

THE UTILITY OF LATENT VARIABLE MODELS IN REFINING BEHAVIOURAL CRIME
SCENE ANALYSIS OF SERIAL STRANGER SEXUAL OFFENCES

by

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Thesis Title: The Utility of Latent Variable Models in Refining Behavioural Crime Scene
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Abstract

Behavioural crime scene analysis (BCSA) is a police tool used to reconstruct an offence based on behaviours. Recently, BCSA has demonstrated clinical utility by predicting recidivism and aiding case conceptualization. However, a systematic review of BCSA models showed a paucity of research evaluating which behaviours are necessary and sufficient to model sexual offences. Groth and Birnbaum's sex offender typology, which is based on offence behaviours, provides a theoretical framework that integrates investigative information and clinical practice. The purpose of this thesis was to evaluate statistical- and theory-based approaches to refine BCSA models that distinguish sexual offenders. In Studies 1 through 3, Multidimensional Scaling, Nonlinear Principal Component Analysis, and Latent Class Analysis were used to create statistically-driven and theory-driven behavioural models from 59 serial, stranger sexual offenders. Validity testing of the theory-driven model indicated that applying Groth and Birnbaum's framework to BCSA could optimize both investigative efforts and clinical decision-making.

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INTRODUCTION

Compared to all other violent offenders, sexual offenders who target stranger victims are the least likely to be arrested and convicted (Bonnar-Kidd, 2010; Brennan & Taylor-Butts, 2008), the most likely to continue offending (Harris & Hanson, 2004), and the most likely to escalate in terms of frequency of offending and seriousness of violence and sexual deviance (Brankley, Goodwill, & Reale, 2014a; Hewitt & Beauregard, 2013; Stermac & Hall, 1989). For these reasons, improving our understanding of individuals who repeatedly commit sexual offences against strangers is of paramount importance to public safety. Stranger or unknown sexual offenders are individual who came into contact with the victim less than 24 hours prior to the offence (Corovic, Christianson, & Bergman, 2012). Optimizing police efforts to identify and incarcerate unknown offenders, increasing the accuracy of risk assessments in identifying factors associated with risk for reoffending upon release, and tailoring treatments aimed to reduce the criminogenic needs can minimize the impact of sexual violence. Presently, there is a lack of research supporting theories of sexual violence that integrate all three domains. Although sexual violence has been theorized and evaluated in risk assessment and treatment (Beech, Fisher, & Ward, 2005; Laws & O'Donohue, 2008; Mann, Hanson, & Thornton, 2010; Marshall, 1996; Marshall & Barbaree, 1990), the perspective adopted in those articles is not readily applicable to police investigations. The unit of focus for clinical research is the individual whose past behaviours and personal characteristics (e.g., age at first offence, psychopathy, paraphilia diagnosis) are examined and used as a basis for predicting future sexual violence. On the other hand, police investigations of unknown offenders have to focus on the information available, namely a description of offence behaviours (e.g., how the offender approached the victim, level of violence used, type of sexual penetration). This information provides a basis for officers to

make inferences about the offender during their investigation. However, these offence behaviours are often ignored in clinical research. Indeed, when risk assessment scales include crime scene behaviours, they exclusively focus on victim selection (Hanson & Thornton, 2000; Quinsey, Harris, Rice, & Cormier, 2006). Therefore, there is an absence of research connecting theories of sexual violence with crime scene behaviours.

When the offender is unknown and there is a dearth of physical evidence to identify suspects, police investigators often rely on crime scene behaviours (Douglas, Burgess, Burgess, & Ressler, 2006; Hazelwood, Ressler, Depue, & Douglas, 1987). Behavioural Crime Scene Analysis (BCSA) is a tool employed by some police investigators to better understand the offence in question. The process of BCSA usually includes two general steps: (1) collecting evidence from a variety of sources (e.g., victim statements, victimology, geography of offence) and then (2) processing and interpreting evidence by making decisions about the key aspects that characterized the offence. The resulting model is then used to guide various aspects of police decision-making. For example, BCSA is often used as a strategic basis for inferring characteristics about the offender (i.e., criminal, criminal personality, or offender profiling) (Devery, 2010; Hicks & Sales, 2006), prioritization potential suspects (Douglas, Ressler, Burgess, & Hartman, 1986; Snook, Cullen, Bennell, Taylor, & Gendreau, 2008), and releasing information to the media during an investigation (Ainsworth, 2001). BCSA has also been used when exploring offence consistency (Harbers, Deslauriers-Varin, Beauregard, & van der Kemp, 2012; Schlesinger, Kassen, Mesa, & Pinizzotto, 2010) in order to see if a series of unsolved offences were committed by one person (i.e., case linkage, Bennell, Jones, & Melnyk, 2009; Bennell & Woodhams, 2012; Winter et al., 2013), and when plotting serial crimes on a map to determine spatial patterns in offending (i.e., geographical profiling (Deslauriers-Varin &

Beauregard, 2013; Goodwill & Alison, 2005). Recently, researchers have argued that crime scene behaviours have clinical utility as predictors of recidivism (Lehmann, Goodwill, Gallasch-Nemitz, Biedermann, & Dahle, 2013) or in aiding treatment conceptualization (Brankley & Goodwill, 2014). Therefore, BCSA has the potential to be useful across the three aforementioned domains of intervention with sexual offenders. However, BCSA has been criticized for producing inconsistent results (Snook et al., 2008; Snook, Eastwood, Gendreau, Goggin, & Cullen, 2007; Snook, Luther, House, Bennell, & Taylor, 2012). Based upon systematic review of BCSA research, Brankley, Goodwill, Reale, Whitney, and Belanger (2014b) proposed that methodological issues plague BCSA research. Specifically, researchers have not attended to the second aforementioned step in constructing a BCSA model: processing and interpreting behavioural evidence to select variables that are necessary and sufficient to model the offence. Therefore, the purpose of this thesis is to *evaluate methodological approaches in refining BCSA models of sexual violence in cases of serial sexual offences committed by strangers and how these methods could optimize the utility of BCSA models for investigative efforts and clinical decision-making.*

CHAPTER ONE: LITERATURE REVIEW

Collecting Behavioural Data for BCSA

Unlike many tools created by psychologists to make inferences about human behaviour, BCSA was created by police officers attempting to solve sexual offences in which little forensic evidence was available. In 1986, Special Agent John Douglas and colleagues at the Federal Bureau of Investigation (FBI) published a paper in which they outlined how to derive a psychological “profile” of an offender by evaluating their crime scene behaviours. In doing so, the authors presented a model for conducting BCSA by first collecting inputs about the offence (e.g., victimology, crime scene, forensic information, location) and then conducting an assessment of the data, in which they mentally reconstructed the crime to determine the offender’s motivation. Whereas Douglas and colleagues gave only a vague description of the information to be collected from the crime scene, Hazelwood and Burgess (1987) provided a series of 14 questions to ask victims to elicit the details needed for BCSA. Although victims are not always present to provide details of the offence, these questions reflect the key aspects of sexual offences that are needed for BCSA.

Hazelwood and Burgess (1987) outlined a number of important behavioural elements to a sexual offence that future researchers expanded and revised. The victim approach is often the first point of contact that demarcates the beginning of the offence: either non-violent (e.g., a *confidence style*) or violent (e.g., *surprise* or *blitz*). A *confidence style* approach refers to cases when the offender uses an inconspicuous stratagem or means of subterfuge to gain control over the victim. A famous example was Ted Bundy’s use of a fake cast and a sling to allay apprehension in young women when he asked them to help him carry groceries to his car (Rule, 2009). In other instances, an offender may *surprise* the victim and use threats of violence or

immediately apply brutal force (i.e., *blitz*) to subdue the victim. Indeed, it is important to note the overall use of force in the offence. Level of force may vary from no force, to minimal force (i.e., application of force only needed to keep the victim compliant), to excessive/brutal force. Victims may engage in a variety of resistance strategies (e.g., verbal, physical). However, it is also of paramount importance to note how the offender responded to resistance. Did the offender stop when resisted against? Did s/he run away? Did he use non-physical threats or did he simply use more physical force to overpower the victim? The type of sexual acts should be documented, including non-contact (e.g., offender masturbating in presence of victim), contact (e.g., fondling, kissing), and penetration. Moreover, it should be noted which orifice was penetrated (i.e., mouth, vagina, or anus) and whether it was penetrated with fingers, penis, and/or objects. It has also been suggested that the order of these behaviours may be important as well, e.g., as if it appeared that the offender was playing out a fantasy (Hazelwood & Burgess, 1987). In addition, offenders sometimes experience sexual dysfunction (Carvalho, Quinta-Gomes, & Nobre, 2013; Metz & Sawyer, 2004), which may provide useful information about the offender. Lastly, affect is important to note. In particular, what was the offender's dominant emotional state during the offence and how did he perceive the victim (e.g., potentially evidenced by questions or comments made to the victim)?

Sexual offences are comprised of sexual and violent activity in service of an unforeseen need. The aforementioned behavioural-oriented interview questions provide police officers with an opportunity to understand the motivations that might have prompted the sexual offence. But, it still requires police officers to make an inferential leap between observable behaviours and latent motivations. This inference is mired by unstructured methods to reliably extract behavioural variables. For these reasons, standardized databases improve upon unstructured

interviews as they increase confidence that the same variables are being examined in each offence.

Standardized Crime Scene Databases

Data collection for BCSA has predominantly been conducted in pursuit of identifying and tracking unknown offenders through case linkage or geographical profiling. The two largest national crime scene database programs in North America - the Violent Criminal Apprehension Program (ViCAP) in the United States and the Violent Crime Linkage System (ViCLAS) in Canada - were created in the latter half of the 20th century, largely upon reflection after solving a case of serial sexual homicides. Although these programs have been instrumental in formalizing and centralizing the process of BCSA, researchers have criticized the construction and utility of these databases (Snook et al., 2008; Snook et al., 2007; Snook et al., 2012).

In the 1950s, Pierce Brooks, a detective with the Los Angeles Police Department, was inspired to track crime scene behaviours after a series of American sexual homicides committed by Harvey Glatman. Brooks dedicated the next 30 years of his life to creating a computer database that facilitated the linking of sexual offences and other serious violent crimes. This database was made available to all U.S. law enforcement agencies, in effect allowing police departments to better coordinate communicative and investigative efforts on potentially linked crimes (FBI, 2008; Howlett, Hanfland, & Ressler, 1986). On May 29th, 1985, analysts began entering case reports on the new ViCAP database at the FBI Academy in Quantico, Virginia (Howlett et al., 1986). ViCAP has now been active for almost 30 years, with over 5,000 police agencies adding more than 85,000 cases to the database (FBI, 2008).

Canadian law enforcement began reviewing their methods for tracking violent offenders in the 1980s, however, it was the series of 11 Canadian sexual homicides committed by Clifford

Olson that spurred officials into the process that would ultimately lead to the development of ViCLAS. The first iteration of this program was the Major Crimes File (MCF) developed by the Royal Canadian Mounted Police (RCMP) after reviewing ViCAP procedures (Wilson & Bruer, n.d.). The MCF had accrued 800 cases by 1990, but it did not provide any cases based on similar crime scene behaviours (Wilson & Bruer, n.d.). After training with the FBI, Inspector Ron MacKay was charged with evaluating and improving the MCF's ability to identify sexual offence series. Inspector MacKay collaborated with police officers and with Dr. Peter Collins of the Clarke Institute of Psychiatry in Toronto, Ontario before spending a year revising MCF into the present ViCLAS system (Collins, 1998; Wilson & Bruer, n.d.). The RCMP maintains that sexual offenders are driven by insatiable fantasies and, thus, they have based many of their 262 ViCLAS variables on this assumption (Collins, 1998; Wilson & Bruer, n.d.). There were 300,000 cases entered into the ViCLAS database as of 2007, leading to the identification of 3,200 linkages. The over 88,000 offence series presently on ViCLAS demonstrate the large number of serial offences committed against Canadians (Wilson & Bruer, n.d.).

The first and most important step of BCSA is data collection. Errors or inconsistency in data collection will skew interpretations and distort the desired application. However, BCSA is more than just data collection. On their own, databases such as ViCAP and ViCLAS neither link violence offences nor produce criminal profiles. Rather, these databases are repositories of information for police officers to review if needed for an investigation; there is currently no clear scientific process for extracting variables. This state of affairs likely arose because most research using BCSA focuses on outcomes (e.g., predicting background characteristics, case linkage) rather than on evaluating the validity or utility of the process used to derive those outcomes. Hence, BCSA has often been evaluated through utilitarian thinking by evaluating the strength of

its predictions. There is no more well-researched or famous application of BCSA than offender profiling.

Applying BCSA: Offender Profiling

Predicting behaviours *from* characteristics is a common research design in psychology (Ajzen, 1987); however, offender profiling is based on the assumption that offender characteristics can be predicted *by* crime scene behaviours. Evaluating how BCSA has been used to predict offender characteristics will provide information on how previous researchers have progressed in selecting behavioural variables. Offender profiling is employed to identify potential characteristics of the offender (Douglas et al., 2006; Scott, Lambie, Henwood, & Lamb, 2006) by making inferences using crime scene behaviours (otherwise known as criminal, criminal personality, or offending profiling). Profiling is based on a series of inferences made by identifying behavioural patterns that relate to an offender's characteristics, such as *modus operandi* (i.e., action taken by an offender during the perpetration of a crime) and *signature* (i.e., an individualized set of behaviours that can point specifically to an offender's personality). Canter (1995, 2004) described offender profiling using the "A → C" equation. In this equation, "A" refers to actions and behaviours related to the offence in question; the content of A is determined through the first step of BCSA. "C" refers to characteristics about the offender that are inferred ("→").

One of the earliest notable instances of profiling occurred in November 1888 in the Whitechapel area of London, England for a series of five unsolved, gruesome sexual murders. Dr. Thomas Bond, a consulting physician and considered by some to be the first offender profiler, surveyed the forensic evidence available and constructed an offender profile on one of the most famous unidentified offenders, labeled by the local media as Jack the Ripper (Canter,

2004). As early as the 1940s, the FBI similarly recruited mental health professionals to analyze crime scene behaviours and establish profiles of unknown offenders (Schlesinger, 2009). These attempts were not always prosperous, however, one successful example in the early half of the 20th century was the 1950s case of the Mad Bomber. Psychiatrist James Brussel constructed a profile, based upon photographs of the crime scene and descriptions of the bombs, that led to the successful apprehension of George Metesky (Schlesinger, 2009). Brussel's profile was constructed from assumptions about the stability of the underlying psychological constructs causing this criminal behaviour. Certainly by the early 1970s, police investigators regularly obtained advice from mental health professionals in cases of unknown serial sexual offences in the United States (Reiser, 1982) and the United Kingdom (Canter, 1994). Notwithstanding the debt owed to profiling pioneers by current forensic investigators and researchers, reliably identifying relevant offender characteristics from BCSA is more difficult than was initially assumed (Mokros & Alison, 2002).

Data Proliferation Due to Lack of Process Research

As noted earlier, researchers using BCSA have often focused on outcomes (i.e., offender profiling, case linkage). But caution is advised in evaluating the specific variables used in these studies as there is a dearth of research evaluating *which* crime scene behaviour variables are necessary and sufficient to model a sexual offence and *how* to model these variables. In other words, there has been considerable emphasis on the “C” of the $A \rightarrow C$ equation, without first evaluating how to measure A. In a recent unpublished review of all empirical papers that utilized some form of BCSA in sexual offences, Brankley and colleagues (2014b) identified over 1,300 distinct crime scene behaviours across 76 different studies. The behavioural variable sets used for input in BCSA studies varied from 4 variables (Myers & Chan, 2012) to 357 variables

(Ressler, Burgess, Douglas, Hartman, & D'Agostino, 1986). Almost 70% of the variables were used only in one study. Also, the level of detail in crime scene behaviours variables varied between some studies. For example, whereas Santtila et al. (2008) coded only the presence of binding at a crime scene, Fujita and colleagues (2013) specified whether bindings were used to restrain the victim or were the cause of death. Importantly, lack of consistency was not necessarily due to poor judgment by the researchers but to limitations in what was available to be coded. Moreover, researchers often just reported their final variable list, leaving it uncertain as to how the list was formed. When data were used from a database, did they use all available behavioural variables? Or did they select variables, and if so, how did they make their decisions? Contrarily, if the researchers had secondary sources (e.g., police reports, offender interviews) or a primary source (e.g., crime scene photographs), how did they proceed in defining and collecting their data? This vast array of decisions often goes unmentioned, yet is crucial to evaluating the behavioural model produced by BCSA.

The paucity of BCSA research on data processing may be related to a recommendation by Canter (2004) who stated that researchers should focus on the inferences made using BCSA. Though investigating these outcomes are of utmost practical importance to using BCSA, one must first, however, evaluate how the behavioural variables were selected. Unwittingly, researchers could have over- or under-emphasized the level of behavioural detail in efforts to detect their desired outcomes. However promising, the results may be trivial if the behavioural model is idiosyncratic to a sample and does not have any meaningful connection to theories of sexual offending. Data collection without a clear method for selecting variables that are meaningfully related to underlying constructs may produce BCSA research that is ambiguous. A

variety of statistical methods can be used to evaluate behavioural models of sexual offences to remedy this issue.

Using Latent Variable Models to Process Crime Scene Behaviour Data

Researchers using BCSA in their studies have either focused on the manifest aspects of the behaviours or made inferences about underlying latent variables. Latent variables have about as many slightly different definitions as they have alternative names (e.g., unmeasured or unobserved variables, true scores, factors, or constructs). However, many agree that latent variables are not real, they are produced by scientists to test their theories (Bollen, 2002). A variety of latent variable models exist in BCSA research; their differences are based upon the measurement levels of the manifest variables and the latent variables. Behavioural variables are nominal, existing almost exclusively in a dichotomous format (i.e., the behaviour was present in the offence or not). Therefore, the various options in latent variable models depend upon the desired measurement level of the latent variables. The most common latent variable modeling procedure used in BCSA research is Multidimensional Scaling (MDS), which provides continuous measures of latent variables.

Multidimensional Scaling

MDS may be used at an exploratory level of inquiry with latent variables as it provides an easy to interpret visual output of the degree of similarity or dissimilarity between behavioural variables. It is often used as an alternative to factor analytic methods, which require that the variables be normally distributed. The straightforward output and relatively few assumptions make MDS a common method in exploratory data analysis. However, MDS does not allow for a fine-grained analysis of the contribution of both the individual variables and the overall model in explaining variance in the dataset. Nonlinear Principal Component Analysis (NPCA) provides a

viable, yet underutilized, alternative to principal components analysis (Jolliffe, 2002) that also provides a continuous level of measurement for underlying latent variables. Although it is similar in many ways to MDS (e.g., they both examine behavioural dimensions), NPCA can expand the results of a MDS analysis by providing a means of removing variables that do not contribute to overall model fit. Utilizing this facet of NPCA would provide researchers with the means to address the data proliferation discussed previously.

Canter and Heritage's 1990 paper on a multivariate model of sexual offence behaviours began the trend of using MDS to conduct BCSA in research. The null hypothesis in MDS is that variables have no reliable influence on each other; for example, the fact that an offender binds a victim's limbs will neither increase nor decrease the chance of the offender also gagging the victim (Canter & Heritage, 1990). The assumption in MDS is that the underlying behavioural structure will be observed most accurately by examining the relation between all analyzed variables simultaneously through a graphical output that represents the overall relationship between variables as a function of the Euclidian distance between variables. The actual measurable distance between variables on the output is meaningless. The reliability of relative differences, however, provides insight into how changes in variables influence other variables. Using this method, the task of interpreting underlying dimensions is a subjective process of analyzing the pattern of data points, referred to in Facet Theory (Canter, 1985) as the regional hypothesis (Canter & Heritage, 1990). Facets can be grouped using the principle of contiguity (Foa, 1958), which states that variables will be empirically correlated due to their functional relationship. The regional hypothesis can be interpreted as an extension of this approach; thus, variables that have shared facet elements will be in the same area of space (Canter & Heritage,

1990). This approach provides an opportunity to generate hypotheses about the nature of regional structures in the MDS output, i.e., the behavioural themes (Canter, 2000).

The accuracy of MDS models are not easily measurable, as accuracy depends upon a complex combination of the number of variables, the amount of error in the data, and the logical strength of the interpretative framework (Canter & Heritage, 1990). In particular, the selection of variables to identify the behavioural patterns in sexual offences has shown great variability across studies. Therefore, whereas MDS provides an excellent means to initially explore behavioural themes, other latent class models can better evaluate which variables are necessary and sufficient to model these themes (i.e., NPCA) and classify offenders into meaningful groups (i.e., LCA).

Nonlinear Principal Component Analysis

NPCA is conducted using many of the same assumptions as MDS: specifically, the null hypothesis is that there is no relationship between the variables. Also, the output of NPCA is highly dependent on the variables inputted to the analysis. However, NPCA allows researchers to do three things that MDS does not (Linting & van der Kooij, 2012): (1) use eigenvalues to measure the variance accounted for (VAF) by each principle component (e.g., underlying themes), (2) measure the VAF by each crime scene behaviour variable indicated by the sums of squared component loadings per variables, and (3) measure the strength of the relationship between crime scene behaviour variables and the components through loading coefficients.

This author is unaware of published comparisons between MDS and NPCA. MDS has often been compared in other areas of psychology with linear Principal Component Analysis and Factor Analysis (FA). Silverstein (1987) found that a FA method was a preferable method when conducting component analysis of the Wechsler's intelligence scales, as MDS often failed to

extract the first component of the scales – general intelligence. In a more recent comparison of MDS and FA in a study about cognitive abilities, Tucker-Drob and Salthouse (2009) found that MDS models were unable to account for multiple factor loadings. In the radex approach, the simplex and the circumplex of the MDS output are interdependent, i.e., higher loading on the general, spatially central facet is conversely associated with less domain specificity. Last, Tucker-Drob and Salthouse noted that the primary advantage of MDS is the visual nature of the output, which, although unique, is primarily qualitative in nature and is not as quantitatively descriptive as FA. In short, MDS has several advantages at an exploratory stage in data processing. However, NPCA extends understanding of those behavioural dimensions by refining the variables and components of interest through convergence of statistical results.

NPCA provides a means to more rigorously model latent behavioural dimensions. However, what is unclear is if these dimensions meaningfully distinguish groups or types of offenders. The dimensional/categorical distinction is a distinction present in the diagnosis of mental illness (e.g., Brown & Barlow, 2005; Widiger & Samuel, 2005). This statement is not meant to imply that patterns in sexual offending are a form of mental illness, rather, the analogy with psychopathology underscores the benefits and limitations of using either a dimensional or categorical approach. Evaluating dimensional latent variables in offending behaviour are likely to have high validity, as they will communicate additional information about the offenders that would be lost in a more descriptive MDS model. But, categorical latent models provide increased utility as they provide clearer support for decision-making, such as differentiating offenders (Park, Schlesinger, Pinizzotto, & Davis, 2008; Salfati & Taylor, 2006).

While MDS and NPCA both provide a continuous measure of latent variables, categorical measures are often argued to be of more use to professionals who rely upon these

models for decision making purposes, e.g., in clinical diagnosis (First, 2005). An alternative to MDS and NPCA that provides a categorical model of latent variables is Latent Class Analysis (LCA). LCA provides researchers with the ability to sort participants into categories depending on the likelihood of engaging in behavioural variables. Indeed, the three methods complement each other well: MDS simplifies initial data exploration through defining important constructs, NPCA facilitates further exploration of behavioural themes and provides a means to remove unnecessary variables, and LCA allows participants to be classified into independent groups.

Latent Class Analysis

MDS and NPCA can help differentiate between behavioural variables, and LCA helps differentiate between offenders. Lazarsfeld and Henry (1968) introduced LCA as a multivariate technique used to create latent classes in which participants could be categorized, based upon a series of dichotomous indicator variables. An assumption in LCA is that individuals in the sample meaningfully differ and form sub-groups (Lanza, Flaherty, & Collins, 2003). However, the underlying constructs that define these subgroups are not directly measurable (i.e., they are “latent”); therefore, observable variables have to be selected based upon the theoretical likelihood that they are measuring the intended latent variables. There are two further assumptions underlying LCA. First, it is assumed that sample participants are only members of one latent class (Goodman, 1974). Second, these latent classes are assumed to be unrelated to each other, which is referred to as the assumption of local independence (Vermunt & Magidson, 2003). At its core, the latent class model is expected to explain all of the associations between the observed variables. LCA has been described as a categorical data analogue to NPCA and FA (McCutcheon, 1987). LCA has also been used to statistically evaluate the models created through MDS and expert opinion (Pacini et al., 2014). LCA has been used in BCSA research

(Deslaurieres-Varin & Beauregard, 2010; Vaughn, DeLisi, Beaver, & Howard, 2008); yet, there is no evidence that it has been used to evaluate the specific contribution of variables to underlying behaviour classes. Comparing LCA with MDS and NPCA in the present study will balance different statistical approaches to modeling latent variables. Interpreting these variables provides a theoretical evaluation of these models. If statistical model improve our understanding of sexual offences and the individuals who commit them, they are of great utility. So, further research on the association between behavioural models and behavioural theories of sexual offences is warranted to increase the utility of BCSA.

Theoretical Approaches for Processing Crime Scene Behaviour Data

Multivariate analysis provides a statistical method to model patterns in sexual offences and this analysis has to be driven by a theoretical framework. A primary postulate in the investigation of individuals who commit sexual offences is that they are not all alike (Groth & Birnbaum, 1979; Marshall & Barbaree, 1990). A vast number of typologies have been proposed based upon various distinctions amongst offenders (Anderson, Kunce, & Rich, 1979; Briggs, Simon, & Simonsen, 2011; Cohen, Seghorn, & Calmas, 1969; Gebhard, Gagnon, Pomeroy, & Christenson, 1965; Guttmacher & Weihofen, 1952; Kopp, 1962; Sewall, Krupp, & Lalumiere, 2013). For example, one of the earliest investigative typologies was Hazelwood and Douglas's (1980) organized/disorganized distinction of violent, serial offenders. Hazelwood and Douglas based this distinction on the manner in which the crime was committed. *Organized* offenders were described as intelligent and often psychopathic (i.e., callous and manipulative), often engaging in forensic counter measures (e.g., using a disguise, condom, gloves to avoid fingerprint detection) and leaving clean crime scenes. On the other hand, an offence was categorized as committed by a *disorganized* offender when there was a high degree of physical

evidence, the environment was greatly disturbed or ransacked, and/or little effort was made by the offender to avoid detection (e.g., no/little cleaning of the crime scene). These offenders were assumed to be less intelligent or even psychotic (e.g., experiencing delusions or hallucinations) and to have made little attempt to alter their crime scene (Holmes & Holmes, 2000).

Later, a third category was added to this typology: the *mixed* offender who displays aspects of organized and disorganized offences (Douglas et al., 2006). Several police services, e.g. the FBI, have readily adopted this typology and it is often associated with BCSA and profiling efforts. However, empirical findings create doubt about its validity (Canter, Alison, Alison, & Wentink, 2004). Another approach is to base the typology around the motivations for the sexual offence. Sexual assaults necessarily imply the presence of violence and sexual acts. The degree of violence used and the level and quality of sexual behaviours may provide insight into the offenders' motivations, which many agree are central to predicting offender characteristics (Andrews & Bonta, 2010; Beech et al., 2005; Ward & Stewart, 2003). Indeed one of the most impactful sex offender-specific motivation-based typologies was developed from clinical observations and interviews conducted by Nicholas Groth and colleagues (Groth, Burgess, & Holmstrom, 1977; Groth & Birnbaum, 1979).

Groth and Colleagues' Typology of Sexual Violence

Groth and colleagues (1977) proposed one of the earliest and most parsimonious typologies of sexual assault. This typology emerged from clinical observations of over 500 offenders. Six different samples of sexual offenders were examined: offenders who were not apprehended (and therefore known only through victim reports), offenders who were identified but were never prosecuted, offenders who were apprehended but found not criminally responsible for their crime, offenders who were tried but not convicted, offenders who were

convicted of sexual assaults, and offenders who were convicted and were identified as being dangerous and at a high risk for reoffending (Groth & Birnbaum, 1979). In the earliest version of their typology, Groth and colleagues categorized offenders as committing offenses based upon power or anger. Power refers to offences motivated by conquest and control. Anger assaults, on the other hand, are characterized primarily by rage and fury towards the victim. Later, in the 1979 book *Men who rape: The psychology of the offender*, Groth and Birnbaum expanded a rarer third category, sadism, in which violence and pain are used as a means for sexual gratification. Though this framework was developed for non-homicide sexual assaults, it has influenced attempts to classify other sub-populations of sexual offences such as intrafamilial sexual assault (Chaffin, 1992), male on male sexual assault (Almond, McManus, & Ward, 2014), homicide (Keppel & Walter, 1999; Myers, Husted, Safarik, & O'Toole, 2006), and child victims (Guay, Prouix, & Ouimet, 2001; Rebocho & Goncalves, 2012). Aspects of this typology have also been predictive of outcomes such as treatment difficulty (Lin, Maxwell, & Barclay, 2000), personality (Lu & Lung, 2012), treatment completion (Chaffin, 1992), and previous criminal convictions (Goodwill, Alison, & Beech, 2009).

Power. Themes of ownership, possession, and conquest typify power assaults. Offenders engaging in these types of attacks are often motivated to control their victims to bolster their faltering sense of their own masculinity. Moreover, these offenders desire to sexually arouse their victim to demonstrate their sexual prowess. Therefore, power offenders are usually curious and concerned about the victims' thoughts regarding the sexual interaction. The individual committing the offence usually suffers from feelings of inadequacy and lack of sexual intimacy (Groth & Birnbaum, 1979). Arguably, the primary motivation of the offence is using sex to empower and reassure the offender's perception of self-worth. Violence is engaged in, out of

service to this primary motivation, to control the victim (Shipley & Arrigo, 2008). These types of offenders are more likely to engage in sexual acts that would mimic consensual sexual encounters (e.g., cunnilingus, masturbation) than in more deviant or degrading sexual behaviour (e.g., object penetration, humiliation). In response to resistance, the offender will be more likely to use threats (e.g., “If you do not want to get hurt, do what I say”) rather than physical force to maintain control over the victim (Groth & Birnbaum, 1979). An individual who commits these types of sexual assaults has few, if any, intimate relationships; may fantasize that the victim may secretly be in love with him; may delusionally believe the victim is not actually being hurt; and will force the victim to engage in sexual behaviours to fulfill the offender’s fantasies (Keppel & Walter, 1999). In the earliest version of the framework, Groth and colleagues (1977) divided power offenders into those primarily interested in intimacy (i.e., power-reassurance) or those primarily interested in dominance (i.e., power-assertive). However, this distinction was not always maintained (Groth & Birnbaum, 1979).

Anger. Offences are categorized under “Anger” due to the usage of high levels of force and violence, as well as a hatred of women. Sexual behaviours are used as a means to further this motivation of hostility towards the victim rather than as a means for gratification. Indeed, sexuality and intimacy may actually be viewed with disgust by these individuals and motivate their need to punish their victims (Pardue & Arrigo, 2008). The fury and rage that characterize the motivation of anger offenders stands in stark contrast to power offences, where pseudo-intimacy and conquest are the goals. Interviews with these offenders revealed a sense of loss of control, where the offence was engaged in as a means of expelling pent up feelings of aggression (Groth & Birnbaum, 1979). BCSA research evidences the notion that anger offenders are more likely to use brute force (e.g., bludgeoning) to beat the victim into submission (Bennel,

Bloomfield, Emeno, & Musolino, 2013; Keppel & Walter, 1999). Similar to power, anger was first divided into two subtypes: retaliatory and excitation (Groth et al., 1977). The descriptions of anger assaults mentioned thus far were largely attributed to the subtype of anger retaliatory. Groth and colleagues also described another subtype, called “anger excitation”, characterized by sexual arousal associated with pain and suffering of the victim. Groth and Birnbaum altered the nomenclature of anger assaults in *Men who rape*, separating the excitation subtype into a new category, sadism, and leaving retaliatory as the sole type of anger.

Sadism. Individuals who use violent and demeaning behaviour in their offences as a means to increase their sexual arousal are categorized into the third typological class, sadism. Previous researchers (Alison, Bennell, Mokros, & Ormerod, 2002; Bennell et al., 2013; Dietz, Hazelwood, & Warren, 1990; Mokros & Alison, 2002; Proulx, Blais, & Beauregard, 2005; Ressler & Shachtman, 1992; Warren, Hazelwood, & Dietz, 1996) have identified a number of crime scene behaviours relevant to sadism, such as torture, binding victims blindfolded or gagged, kidnapping, humiliation, torture, asphyxiation as primary means of death, trophies collected, foreign object penetration, use of a rape kit, and postmortem sexual acts or mutilation. Unlike power or anger, sadism existed as a meaningful sexual-offence construct prior to its inclusion in Groth and Birnbaum’s (1979) typology. Sadism is most often defined as a paraphilia in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM; American Psychiatric Association [APA], 2013). Specifically, it is defined as Sexual sadism disorder and characterized by “recurrent and intense sexual arousal from the physical or psychological suffering of another person, as manifested by fantasies, urges, or behaviors” (APA, 2013, p. 695). Prevalence rates in the correctional population vary due to documented issues of diagnostic reliability (Yates, Huck, & Kingston, 2008). The DSM 5 reported that at least 10% of all sexual offenders are likely to

have reported symptoms that meet criteria for sadism, with estimates climbing to 37-75% in the subpopulation of individuals who committed sexually-motivated homicide (APA, 2013).

However, researchers typically report frequencies of sadism at around 5-10% (e.g., Abel, Becker, Cunningham-Rathner, Mittelman, & Rouleau, 1988).

Impact of Groth and colleagues' typology. The power, anger, and sadism typology has been influential in many subsequent classification systems of sexual offenders. Hazelwood (1987) adopted the subdivided power and anger model, adding a new category of “opportunistic” to describe individuals whose sexual assault was incidental and was committed during the act of another crime (e.g., robbery, home invasion). Canter and Heritage (1990) developed a more statistically driven typology influenced by power, anger, and sadism. Using MDS analyses, they evaluated five behavioural themes of offence behaviours: intimacy, sexuality, violence, impersonal, and criminality. Intimacy and sexuality include behaviours reminiscent of the power category. Intimacy is characterized by behaviours such as complimenting or asking questions of the victim; sexuality is characterized by performing or receiving oral sex. Violence includes behaviours that could be present in both anger and sadism (e.g., physical or verbal violence). Criminality includes several behaviours that directly relate to sadism (e.g., binding and gagging) if they were motivated by sexual arousal rather than control. Indeed, an enduring issue with BCSA is that behaviour may be produced by distinct motivations. To better characterize motivation, Canter and colleagues (Canter, Bennell, Alison, & Reddy, 2003) expanded upon Groth and Birnbaum's (1979) classification system, arguing that offenders can also be classified based upon the severity and quality of harm to the victim. Their work produced four thematic styles: hostility, control, theft, and involvement. In a previous version of the model (Canter et al., as cited in Santtila, Junkkila, & Sandnabba, 2005), the theft type was incorporated within the

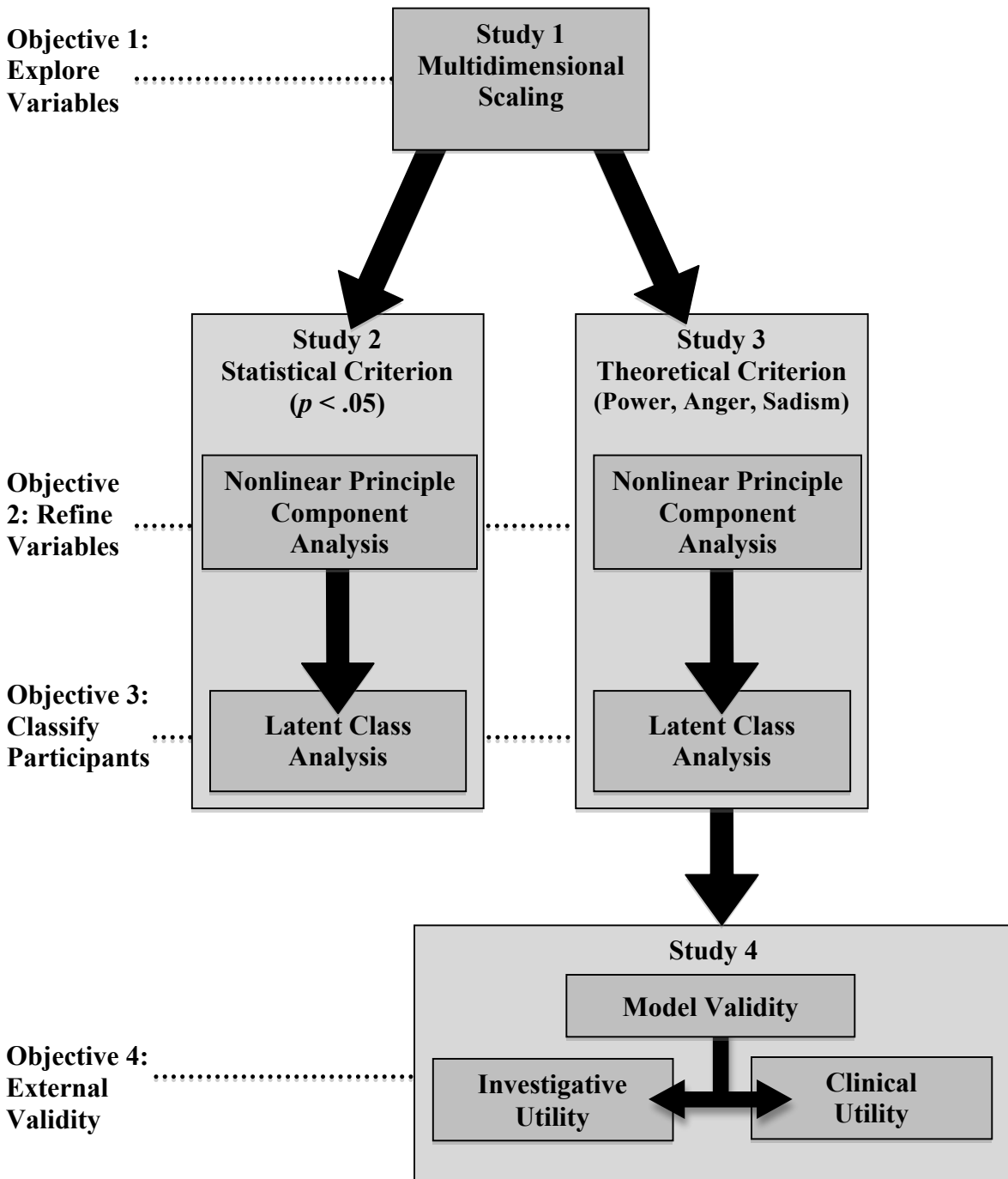
control theme. This combination of control and theft is consistent with power offences characterized by theft from the victim and threatening the victim verbally or with weapons to achieve control.

The power, anger, and sadism framework has also influenced clinical practice through treatment driven typologies. An alternative to the investigative-driven typology was produced by Canter and colleagues is the Massachusetts Treatment Centre Rape Classification System (MTC, Knight & Prentky, 1990). Currently in its 3rd version, it is used to aid in the assessment and treatment of sexual offenders. Throughout the various iterations of this typology, four themes have been present: degree of violence in the offence, presence of antisocial traits in the offenders, the presence of sexual motivation, and sadism (Polaschek, 2003). Of the 9 types in the MTC:R3, Type 3, pervasively angry, and Types 4 and 5, sadistic, directly relate to the categories Anger and Sadism respectively (Knight & Prentky, 1990). Whilst other typologies exist, both related and unrelated to Groth and Birnbaum's (1979) framework, Canter's behavioural thematic model and the MTC:R3 are quite influential in their respective fields (Brown & Forth, 1997; Marshall & Kennedy, 2003; Salfati, 2003; Salfati & Canter, 1999). Moreover, in Goodwill, Alison, and Beech's (2009) comparative study of behavioural models in BCSA, the authors found the models that performed best (e.g., predicting an offender's previous convictions) were all based on Groth and Birnbaum's framework. Therefore, the typology of power, anger, and sadism was adopted in the current study as the theoretical framework to evaluate behavioural models of sexual violence.

CHAPTER TWO: RESEARCH DESIGN AND IMPLEMENTATION

There is a paucity of research specifically investigating which crime scene behaviours are both necessary and sufficient to model sexual violence. The purpose of this thesis was to explore multivariate methods for constructing BCSA models that directly inform the investigation of sexual offenders, as well as the assessment and treatment of those offenders. Four research objectives, as outlined graphically in Figure 1, were explored across four studies on BCSA data of serial sexual offences committed by strangers. In Study 1, patterns in sexual offences were *explored* using MDS analysis. In Study 2, a statistical criterion (i.e., $p < .05$) was used to refine statistical models of sexual violence. First, NPCA was used to *refine variables* into themes and the LCA was used with the remaining variables to *classify participants*. The statistical criterion approach was contrasted in Study 3; a behavioural model was constructed by selecting variables consistent with Groth and Birnbaum's (1979) categories of power, anger, and sadism. NPCA and LCA were used in Study 3 to evaluate whether a theoretical criterion method for variable refinement produced a model that was a good fit for the data. To further evaluate the theoretical model, *model validity* and *practical utility* were evaluated in Study 4 by predicting participants' background characteristics. The impact of this investigation was to underscore the importance of evaluating data by identifying superfluous variables that do not contribute towards an understanding of sexual violence. This approach will begin a body of research for future researchers to reference in developing a tool for BCSA that will validly identify these behavioural typologies in sexual offences.

Figure 1. Research Outline



Definition of Sexual Offences

Sexual offences were defined according to Canadian standards. In Canada, sexual offences are divided by the *Criminal Code* (1985) based on crime scene behaviours: (1) Sexual Assault level 1 (s. 271), which involves assault, is defined in section 265 as a touching of a sexual nature, without the consent of the complainant, and which violates the sexual integrity of the victim; (2) Sexual Assault level 2 (s. 272), whereby the offender (a) carries, uses, or threatens to use a weapon, (b) threatens to cause bodily harm to a person other than the victim, (c) causes bodily harm to the victim, or (d) is a party to the offence with any other individual; and (3) Aggravated Sexual Assault (level 3, s. 273) where an individual assaults, wounds, maims, disfigures, or endangers the life of another. Stranger sexual offences are defined as the offender first coming into contact with the victim less than 24 hours prior to the offence (Corovic et al., 2012).

Participants

Data for the present study was extracted from a larger database on serial sexual offences collected by Eric Beauregard. Participants were individuals incarcerated in a Correctional Service of Canada penitentiary (an institution where inmates serve a sentence of two years or more) located in the province of Québec. Inclusion criteria were that participants had committed two or more sexual offences, at least one victim was a woman, and the victim was a stranger. Beauregard constructed a semi-structured interview to collect behavioural information about participants' offences. Interviews were conducted in either French or English and ranged from 2 to 12 hours, depending upon the number of offences committed. Also, participants provided consent for researchers to access their correctional files. The content of these files varied depending on the offender but reliably included in the original police reports from their offences

as well as psychological reports conducted during the penitentiary intake. Although this sample is part of a larger database that has been utilized in a number of publications to date (e.g., Beauregard, Proulx, Rossmo, Leclerc, & Allaire, 2007; Beauregard, Rossmo & Proulx, 2007; Oziel, Goodwill, & Beauregard, 2014), subsets of variables used in the present study differ from previous research.

Selecting Crime Scene Behaviour Variables

Beauregard's interview included questions about 77 crime scene behaviours. The main focus of the larger study was to analyze patterns between crime scene behaviours and geographical location. Upon review, 41 variables were specific to modeling geographical patterns (e.g., *victim release site, description of the vehicle used in the offence*). For the purposes of the current study to model offence behaviours more generally (i.e., not specifically geographic patterns), these variables were removed, leaving 36 usable behavioural variables. Serial offences were then collapsed and recoded, as the unit of measure was the individual committing the offences and not the offences themselves. The new variables indicated whether participants ever engaged in specific behaviours regardless of frequency. This approach provided an inclusive measure of the participants' behavioural repertoire. Please see Appendix A for the variable pool and Beauregard's coding guide for the 36 variables; all variables were measured dichotomously based upon their presence in a participant's given case file.

CHAPTER THREE: DEMOGRAPHIC INFORMATION

Data for this current study were obtained from a database in which participants had been recruited between 1995 and 2004 from multiple correctional sites of varying security levels in the Canadian province of Québec. Amongst the thousands of sex offenders incarcerated during this period, only 59 individuals met the inclusion criteria and also agreed to participate in this research. The sample size was still relatively small despite the fact the database represents over a decade of province-wide data collection. The ages of participants at the time of the offences ranged from 18 to 55 years ($M=30.73$, $SD=9.40$). The first language for a majority of the participants was French ($N=52$, 88.14%). Participants offended against a total of 277 females, with the number of female victims per offender ranging between 1 and 37 ($M=4.69$, $SD=6.25$). Victims ranged in age from 4 to 68 years old, with approximately half being 18 years or older ($N=148$). Seven participants also offended against male victims, with one participant offending against eight male victims. However, the offences against male victims were not included in the present analyses. See Table 1 for further demographic information.

Table 1: Sample Demographic Information

	Mean (Standard Deviation)	Frequency (Percentage)
Participants (N=59)		
Age at Time Offence in years (N=56)	29.95 (8.82)	
Marital Status		Partnered 26 (44.10) Single 23 (39.00) Married 5 (8.50) Divorced 3 (5.10) Separated 1 (1.70) Widow 1 (1.70)
Sexual Orientation		Heterosexual 55 (93.20) Homosexual 2 (3.40) Bisexual 2 (3.40)
Offender Employed		Yes 36 (61.00)
Number of Female Victims	4.69 (6.24)	
Number of Male Victims	0.33 (1.21)	
Victims (N=277)		
Age in years	20 (9.27)	
Race		White 271 (87.80) Black 3 (1.10) Asian 1 (0.40) Other 2 (0.70)

CHAPTER FOUR: INITIAL EXAMINATION OF UNDERLYING BEHAVIOURAL PATTERNS

Approximately one third of previous BCSA research on sexual offences uses some form of MDS analysis to analyze crime scene behaviours, formulate predictions about offender characteristics, and/or classify offenders and offences (Brankley et al., 2014b). However, the primary function of MDS is to explore the underlying associations between data by producing a visual representation of similarities between variables. Variables are assigned a location in *N*-dimensional space, with closer objects indicating stronger relationships (Borg & Shye, 1995). Variables that are further away are considered to be more unique. This approach is useful for BCSA researchers looking for patterns in behaviour. However, as this is an exploratory, dimensional method, an individual in a data set may have engaged in all, some, or none of the behaviours. In other words, MDS is unable to provide a means to make a categorical distinction between groups of offenders. Despite this fact, researchers have sometimes used it as the basis for classifying offenders (e.g., Salfati & Dupont, 2006; Salfati & Park, 2007). The purpose of Study 1 was to explore any underlying patterns in sexual and violent behaviours.

Analyses for Study 1

In SPSS (IBM Corp., 2011) MDS is computed based on an association matrix. If the focus of the study is on similarities (as compared to differences) between variables, one must select the MDS PROXSCAL function (Busing, Commandeur, & Heiser, 1997; Commandeur & Heiser, 1993) as the MDS ALSCAL feature (Takane, Young, & de Leeuw, 1977) is based on a *dissimilarity* matrix and will thus lead to erroneous findings (Goodwill, Alison, & Humann, 2009; Sturidsson et al., 2006). While various measures of association have been used in previous BCSA research, e.g., the Bray-Curtis coefficient (Bennell et al., 2013; Santtila, Korpela, &

Häkkinen, 2004), the Jaccard's measure is the most common one in BCSA research (Lehmann et al., 2013). The Jaccard's measure (also known as Jaccard's Index or similarity coefficient) was developed by Paul Jaccard (1901) to measure similarity and diversity in samples. The coefficients range from 0 to 1 and are calculated by the number of instances in which two behaviours co-occur divided by the number of cases as a proportion of the occasions when at least one of the behaviours was enacted. This formula is symbolized as follows: $(a/[a + b + c])$. This approach was used to transform the dichotomous data into a similarity coefficient matrix that was entered into an ordinal (non-metric) MDS analysis.

The number of dimensions in an MDS solution is decided by investigating the scree plot. A heuristic for selecting potential dimensions is to enter one less than the number of variables in the analysis. Interpreting the plot occurs in an opposite manner to an FA or NPCA scree plot. Put simply, increased stress relates to poor model fit. The best model is equal to the solution with the fewest number of dimensions that does not significantly increase stress (Borg & Groenen, 2005). Stress significantly reduces after four or more dimensions, with little benefit from including further dimensions. However, to simplify interpretations, previous BCSA researchers have commonly selected two-dimensional models. So, instead of referring to the scree plot to select the number of dimensions for the analysis (Borg & Groenen, 2005), a two-dimension solution was selected for ease of interpretation.

Model fit for an MDS model is often evaluated by multiple measures of stress, most notably Dispersion Accounted For (DAF) and Tucker's congruence coefficient c (Borg & Groenen, 2005). DAF measures the variance accounted for by the MDS model. This is calculated by the proportion of the sum of squared disparities accounted for by the distances in the MDS plot (Borg, Groenen, & Mair, 2013). Tucker's congruence coefficient c is the square root of the

DAF and can be interpreted similarly to a *Pearson* correlation coefficient between sets of distances. Both were used to evaluate model fit in Study 1.

Results for Study 1

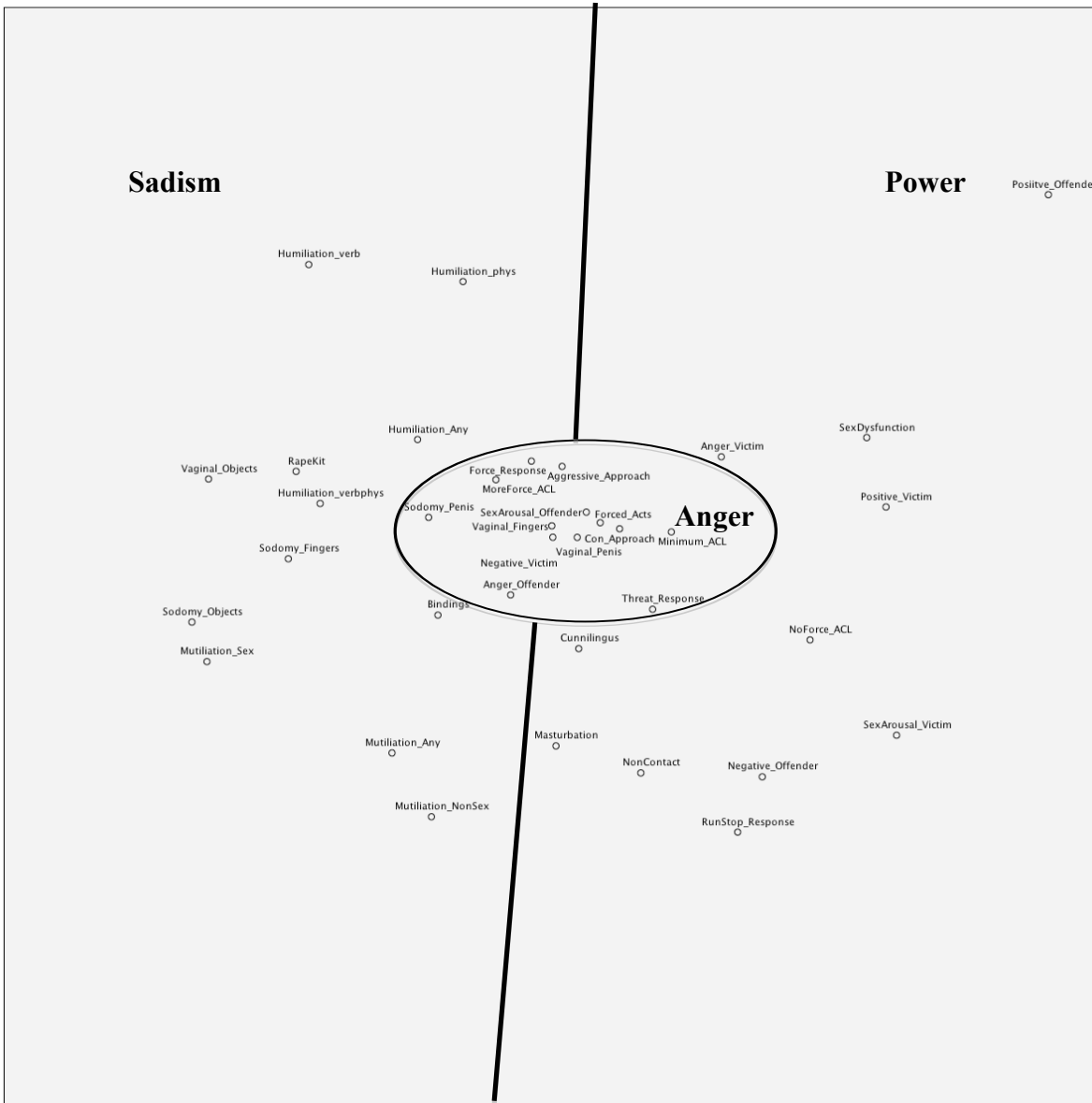
An association matrix of the 36 crime scene behaviour variables was computed on the basis of Jaccard's measure of association. As noted previously, stress levels closer to 0 indicate good model fit. Stress for dimension 1 and 2 were relatively low (i.e., Stress-I = .16 and Stress-II = .33) and are therefore in acceptable ranges. The current MDS model is a superior fit for the data, with DAF and Tucker's $c > .97$.

Interpretation of MDS plots is typically subjective and influenced by the theoretical framework driving the researcher's hypotheses. Examining patterns of sexual violence that were potentially related to power, anger, and sadism drove the interpretation of this MDS, and all three constructs related to patterns in the output (see Figure 2). A circle drawn around the middle of the plot encompassed 13 variables. Variables in the center of the MDS output did not distinguish between any themes and could be interpreted as essential to the overall construct being studied: in this case, sexual violence. These variables measured both the construct of "sexuality" (e.g., *Vaginal Intercourse, Penis or Vaginal Intercourse, Fingers*) and "violence" (e.g., *Approach, Aggressive; Level Of Force, More Force than Necessary*). The presence of multiple variables related to violence and the affect variable *Offender, Anger* resonated with Groth and Birnbaum's (1979) anger construct. The remaining 23 variables were scattered evenly around the four quadrants of the graph, suggesting distinct behavioural themes. Behaviours spread in the left quadrants were highly related to a theme of sadism. The top left quadrant contained all of the *Humiliation* variables (i.e., *any, verbal, physical, and verbal and physical*), whereas the lower left quadrant contained all of the mutilation variables (i.e., *any, sexual, and nonsexual*).

Impersonal deviant sexual behaviours (e.g., *Vaginal intercourse, Objects; Sodomy, Objects; Sodomy, Fingers; Rape Kit; Bindings*) were located in the middle of the graph. The right quadrants were characterized by elements of Groth and Birnbaum's power construct, including affect (e.g., *Victim, Positive; Victim, Sexual Arousal; and Offender, Negative*), sexual behaviours (e.g., *Masturbation, Non-contact, Cunnilingus*), *Sexual Dysfunction*, and *Level Of Force, None*.

Interpreting the two halves of the plot provided a basis to label the dimensions of the plot. The x-axis arguably moved from higher sexual deviance (on the left hand side of the plot, sadism theme) to lower sexual deviance (on the right hand side, power theme). The y-axis arguably distinguished higher engagement on the bottom (e.g., *Mutilation, Masturbation*) from lower engagement at the top (e.g., *Sexual Dysfunction*). However, the y-axis was more problematic than the x-axis, as the lower half of the plot included *Non-contact* and *Response, Stops/Run Away*, which would likely be categorized as low engagement behaviours.

Figure 2: PROXSCAL Plot of all Crime Scene Behaviour Variables



Discussion for Study 1

MDS provides an appropriate type of analysis to begin processing behavioural data for BCSA. Before evaluating which variables are essential for modeling patterns of sexual violence, it first had to be determined whether any initial associations existed. Properly utilized, MDS provided for this initial conclusion. In Study 1, focusing on model fit criteria, a two-dimensional model accounted for almost all of the dispersion between variables. The 13 variables in the

center of the MDS scatterplot evidenced potential core elements in the offending behaviour of the participants. Indeed, non-deviant sexual behaviours and extreme violence were core elements in the output. Moreover, these elements were strongly related to Groth and Birnbaum's (1979) construct of anger. One potential interpretation of this finding is that anger, interpreted dimensionally, represents the core feature of sexual violence. This interpretation is consistent with Groth and Birnbaum's (1979) assertion that sexual assaults are "always first and foremost an aggressive act" (p. 13). On the other hand, variables further from this center cluster represent unique patterns of behaviour. The distinction between variables, using the x-axis, strongly indicates separate patterns of sadism (i.e., sexualized violence through humiliation and mutilation) and power (i.e., viewing the offence as a pseudo intimate act). Interestingly, the variable clusters provided strong evidence of themes of power, anger, and sadism despite there being no prior hypothesis or variable selection to focus the selection of variables. These unexpected findings lend support for the importance of power, anger, and sadism in understanding serial, sexual offences.

Due to the exploratory nature of MDS, there were several limitations in Study 1. The lines drawn on Figure 2 represent the subjective interpretations of the author, rather than empirically-based distinctions in the data. For instance, the behavioural variable *Bindings*, which is theoretically linked to sadism, existed in the half of the plot with other variables associated with sadism and was, therefore, included in that section. However, if the criterion for grouping was a sheer measure of distance, the closest variables to it were those in the middle of the plot. This was true for several other variables, such as *Cunnilingus*, *Response*, *Threat*, and *Sodomy*, *Penis*. In summary, the demarcations between behavioural patterns in Study 1 were subjective. Further, these borders were theoretically ambiguous as it was not objectively clear if the imposed

borders represented distinct objective phenomena. These limitations were addressed to some extent in Study 2 by using NPCA, which provided a more fine-grained analysis of model fit and variable contribution.

CHAPTER FIVE: DATA REFINING BASED UPON STATISTICAL CRITERIA

It was expected that the results from Study 1 could be used as evidence to support further investigation of behavioural patterns in sexual offences committed by serial, stranger offenders. It was unclear how distinct these patterns were from each other and what behaviours necessarily comprised them. The purpose of Study 2 was to compare and contrast various alternatives to MDS where statistical criteria could be used to evaluate model fit and eliminate variables that did not contribute to explaining variations in the data. First, NPCA was used to refine variables (i.e., Research Objective 2, Figure 1) by evaluating their contribution to model fit. Then, LCA was used to classify participants into sub-groups based upon behavioural patterns (i.e., Research Objective 3, Figure 1). Both sets of models were assessed for consistency with theories of sexual offending.

Analysis for Study 2

Variable refinement.

In order to better understand the latent variables that explain the relation between the manifest behaviours, NPCA was conducted in the optimal scaling section of SPSS (IBM Corp., 2011). Preliminary analyses included removing case outliers that were likely to skew model fit and distort behavioural patterns in the remaining participants. To detect outliers, the object plot was examined. The object plot displays component scores in the principal component space. Component scores are standard scores, and those exceeding $|3.5|$ are recommended for removal (Linting & van der Kooij, 2012). In NPCA, the number of components selected may affect their eigenvalues as the process of optimal scaling maximizes the eigenvalues of the requested number of components. Therefore, several models were fitted with different numbers of components. Model fit parameters were examined at each step. VAF is the most important indication of fit for

model and variable selection and, therefore, VAF was used as the main criterion for evaluation (Linting & van der Kooij, 2012).

Components were selected through examining a significant decline in VAF. After the number of components was selected, the variable VAF was evaluated. Comrey (1973) established the following standards for variable VAF: 10% is poor, 20% is fair, 30% is good, 40% is very good, and 50% is excellent. Linting and van der Kooij (2012) recommended a VAF total cut off of .25. Variables below that cut off were removed. This process of component and variable selection was repeated until all variables had a VAF of greater than 25%. As with principle component analysis, an orthogonal rotation of the component solution can maximize the sum of the variances of the squared variable loadings. Stevens (2002) suggested a cut-off of 0.40 for component loadings to maximize interpretation and thus only variables with a loading of $|0.40|$ were used to interpret the components.

Participant classification.

LCA models were run using Latent Gold® 4.0 software (Vermunt & Magidson, 2005) to evaluate whether participants could be clustered into groups based upon their crime scene behaviours. Latent Gold provides several parameters of model fit from which to select the optimal number of clusters. One of the most frequently used is the Bayesian Information Criterion (*BIC*); this statistic weighs model fit and parsimony by adjusting the likelihood estimation to account for the number of parameters in the model (Vermunt & Magidson, 2005). The lower the value, the better the model. Model chi-square (L^2) represents the amount of relationship between the variables that remains unexplained by the model. Therefore, if the L^2 exceeds the critical cut-off value (often $p = .05$) then the LCA model fails to conclude that the model fits the data. Class error and entropy statistics provide information to assess how well the

models classify the cases into clusters. Classification error is based on the modal assignment of participants to clusters; this statistic indicates the proportion of cases that are misclassified (Vermunt & Magidson, 2005). Entropy R^2 coefficients range from 0 to 1 with values closer to 1 indicating increased class separations and homogeneity. Behavioural variables were then examined through the parameters output box, which provided parameter estimates (betas) and measures of significance (p value, R^2 , and the Wald statistic). The Wald statistic tests the hypothesis that the parameter estimates in that set equals zero. Larger Wald Statistics values indicate increased separation between parameter estimates. In Study 2, variables whose p value exceeded .05 were removed.

Results for Study 2

Nonlinear Principal Component Model

Preliminary analyses revealed that only one case met the criterion for removal, at a score of +4.50. The case outlier was removed, leaving the number of cases for analyses at 58. Also, as this participant was the only individual to engage in *Sodomy, Object*, that variable was removed from the variable pool. Models with 2 to 6 components were analyzed. In all 5 models, the first and second components accounted for a significant portion of the variance, therefore the decision was whether to add a third or fourth component. Components 3 and 4 each had an eigenvalue \approx 2. However, component 3's VAF accounted for 8.16%, whereas component 4's VAF accounted for \approx 6%, similar to component 5. Therefore a three-component solution was maintained. The first component had an eigenvalue of 4.85 (VAF% 13.97; Cronbach's $\alpha = .82$), the second component had an eigenvalue of 3.18 (VAF% 9.08; Cronbach's $\alpha = .71$), and the third component had an eigenvalue of 2.86 (VAF% 8.16; Cronbach's $\alpha = .67$).

An evaluation of the VAF contribution of each variable was completed through a summing of the vector coordinates. Eleven (30.56%) of the variables poorly contributed to the overall model; five (13.89%) were fair contributors, nine (25.00%) were good, five (13.89%) were very good, and six (16.67%) were excellent. Linting and van der Kooij (2012) recommended a VAF total cut off of .25. Based upon those criteria, 18 variables were removed in the first round of variable refinement. Seventeen variables were entered into the second NPCA model. After removing these variables, the number of components was re-evaluated. An evaluation of 2 through 6 component models continued to reveal an observable drop-off in VAF and eigenvalues after three components. The first component had an eigenvalue of 3.71 (VAF% 21.82; Cronbach's $\alpha = .78$), the second component had an eigenvalue of 2.75 (VAF% 16.15; Cronbach's $\alpha = .68$), and the third component had an eigenvalue of 2.10 (VAF% 12.38; Cronbach's $\alpha = .56$). Investigation of item VAF revealed that no further refinement was required, with all items $> .29$.

Table 2: Study 2: Vector Coordinates for All Variables in a 3-Dimensional NPCA Model

Crime Scene Behaviours	Variance Accounted For			
	Components			Total
	1	2	3	
Final Variables				
Response, Physical Force	0.58	0.00	0.22	0.81
Mutilation, Non Sexual	0.05	0.63	0.06	0.74
Mutilation, Any	0.04	0.62	0.02	0.68
Level Of Force, None	0.58	0.05	0.00	0.63
Level Of Force, More Force than Necessary	0.32	0.15	0.10	0.56
Masturbation	0.22	0.27	0.06	0.55
Offender, Anger	0.10	0.12	0.29	0.51
Response, Threat	0.01	0.01	0.48	0.50
Vaginal intercourse, Penis	0.21	0.22	0.06	0.50
Offender, Sexual Arousal	0.09	0.08	0.32	0.49
Response, Stops/Run Away	0.30	0.02	0.13	0.45
Vaginal intercourse, Fingers	0.26	0.07	0.10	0.43
Non Contact	0.05	0.29	0.07	0.42
Offender, Negative	0.12	0.16	0.09	0.37
Approach, Aggressive	0.34	0.01	0.00	0.35
Approach, Confidence	0.22	0.03	0.05	0.30
Humiliation, Any	0.20	0.03	0.06	0.29
Variables Removed				
Level Of Force, Minimum Force	0.01	0.08	0.13	0.22
Humiliation, Verbal	0.21	0.00	0.00	0.21
Victim, Negative	0.18	0.03	0.00	0.20
Victim, Sexual Arousal	0.07	0.00	0.13	0.20
Bindings Used	0.10	0.10	0.01	0.20
Rape Kit	0.16	0.00	0.04	0.20
Humiliation, Physical	0.12	0.03	0.08	0.20
Victim, Positive	0.09	0.02	0.08	0.18
Sodomy, Fingers	0.15	0.00	0.03	0.18
Humiliation, Verb & Physical	0.17	0.00	0.01	0.18
Mutilation, Sexual	0.00	0.04	0.13	0.17
Sexual Dysfunction	0.00	0.12	0.03	0.16
Cunnilingus	0.01	0.00	0.15	0.16
Sodomy, penis	0.14	0.00	0.00	0.14
Forced Sexual Acts	0.00	0.03	0.09	0.12
Victim, Anger	0.03	0.05	0.03	0.10
Offender, Positive	0.07	0.01	0.02	0.10
Vaginal intercourse, Objects	0.05	0.02	0.00	0.07

To increase the interpretation of the three components, orthogonal (Varimax) rotations were applied. Item loadings greater than 0.40 are summarized in Table 3. Components 1 and 3 were characterized by physical violence (e.g., *Approach, Aggressive; Response, Physical Force*, and negative loadings for *Level of Force, None* and *Response, Stops/Run Away*) in the absence of sexual deviant items. However, Component 1 includes items of non-deviant sexual behaviour (e.g., *Vaginal Intercourse, Penis*) but Component 3 did not. *Offender, Sexual Arousal* negatively loaded on Component 3. Component 2 included many items relating to sadism and sexual deviance (e.g., *Mutilation, Any; Masturbation*). However a core feature of sadism, *Humiliation, Any*, loaded on Component 1 but not on Component 2.

Table 3: Study 2: Item Loadings for 3-Dimensional NPCA Model, Orthogonal Rotation Crime Scene Behaviours

	Dimension		
	Sexual Violence (1)	Sexual Deviance (2)	Violence (3)
Level Of Force, None	-0.68		
Vaginal intercourse, Fingers	0.66		
Vaginal Intercourse, Penis	0.65		
Response, Stops/Run Away	-0.58		
Approach, Confidence	-0.55		
Humiliation, Any	0.54		
Approach, Aggressive	0.50		
Mutilation, Non Sexual		0.83	
Mutilation, Any		0.81	
Masturbation		0.67	
Non Contact		0.58	
Offender, Negative		0.49	
Response, Physical Force	0.41		0.72
Offender, Anger			0.68
Response, Threat			-0.64
Level Of Force, More Force than Necessary	0.45		0.59
Offender, Sexual Arousal	0.41		-0.44

Note: Coefficients <.40 were suppressed

Latent Class Model

Table 4 displays results for the one to five class estimates. The 2-class solution ($BIC[LL] = 1009.15$) was the best model for the data, despite the fact that the model did not significantly account for the observed variance, $L^2(23) = 419.25$, $p < .001$. All models showed low class error (i.e., $< .01$) and high Entropy R^2 values (i.e., $> .93$).

Table 4: Study 2: Initial Fit Indices for Latent Classes

Model	$BIC(LL)$	$L^2(df)$	Class Error	Entropy R^2
1 Cluster	1057.46	540.65 (41)*	0.00	1.00
2 Cluster	1009.15	419.25 (23)*	0.00	0.99
3 Cluster	1014.93	351.95 (5)*	0.01	0.96
4 Cluster	1049.20	313.12 (-13)	0.01	0.97
5 Cluster	1097.22	288.06 (-31)	0.01	0.97

* $p < .001$

The contribution of individual items to the overall model were measured by their p values, R^2 values, and the Wald Statistic, as displayed in Table 5. Of note, 12 (70.59%) of the variables had a p value greater than .05, indicating that most variables did not reliably contribute towards participant classification. Also, variables ranged in effect size, with 10 (58.82%) having a small effect ($R^2 < .10$).

Table 5: Study 2: Variable Contribution To 2-Cluster Model Fit

Crime Scene Behaviours	Cluster Parameter Estimates		<i>p</i> -value	<i>R</i> ²	Wald
	1	2			
Final Variables					
Level Of Force, More Force than Necessary	-1.10	1.10	0.0048	0.59	7.96
Response, Physical Force	-0.89	0.89	0.00037	0.50	12.69
Offender, Anger	-0.76	0.76	0.011	0.24	6.54
Approach, Aggressive	-0.47	0.47	0.0045	0.19	8.08
Variables Removed, Second Round					
Vaginal intercourse, Penis	0.35	-0.34	0.061	0.09	3.51
Variables Removed, First round					
Level Of Force, None	1.33	-1.33	0.069	0.29	3.32
Response, Threat	1.31	-1.31	0.074	0.29	3.20
Vaginal intercourse, Fingers	-0.23	0.23	0.10	0.05	2.68
Offender Affect During, Negative	0.41	-0.41	0.14	0.04	2.20
Masturbation	1.26	-1.26	0.17	0.17	1.93
Approach, Confidence	0.21	-0.21	0.18	0.03	1.82
Mutilation, Any	0.35	-0.35	0.22	0.03	1.51
Offender Response - Stops/Run Away	1.23	-1.23	0.27	0.10	1.22
Humiliation, Any	-0.19	0.19	0.27	0.02	1.24
Non Sexual Mutilation	1.21	-1.21	0.38	0.07	0.79
Non Contact	0.12	-0.12	0.52	0.01	0.41
Offender, Sexual Arousal	-0.10	0.10	0.57	0.01	0.32

In the second round of analyses, goodness of fit indices for the 2-cluster solution were consistent, but the variable *Vaginal intercourse, Penis* no longer significantly contributed to model fit, $p = 0.061$. The variable was removed and 5 model estimates were again analyzed with 1-5 clusters. See Table 6 for fit indices. Models were characterized by only four crime scene behaviours, all of which related to non-sexualized aggression and violence. Models 2 through 4 showed low class error (i.e., $<.80$) and modest Entropy R^2 values (i.e., $>.76$). The 2-class solution had the lowest *BIC* value, $BIC(LL) = 296.92$, and yet was not a statistically good fit for the data, $L^2(6) = 10.62$, $p < .001$. In particular, using more force than necessary predicted 59% of the variance in the clustering. Inspection of the profile plot of the mean conditional posterior

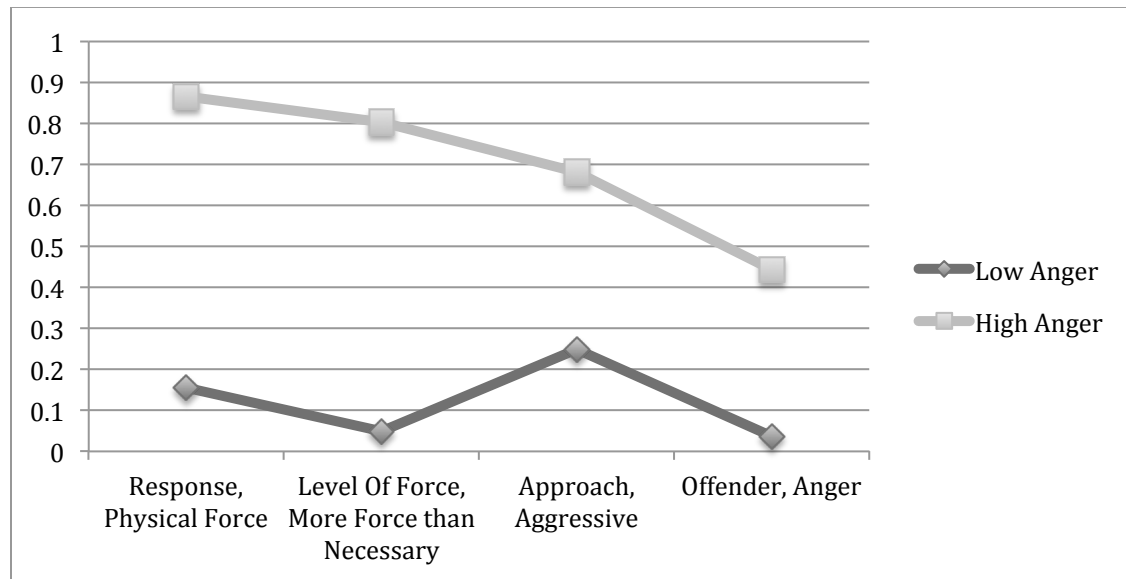
probabilities for categorizing participants into the two clusters (see Figure 4) revealed good between the clusters on all items.

Table 6: Study 2: Final Fit Indices for latent classes

Model	<i>BIC (LL)</i>	<i>L</i> ² (df)	Class Error	Entropy <i>R</i> ²
1 Cluster	315.99	49.99 (11)*	0	1
2 Cluster	296.92	10.62 (6)*	0.05	0.78
3 Cluster	314.00	7.40 (1)*	0.08	0.76
4 Cluster	330.00	3.10 (-4)	0.07	0.81
5 Cluster	349.08	1.88 (-9)	0.17	0.70

* *p* < .001

Figure 3: Study 2: LCA Profile Plot



Discussion for Study 2

The use of a standardized criterion (*p* < .05) facilitated a more objective data refinement procedure than did the subjective interpretation of the MDS plot in Study 1. Over half of the crime scene behaviours were not statistically useful in forming either the dimensional (NPCA) or categorical (LCA) models. In the dimensional analysis, theoretically useful variables were removed. Many variables related to sadism (*Mutilation, Sexual; Humiliation, Verb & Physical; Bindings; Rape Kit; and Humiliation, Verbal*) were removed, leaving only aggregate variables (e.g., *Humiliation, Any*) in the final model. Further, the variables relating to how the offender

viewed the victims' emotional responses were removed. This result poses problems to cognitive-behavioural models of sexual offending that include such variables (Marshall, Marshall, Serran, & O'Brien, 2009) to assist in treatment planning. These issues may explain difficulties in interpreting the final component loadings. Component 3 was characterized by violence in the absence of sexual behaviours and was, therefore, most easily interpretable as representing a dimension of violence (i.e., degree of force used in the offence). This component may be related to Groth and Birnbaum's (1979) anger type as this dimension also had high loadings of reported offender anger. Components 1 and 2 were not as easily interpreted as both included items relating to sexual behaviour and violence. Negative loadings of *Level Of Force*, *None*, *Approach*, *Confidence*, and *Response*, *Stops/Run Away*, alongside positive loadings of *Response*, *Physical Force*, *Level Of Force*, *More Force than Necessary*, and *Approach*, *Aggressive*, characterized a propensity to be forceful and aggressive in the crime – similar to Component 3. However, many sexual behaviours such as *Vaginal Intercourse*, *Fingers*, *Vaginal Intercourse*, *Penis*, and *Humiliation*, *Any* loaded highly on this component too, indicating that higher scores for participants on this component related to a propensity to sexualized violence. Variables similar to Component 1 characterized Component 2, but with a difference of emphasis. Whereas violence was more prominently represented in Component 1, most of the items in Component 2 were divided between *Mutilation (any and Non Sexual)*, sexual behaviours (*Masturbation* and *Non Contact*), and *Offender*, *Negative*. It may be the case that this item relates strongly to sexual deviance. However, failing to have items such as *Offender*, *Sexual Arousal* associated with this component, does not support this proposition. At best, the NPCA produced components that need to be investigated and replicated by future research. Aspects of the components did relate to constructs found elsewhere (e.g., anger sexual assault), however there were no strong theoretical

bases supporting the overall model. Whether this finding reveals a reliable pattern in sexual offending or it is simply an artifact of sample-specific variance remains a question to be evaluated in future research.

Participant classification using LCA further emphasized the number of statistically superfluous variables present in the models. All but four variables were eventually removed. The resulting model was composed of variables that strongly influenced the classification of participants (medium to large R^2). Both clusters were composed of items that were internally consistent. Cluster 2 was composed of individuals who were likely to engage in *Approach*, *Aggressive*, *Offender*, *Anger*, *Level Of Force*, *More Force than Necessary*, and *Response*, *Physical Force*. The opposite was true for participants categorized into Cluster 1. Participants in Cluster 2 exhibited many of the same behavioural characteristics that were found in Groth and Birnbaum's (1979) anger type. Also, it is possible that participants in Cluster 1 may have committed offences similar to the power type. There was simply not enough behavioural detail to make clear assertions.

One of the major limitations of the empirically-driven method for data reduction with LCA is that all of the variables related to sexual behaviour and affect were removed. Yet, these variables provide important details that are necessary to characterize sexual offences. While it is possible that the most important aspects of sexual assaults relate to the level of violence exhibited, it is unlikely that variations in sexual behaviour play no role. Many of the variables that were irrelevant in distinguishing participants in the sample might be statistically significant in a larger sample. This potentiality is acceptable given that the objective of Study 2 was to model how a BCSA could be completed using NPCA and LCA; the objective was not to claim that the final variables were necessarily indicative of more generalizable patterns. It may be that

the resulting four variables in the 2-class LCA model are the most important and most generalizable.

Comparing the results of Studies 1 and 2 reveals several differences in behavioural patterns. First, variables that appear to uniquely characterize quadrants in the MDS plot did not statistically contribute to similar models of dimensional themes in either behaviour or categorical models of offenders. For instance, the most unique MDS variable, *Offender, Positive*, was removed in both the NPCA and LCA. Moreover, themes of sadism and power were not reliably evident in the NPCA or LCA solutions, as they had been in the MDS plot in Study 1. This result may be due to the fact that variable selection was rather atheoretical. Overall, the MDS related poorly to the NPCA and LCA.

The results from Study 2 provide insight into the contribution of crime scene behaviours to BCSA models. As the variable pool in this study was developed from the most frequently used items in other BCSA studies, these findings raise doubt over the utility of previous BCSA models that did not explicitly engage in data reduction or selection. However, the explicitly empirically-driven method of data reduction employed in Studies 1 and 2 led to a different problem – that of difficult to interpret or atheoretical models. As many of the variables did not significantly contribute to the statistical fit of the model, it is questionable whether statistical fit is the only means through which model fit should be evaluated. BCSA research is still in the relatively early stages – balancing theoretical and empirical criteria for model fit may provide meaningful constructs to refine future research.

CHAPTER SIX: THEORY DRIVE DATA REFINEMENT

The resultant models from Study 2 were known to be atheoretical, and thus their contributions to understanding of sexual offences were ambiguous. An alternative methodology was then to augment the model from Study 2 with variables consistent with theories of sexual offending. As observed by Douglas and colleagues (Douglas et al, 1986; Douglas et al., 2006), BCSA begins with the investigator making decisions about what data to include. This approach is similar to early steps in scale construction, where researchers poll other experts in the field to collect a list of items to measure their desired construct (Netemeyer, Bearden, & Sharma, 2003). One of the most useful latent constructs in sexual offence research for police investigators and clinicians is offender motivation (Andrews & Bonta, 2010; Canter et al., 2003). Therefore, refining BCSA models with the intent to measure motivation was expected to facilitate its utility to both help in the investigation of unknown offenders and prevent reoffending.

As previously mentioned, Groth and Birnbaum's (1979) typology is a motivation-based framework that was built upon clinical interviews of offenders' crime scene behaviours. Moreover, the constructs of power, anger, and sadism were the basis of several more complex frameworks used currently by police investigators and clinical practitioners. Therefore, the Groth and Birnbaum's typology was deemed a suitable framework to test theory driven model refinement. To be clear, the purpose of this study was not to establish an authoritative BCSA model using the categories of power, anger, and sadism. Rather, the purpose of Study 3 was to evaluate the methodology of constructing a BCSA model using a mixture of statistical and theory criteria. As this research project was exploratory in nature, it was prudent to expect that some variables would not meet statistical criteria of significance (i.e., $p < .05$). This potentiality was acceptable for examining overall model fit. The result of this mixed methodological approach

was a form of data *selection* rather than data *reduction*. Therefore, potential goodness of model fit was a result of data supporting theoretical models of sexual offending behaviour. This macro-level goal provided a synthetic approach to model construction that was complementary to the analytic, reductive approach of Study 2.

Item Selection

The final 17-item set of the NPCA in Study 2 was adopted for the beginning of item selection due to its superior statistical properties. Eight additional items were removed to improve the ability to measure power, anger, and sadism. Specifically, the two approach variables (i.e., *Approach, Aggressive* and *Approach, Confidence*) were removed as Groth and Birnbaum (1979) had argued that individuals engaging in one type of offence, the example given was power, could engage in any of a blitz attack, a confidence approach, or a surprise attack. *Mutilation, Non Sexual* was removed, and *Mutilation, Any* was retained, as there was no known reason to argue that subtypes of mutilation would necessarily distinguish between power, anger, and sadism. All types of offender affect were removed for three reasons. First, all variables (except for *Offender, Anger*) were removed in Study 2 for statistical reasons. Second, previous research had indicated that individuals often have difficulty recalling and labeling intense emotions experienced during the commission of a sexual offence (Keltikangas-Järvinen, 1982; Kroner & Forth, 1995; Reid, Carpenter, Spackman, & Willes, 2008; Ward, Keenan, & Hudson, 2000). And third, from an investigative perspective, the identity, and therefore the internal cognitions, of the offender are unknown.

Response, Stops/Run Away was perceived as likely too ambiguous to discriminate between offenders' motivations as this response could be due to contextual cues. For example, offenders may stop or run away if they perceive the resistance as a rejection of their sexual

advances, or they may stop or run away if they are in a public environment and afraid of being caught. This variable was, therefore, removed. The last variable to be removed, *Vaginal intercourse, Penis* was removed because over 70% of participants engaged in this behaviour at some point during the offending history and it was not necessarily related to any particular type. For example, in a power offence, an offender may engage in *Vaginal intercourse, Penis* to mimic normal intimacy encounters; contrarily, in an anger offence, an offender may engage in the same behaviour without the motivation of sexual pleasure but, rather, with the motivation of forcing the victim into submission.

Six variables which were removed in Study 2 were added to the model in Study 3 for the following reasons. *Bindings, Rape Kit, Forced Sexual Acts*, and *Sodomy, Penis* were added as there was strong theoretical and empirical literature supporting their presence during sadistic offences (Dietz et al., 1990; Gray, Watt, Hassan, & MacCulloch, 2003; Neuwirth & Eher, 2003; Ressler & Shachtman, 1992; Richards & Jackson, 2011). The variable *Victim, Positive* was included to aid the model in measuring Groth and Birnbaum's (1979) concept of power offenders. Power offenders often view the victim as enjoying the intimacy and authority of the offender (Groth & Birnbaum, 1979). Moreover, *Cunnilingus* was included to improve the modeling of sexual intimacy that is characteristic of power offences. The resultant item pool for analyses was 15 variables.

Analyses for Study 3

The same data analyses methods utilized in Study 2 were used in Study 3. The distinction between the two studies was in *how* the analyses were used. In Study 2, the statistical analyses were used to evaluate and improve model fit by pruning superfluous variables that did not contribute to model fit. In Study 3, the statistical analyses were used to evaluate whether theory

driven data selection rendered a viable statistical model. The NPCA was used to evaluate whether latent dimensional variables coincided with Groth and Birnbaum's (1979) framework. Similarly, LCA was used to investigate potential categories of power, anger, and sadism. No variables were to be removed on statistical grounds.

Results for Study 3

Nonlinear Principal Component Model

To evaluate whether the 3-component solution (i.e., power, anger, and sadism) was statistically viable, a series of models with 2 to 6 components was computed for comparison. As anticipated, eigenvalues and VAF decreased markedly after three components, indicating that a three-model solution was optimal. The first component had an eigenvalue of 2.94 (VAF% 19.63; Cronbach's $\alpha = .71$), the second component had an eigenvalue of 2.29 (VAF% 15.29; Cronbach's $\alpha = .60$), and the third component had an eigenvalue of 1.54 (VAF% 10.28; Cronbach's $\alpha = .38$). VAF for the 15 items are displayed in Table 7. Overall, the items contributed strongly towards the overall model fit, with only three variables falling slightly short of the recommended .25 cut off.

Table 7: Study 3: Vector Coordinates for Variables in the 3-Dimensional NPCA Model
Crime Scene Behaviours

	Variance Accounted For			Total
	1	2	3	
Rape Kit	0.17	0.05	0.04	0.25
Level Of Force, More Force than Necessary	0.55	0.01	0.10	0.66
Sodomy, penis	0.16	0.03	0.00	0.19
Humiliation, Any	0.36	0.07	0.02	0.45
Mutilation, Any	0.05	0.31	0.07	0.42
Bindings Used	0.17	0.14	0.01	0.32
Response, Physical Force	0.49	0.21	0.10	0.79
Vaginal intercourse, Fingers	0.24	0.07	0.01	0.31
Response, Threat	0.02	0.22	0.51	0.74
Victim, Positive	0.10	0.07	0.07	0.23
Level Of Force, None	0.59	0.03	0.04	0.66
Cunnilingus	0.01	0.17	0.01	0.19
Masturbation	0.03	0.59	0.10	0.73
Non Contact	0.02	0.10	0.43	0.54
Forced Sexual Acts	0.00	0.24	0.06	0.30
Active Total	2.94	2.29	1.54	6.78
% of Variance	19.63	15.29	10.28	45.20

Orthogonal rotation produced variable loadings consistent with only some of the previous research on Groth and Birnbaum's (1979) typology (see Table 8). The first component was consistent with the theoretical category of sadism. It was characterized by distinctive sadistic behaviours (e.g., *Humiliation, Any; Bindings; Sodomy, Penis, Rape Kit*, and negative loading of *Victim, Positive*) as well as high degrees of violence (e.g., *Level Of Force, More Force than Necessary*). However, the other two components were not consistent with the concepts of power and anger. Component 2 was characterized by no force used in the crime and by a high likelihood of using threats as a response to resistance. Component 3 was characterized by engaging in multiple sexual and violent behaviours (e.g., *Masturbation, Non Contact*, and *Forced Sexual Acts*). Several items loaded on to unanticipated components. For example, *Mutilation, Any* was anticipated to load on Component 1 (Sadism), which it did at 0.312, but it

loaded more strongly on Component 3 (Sexual Violence). *Cunnilingus* loaded on both Components 2 and 3.

Table 8: Study 3: Item Loadings for 3-Dimensional NPCA Model, Orthogonal Rotation

Crime Scene Behaviours	Dimensions		
	Sadism (1)	Threat (2)	Sexual Violence (3)
Humiliation, Any	0.67	-0.04	0.05
Level Of Force, None	-0.66	0.34	0.33
Vaginal intercourse, Fingers	0.55	-0.03	0.09
Bindings Used	0.53	0.06	0.19
Rape Kit	0.50	0.05	0.00
Victim, Positive	-0.45	-0.16	-0.00
Sodomy, penis	0.42	-0.10	0.08
Response, Threat	0.29	0.80	-0.10
Response, Physical Force	0.34	-0.79	-0.21
Level Of Force, More Force than Necessary	0.51	-0.63	0.07
Cunnilingus	0.12	0.35	0.23
Masturbation	0.04	0.27	0.81
Non Contact	-0.20	-0.22	0.67
Mutilation, Any	0.31	-0.00	0.58
Forced Sexual Acts	0.11	0.12	0.51

Note: Bolded coefficient indicates highest loading

Latent Class Model

LCA was conducted to evaluate whether cases could be clustered into the three dimensions of power, anger, and sadism based upon the selected 15 items. Table 9 displays results for the one to five class estimates. Models 2, 3, and 4 show low class error (i.e., <.10) and high Entropy R^2 values (i.e., >.93). The lowest *BIC* value was the 2-class solution ($BIC[LL] = 950.41$). However, the 3-class solution was selected in order to model the three classes of Groth and Birnbaum's (1979) typology.

Table 9: Study 3: Fit Indices for 1 to 5 Cluster Latent Class Models

Model	<i>BIC (LL)</i>	<i>L</i> ² (df)	Class Error	Entropy <i>R</i> ²
1 Cluster	968.74	443.06 (44)*	0	1
2 Cluster	950.41	359.49 (28) *	0.00	0.98
3 Cluster	960.12	303.96 (12)*	0.01	0.97
4 Cluster	997.89	276.49 (-4)	0.01	
5 Cluster	1042.60	255.96 (-20)	0.03	

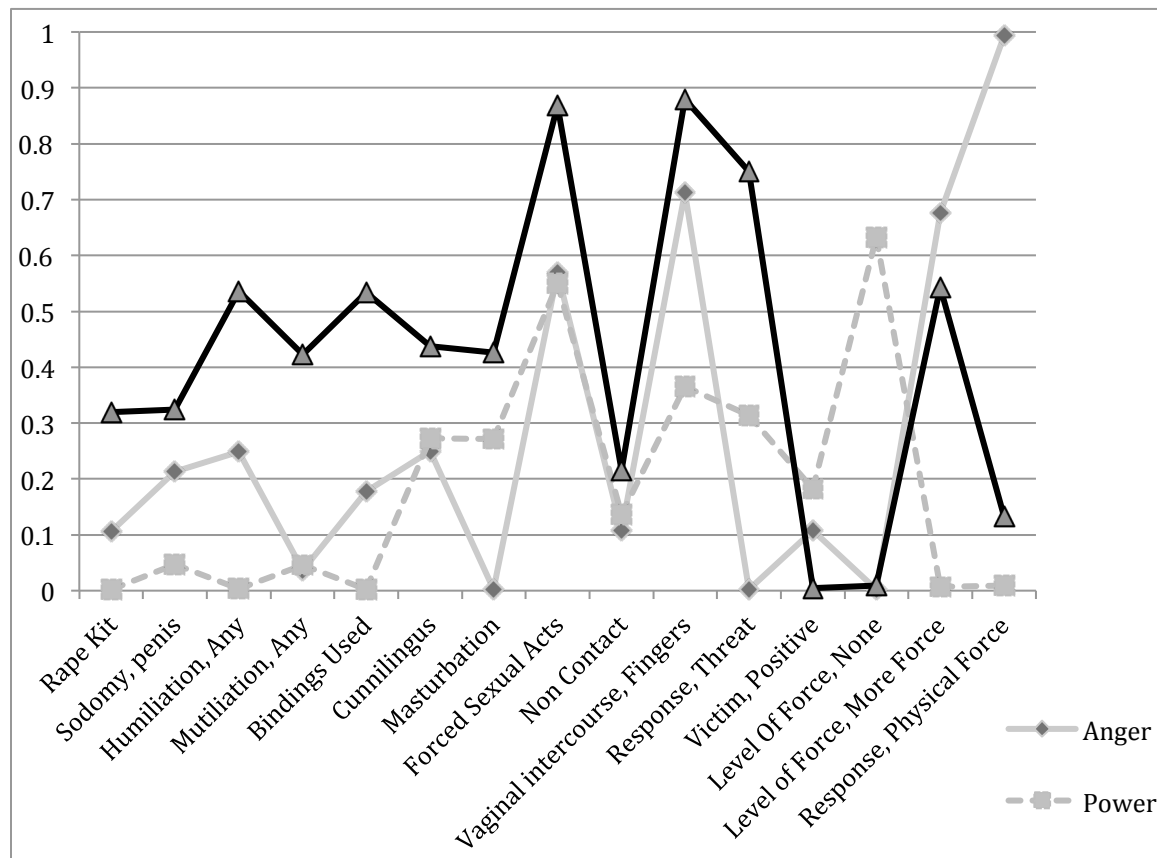
* $p < .001$

Table 10 displays the contribution of individual items to the overall model, as measured by their p values and R^2 values. Of note, 11 out of the 15 items had a p value greater than .05. Also, variables ranged in effect size from 0.01 to 0.90. The variables that most contributed to predicting variance in this model were related to violence (e.g., *Response, Physical Force; Response, Threat*). Many of the sexually deviant behaviours were not significant, however, marginal conditional probabilities for categorizing participants into the three clusters, displayed in Figure 3, revealed noticeable separation on both sets of variables. Consistent with Groth and Birnbaum's (1979) typology, Cluster 1 was typified by higher degrees of violence (e.g., *More force than necessary; Response, Physical Force*), which is typical for Anger offences. Cluster 2 was characterized by lower rates of extreme sexual violence (e.g., *Mutilation, Any*), moderate levels of Forced Sexual acts and other sexual behaviours (e.g., *Masturbation, Cunnilingus*), and high probabilities of *Victim, Positive*, and *Level Of Force, None*. These probabilities are most indicative of Power offences. Last, Cluster 3 was associated with Sadistic type behaviours - higher degrees of sexual violence and deviance (e.g., *Sodomy, Penis; Humiliation; Mutilation; Forced Sexual Acts*). Moreover, there was no probability in this cluster that participants reported *Victim, Positive*, and *Level Of Force, None*.

Table 10: Study 3: Variable Contribution To 3-Cluster Model Fit

Crime Scene Behaviours	Cluster Parameter Estimates			<i>p</i> -value	<i>R</i> ²	Wald
	1	2	3			
Response, Physical Force	2.75	-2.08	-0.67	0.01	0.9	8.81
Level Of Force, None	-1.28	1.93	-0.65	0.08	0.51	5.14
Level Of Force, More Force than Necessary	1.06	-1.84	0.78	0.09	0.40	4.76
Response, Threat	-2.01	0.54	1.48	0.03	0.39	6.77
Bindings Used	0.46	-1.76	1.30	0.07	0.22	5.44
Mutilation, Any	-0.53	-0.41	0.95	0.02	0.21	8.45
Humiliation, Any	0.53	-1.69	1.16	0.14	0.21	3.96
Masturbation	-1.86	0.76	1.10	0.31	0.20	2.35
Vaginal intercourse, Fingers	0.06	-0.67	0.60	0.01	0.16	8.50
Rape Kit	0.45	-1.59	1.14	0.25	0.12	2.81
Sodomy, penis	0.19	-0.66	0.47	0.17	0.07	3.50
Forced Sexual Acts	-0.25	-0.29	0.55	0.29	0.05	2.45
Victim, Positive	0.46	0.76	-1.22	0.58	0.03	1.08
Cunnilingus	-0.16	-0.10	0.26	0.55	0.02	1.19
Non Contact	-0.18	-0.05	0.23	0.71	0.01	0.67

Figure 4: Study 3: LCA Profile Plot



Discussion for Study 3

Results from Study 3 provide initial support for mixing theory and statistical criterion for selecting variables in BCSA. In the NPCA, the three-component solution accounted for 45.20% of the variance in the data. In the LCA, the three-class solution provided for excellent modal assignment to participant clusters, class separation and homogeneity within classes, and model fit. Almost 75% of the variables in the LCA model had a moderate to large effect size in separating participants into clusters. Moreover, the characteristics of the three-class solution were consistent with Groth and Birnbaum's (1979) model. Sadism was the smallest category, consistent with estimates in the sex offender population. However, it was characterized by excessive sexual deviance and violence: in particular, *Humiliation, Any, Mutilation, Any, Bindings, Sodomy, penis, and Forced Sexual Acts*. Conversely, participants in the power class had lower scores on the aforementioned items. Also, these power-motivated participants had higher scores on *Level Of Force, None* and *Victim, Positive*. The anger class showed less sexualized violence and deviance than the sadism group, but more general force and violence. A comparison of the three LCA models in Studies 2 and 3 indicates high construct agreement. Specifically, there is high agreement for separate clusters based upon the level of deviance and violence. The splitting of this category into anger and sadism in Study 3 does not diminish the overall trend in relationships. Moreover, many of the items that characterized sadism (e.g., *Rape Kit, Humiliation, Any, Mutilation, Any*) and power (e.g. *Level Of Force, None; Victim, Positive*) were also present in the MDS plot. Therefore, despite nuances in the variables used to construct these models, cross-method trends were still observable.

A reasonable criticism of Study 3 is about the use of theory to select variables that were removed as being statistical superfluous. One could argue that it is a circular process to select

variables according to a theoretical framework then use the same framework to evaluate the product of the analyses. The philosophical term for this criticism is *petitio principii*, i.e., an error in logic made when the conclusion sought is included in the premise of the argument. In the context of Study 3, this fallacy would mean that finding an LCA model that resembles power, anger, and sadism is trivial because power, anger, and sadism was the theory used to select the variables in the first place. However, this pattern of results is only trivial if there was already a general consensus that power, anger, and sadism were latent variables contributing to offence behaviours – which there is not. Not only are there several other theoretical frameworks that could be used to explain offence behaviours (e.g., organized/disorganized), some would argue that it may not be possible to infer characteristics of the offender from offence behaviours (Snook et al., 2008). This criticism confuses a theoretical model and a behavioural model. Finding a relation between the two in Study 3 provides evidence for researchers to use theory in constructing behavioural models of sexual offences. Ultimately, to determine the utility of such an inferential model the model must be assessed for its practical validity.

CHAPTER SEVEN: External Validity of the Theory-Driven Model

The purpose of Study 4 was to investigate the validity and utility of the theory-driven model produced in Study 3. If evidence could be found to support the theoretical consistency of the LCA model from Study 3, then it was expected that the model should be useful in predicting background characteristics that would be of use to police investigations or clinical practice. Practical applications for BCSA depend upon two central premises. First, it is assumed that individuals commit their offences in a behaviourally consistent fashion (Canter, 1995; Farrington, 1997). Second, it is assumed that these underlying behavioural patterns facilitate a greater understanding of the offence and the offender. Currently, there is more evidence for the first assumption (Craig & Patrick, 1994; Goodwill & Alison, 2005; Grubin, Kelly, & Brunson, 2001; Santtila et al., 2005), with some researchers even challenging the second assumption (Alison et al., 2002; Mokros & Allison, 2002; Snook et al., 2008). This dispute is largely due to inconsistent empirical support because some researchers found support for this relationship (Corovic et al., 2012; Davies, Wittebrod, & Jackson, 1997) while others did not (Mokros & Alison, 2002). As discussed earlier, inconsistency in the empirical literature may be due to inconsistent BCSA methodology. At a theoretical level, the second assumption is not dissimilar to the assumptions clinicians adopt when attempting to identify the criminogenic needs that motivated their clients to offend (Brankley & Goodwill, 2014). So, grounding BCSA in a theory-driven framework offered the possibility of producing a model that could reliably predict offender characteristics.

An examination of the behaviours comprising the three cluster LCA model in Study 3 provided good face validity with Groth and Birnbaum's (1979) categories of power, anger, and sadism. However, external evidence of the model validity was required before testing further the

model's predictive utility. Background characteristics of participants were examined first to see if they were associated with the core features of power, anger, or sadism. Participants in the power cluster were expected to have some evidence for desiring or perceiving the assault as a pseudo-intimate act. On the other hand, it was anticipated that participants in the anger cluster would demonstrate issues with anger and violence. Last, participants in the sadism cluster were expected to demonstrate increased sexual arousal to violence and humiliation. These features underlie the construct discussed by Groth and Birnbaum (1979) and so were expected to provide increased confidence that the clusters in the Study 3 LCA actually referred to power, anger, and sadism.

Measures

Criminal and Psychological History

As previously noted, information on the participants was collected from case files and an in-person interview. The case files included detailed psychological reports, in which scores on several clinical measures were given¹: the Millon Clinical Multiaxial Inventory (MCMI; Millon, 1983), the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1967), and Grasmick, Tittle, Bursik, and Arneklev's (1993) self control scale. The MCMI has 175 true-false questions based on the third edition of the DSM (1980), which produce 11 personality scales and nine clinical syndrome scales. Similarly, the MMPI has 567 true-false questions based on psychodynamic conceptions of psychopathology. The self-control scale has four factors: temper, impulsivity, simple tasks, risk seeking, physical activities, and self-centered.

¹ As the data was original collected from psychological reports, limited information was available on the statistical prosperities of the scales.

Phallometric Assessment

Many clinical files also included scores of participants' phallometric assessment to measure arousal to deviant sexual fantasies or behaviours. The participants had placed a small circumferential-type transducer, composed of a mercury-in-rubber strain gauge, on their penis. Electrical conductance fluctuations in the gauge, resulting from changes in penile circumference, was recorded with a Parks Electronic Model 240 plethysmograph using PrefTest 2000, a customized software (Limestone Technologies, Inc.). Each participant listened to a series of nine audiotaped scenarios in private. A semantic tracking task was used to inhibit the participants' ability to control penile responses (Harris, Rice, Chaplin, & Quinsey, 1999; Proulx, Côté, & Achille, 1993). Specifically, participants were asked to push a button with their right hand if the content of the stimulus was sexual and push a different button with their left hand if the content was violent. If the content was both sexual and violent, they were asked to push both buttons simultaneously.

The stimuli used for the participants were French translations of audiotaped recordings developed by Abel, Blanchard, Becker, and Djenderedjian (1978). These stimuli have been shown to differentiate sexual offenders from non-sexual, violent offenders (Proulx, Aubut, McKibben, & Côté, 1994). The audiotapes were categorized as (1) mutually consenting sexual relationship, (2) sexual assault with physical violence, (3) sexual assault with humiliation, (4) nonsexual physical aggression; and (5) lastly a nonsexual, nonaggressive control stimuli. In Study 4, phallometric data were used to calculate sexual assault indexes according to the method used by Abel and colleagues (1978). The rape index is a ratio of the penile response to rape stimuli as the numerator and the response to mutually consenting sex stimuli as the denominator.

Rape indexes were calculated for scenarios of rape with humiliation and rape with physical violence.

Analyses for Study 4

Output from the LCA 3-cluster model in Study 3 included a vector of class probabilities for each participant. The highest probability was selected to identify class membership for a specific individual, *a posteriori*. Using this method, there were 22 participants in the power group, 28 in the anger group, and nine in the sadism group. SPSS (IBM Corp., 2011) has a function called “Custom Tables” that is useful when desiring to compare a categorical variable on several outcome variables of different measurement levels. When comparing column means, Custom Tables will only provide a subscript to indicate mean values that differ at a predetermined significance level. Given the exploratory nature of this study, a liberal critical value of $p < .10$ was used to investigate a wider variety of potential relations between offence behaviours and background characteristics that could provide fruitful avenues for further research. For frequency data, the χ^2 statistics are summarized in a separate output table. The Custom Tables function was used to evaluate associations between the 3-cluster model and background characteristics in two stages. First, outcomes that were specifically related to the content of Groth and Birnbaum’s (1979) framework were entered to evaluate the validity of the 3-cluster model. To evaluate power, *belief that the victim consented to the offence* and the *Consenting Phallometric Index* were selected. To evaluate anger, *reporting a history of problems associated with anger in adulthood* and the *Temper* factor of Grasmick and colleagues’ (1993) self-control scale were selected. Lastly, the *Humiliation* and *Sexual Violence Phallometric Indices* were selected to measure sexual arousal to violence consistent with the category of sadism. In the second stage, the practical utility of the 3-cluster LCA model was evaluated

through predicting responses on the self-report clinical scales, phallometric data, and details of the participants' offending history and arrest. In the results section, these outcomes have been divided into findings that are more relevant to either investigative (e.g., subject prioritization, case linkage) purposes or to clinical purposes (e.g., risk assessment, treatment planning).

Results for Study 4

Model Validity

Table 11 summarizes evidence supporting the validity of the three-cluster model from Study 3. Over a quarter (N=6) of participants in the power cluster believed that their victims consented to the offence; significantly more than participants in any other cluster, $\chi^2(2) = 7.80, p < .05$. The second participant characteristic examined related to phallometric arousal to consenting sexual scenarios. Again, participants in this category had the strongest phallometric response to these scenarios ($M=1.08, SD=0.73$), especially in comparison to participants in the sadism category ($M=-0.22, SD=1.05$). Participants in the anger category had a history of anger problems, with 50% reporting adult problems associated with anger, $\chi^2(2) = 7.98, p < .05$. Moreover, these participants scored higher than all other participants on self-report measures of anger from Grasmick and colleagues' (1993) self-control scale. Example items from the temper scale are "I lose my temper easily" and "Often, when I'm angry at people I feel more like hurting them than talking to them about why I am angry". Last, when compared to the other participants, those in the sadism category had strong phallometric responses to sadistic scenarios. Specifically, the participants in the sadism category had stronger phallometric response to sexual acts involving humiliation ($M=0.61, SD=0.92$) and sexualized violence ($M=-0.08, SD=0.84$). The low base rate of sadism in the sample (N=9) is similar to the ratio consistent with that observed by

Groth and Birnbaum (1979) in their sample. These results provide initial support for adopting Groth and Birnbaum framework.

Table 11: Study 4: Custom Tables Results for Model Validity

Outcomes	Anger % Mean(SD)	Power % Mean(SD)	Sadism % Mean(SD)	χ^2 value
Power Related				
Believe Victim Consented	3.57	27.27	0	7.80**
Consenting Phallometric Index	0.44 (0.87) _{a,b}	1.08 (0.73) _a	-0.22 (1.05) _b	
Anger Related				
Adult History of Anger (Interview)	50	13.64	44.44	7.98**
Temper (Self control subscale)	2.95 (0.81) _a	2.02 (1.00) _b	2.44 (1.10) _{a,b}	6.077***
Sadism Related				
Humiliation Phallometric Index	-.11 (0.44) _a	.14 (0.64) _{a,b}	.61 (0.92) _b	
Sexual Violence Phallometric Index	-.53 (.32) _{a,b}	-.74 (.25) _a	-.08 (0.84) _b	

Values in the same row not sharing the same subscript are significantly different at $p < 0.10$.

* $p < .10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Investigative Utility

Table 12 summarizes a number of outcomes relevant to police investigations. Individuals committing power offences selected the youngest victims, $M=14.91$, $SD=8.93$, and were the most likely to be in a relationship, $\chi^2(2) = 8.31$, $p < .05$. These individuals tended to meet their victims through their occupation, for example as a high school coach or bartender (40.90%, $\chi^2(2) = 8.09$, $p < .05$). They were often arrested as a result of either the victim reporting the offence (63.64%, $\chi^2(2) = 8.66$, $p < .05$) or the victim's family member reporting the offence (31.82%, $\chi^2(2) = 8.47$, $p < .05$). Individuals committing anger offences distinguished themselves from the other classes

by all having a criminal record, $\chi^2(2) = 7.18, p < .05$. They were also more likely to not have a specific hunting ground, meaning that they did not have a specific area where they went to find victims (53.57%, $\chi^2(2) = 7.34, p < .05$), and may select victims through local visibility (42.86%, $\chi^2(2) = 5.00, p = .08$). Similar to power offenders, these offenders tended to be arrested because of victim reporting (64.29%, $\chi^2(2) = 8.66, p < .05$). Individuals committing sadistic offences spent the most time with their victims, $M=207.14, SD=463.52$, which was twice as long as anger offenders and eight times as long as power offenders. They also had the highest number of offences ($M=8.56, SD=11.97$), which was also approximately double the amount of offences in the other two classes. Although more participants in the anger class had a criminal record, participants in the sadism class had a higher number of charges for non-sexual and non-violent crimes, $M=22.00, SD=29.36$. When participants in the sadism class attacked, their victims were always alone, $\chi^2(2) = 11.66, p < .01$. Moreover, police investigation, rather than victim report for example, led to the arrest of all of these individuals at some point in their sexual offence history, $\chi^2(2) = 22.54, p < .001$. None of the sadism offenders met their victims through their occupations; they either used a direct attack, local visibility, or even newspaper advertisement to find a victim. None of the sadism offenders encountered the victim before their offence, $\chi^2(2) = 6.92, p < .05$.

Table 12: Study 4: Custom Tables Results for Investigative Outcomes

Outcomes	Anger		Power		Sadism		χ^2 value
	%	Mean (SD)	%	Mean (SD)	%	Mean (SD)	
Offence Length (Minutes)		100.50 (148.85) _{a,b}		25.76 (23.72) _a		207.14 (463.52) _b	
Victim Age		23.00 (8.17) _a		14.91 (8.93) _b		20.41 (5.42) _{a,b}	
Victim Count		3.43 (2.83) _a		4.73 (5.88) _{a,b}		8.56 (11.97) _b	
Charges for non sexual/ violent crime		15.30 (24.09) _{a,b}		5.68 (6.81) _a		22.00 (29.36) _b	
History of Break-ins	82.14		40.91		88.89		11.76***
Criminal Record	100		77.27		77.78		7.18**
Partnered	32.14		72.73		66.67		8.31**
No Specific Hunting Ground	53.57		36.36		11.11		7.34**
Never encountered	82.14		59.09		100		6.92**
Victim Before Victim alone when attacked	89.29		54.54		100		11.66***
Cause of Arrest							
Police Investigation	71.43		18.18		100		22.54****
Victim Family Member	7.14		31.82		0		8.47**
Victim Reported It	64.29		63.64		11.11		8.66**
Victim Selection Method							
Occupation	14.29		40.90		0		8.09**
Direct Attack	75		27.27		77.78		13.26****
Local Visibility	42.86		13.64		33.33		5.0002*
Newspaper Ad	0		0		11.11		5.651*

Values in the same row not sharing the same subscript are significantly different at $p < 0.10$.

* $p < .10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Clinical Utility

Table 13 summarizes the results for outcomes relevant to assessment and treatment of sexual offenders. As age of first offence is related to likelihood of recidivism, with lower ages being inversely related to greater likelihood of future offending, the age of first offence is an important factor for determining an offender's risk level (Quinsey et al., 2006). Power offenders were the oldest at the beginning of their offence series ($M=33.45$, $SD=10.87$), compared to anger offenders, who were the youngest at the start of their offending series ($M=27.88$, $SD=6.54$).

Power offenders were the least likely to engage in non-structured premeditation before their offences, 18.18%, $\chi^2(2) = 8.03$, $p < .05$. Non-structured premeditation refers to when the participant had an awareness that he was going to commit a sexual assault but did not know when, where, or against whom. Forty percent ($N=9$) of power offenders admitted to a history of exhibitionism, $\chi^2(2) = 8.11$, $p < .05$. In terms of participants committing anger offences, 60.71% engaged in behavioural fantasy try-outs prior to their offence, $\chi^2(2) = 9.27$, $p < .01$. An example of a behavioural fantasy try-out was a participant following a woman on the street without assaulting her, breaking into the victim's residence, or observing the victim while she slept but not committing any sexual acts while in the residence.

Anger offenders also scored higher on the other subscales of low self-control. Specifically, on impulsivity ($M=3.24$, $SD=0.88$) and a preference for simple, uncomplicated tasks ($M=2.67$, $SD=1.056$). Also, individuals in the anger and sadism clusters were equally more self-centered in comparison to power offenders. Participants in the anger cluster also had the highest scores on several clinical scales; including antisocial ($M=33.45$, $SD=10.87$), drug dependence ($M=33.45$, $SD=10.87$), and alcohol use before the crimes ($M=33.45$, $SD=10.87$). In particular, these

participants seemed to prefer Cannabis (25%) or Stimulants (42.86%). Interestingly, anger offenders also significantly related to high scores on the MMPI measure of hypochondriasis, $M=33.45$, $SD=10.87$.

Table 13: Study 4: Custom Table Results for Clinical Outcomes

Outcomes	Anger		Power		Sadism	χ^2 value
	%	Mean (SD)	%	Mean (SD)	% Mean (SD)	
Age at the start of the crimes		27.88 (6.54) _a		33.45 (10.87) _b	28.29 (5.56) _{a,b}	
Non-structured Premeditation	57.14		18.18		44.44	8.03**
Sexual Deviance						
Exhibitionism	7.14		40.91		22.22	8.11**
Behavioural Fantasy Try-outs	60.71		18.18		44.44	9.27***
Self Control Scale (Grasmick et al., 1993)						
Impulsivity		3.24 (0.88) _a		2.96 (0.85) _{a,b}	2.67 (0.64) _b	
Simple Task		2.67 (1.056) _a		2.08 (0.85) _b	2.42 (1.08) _{a,b}	
Self-Centered		2.35 (0.99) _a		1.77 (0.79) _b	2.44 (1.09) _a	
Mental Health						
Antisocial (MCMI)		63.50 (12.77) _a		37.50 (10.61) _b	26.50 (4.95) _b	
Hypochondriasis (MMPI)		64.14 (13.18) _a		53.88 (8.37) _b	61.40 (17.08) _{a,b}	
Drug Abuse (MCMI)		71.88 (4.76) _a		67.50 (4.95) _{a,b}	52.00 (16.97) _b	
Alcohol used before crime	64.29		31.82		22.22	6.95**
Drugs used before crime	64.29		31.82		33.33	5.63*
Drug Preference						8.51*
<i>Cannabis</i>	25		9.09		0	
<i>Stimulants</i>	42.86		27.27		33.33	
<i>Medication</i>	0		0		11.11	

Values in the same row not sharing the same subscript are significantly different at $p<0.10$. * $p<.10$, ** $p<0.05$, *** $p<0.01$, **** $p<0.001$

Discussion for Study 4

The results from Study 4 provide support for using Groth and Birnbaum's (1979) power, anger, and sadism framework to label the three-cluster LCA model from Study 3, and indicate that this model, and by extension the process used to derive it, has some investigative and clinical utility. The core features of power, anger, and sadism were supported based upon the hypothesized association between need for intimacy, anger, and arousal to sexualized violence, respectively. A major theme in power-themed offenders is artificial intimacy. Case study research reveals that power offenders go to great lengths to mimic normal courtship behaviours and may even believe that their victim is consenting to the sexual act (Groth & Birnbaum, 1979). A need for intimacy is characterized by severe interpersonal deficits resulting in social isolation, despite a desire for emotional and physical closeness (Hudson & Ward, 2000; Marshall, 1989). Marshall argued that for individuals who commit sexual offences, failure to engage in or maintain intimate relationships produces loneliness, which then leads to the pursuit of less appropriate and eventually non consenting, sexual partners. Need for intimacy has been an important construct, predicting sexual recidivism in two meta-analytic reviews (Hanson & Bussière, 1998; Hanson & Morton-Bourgon, 2009).

On the other hand, the participants in the anger cluster were associated with persistent self-reported issues with anger. This connection is specifically important for risk assessment research, as hostility is one of the empirically-supported risk factors. In particular, Mann and colleagues (2010) emphasized that the type of hostility especially relevant to a risk for reoffending is a schema characterized by grievance, a perception of wrong doing by others or the world, an almost identical description to anger offenders in Groth and Birnbaum's (1979) framework. Hostility is also associated with deficits in perspective taking that adds to offenders'

inability to restructure their grievance schema and may lead to committing acts of violence (Hanson & Morton-Bourgon, 2005). Similar to anger offenders, Mann and colleagues emphasized the predictive power of sexual arousal to violence as an additional important risk factor. Indeed, the nine participants in the sadism cluster showed robust phallometric responses to sexualized violence and humiliation. These findings not only represent strong associations with the content of Groth and Birnbaum's framework, but also associations with factors relevant to police investigations or clinical practice.

Differences in participants' offence history provide a unique insight into how Groth and Birnbaum's (1979) framework is useful for police investigations and clinical practice. Similar to findings in Study 4, individuals who commit power offences are more likely to target younger victims and to be in a relationship (Graney & Arrigo, 2002; Groth & Birnbaum, 1979). Victims of power offences are often individuals within the social sphere of the offenders, even if they are not acquainted. For instance, a power-themed offender may attack a co-worker whom they have seen and admired if, upon interacting with this person, the offender feels his sense of self-worth or competency as a man is threatened. Due to the lack of violence in the power offence as compared to anger or sadism, the victim may internalize responsibility and confide in a family member rather than seeking medical attention (Groth & Birnbaum, 1979). Clinicians presented with a client who has engaged in a series of power offences would likely find that these offences occurred spontaneously, with a lack of structured premeditation (Groth & Birnbaum, 1979). Lastly, it was consistent with previous findings that these cluster of participants were more likely to have engaged in exhibitionism at some point in their life as non-contact paraphilias (e.g., exhibitionism) are preferred by individuals who seek to gain sexual power over others without necessarily engaging in overt violence (Tuch, 2008).

Participants in the anger cluster had lowest self-control, were highly impulsive in their offending, were antisocial, and were more likely than other participants to use alcohol and illicit substances. Consistent with previous findings, police investigating anger offences are likely to find that the guilty individual has a history of prior criminal convictions (Lindqvist, Daderman, & Hellstrom, 2005). Moreover, these anger-motivated assaults are thought to be spontaneous and driven by emotional dysregulation, meaning that these individuals are less likely to engage in premeditation or have reliable hunting patterns (Rossmo, 1999). Also, they are more sporadic than those committing sadistic offences (Groth & Birnbaum, 1979). Clinicians treating individuals who have committed anger-motivated offences are likely to find additional issues with impulsivity (Chereji, Pintea, & David, 2012; Eher, Neuwirth, Fruehwald, & Frottier, 2003), alcohol use (Barbaree, Marshall, Yates, & Lightfoot, 1983; Ward & Hudson, 1998), substance use (Marshall, 1996), and antisocial personality disorder (Larochelle et al., 2010).

Compared to power- and anger-motivated participants, more research has focused on individuals whose sexual offences were motivated by sadism. This focus may be due to the extreme violence and psychological trauma unleashed upon the victim. Consistent with previous findings, the nine participants in the sadism group had spent large amounts of time with their victim (Pardue & Arrigo, 2008). Two novel findings about sadistic-motivated offenders in this sample were that these participants had very little contact or awareness of their victim prior to the offence, which rules out typical pre-offence behaviours like grooming or stalking. Also, a police investigation, rather than confessing or being identified by the victim, almost always stopped these offenders. The results of Study 4 also emphasized the importance of sexual deviance, rather than substance use or antisociality, to understanding sadistic-motivated participants. Cognitively, these individuals are quite unlike individuals who commit power

offences. Specifically, individuals who commit power offences are likely to see their victims as consenting or even enjoying their offence. Conversely, individuals with sadism strive to make the victim suffer; it is important to their sexual fantasies that they believe the victim is not consenting or enjoying the encounter.

Overall, the theoretically-driven LCA model was consistent with the second assumption for the practical application of BCSA: that underlying behavioural patterns facilitate a greater understanding of the offence and the offender. However, caution is urged in drawing further inferences based upon the specific constellation of crime scene behaviour variables used to create this model. The purpose of this research project was to evaluate a more explicit method of identifying crime scene behaviours that are both necessary and sufficient for modeling a sexual offence, rather than *creating the scale* itself. These findings evidence that the use of NPCA and LCA to evaluate a theory-driven method of BCSA has some external validity. However, that conclusion does not lead to the inference that these specific behavioural variables definitively model all sexual offences, or even serial-stranger sexual offences. What one can infer is that the methodologies used to derive this scale have a degree of external validity and should continue to be tested.

CHAPTER EIGHT: GENERAL DISCUSSION

The methodology used for conducting BCSA has evolved over the last hundred years, from expert opinions to multivariate statistics. To date, research on BCSA has been largely exploratory in nature (Alison et al., 2002). Additionally, there has been little agreement on what behaviourally defines a sexual offence beyond the violation of the victims' integrity, and little research has investigated the correspondence between crime scene behaviours and offender characteristics (Alison, Goodwill, Almond, van den Heuvel, & Winter, 2010). The present studies form an initial attempt to move beyond exploratory BCSA by using more rigorous statistical methods to behaviourally model sexual violence. The exploratory MDS model in Study 1 provides evidence that behavioural variables cluster into theoretically meaningful clusters; in this case, consistent with the Groth and Birnbaum's (1979) framework of power, anger, and sadism. However, using a purely statistical criterion in Study 2 revealed how few of the variables actually contribute to the overall model fit. Unfortunately, removing these variables produced models that were largely descriptive and did not connect strongly to any theory of sexual offending. However, by revising the Study 2 model with a theory-driven approach for selecting variables, BCSA models were constructed with excellent face validity (Study 3) and external validity (Study 4).

Exploratory research of this nature does have several limitations. Two cross-study limitations beyond the idiosyncratic limitations to the specific studies discussed previously are worthy of note. First is the potential subjective influence and quality degradation that occurs in the collection of BCSA data (Alison, Snook, & Stein, 2001). Unlike self-report data collected in many other social science fields, where individuals are asked to subjectively reflect upon either current internal states or trends across time, BCSA data are based on obtaining an account of

behaviours that transpired in a finite and distal location in time. Simply put, the characteristics of an offence have an objective nature that may be heavily influenced by the impact of memory or the degradation or neglect of forensic evidence. The data collected for this study were likely subject to many alterations (both intended and unintended) as the participants were asked to recall offences that happened years in the past. Police reports may be used to provide an additional source of information, but they too are biased by the context in which the police officer collected and synthesized the potentially limited source of information available to him or her. In summary, BCSA data are always subject to the potential criticism that they may not fairly represent the objective nature of the offence that occurred but, rather, they may represent a synthesis of the various opinions and biases of the subjects who provided the account. These issues are not idiosyncratic to the present study but are an obstacle for all researchers to overcome when using crime scene information to reconstruct an offence. Recommendations (Brankley et al., 2014b.) to minimize the impact of data degradation include collecting information from multiple sources at varying degrees of distance from the offence (e.g., primary sources, like crime scene photographs, or secondary sources, victim or offender accounts).

The second limitation lies with the adoption in these studies of the power, anger, and sadism framework (Groth & Birnbaum, 1979) as an informative and representative theory of sexual offending. It may be that the behaviours characterized in power, anger, and sadism offences are not causally related to an offender's motivation. Motivation cannot be directly observed from the crime, the offenders' reports, victim report, or any other source of objective data and must, therefore, be inferred (Canter et al., 2003). Groth and Birnbaum's typology was largely constructed and refined using case evidence and clinical opinion, rather than statistical modeling; and despite some recent research using MDS to statistically investigate aspects of the

typology (Bennell et al., 2013; Goodwill et al., 2009), case-based research still dominates the evaluation of Groth and Birnbaum's model (Pardue & Arrigo, 2008; Salfati & Taylor, 2006). Despite potential criticism on the origin of Groth and Birnbaum's typology that may be cause for concern, the influence and practical impact of this typology have been vast. As mentioned previously, Canter's behavioural themes and the MTC:R3 are largely based on power, anger, and sadism. In point of fact, Canter's themes and the MTC:R3 were constructed only based upon crime scene information and offenders' report. Groth and Birnbaum (1979) showed that power, anger, and sadism were also derivable from victim statements. The influence of Groth and Birnbaum does not negate the presence of distinct and equally influential alternative models (e.g., organized/disorganized), yet the accrued research base provides evidence that power, anger, and sadism are indeed conceptually distinct and valid categories recurring throughout both research findings and clinical practice with sexual offenders. Rather than stymieing confidence regarding the conclusions drawn herein, these limitations are avenues for future researchers to challenge and build upon these results. However, similar to the MTC:R3 and other motivation-based typologies, expertise and training is required in order to interpret crime scene information, victim statements, and offender statements as being indicative of any particular type.

Future researchers may debate using the various merits of adopting either an empirical or theoretical criterion; however there is less doubt that NPCA and LCA improve upon our model refinement compared to a simple exploratory approach with MDS. Indeed, while the MDS approach (Study 1) provided useful information as to the potential underlying behavioural patterns (e.g., sadism), it was unable to produce a model of behaviour that meaningfully separated offenders into groups based upon behavioural variables (as was the case with LCA). If BCSA is to be of continued use to professionals, it must aid decision-making that is categorical

in nature. Such classification enables police investigators to make decisions related to which suspects to pursue or what previous offences the same offender may have committed. Likewise, in treatment, clinicians require the ability to identify mechanisms that best explain the client's offending behaviour. Dimensional descriptions of behavioural themes offered by MDS and NPCA solutions may primarily be of interest to researchers, nevertheless the classes derived from LCA are of practical interest. It is important that researchers avoid limiting themselves to purely statistical criteria, but should explore the inclusion of variables that facilitate a theoretical interpretation of models. When used in conjunction with a theory-based framework for selecting variables, LCA categorized participants into meaningful and informative categories. It is, therefore, recommended that future researchers adopt and report on their methodology for data refinement in creating BCSA models, or explain why such methods are not in the best interest of both the academic and professional community.

Implications

Both researchers and professionals have harshly criticized BCSA. Snook and colleagues (2008) wrote a scathing indictment of offender profiling, arguing that its undeserved popularity is due to anecdotes and fictional portrayals. A pillar in the paper's argument is the proposition that the success of offender profiling is attributable to some special ineffable skills possessed by a select few. Snook and colleagues are right to chastise proponents of such an outlandish notion. Relying on opinion and subjective guesswork is antithetical to a scientific orientation. The present series of studies provides a meaningful alternative: an empirical basis to construct offender profiles based upon statistical models of crime scene behaviours. Therefore, the psychologist who provides investigative advice to police officers need not rely on charisma and anecdotes, but can provide statistical evidence to support their recommendations. Arguably then,

the future utility of BCSA is dependent upon researchers establishing models populated by behaviours that are both necessary and sufficient for modeling the offence. Like untamed shrubbery, BCSA models must be pruned of redundant or uninformative variables. This approach is essential for police officers and clinicians who cannot afford to spend unnecessary time and effort collecting data that will present no measurable benefits. Indeed, if improved methodological research on BCSA can reduce the large number of variables used in national behavioural databases (e.g., the 262 variables in ViCLAS) into a more theoretically-grounded and meaningful set of variables, then these programs will have increased utility in helping investigators track and apprehend unknown offenders.

Conclusion

Sexual offences are uniquely heinous due to the intimate violation of an individual's integrity. This observation is not made to demonize the individuals who commit crimes, but rather to redirect readers' attention to the principal motivating factor behind research of this nature: the victim. While the modest aim of this study was to provide results about a more advanced method to process data for BCSA of sexual offences, the intended impact is much larger. Latent variable models provide a means to refine understanding of potential underlying motivation in sexual offences by providing measures of each variable's contribution to the overall model fit. These models may form the basis for an empirically-based approach to investigative decision making in rare and challenging cases of sexual offending. Likewise, clinicians can buttress their assessment and treatment approaches through the addition of BCSA. These advances provide professionals a means by which to understand the key behaviours in a sexual offence and thus increase the likelihood in preventing them.

Appendix A

*Frequency of behaviour in parentheses

Affect During Offence: Predominant affect during the crime.

Offender, Anger (13): Includes anger, frustration, and aggressiveness

Offender, Negative (6): Includes guilt, shame, regret, loneliness, bored, sadness, depression, anxious, nervous, agitated, fear, emptiness, and confusion.

Offender, Positive (1): Happiness, joy, love, calmness, and well-being.

Offender, Sexual Arousal (49).

Victim, Anger (15): Includes anger, frustration, and aggressiveness.

Victim, Negative (45): Includes guilt, shame, regret, loneliness, bored, sadness, depression, anxious, nervous, agitated, fear, emptiness, and confusion.

Victim, Positive (7): Happiness, joy, love, calmness, and well-being.

Victim, Sexual Arousal (4).

Approach: Strategies used to approach the victim.

Aggressive (26): Surprise or blitz attack.

Confidence (45).

Bindings Used (10): Physical restraints used during the offence.

Cunnilingus (17): Participant performed cunnilingus on victim.

Forced Sexual Acts (36): Participant forced victim to commit sexual acts.

Humiliation: Victim was humiliated during the offence.

Any (12).

Physical (5): Examples given were urinating on the victim, asking the victim to assume a degrading posture.

Verbal (3). Examples given were insulting the victim or having the victim say degrading things about themselves.

Verbal and Physical (6).

Level of Force – Avery-Clark & Laws (1984): Level of physical force used by the offender to commit the crime.

Minimal (21).

More than necessary (24).

None (14).

Masturbation (10): Participant masturbated victim during the offence.

Mutilation: Victim was mutilated during the offence.

Any (6):

Non-Sexual (4): Non-sexual body parts were mutilated.

Sexual (2): Sexual body parts were mutilated.

Non-contact Sexual Acts (8): Participants engaged in non-contact sexual acts.

Response to Victim Resistance: Participants' response to victim resistance.

Physical Force (29).

Stops/ Runs Away (6).

Threat (14).

Rape Kit (6): Participant brought equipment to the offence with items such as a ligature, weapon, tape, or blindfold.

Sexual Dysfunction (3): Participant experienced sexual dysfunction during the offence.

Sodomy: Anal penetration occurred during the sexual offence.

Fingers (5).

Objects (1).

Penis (10).

Vaginal Intercourse: Vaginal penetration occurred during the sexual offence.

Fingers (36).

Objects (3).

Penis (41).

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