Yes	121	37	*n.s.*	.51
No	11	2		
Total	132	39		
3. Prolific Offender				
Yes	86	29	*n.s.*	.28
No	46	10		
Total	132	39		
4. Prev.Convictions				
Yes	109	34	*n.s.*	.50
No	23	5		
Total	132	39		
5. Prev. Incarceration				
Yes	79	33	8.17*	.00
No	53	6		
Total	132	39		
6. Property Arrest†				
Yes	116	36	*n.s.*	.44
No	16	3		
Total	132	39		
7. Violent Arrest				
Yes	74	31	6.97*	.01
No	58	8		
Total	132	39		
8. Deception Arrest				
Yes	31	9	*n.s.*	.96
No	101	30		
Total	132	39		
9. Weapon Arrest				
Yes	28	19	11.43*	.00
No	104	20		
Total	132	39		

Appendix A

Arson Crime Scene Variables

Light: Was it dark or daylight when the arson occurred?
Prior Arson: The offender had previous arrests or convictions for arson.
Institution: Was the offender living in an institution at the time of the offense (e.g., hospital, group home, care facility)?
Drugs: Was the offender under the influence of drugs when the arson occurred?
Non-Specific Trigger: There was no specific trigger or reason for the arson that was evident to the investigators.
Business: Was the premises targeted a business?
Daytime: Did the arson occur during daylight hours?
Remained: Did the arsonist return to the scene of the arson, or remain at the scene?
Multiple Items Fired: There were multiple items set fire.
Multiple Seats of the Fire: There were multiple fires set.
Spree: The offender set more than one fire in a 24-hour period.
Multiple Offenders: There was more than one offender who participated in the arson.
Miscellaneous: The property that was set on fire was derelict or uninhabited.
Illegal: The arsonist used the fire to cover up another crime.
Theft: The offender had stolen items from the scene of the arson.
School: A school was the target of the arson.
Outside: The arson took place outside, not inside a building or structure.
Public View: The arson took place where it was observable by the public.
No Alert: The offender alerted someone of the fire.
Threats of Arson: The offender had threatened to commit arson.
Car: A vehicle was the target of the fire.
Accelerant Used: An accelerant (e.g., gasoline) was used to fuel the fire.
Material Brought: Material was used for the arson was brought to the scene (e.g., matches).
Alcohol: The offender was under the influence of alcohol when the arson occurred.
Planned: There was evidence that the offender had planned the arson.
Witness: There was a witness(s) present for the arson.
Argument: The arson followed an argument.
Trigger-Specific: There was a specific trigger evident for the arson (e.g., an argument).
Partner: The victim of the arson was the offender's partner.
Threats: The offender had made non-specific threats of harm towards the victim.
Suicide Note: The offender had left a suicide note.
Self: The offender set fire to him/herself.
Lives Deliberately Endangered by Location: The arson endangered lives by the location of the arson.
Lives Deliberately Endangered: The offender deliberately set the fire to harm others.
Residence: The target of the arson was the offender's own home.
Victim Known: The victim of the arson was known to the offender.

Public: The fire occurred at a building that the public had access to.
Prior Violence/Argument: Any previous argument or event between the offender and the victim.
Prior Threats: Any threats made by the offender towards the victim.
Prior Threats of Arson: Any prior threats of arson made by the offender.
Prior Arson: Any previous arrests for arson.
Set Fire: The offender set the fire.
Serial: The offender had previously set more than one fire over several months.
Forced Entry: The offender had to make an effort to get inside the building (e.g., break window).
Crusade: The fire setting is attention-seeking behavior.

Appendix B

Arson Background Characteristics

Previous Convictions: The offender had previous convictions of any kind.
Student: The offender was in school, and under the age of 16 even if they did not attend.
Psychiatric Diagnoses: The offender had a psychiatric disorder.
History of Theft: The offender had a history of theft offenses.
History of Burglary: The offender had a history of burglary offenses.
Caution: The offender had been previously come to attention to police, but not formally charged.
Assault: The offender had an arrest history for assault.
Criminal Damage: The offender had a history of vandalism or damaging property.
Fail to Appear/Fail to Comply: The offender had an arrest history for not appearing in court or abiding by probation/compliance orders.

Appendix C

Canter and Fritzon's (1998) Coding Guide for Arson

Expressive Object

1. Hospital/Institution
If fire was set on the grounds of an institution.

2. Drugs
Refers to any recreational or non-prescription drug use, or solvents.

3. Non-specific Trigger
If the fire-setting occurs immediately following, or within a reasonable time period of an argument or other, usually emotionally trigger, and there is no obvious targeting of a specific person or property.

4. Serial
Offender sets more than one fire with a gap of more than 24hrs. If the gap is a matter of weeks, months or years then not serial – prior arson.

5. Prior Arson
Offender has set any fires prior to the current offense.

6. Business
Building is currently used as a business premise.

7. Public (Civic Building)
A premise to which public have access to, e.g., library, church, town hall, courts, police station.

8. Daytime
Offense occurred during daylight hours.

9. Remained at/Returned to Scene
This is where the offender either remains at the scene, or returns while the fire is burning, or returns to the same property to set another fire.

10. Multiple Items
Refers to the objects that have actually ended up in the fire, rather than secondary objects which were used to start the fire. If multiple waste bins or skips are fired then this variable is coded as present, but if multiple bits of newspaper are used to set fire to one waste bin than this is not coded.

11. Multiple Seats
Refers to initial ignition points of the item(s) fired. For example, if a house is fired by pouring gas in one room and holding a match to a curtain in another room, then the fire has multiple seats. the number of seats in a fire are usually stated in the investigating fire officer's report.

Instrumental Object

1. Spree
If offender sets more than one fire with a gap of more than 24 hours than this is coded as a spree.

2. Miscellaneous/Uninhabited or Derelict Property
Items fired which were not inside a property, for example or a rubbish bin or park bench. However, anything which is fired inside a property will be coded as that property, e.g. a rubbish bin inside a school is coded as school. Uninhabited or derelict properties can be both commercial and residential properties which are not currently in use.

3. Multiple Offenders
The other individual need not be instrumental in the actual setting of the fire, e.g., they could be acting as a look-out. If another person is present during the firesetting and do not actually try to stop the offender than they are coded as a co-offender.

4. Illegal or Forced Entry
If the offender was required to make some effort to obtain entry to the fired property, then this would be coded as forced/illegal entry. Also, if the offender could be said to be trespassing, can be coded present.

5. Theft
If any property is taken before, during or after the fire.

6. School
A fire which occurs in any area of an educational establishment.

7. Outside
If fired object is outside, or if individual sets fire to a house by throwing a fire-bomb or inserting lighted material through letterbox than this is coded as outside.

8. Public View
Firesetting occurs in a place and time where the offender could potentially be seen by a passer-by or recorded by camera.

9. Not Alert

If the offender left the scene and did not alerting either the fire department or any other person.

Instrumental Person

1. Threat of Arson
If offender made any prior threats of arson towards the victim, even in an abstract manner (e.g., "I once knew a person whose house burned down.")

2. Car/Vehicle
Any type of vehicle which is used for transportation of goods or people, including bikes and boats.
3. Accelerant
Mentioned in the Fire Investigator's report.

4. Material Brought
Anything which the offender brought for the specific purpose of starting or accelerating the fire, would be coded as this. It's important that the material is something which would not be normally carrying e.g., matches, lighter).

5. Alcohol
Offender consumed alcohol at time of offense (whether admitted to, or observed by police).

6. Planned
If materials were brought to the scene, like gasoline or matches, suggests planning. Also, if the individual avoided detection (e.g., wearing gloves when handling gas containers).

7. Witness
Firesetting takes place in front of another person who is not a willing participant, i.e. explicitly or implicitly does not condone the act.

8. Argument
Refers to a dispute or argument with the victim, preferably heated, occurring within a reasonable time frame (usually not more than a month) of the arson.

9. Trigger Specific
If the firesetting occurs immediately following, or within a reasonable period of an argument, or other, usually an emotional trigger, and is targeted at a specific person, or property, than that is a victim-specific trigger.

10. Partner

If offender fires property belonging to someone close to his/her (ex-)partner, e.g., a family member or new partner. The rationale for this is that the person would not have been targeted were it not for their association the ex-partner.

11. Threats
Physical or verbal threats towards the victim that are overt or implicit in nature.

12. Targeted Property
If there is any evidence to suggest that a specific property was fired for a particular reason, then this is coded as targeted. It must be readily apparent, or readily inferred that the offender(s) would not have set fire to anything else than that object.

Expressive Person

1. Suicide Note
Presence of an actual suicide note, or if offender has alerted anyone prior to the fire of their intention or wish to commit suicide.

2. Self
If offender sets fire in own home and makes no attempt to leave or alert anyone.

3. Own Home
In addition to residential and/or self.

4. Lives Endangered Deliberately
If the offender knew that the property was occupied at the time of the fire and made no attempt to alert the occupants.

5. Lives Endangered by Location
A fire in a residential property, or building attached to a residence, which is not completely detached has the potential to endanger lives.

6. Residence
A property which at the time of the fire was used for residential purposes, or a property known to be used by squatters.

7. Victim Known
Along with targeting, includes institutions or governing bodies that the offender has been involved with.

Appendix D

Alison, Rockett, Deprez and Watts' (2000) Coding Guide for Robbery

Cowboys

1. Weapon Indicated
Those offenders who are prepared to indicate or imply that they are armed, whether they later produce a weapon or not.

2. Response Violence
The offender/s are prepared to use physical violence including the use of a weapon in response to resistance or non-co-operation; or perceived resistance or non-co-operation by the victim.

3. Resistance Undeterred
Offender/s actions or intentions are not changed by victim resistance or intervention whether it is physical or verbal.

4. No Disguise
Offender/s make no attempt to disguise their features.

5. Offender/s
Alone or in groups.

6. Target Business
The target is a business, whether commercial or otherwise, including supermarkets, gas stations, and industrial premises.

7. Victim Participation
The offender/s instruct the victim/s to perform a task for them such as opening safes, indicating alarms, and putting money into a bag within reach of the offender.

8. Personal Property Stolen
The type of property stolen by the offenders is personal items such as jewellery, wallets, bikes.

9. Non-Personal Property Stolen
Type of property stolen is not personal such as securities, business cash/cheques or commercial goods.

10. Target Dwelling
The target is an individual or property in a particular dwelling.

Bandits

1. Resistance Deterred
The offender/s actions or intentions change in some way due to the victim resistance or intervention.

2. Gratuitous Violence
An assault by the offender/s which is more than necessary to assert or maintain control over the victim.

3. Responsive Verbal Attack
Any verbal threat or intimidating language that the offender/s use as a result of non-co-operation by the victims.

4. Blitz Attack
An attack that is either sudden or preceded by a confidence approach in which there is an immediate use of physical force or an assault, that permanently or temporarily incapacitates the victim.

5. Improvise Disguise
An item used to disguise the offender/s appearance that is an everyday item such as a hood, glasses, hat.

6. Target Financial
The target is a premises which provides a public financial service, e.g., banks or building societies.

7. Overt Security
The target has clearly visible protection, or is well known to be protected in some way by alarms, bandit glass, security personnel.

8. Surprise Attack
An attack by offender/s on the victims whether preceded by a confidence approach or not. The attack is sudden, and characterized by the use of verbal threats and threats of harm, including with a weapon, verbal abuse but not physical violence.

9. Weapon – Firearm
The offender/s carry a weapon that can be classified as a firearm, for example, handgun, shotgun, imitations or real.

10. Confidence Approach
Style of approach involves contact with the victims in order to give the false impression of legitimacy, by means including, a false story, asking for directions or posing as a customer.

11. Verbal Instructions
Language used by the offender/s, which instructs the victims to do or not to do an act, and includes demands for goods or money.

Robin's Men

1. Made Disguise
An item used by the offender/s to disguise their appearance which has been made or altered specifically for that purpose, including stockings, woolen sleeves with eyeholes cut.

2. Spontaneous Verbal Threat
Any verbal threat that the offender/s use that implies harm to the victim to control them, and is not a response to victim resistance.

3. Demeaning Language
Language used by the offender/s that is demeaning or insulting to the victim, this is above the general use of profanities used whilst giving instruction.

4. Apologetic Language
Language used by the offender/s at any stage that is directed at the victim/s and is apologetic in its nature.

5. Hostage Taken
Where an offender takes a hostage to control the victim. This includes customers held while demands are made, or other persons not directly involved with the target such as relatives held at other locations.

6. Victim Security
The offender/s take action to secure the victim or other person/s present by physical means including binding, locking them in a room.

7. Floor
As part of the offence the offender/s force the victim/s to lie or sit on the floor.

8. Enters Private Area, Control
The offender/s enter a private area of the premises in order to assert control over the victim/s, includes entry by confidence trick, jumping over a payment counter.

9. Enters Private Area, Later
The offender/s enter a private area having gained control, in order to search, or for any other reason.

10. Implied Knowledge
Attacks where the offender/s appear to know something about the target, whether they are a person or a business. Such personal details, or knowledge of the alarm systems.

11. Reassurance Language
Those offender/s who use reassuring/comforting language both spontaneously or accompanying a threat to comply with instructions.

12. Weapon – Other
The offender/s carry weapons during the offense that are not firearms, for example, knives, bat, noxious sprays etc.

13. Precautions
The offender/s take precautions to ensure that they are not detected while committing the offence, e.g., pulling down the blinds, disconnecting phones and locking doors.

Appendix E

Robbery: Crime Scene Behaviors

Premises: Type of premises targeted (e.g., convenience store, bank).
Video: Was there a closed-circuit TV security system on the premises.
Cash: Was cash taken.
Cigarettes: Were cigarettes taken.
Alcohol: Was alcohol taken.
Other: Other items were taken.
Style: The confrontation style of the robber during the robbery (e.g., surprise attack or delayed).
Behavioral Demeanor: The behavioral demeanor of the robber during the robbery (e.g., restrained or aggressive).
Type of Weapon: Type of weapon used to commit the robbery (e.g., gun, knife, tool).
Implied: The weapon used in the robbery was not seen, but implied.
Violence: The robber used violence towards the victim during the robbery.
Pushing: The robber pushed the victim during the robbery.
Punching: The robber punched the victim during the robbery.
Stabbing: The robber stabbed the victim during the robbery.
Shooting: The robber shot the victim during the robbery.
Aggressive: What style of aggression the robber(s) were during the robbery (e.g., controlling or used gratuitous violence) towards employees/customers during the robbery.
Threats: The robber threatened violence towards the victim during the robbery.
Nature of Threats: The threats made by the robber were spontaneous or in response to resistance by the victim.
Announced: The robbery was announced by the robber.
Demand: The robber demanded cash or an item.
Instruct: The robber directs the victim to comply with requests.
Reassure: The robber reassures the victim.
Apologize: The robber apologizes to the victim.
Justifies: The robber justifies the robbery to the victim.
Foul: The robber uses foul language directed at the victim.
Delay: The robber told the victim to delay reporting the robbery.
Floor: The victim was required to lay on the floor during the robbery.
Bind: The robber bound the victim.
Blindfold: The robber blindfolded the victim.
Disguise: The robber used a subtle or overt disguise.
Lookout: The robber had an accomplice who kept a lookout while the robbery took place.
Tamper: The robber tampered with any security measures on the premises.
Disable: The robber disabled the telephone.

Appendix F

Robbery: Offender Background Characteristics

Tattoo: Did the offender have any tattoos.
Previous Arrests: Did the offender have any previous arrests.
Prolific: Was the offender a 'prolific' offender, e.g., long criminal career history.
Convictions: Did the offender have any previous convictions.
Incarcerated: Was the offender previously incarcerated.
Property: Did the offender have an arrest history of property-related offences.
Violent: Did the offender have an arrest history for violent offences.
Sex: Did the offender have an arrest history for sexual offences.
Deception: Did the offender have an arrest history for fraud-related offences.
Weapons: Did the offender have an arrest history for a weapon-related offence.
Robbery: Did the offender have an arrest history for robbery.
Burglary: Did the offender have a history for burglary.
Arson: Did the offender have a history of arson offences.
Drugs: Did the offender have a history of drug offences.
Others: Did the offender have an arrest history of other offences.
Crime: What type of crime the offender was last arrested for.
Age: Age of the offender.
Last Arrest: In days, how long had it been since the offender was last arrested.