

**Consistency in crime site selection: An investigation of crime sites used by serial sex offenders across crime series**

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### Abstract

**Purpose:** Knowing sites used by serial sex offenders to commit their crimes is highly beneficial for criminal investigations. However, environmental choices of serial sex offenders remain unclear to this date. Considering the challenges these offenders pose to law enforcement, the study aims to identify sites serial sex offenders use to encounter and release their victims and investigate their stability across crime series.

**Methods:** The study uses latent class analysis (LCA) to identify victim encounter and release sites used by 72 serial sex offenders having committed 361 sex offenses. Additional LCA are performed to investigate the stability of these offense environments across offenders' crime series.

**Results:** Distinct profiles of crime sites that are recurrent across crime series are found, suggesting that serial sex offenders present a limited diversity of victim encounter and victim release sites. Encounter sites representative of longer crime series are also identified. Specifically, the use of sites known to "attract" potential victims decreases over series and offenders become more risk-taking in regard of sites used to encounter their victims.

**Conclusions:** The study identifies patterns of site- selection for the victim encounter and release in cases of serial crimes. Implications for crime linkage and police investigations strategies are discussed.

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Crimes tend to cluster at a few and very specific places within communities. Moreover, crimes often happen on very specific times and days of the week and are generally committed by a few chronic and persistent offenders (Braga, 2011). In spite of such patterns, these offenders and the offenses they are responsible for tend to create issues and challenges for law enforcement. This is especially true for serial sexual offenders for which a connection between the offender and the victim rarely exists (Rossmo, 2000). In recent years, crime linkage analysis has emerged as an investigative strategy helping to determine whether behavioral evidence can inform police investigators in identifying problematic serial offenders. Crime linkage involves the identification of similarities between offenses of the same type to help identify the individual responsible for the crime being investigated. More specifically, with the use of police databases, crime linkage helps to determine if a crime for which the offender is not yet known presents evidence of similar offender behaviors with another (previous) crime for which the offender is already known (Woodhams, Hollin, & Bull, 2007). In other words, this investigative strategy implies that offenders will repeat the same crime, but will also commit these crimes in a consistent way across crime events.

Associated with the emergence of crime linkage, researchers started to question whether offenders are in fact consistent in the way they commit their crimes across their series (behavioral consistency) and if behavioral evidences could be used to reliably link unsolved crimes. Yet, a review of the scientific literature reveals that the identification of offending behaviors and components to be used to link crimes remains elusive due to the scarcity of research on the behavioral consistency assumption (Deslauriers-Varin & Beauregard, 2013; Sorochinski & Salfati, 2010). Moreover, studies on behavioral consistency are based on various conceptual,

methodological, and analytical procedures, which further limit the conclusion that can be drawn (see Deslauriers-Varin & Beauregard, 2013; Woodhams & Labuschagne, 2012). Nevertheless, findings from recent studies indicate that, when examining suitable behavioral domains or individual behaviors, high consistency exists among offenders' behaviors and that these behaviors can be thus used to successfully link serial crimes (Bennell & Jones, 2005). For example, previous research has shown that behaviors that are less dependent on situational factors and over which the individual exerts control present higher level of consistency (e.g., Bennell & Canter, 2002; Davies, 1992; Markson, Woodhams, & Bond, 2010). More recently, the notion of offense consistency has been applied to geographic and spatial behaviors, which can be seen as less situation dependent. So far, study findings show that these aspects of a crime could in fact outperformed traditional modus operandi behaviors (e.g., Bernasco, 2008; Goodwill & Alison, 2006; Markson et al., 2010; Tonkin, Grant, & Bond, 2008). For example, Bennell and Jones (2005) argued that the location chosen to commit a crime is a decision that the offender has control over and is less dependent on the situation. As such, spatial behaviors and crime site selection should present higher level of consistency comparatively to other traditional modus operandi behaviors, such as the level of violence use during the commission of the offense. Most of the research on geographic consistency, however, has looked at the offender's journey to crime (e.g., distance traveled to crime). Much less research has focused on the environmental characteristics of sites where crimes most likely take place. More specifically, the environmental decision-making and crime site selection of serial offenders across their series remain unclear.

### Crime Pattern

Crime, as suggested by the crime pattern theory, is not distributed randomly in space and time, but rather occurs within a situation, at a site, on a non-static "environmental backcloth". Backcloth, as defined by Brantingham and Brantingham (1993) refers to the variables or

“uncountable elements that surround [...] an individual and that may be influenced by or influence his or her criminal behavior” (p.6). In other words, the backcloth refers to the physical infrastructure of the environment (i.e. buildings, roads, transit systems, land uses, design) at a specific time and place, as well as the people located within that physical infrastructure, as perceived by individuals standing in this environment that surrounds them. Underpinning the notion of environmental backcloth is thus the idea that the occurrence of a criminal behavior (i.e., crime opportunity) is dependent on the offender’s routine activity patterns and awareness space (e.g., places or areas that the offender visit or spend some time regularly and thus became familiar with - home location or neighborhood, areas where he works or go to for recreational purposes, etc. - and aware of), as well as the distribution of targets (Beauregard, Proulx, & Rossmo, 2005; Clarke & Felson, 1993; Deslauriers-Varin & Beauregard, 2010; Eck & Weisburd, 1995). Indeed, daily activities and lifestyles will nurture a criminal opportunity structure by enhancing the exposure and proximity of crime targets to motivated offenders (i.e., crime concentration) (Felson & Cohen, 1980; Miethe & Meier, 1990; Mustaine & Tewksbury, 2002). As such, certain environments may generate more opportunities than others at certain times of the day and week (Lundrigan, Czarnomski, & Wilson, 2010). Specific environments and locations are thus more prone to be selected over and above others considering the crime opportunities and pool of potential targets they provide (e.g., locations known for attracting potential targets or limiting the presence of guardians). Based on the crime pattern theory, it would therefore be expected that offenders would likely choose offending locations close to their home or familiar to them and part of their awareness space. More specifically, among their awareness space, locations that are known to attract numerous potential victims and to generate criminal opportunities should be privileged (e.g., schools, shopping centers, public transport hubs, parks). Also, because the area where offenders will offend is largely based on their routine activities and

awareness space (e.g., Felson & Cohen, 1980; Townsley & Sidebottom, 2010), crime site selection is expected to change over the offender's criminal career (Baudains, Braithwaite, & Johnson, 2013) - new routines changing the awareness space and bringing new opportunities at new locations.

#### Environmental Consistency and Serial Offenders

Studies analyzing the offender decision-making process related to the location of the crime have mostly been carried out for property crimes such as burglary (e.g., Bernasco & Nieuwbeerta, 2005; Clare, Fernandez, & Morgan, 2009; Coupe & Blake, 2006; Nee & Meenaghan, 2006; Wright, Logie, & Decker, 1995) and robbery (e.g., Bernasco & Block, 2009; Bernasco, Block, & Ruiters, 2013; Petrosino & Brensilber, 2003). Recent studies have also investigated target selection and spatial choices of rioters (e.g., Baudains et al., 2013; Martin, McCarthy, & McPhail, 2009). These previous studies have provided evidence that the selection of locations to commit crimes is not random and "irrational" but rather controlled and based on the available information and internal cost-benefit calculation of the offender. However, not much is known when it comes to person-oriented offenses such as sex crimes. Here again, still, prior research shows that, while the environmental decision and selection of the site might be influenced by dynamic factors, serial offenders often use the same geographic and ecological space and tend to pattern themselves geographically (e.g., Beauregard, Proulx, Rossmo, Leclerc, & Allaire, 2007; Canter, 2000; LeBeau, 1987). In a recent study, Lundrigan, Czarnomski, and Wilson (2010) examined the consistency displayed by serial sex offenders in regards to the crime location and characteristics of the crime site selected - what they refer to as environmental consistency. Their results indicate that these offenders show high environmental consistency across crime series, suggesting that serial offenders are not randomly selecting environments to commit their crimes but that whatever might be influencing the selection of one environment is

also influencing the selection of following environments. Canter (2000) suggests that consistency in spatial behaviors and the environment selected is seen in serial offenders as they operate over somewhat limited environments, preferring those that are more familiar to them and therefore more predictable. The offenders' environmental and site selection decision can then be seen as the reflection of their own knowledge and experience of the environment. This knowledge, as suggested previously, can be gained as the offenders go on in their non-criminal and daily routine activities (e.g., Beauregard et al., 2005; Brantingham & Brantingham, 1993; Clarke & Felson, 1993). The offender's familiarity with a specific site can also follow from the previously successful use of a specific site or type of environment to commit crimes. Hence, as suggested by Lundrigan and colleagues (2010), the knowledge and experience of the offenders can lead not only to the consistent use of one specific site but also to the consistent use of similar types of environment and locational settings. Sexual offenders would then select their targets and crime locations in a somewhat consistent and "rational" way. While consistency for crime sites is found in prior studies, the nature of the sites used by sex offenders, however, has not been described and is still left unknown.

#### Serial Sex Offenders and Crime Sites Used

Not all serial offenders show the same geographic behaviors and, therefore, classification models have been proposed to describe this heterogeneity. In particular, these models have been emphasized toward the hunting and target selection patterns of serial sex offenders (e.g., Beauregard et al., 2007; Deslauriers-Varin & Beauregard, 2010; LeBeau, 1987; Rossmo, 2000). For example, Rossmo (2000) developed a hunting pattern typology of serial murderers. Underpinning this typology is the idea that a crime event is composed of multiple stages and that offenders can move location from one offending stage to the other. While sites used by offenders throughout their crime series are not all known by the police, two stages have greater likelihood

of being known after the commission of a crime: 1) the victim encounter, or the beginning of the crime event, and 2) the release of the victim, or the end of the crime event. Moreover, Rossmo (2000) suggests that the method used by these offenders to commit their crimes (i.e., *modus operandi*) will influence their spatial and geographic behaviors at each stage. More specifically, the offender's victim search methods will influence the victim encounter site selected while his attack methods will influence the victim release site. As such, Rossmo's typology is based on a combination of behaviors at both these stages of the crime-commission process and presents four victim search methods (i.e., hunter, poacher, troller, and trapper) and three attack methods (i.e., raptor, ambusher, and stalker). For example, trappers use subterfuge or an occupation that persuade potential victims into their home or in an area where they will feel in control. Trollers, however, are opportunistic offenders who encounter their victims as they go on in their daily routine activities and may be more prone to encounter their victims in public places or outside. The same could be said for stalkers (attack method) for whom the victim release site is strongly influenced by the victim activity space, while the ambushers attack their victims on sites where they have a great deal of control. While Rossmo considered environmental and spatial behaviors in his typology, here again however, the specific nature of sites used by serial sex offenders to commit their crimes was left overlooked.

Using Rossmo's hunting typology (2000), other studies further demonstrated that the offender's hunting process and target selection (and, implicitly, the victim routine activity) is closely tied to the site selected for the crime commission (e.g., Beaugard et al., 2007; Deslauriers-Varin & Beaugard, 2010; Hewitt, Beaugard, & Davies, 2012). In their study, Beaugard et al. (2007), used multiple correspondence analysis and hierarchical cluster analysis to identify three hunting process scripts of serial sex offenders: 1) the Coercive script, including the home-intrusion rape and two outdoor rape tracks; 2) the Manipulative script, including the

sophisticated rape track and family-infiltrator tracks; and 3) the non persuasive script, including the direct action rape track. The home-intrusion rape and family-infiltrator tracks refer to the victim being encountered in an indoor and private location, either at the victim's or the offender's home, whether "invited" or not into the home. The victim is then released at the same location where they encountered the offender. The outdoor rape tracks are both characterized by the use of a public place to encounter the victim. In one of the tracks, however, the victim is encountered in an outdoor public place and, most of the time, released in an outdoor public place familiar to the offender. For the other outdoor track, the victim is rather encountered indoor and released at an outdoor and private site that neither the victim nor the offender are familiar with. For the last two tracks, the sophistication rape and the direct action rape, the victims are encountered at a site similar to the one where they are released: a public outdoor site known by both the offender and the victim for the sophistication track, and a public indoor site also known by both the offender and the victim for the direct action track.

In a recent study using a sample of 77 adult offenders convicted for having committed a sexual offense against a child, Leclerc, Wortley, and Smallbone (2010) concluded that almost all offenders used their home at some point during the crime. The use of their own home allows them to have a greater control over the situation and their victim and to reduce the probability of interference by a witness. Offenders also have more time to commit the crime. This location thus provides them with high odds of successfully committing their crimes. Using the child's home or an isolated area outdoors were also common places used by offenders to abuse their victim.

Sexual offenders and the offenses they are responsible for tend to create issues and challenges for law enforcement. This is especially true for persistent serial sex offenders. Understanding where, when, how, against whom, and by whom these criminal activities are committed is thus highly relevant for the criminal justice system. Prior studies on the hunting



process and target selection show that serial offenders are not randomly selecting environments to commit their crimes and that environmental and spatial patterns of crime exist. For example, the offender's home, the victim's home, and public places were previously identified as crime sites more prone to be used by offenders to find their victims and commit their crime (e.g., Brantingham & Brantingham, 1993; Beauregard et al., 2007; Deslauriers-Varin & Beauregard, 2010; Leclerc et al., 2010; Rossmo, 2000). However, prior studies always investigated the hunting and offending processes and its relationship with the locational settings of the crime; none of these studies considered looking only and specifically at the characteristics of the site selected itself and how sites selected evolve across series. Identifying and describing the nature of sites used by serial sex offenders could be beneficial for police investigations in helping to orient apprehension efforts. Considering the effect of the time at play in the very nature of serial offenders, is it still possible that sites used by serial sex offenders are static across series? In other words, can we assume that offenders are using the same pool of sites to commit their crimes across series? Or rather, are the crime sites used changing across series as offenders are progressing and gaining knowledge and experience or as their awareness space changes? In such case, some sites could be indicative of the beginning or later stages in an offender's sex crime series (i.e., reflective of offenders with a shorter or longer sexual crime "career"). Knowing if some sites are more prone to be used by offenders with an already longer sex crime series could be beneficial for offender profiling and crime linkage in helping to narrow down the pool of potential suspects. There is thus a need to investigate how consistent serial offenders are in their site selection across series, specifically for the victim encounter and victim release offending stages. Using the underlying assumptions of the crime pattern theory as a backcloth, the current study addresses this need by, first, identifying if recurrent sites are selected by serial sexual

offenders and, second, investigating if sites used remain stable across series or if new sites emerge as offenders are progressing in their respective series.

### Methodology

#### Sample

The initial study sample consisted of all male sex offenders convicted of a sentence of 2 years or more between 1995 and 2004 in Quebec, Canada. Among these, 92 individuals had committed at least two sex crimes against stranger victims, and 72 of these agreed to participate in the study. Together, these men were responsible for a total of 361 sexual assaults for which they were charged and convicted. The final sample includes individuals who have committed sexual assaults involving a victim of any age and any gender with whom the offender had no personal relationship prior to the day the offense was committed. Offenders included in this study have sexually assaulted adult women (n=33), children (n=17), or both (n=22), and 80.0% (n=291) of the victims are female. The victim's mean age is 18.7 years (SD=9.6). The majority of the offenders are White (91.3%; n=63), and their average age at the beginning of the crime series is 30.7 years (SD = 9.4). The participants have committed an average of five sex crimes in their series (ranging from 2 to 37 sexual assaults each) and the average crime series length is 1,718 days (approximately 5 years).

#### Procedures

A questionnaire was developed to collect information from police investigation reports and to guide in-depth, semi-structured interviews with offenders. This questionnaire was developed using pre-existing questionnaires (ViCLAS – Violent Crime Linkage System, VICAP – Violent Criminal Apprehension Program, Computerized Questionnaire on Sexual Aggressors; Proulx, St-Yves, & McKibben, 1994) and includes five sections that allow for the collection of information on pre-crime factors, target selection processes, modus operandi, post-crime factors

and geographic behaviors. Information collected on the behavioral and geographic components of the target selection process were gathered from police reports. The interviews were conducted by the lead researcher in a private office isolated from correctional staff and other inmates.

Participants were not paid for participating in the study. All participants signed a consent form after being explained the purpose of the study<sup>1</sup>.

### Variables

The investigation of classes of crime sites is performed using eight environmental indicators related to physical and contextual features of the offense at two different stages: 1) the encounter with the victim, and 2) the victim release. As mentioned earlier, these two stages are specifically selected as they represent the two most commonly known locations for police investigations (Rossmo, 2000). The eight variables are as follows: 1) offense land area use for the two stages of the offense (1 = residential area; 2=commercial area; 3=park/wilderness/rural area; 4=others (industrial and institutional areas); 2) offense location (1=inside; 2=outside) for the two stages of the offense; 3) type of site for the two stages of the offense, referring to whether the offense was committed on a private (e.g., home, backyard) or public/semipublic site (e.g., park, business/shopping site, street) (1 = private; 2 = public/semi-public), and; 4) offender and victim familiarity with the offense site (1 = not familiar to both of them; 2=familiar to the offender; 3=familiar to the victim; 4=familiar to both the offender and the victim) for the two stages of the offense. The frequency data for the eight variables described above are presented in Table 1.

---Insert Table 1---

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<sup>1</sup>In order to minimize response distortion, offenders were promised confidentiality and a guarantee that the information provided could not be used in anyway against them by the Correctional Service of Canada.

### Analytical strategy

First, Latent Class Analyses (LCA) are performed using variables related to environmental aspects of the crime scenes, for two stages of the offense: 1) Victim encounter; and 2) Victim release. LCA are performed separately with the environmental aspects of the crime scene for the encounter stage and the victim release stage. Investigating classes of crime sites for those two stages separately will allow identifying different classes (and prevalence of class) for each stage, if any, while permitting better statistical power<sup>2</sup>. Classes of sites identified for each offending stage are then cross-tabulated to determine how each latent class of offending site found for the encounter stage associates with the ones identified for the victim release stage. This step is conducted in order to determine whether there is some continuity or change between geographical locations across the two offending stages. Second, through additional LCA, classes of crime sites are also investigated over the offenders' series/crime transitions. In order to do so, crimes are categorized according to their chronological position in each of the offender's crime series. Sites used by offenders to encounter and release their victims are then analyzed separately for each crime transition created. By comparing latent classes of sites selected by offenders throughout crime transitions it is thus possible to determine if crime sites are stable over crime transitions (transition-independent hypothesis) or if new crime sites emerge as offenders are progressing in their "career" (transition dependent hypothesis). In other words, this procedure allows investigating whether crime sites used change across sex crime series (i.e., 1st offense, 2nd offense, and so on) and, therefore, identifying if specific crime sites are representative of - or associated with - shorter or longer crime series.

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<sup>2</sup>Eliminating one or more variables to be estimated can sometimes help to achieve a better model identification. Reducing the number of variables decreases the number of item-response probabilities to be estimated and the number of cells in the contingency table, thus increasing the number of subjects per cell. Identification of the best-fit model in the data is then better achieved (Collins & Lanza, 2010).

LCA are performed using PROC LCA, an add-on for SAS 9.3 for Windows (Lanza, Collins, Lemmon, & Schafer, 2007). While the application of LCA has been primarily restricted to medical, educational, psychological, and sociological domains, this technique has been increasingly used in behavioral research, particularly in criminology, over the past few years (e.g., Dayton, 2008; Deslauriers-Varin & Beauregard, 2010; Fox & Farrington, 2012; Lanza et al., 2007; McGloin, Sullivan, & Piquero, 2009). LCA assumes that discrete latent variables<sup>3</sup> underlie a specific population and helps to identify underlying patterns in data or subgroups of individuals who share important characteristics or behaviors (Collins & Lanza, 2010). More specifically, LCA predicts subjects' subgroup membership based on their responses to a set of observed categorical variables and produces mutually exclusive and exhaustive classes of individuals (Dayton, 2008; Goodman, 1974; Lanza et al., 2007). LCA is particularly valuable when the theoretical construct of interest is made up of qualitatively different groups of individuals, but the group membership of individuals is unknown and must therefore be inferred from the data (Collins & Lanza, 2010).

## Results

### Identification of Latent Subgroups of Victim Encounter and Victim Release Sites

First, a series of LCA were conducted using the environmental indicators of the victim encounter and victim release sites. LCA were performed separately for environmental indicators of the victim encounter and those of the victim release sites. For all information criteria used to compare solutions<sup>4</sup>, a smaller value for a particular model suggests that the trade-off between

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<sup>3</sup> These variables cannot be observed directly and must be inferred from observed items pre-selected by the researcher (Collins & Lanza, 2010; Lanza et al., 2007).

<sup>4</sup> The Bayesian Information Criterion (BIC; Schwarz, 1978), Akaike's Information Criterion (AIC; Akaike, 1974) and Adjusted Bayesian Information Criterion (ABIC; Sclove, 1987) are penalized log-likelihood model information criteria that were used to compare competing model fit to the same data (i.e., models with different numbers of latent classes). It was decided to also use the ABIC in order to better identify the best-fit model considering that the BIC

model fit and parsimony was achieved. As shown by the information criteria, the addition of classes beyond four classes provides no improvement in model fit for the victim encounter LCA model. For the victim release LCA model, information criteria are not as clear and suggest that either a four-class model or a five-class model would be a good fit. An inspection of the parameter estimates for the four-class model for both stages suggests that the classes found are distinguishable, non-trivial (i.e., no class with a near-zero probability of membership), and that meaningful labels can be assigned to each class found. Therefore, the four-class model was selected as the model providing the best overall fit to the data for both offending stages (see Table 2).

For both the encounter site and the victim release site LCA solutions, the estimation was repeated using different sets of starting values (Lanza et al., 2007), and the four-class solution here presented was identified as the dominant solution that was obtained most frequently among the various sets of starting values.

--- Insert Table 2---

For both the encounter site model and victim release site model, the likelihood-ratio G2 statistic was used to compare which four-class solution was the best (lowest G2 value) among the different four-class solutions obtained using different sets of starting values. The best-fit four-class solution selected for each offending stage presented high classification accuracy based on posterior probabilities<sup>5</sup>, confirming their stability and relevance. The assigned label and probability of membership for each encounter site and victim release site class, as well as the item-response probabilities for endorsing each item of the class, are shown in Tables 3 and 4

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tends to underestimate the number of latent classes when limited sample sizes and/or large numbers of parameters are engaged (Yang, 2006).

<sup>5</sup>Average assignment probabilities based on posterior probabilities for the four model solution ranged from .973 (.564-.993; neighborhood site profile), to .912 (.413-.999; shopping center site profile) for the victim encounter LCA solution and from .999 (.999-1.00; unfamiliar site profile), to .940 (.536-1.00; shopping center site profile) for the victim release LCA solution.

respectively. Item-response probabilities vary from 0 to 1.00; an item-response probability closer to 1.00 indicates the presence of the item for the class. All victim encounter and victim release classes identified were labeled based on what seemed to best represent the environment/location where it took place.

--- Insert Table 3---

---Insert Table 4---

#### Victim encounter sites

The most prevalent victim encounter site found, labeled neighborhood, represents 36% of the 361 sex crime events included in the study and was used at least once by 49% of the 72 offenders in the sample. For this class, the victim is encountered at a residential area (0.72), public or semi-public (0.97), outside (0.98), and both the offender and the victim are familiar with this site (0.94). An example of such environment, as suggested by its label, is the offender encountering his victims in a neighborhood where they both live. It could also be a residential area where only the victim lives but where the offender often has to travel or commute and has then become familiar with over time. The second victim encounter site identified, labeled shopping center, represents about 28% of the crime events included in the study and was used by half of the offenders of the sample. The victim is encountered in a public or semi-public (0.99) commercial area (0.81), inside (0.68), and both the offender and the victim are familiar with this site (0.89). The third victim encounter site identified, labeled victim's home, represents about 19% of the sex crime events and was used by 32% of the offenders. The victim is encountered in a private (0.76) residential area (0.99), inside (0.94), and only the victim is familiar with the site (0.95). The last victim encounter site identified, labeled offender's home, represents about 16% of the 361 crime events analyzed in the current study and was used by 28% of the offenders. Crime events grouped in this class are characterized by a victim encounter that takes place in a

private (1.00) residential area (0.98), inside (0.92), and only the offender is familiar with this site (0.87).

#### Victim Release Sites

The four-class model for the victim release sites includes the following latent classes. The most prevalent victim release site found, labeled home, represents about 44% of the crime events in the sample and was used by 67% of the offenders of the sample. This class regroups crime events where the victim was released at a location that seems to be either inside the offender's or the victim's home. Hence, the victim was released in a private (0.91) and residential land area (0.97), inside (0.99), that either the offender (0.48) or the victim (0.46) is familiar with. The second most prevalent victim release site found, labeled neighborhood, represents 28% of the crime events and was used by 49% of the 72 offenders in the sample. Victims in the neighborhood victim release site profile are released, similarly to the neighborhood victim encounter site identified previously, in a public or semi-public (0.99) residential area (0.51), outside (1.00), that only the offender is familiar with (0.60). Alternatively, the victims may be released in a park, in the wilderness or in a remote area (0.40) that both the victim and the offender are familiar with (0.33). The third victim release site identified, labeled shopping center, represents about 18% of the crime events analyzed and was used by 32% of the offenders of the sample. This profile is also similar to its victim encounter site counterpart: the victim is released in a public or semi-public (1.00) commercial area (0.75), inside (0.68), and both the offender and the victim are familiar with it (0.83). Finally, the fourth victim release site identified, labeled unfamiliar site, is a new site that has not been identified in our previous LCA model analyzing the victim encounter sites. This class, which represents 10% of the crime events analyzed and was only used by 10% of the offenders, is characterized by the victim being released in a private



(0.99) and residential (0.98) land area, outside (0.99), that neither the offender nor the victim is familiar with (0.83).

#### Associations Between Victim Encounter Sites and Victim Release Sites

Crosstabulations with the victim encounter site latent classes (LC) and the victim release site LC were performed to analyze how both sets of sites associated with one another (Table 5). Overall, the victim encounter site classes found significantly associate with their victim release site classes' counterpart ( $X^2(9)=320.9$ ,  $p < .001$ ; Contingency coefficient = .69). For example, respectively 94% ( $n = 63$ ) and 93% ( $n = 54$ ) of the crime events included in the victim's home and the offender's home encounter site profiles associate with the home victim release site. In the same way, close to 59% ( $n=74$ ) of the crime events included in the neighborhood victim encounter site profile are also included in the neighborhood profile for the victim release stage.

---Insert Table 5---

Some encounter sites found, however, associate with different victim release sites, creating "new" patterns of environmental site of crime scenes. This is specifically true for the neighborhood and the shopping center encounter site profiles found. For example, for 20% ( $n=22$ ) of the crime events where the offender encounters the victim in a shopping center site, the victim is released in a neighborhood. In this case, the victim is encountered in a public/semi-public commercial land area, inside, that both the offender and the victim are familiar with, but the victim is released at a public/semi-public residential or park area, outside, that only the offender is familiar with. In the same way, results show that for crime events where the victims were encountered in a shopping center, the victim was sometime released at an unfamiliar site (14%) or a home site (12%). Similar patterns are found for crime events where the victims are encountered in a neighborhood: after the crime commission, the victims are released in a home (21%) or at an unfamiliar (18%) site.

### Stability of Victim Encounter and Victim Release Sites Over Crime Series

Next, the stability of the latent class solutions across crime transitions was examined to determine if classes of crime sites found were transition-dependent. The purpose of this series of analyses was to inspect whether the latent classes found for the victim encounter and the victim release sites were consistent independently of their ordering in the offender's crime series. In other words, the analyses seek to determine if the pool of crime sites identified at the beginning of sex offenders' series is the same as the one identified later in their series<sup>6</sup>. Hence, is it possible that certain crime sites are more indicative of the beginning or later stages in an offender's crime series? The transition-dependent hypothesis suggests that classes of crime sites change across crime transitions, meaning that the pool of crime sites is not static and can vary according to the offenders' progression in their respective series (e.g., awareness space, experience, knowledge, opportunities). The alternative hypothesis, the transition-independence, refers to a situation where the pool of possible crime sites remains the same across offenders' crime series, suggesting that offenders tend to encounter and release their victims in the same type of environments, independently of their series progression.

In order to do so, the four-class solutions found for the victim encounter and the victim release sites were further inspected using a series of LCA. For each LCA analysis, crimes were categorized according to their position in each of the offender's crime series. Four scenarios were inspected to test for the transition-dependent/independent hypotheses: 1) the latent classes of crime sites for the first crime in the offender's series were compared to all other subsequent sex crimes in the offender's series; 2) the first two sex crimes in the offender's series were compared

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<sup>6</sup>This series of analyses is concerned with crime events rather than offenders. Therefore, the stability of crimes events over time is examined rather than the offender's offending consistency. Hence, the focus of analyses is different from examining whether an offender is using the same site to commit the offense from one crime to the other. An offender's crime series could be characterized by crime switching patterns over time in regards to the crime site selected but the pool of crime sites could remain the same. Said differently, offenders could be switching their site selection among a relatively fixed pool of crime sites.

to all other subsequent sex crimes in the offender's series; 3) the first three sex crimes in the offender's series were compared with all other subsequent sex crimes in the offender's series; and, 4) the first four sex crimes in the offender's series were compared with all other subsequent sex crimes of the series<sup>7</sup>. Two models were estimated for each of the four scenarios: 1) a freely estimated (FE) model across crime transition, allowing for transition-dependent patterns to emerge; and, 2) a measurement invariance imposed model (MI) across transition forcing transition-independent patterns. By comparing the model fit for the FE and the MI models, it is possible to test for the transition-dependence/independence hypotheses. Situations where the model fit of the FE model is significantly different than the MI model indicate that classes change across the crime transition tested. Conversely, situations where the model fit of the FE model is not significantly different than the MI model indicate that classes of crime sites do not change across the crime transition analyzed. Results are presented in Table 6.

---Insert Table 6---

First, results for the victim encounter sites are examined. The first analysis included the comparison between crime sites for the first crime of the offender's crime series to all other crimes (i.e., 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, etc.). The crime transition hypotheses were tested by comparing the G<sup>2</sup> statistic of both the FE (G<sup>2</sup>= 19.67) and the MI (G<sup>2</sup> =42.40) models. The G<sup>2</sup> difference between the two models found was not statistically significant at p < 0.05 (G<sup>2</sup> difference=20.73, df=28). Therefore, classes of crime sites found for the first crime of the offenders' series are not different from classes of crime sites found for subsequent crimes.

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<sup>7</sup> It was not possible to examine crime at each transition separately due to the small number of offenders having more than three offenses. Therefore, decision was taken to keep all the crime events in the analyses and group them according to their ordering in the offender's crime series.

The second analysis conducted included the comparison between classes of crime sites for the first and second crimes of the offenders' series with all other crimes (i.e., 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, etc.). The difference between the  $G^2$  statistic of both the FE ( $G^2= 22.10$ ) and the MI ( $G^2 =64.01$ ) models was statistically different ( $G^2$  difference = 41.91,  $df = 28$ ) at  $p < 0.05$ . Therefore, classes of crime sites found for the third and subsequent crimes of the offenders' series are different from the sites selected for the first two crimes committed. If the third crime marks a shift in the victim encounter sites found, this difference becomes even more pronounced for subsequent crimes. Hence, the difference in model fit between the FE and the MI models for the third and fourth transitions become statistically significant at  $p < 0.001$ .

Subsequent analyses (not shown) were performed in order to further examine the significant difference found between the FE and MI models analyzed. Three main results emerged from the additional LCA performed. First, the number of site classes changes across offenders' crime series. More specifically, the findings of this study suggest that the number of crime site classes found changes at the third transition (i.e., fourth crime). Indeed, the additional LCA analyses show that three classes of victim encounter sites are found at the beginning of a crime series (i.e., first three crimes of the offenders' crime series): 1) shopping center; 2) victim's home; and, 3) neighborhood. At the third transition, the same three classes are found but the offender's home site emerges. In other words, the offender's home is an encounter site that is selected by offenders later on in their series as no latent class of this nature is found for the previous crime transitions. Second, the prevalence of the victim encounter site classes found changes. For example, until the third transition (i.e., fourth crime), the shopping center class represents about 35% of the first three crimes committed. That is to say that in 35% of the first three crimes committed by offenders, the shopping center site will be used to encounter their victims. However, when analyzing sites for the subsequent crimes in the offenders' series (fourth

and up) the prevalence of this site drops at 22%. It appears that sex offenders are less likely to use this site to encounter their victim after their third crime. Third, and in line with the previous result, the most prevalent victim encounter sites at the beginning of the offenders' series are not the most prevalent later in the series. For instance, the shopping center and the victim's home are the two most prevalent sites among the first three crimes of the offenders' series, each representing about 35%. For the following crimes, however, the neighborhood site profile becomes the most prevalent site, increasing from 30% to 43%. While the offenders will more likely use the shopping center and the victim's home to encounter their victims at the beginning of their series, they will more likely use the neighborhood site profile to encounter them later on in their series.

Next, results for the victim release sites are examined. Here again, the first analysis included the comparison between crime sites for the first crime of the offender's crime series to all other crimes. Using the  $G^2$  statistic, the crime transition hypotheses were tested by comparing it for both the FE ( $G^2=64.11$ ) and the MI ( $G^2=87.21$ ) models. The  $G^2$  difference between the two models found was not statistically significant at  $p<0.05$  ( $G^2$  difference=23.10,  $df=32$ ). Therefore, classes of victim release sites found for the first crime of the offenders' series are not different from those found for subsequent crimes. In fact, none of the crime transitions for the victim release sites shows a statistically significant difference in model fit between the FE and the MI models. Therefore, in line with the transition-independent hypothesis, types of victim encounter sites stay the same across offenders' crime series. This does not mean, however, that offenders are not switching victim release locations across sex crime transitions, but rather, that the nature and prevalence of victim release sites are relatively constant, independently of whether the offense is committed at the beginning or later in the crime series. Inspection of LCA solutions tested (not shown) confirms this stability.

### Discussion

The current study aimed at investigating consistency in crime site selection by a sample of convicted adult male serial sex offenders. Using LCA, results show distinct classes of crime sites that are recurrent across sex crime series. These sites are similar to those found in prior studies and show that, in line with what Canter (2000) suggested, serial offenders operate over limited environments. The prevalence and nature of distinct and recurrent crime sites highlights that serial sex offenders show a limited diversity of victim encounter and victim release sites. The victim encounter and release sites are relatively bound together and part of environmental crime scripts characterizing this sample. In fact, in line with the crime pattern theory and prior research (e.g., Baudains et al., 2013; Brantingham & Brantingham, 1993; Bernasco, 2010; Felson & Cohen, 1980; Townsley & Sidebottom, 2010), it seems that they tend to specifically select sites that are more familiar to them but also known to attract more potential victims and generate more criminal opportunities. The current study also provides preliminary data suggesting that there are connections between the victim encounter site and the offender's series progression. Indeed, results help to identify encounter sites more likely to be selected by offenders having a longer crime series. Taken together, the current study provides new insight about geographical behaviors of serial sex offenders across their crimes series. More specifically, the current research highlights five key empirical observations regarding sex offenders' geographical behaviors.

First, consistency in crime site selection was generally found across offenders' series. Indeed, and in line with the crime pattern theory, it was possible to identify a relatively fixed pool of recurrent sites selected by serial stranger sex offenders that would hold across crime series. Four latent classes of victim encounter sites (i.e., neighborhood, shopping center, victim's home, and offender's home) and four classes of victim release sites (i.e., home, neighborhood, shopping

center, unfamiliar site), and their respective prevalence of use, were found. Specific locations are thus more prone to be selected over and above others across offenders' crime series.

Second, results found when analyzing the victim release stage suggest more stability of crime sites selected by offenders over crime series. The current study is concerned with crime events rather than offenders. Therefore, the stability of crime events over time is examined rather than the offender's offending consistency. Hence, this result does not mean that one offender is consistently using the same site to commit the offense from one crime to the other. In fact, it was previously found that the victim release site characteristics showed a lower level of individual consistency compared to the encounter site characteristics (see Deslauriers-Varin & Beauregard, 2013). Instead, it means that victim release sites selected by offenders for the first few crimes of their series are not different from those selected for any other subsequent crimes committed by the offenders. In other words, even if offenders might be individually inconsistent (or consistent) in their victim release site selection, they are still selecting the site/location to release their victims in a relatively fixed pool of crime sites.

Third, as expected and as suggested by prior studies on offenders' site selection (e.g., Baudains et al., 2013; Townsley & Sidebottom, 2010), series of analyses conducted to investigate the stability of the encounter sites provide evidence of the diversification of the sites selected with longer series. More specifically, the study findings suggest that the number of crime sites found changes at the third transition (fourth crime). For example, when taking into consideration recurrent sites selected at each crime transition individually, there are only three prevalent sites used by serial sex offenders for the first three crimes of their series. After the third crime, however, a fourth crime site emerges. In that regard, the initial LCA solution found when including all crimes committed is more representative of the pool of sites selected for crimes committed later in the series. This result could be interpreted in two ways.

On the one hand, it could be that offenders with a fewer number of offenses are somewhat different than those with more offenses in regard to where they typically encounter their victims across crime series. Future studies should try to further investigate sites used by serial sex offenders while taking into account the impact of the number of sex crimes they have committed. If offenders with shorter series (in regard to the number of sex crimes committed) do have a distinctive pattern, perhaps it would be worthwhile to distinguish serial sex offenders based on the number of crimes committed (i.e., offenders with shorter versus longer crime series). On the other hand, it could also be that, as the series become longer, offenders are modifying their offending which results in the patterns observed. In line with a more traditional view of criminal career (Blumstein, Cohen, & Farrington, 1988) and more recent studies in the behavioral consistency field (Deslauriers-Varin & Beauregard, 2013; Harbers, Deslauriers-Varin, Beauregard, & van der Kemp, 2012; Sorochnski & Salfati, 2010), this result could indeed suggest that offenders having committed three offenses or less are still discovering and evaluating the different and most successful ways and locations to encounter their victim and commit their crime. This result is also consistent with the learning process hypothesis suggesting that most offenders learn from their past experiences and will try something different (i.e., committing a crime in a different way, at a different place) after the first few offenses in order to determine what strategy works best for successfully achieving their goal (e.g., Cusson, 1993; Rossmo, 2000; Sorochnski & Salfati, 2010). Once a successful strategy has been determined, the offender can then start to reproduce it when committing his following crimes, which leads to the consistent use of specific sites or sites with similar locational settings (Lundrigan et al., 2010). Considering crime linkage purposes, it might be beneficial for police investigators and crime analysts to be aware that a switch in terms of the site selected to encounter potential victims might happen, especially after the first few sex crimes.



Fourth, the prevalence of sites used by offenders to encounter their victims changes across series. Indeed, results show that even if the same classes of sites can be found, the prevalence of use of these sites can vary across series. Consequently, the most prevalent victim encounter sites at the beginning of the offenders' series are not the most prevalent sites used later in the series. Accordingly, it can be expected that crimes committed later in the offenders' series will tend towards more prevalent crime sites. For example, the shopping center and the victim's home are the two most prevalent sites among the first three crimes of the offenders' series. For the following crimes, however, the neighborhood becomes the most prevalent site used by offenders to encounter their victim. It can thus be expected that more offenders will select such an environment to find their victim once they are more "established" in their sexual career. Also, if some sites seem to be more prevalently used by offenders as their series progresses, this suggests that some offenders are switching and changing their way of operating to encounter their victims. While specific characteristics of the crime site have shown individual consistency (see Deslauriers-Varin & Beauregard, 2013), the pool of sites used by offenders has shown some diversity as the offender progresses in his crime series. For example, it is noteworthy that the use of the neighborhood to encounter victims becomes more prevalent as the crime series gets longer. This information could potentially inform police investigators of the offender's "standing" in terms of his sexual crime series. Indeed, knowing that this type of site is associated with a crime committed later in the crime series, police investigators could then focus their attention on suspects having a more extensive sexual criminal background.

Last, some crime sites are more indicative of crimes committed later during the series. In that regard, the use of the offender's home to encounter the victim is associated with crimes committed later in the crime series. Offenders are thus using their own home as a site to encounter and commit their crime once they are more "established" in their sexual career.

Consequently, when faced with a crime where the victim was encountered (and possibly released) at the offender's home, it may be assumed that this offender has committed other sex offenses before. This information could be of interest for crime linkage purposes. Indeed, considering that this type of site is associated with a crime committed later in the crime series, investigators arresting an offender who has committed a sexual offense in his home could well be in presence of a serial sex offender. A retrospective search for unresolved sex crimes that fit the offender's characteristics and whereabouts could then contribute to solving crimes for which a suspect has not been identified yet. Moreover, this result suggests that, as offenders progress in their series of sex crimes, they might become more confident and risk-taking and will start to select sites they are more familiar with to encounter their victim. Hence the emergence of the offender's home site. This hypothesis is also supported by the fact that the neighborhood site also becomes more prevalently used by offenders having committed more than three sex offenses. Indeed, linking it back to the crime pattern theory, after using sites known for providing high crime opportunities and potential targets for their first few crimes (e.g., victim's home, shopping center) these offenders gain experience and confidence and start using sites that are riskier and more uncertain to encounter their victims (e.g., neighborhood, offender's home), which might have led to their current arrest. It might as well be that their first few crimes are more opportunistic at first but become more planned and organized as their series becomes longer. This would explain the "switch" from sites known to attract victims and where the likelihood of a criminal opportunity is higher to sites that are riskier, uncertain, and where they could be more easily recognized and identified.

Although this study is one of the few investigating the homogeneity and stability of offense environments of serial sex offenders, this study suffers from limitations that need to be acknowledged. First, the sample only included crimes committed by incarcerated offenders and

for which the offenders were charged and convicted. Therefore, the results of the current study might only reflect the offense site selection of offenders who were not able to avoid detection and were thus apprehended by the police. Second, this study is based on self-reported information gathered during semi-structured interviews with the offenders, which might only reflect the offender's perception of the crime. Safeguarding against this concern, it is important to emphasize the fact that self-reported information was compared to official data (i.e., police reports) when possible. Third, offenders included in the sample differed in the number of sex crimes they committed, ranging from 2 to 37. This might have had an influence on the results, as the weight that each offender carries on the final LCA solution is not equal. More specifically, assuming stability in an offender's crime site selection, the prevalence of each script found might be the result of our decision to count an uneven number of crimes per offender. However, additional analyses showed that the victim encounter and release sites identified in the current study were used by a good proportion of offenders of the sample and, therefore, were not only found due to a small number of more prolific offenders who used a specific type of site several time across series. Finally, the current study only included offenders who had committed at least two sex crimes. Considering that, in practice, crime analysts will search databases of offenses whose author will sometimes be a serial offender but more likely a one-time offender, it would have been ideal to include single offense offenders in the current analyses. This would have allowed to determine whether these offenders are distinct from serial offenders and show a different pattern and pool of crime-site locations<sup>8</sup>. Future studies should further investigate if differences exist between crime sites used by single- and multiple-offenses offenders. If some sites used were found to be specific to single-offense or serial sex offenders, here again, police

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<sup>8</sup>Indeed, prior researches tend to suggest that significant difference might exist between one-time and serial offenders (e.g., criminal history: Trojan & Salfati, 2011; modus operandi behaviors: Corovic, Christianson, & Bergman, 2012).

investigative strategies could be enhanced and crime linkage analysts could better identify whether they are likely in the presence of a serial sex offender.

### Conclusion

The location where the victim is encountered and then released is one of the least ambiguous elements of an offense. Fortunately, in line with the crime pattern theory, prior studies have shown that serial offenders are not randomly selecting environments to commit their crimes and that environmental patterns of crime exist. In other words, because offenders operate over somewhat limited environments and that the offense environment selection by offenders is influenced by their awareness space, knowledge, experience, and target needs, offenders tend to pattern themselves geographically. Results from this study tend to support this affirmation. Indeed, it has been possible to demonstrate that offenders are relatively consistent in the sites they use to encounter and release their victims. While the use of some crime sites are associated with crimes committed later in the series, offenders are still selecting the location to encounter and release their victim in a relatively fixed and small pool of crime sites. Combined with geographic profiling information, this suggests that police departments could not only focus their search and patrols in specific geographic areas when looking for a presumed sex offender, but could also further concentrate their attention on specific sites most likely to be used by the offender among these identified areas (e.g., shopping centers). In doing so, the potential for suspect prioritization and apprehension efforts in the investigation of repetitive offenses could be greatly enhanced. Moreover, results from this study show that serial sex offenders, prior to their arrest for their index crime, tend to move to more uncertain (i.e., attracting fewer potential victims) and risk-taking encounter crime sites over time. This lends further support to the notion that spatial patterns and environmental decision-making of serial offenders can be used to reveal something about them and their understanding of the environment in which they operate. The

environmental and locational patterns identified here can also provide useful information for crime linkage purpose that might help police investigators to prioritize potential suspects, better understand the offender they are dealing with and his “standing” in terms of his sexual crime series, and to help solve crimes for which a suspect has not been identified yet.

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Table 1. Descriptive information on the study variables

		Victim encounter	Victim release
		% (n)	% (n)
Land area			
	Residential	61.8 (223)	68.4 (247)
	Commercial	25.2 (91)	15.5 (56)
	Park/wilderness/remote	8.6 (31)	12.2 (44)
	Institutional/Industrial	4.4 (16)	3.9 (14)
Location			
	Inside	52.9 (191)	55.7 (201)
	Outside	47.1 (170)	44.3 (160)
Site			
	Private	32.1 (116)	50.1 (181)
	Public/semi-public	67.9 (245)	49.9 (180)
Site familiarity			
	Not familiar	0.0 (0)	8.9 (32)
	Offender	16.6 (60)	39.9 (144)
	Victim	21.6 (78)	24.1 (87)
	Both	61.8 (223)	27.1 (98)

N = 361

Table 2. Comparison of baseline models for the victim encounter and victim release LCA

LCA	No. of Classes	Degrees of freedom	AIC	BIC	Adjusted BIC	Entropy
Victim encounter sites						
	2	32	173.80	232.13	184.55	0.92
	3	24	81.88	171.32	98.35	0.97
	<b>4</b>	<b>16</b>	<b>78.41</b>	<b>198.97</b>	<b>100.62</b>	<b>0.98</b>
	5	8	90.51	242.18	118.45	0.82
Victim release sites						
	2	46	328.04	394.15	340.22	0.91
	3	37	236.07	337.18	254.70	0.91
	<b>4</b>	<b>28</b>	<b>114.89</b>	<b>251.00</b>	<b>139.96</b>	<b>0.95</b>
	5	19	109.33	280.44	140.85	0.98

Boldface type indicates the selected model.

AIC=Akaike's Information Criterion (Akaike, 1974); BIC=Bayesian Information Criterion (Schwarz, 1978).

ABIC=Adjusted Bayesian Information Criterion (Sclove, 1987).

Table 3. Item-response for four-class model based on probability of endorsing item given latent class for the victim encounter stage

Item	Latent classes			
	Neighborhood <sup>a</sup> 36.4% (n=126)	Shopping center <sup>b</sup> 28.2% (n=110)	Victim's home <sup>c</sup> 19.1% (n=67)	Offender's home <sup>d</sup> 16.2% (n=58)
Encounter land area				
Residential	0.72 (0.14)	0.03 (0.05)	0.99 (0.02)	0.98 (0.02)
Commercial	0.05 (0.16)	0.81 (0.06)	0.00 (0.00)	0.02 (0.02)
Park/wilderness/remote	0.23 (0.06)	0.01 (0.02)	0.01 (0.02)	0.00 (0.00)
Institutional/Industrial	0.00 (0.02)	0.15 (0.04)	0.00 (0.00)	0.00 (0.00)
Encounter location				
Inside	0.02 (0.04)	0.68 (0.17)	0.94 (0.05)	0.92 (0.04)
Outside	0.98 (0.04)	0.32 (0.17)	0.06 (0.05)	0.08 (0.04)
Encounter site				
Private	0.03 (0.03)	0.01 (0.01)	0.76 (0.07)	1.00 (0.00)
Public/semi-public	0.97 (0.03)	0.99 (0.01)	0.24 (0.07)	0.00 (0.00)
Encounter site familiarity				
Not familiar*	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Offender	0.03 (0.02)	0.05 (0.02)	0.00 (0.01)	0.87 (0.18)
Victim	0.03 (0.03)	0.06 (0.03)	0.95 (0.11)	0.04 (0.18)
Both	0.94 (0.03)	0.89 (0.03)	0.05 (0.11)	0.09 (0.10)

Rho estimates and standard errors (in brackets) are presented; a data-derived prior was applied to the rho parameters to help avoid parameter estimates on boundary values of zero and one.

\* None of the encounter site selected among the 361 crime events was unknown to the offender and/or the victim. This category was then removed from the analyses.

<sup>a</sup>Site used by 48.6% (n=35) of the offenders of the sample.

<sup>b</sup>Site used by 50.0% (n=36) of the offenders of the sample.

<sup>c</sup>Site used by 31.9% (n=23) of the offenders of the sample.

<sup>d</sup>Site used by 27.8% (n=20) of the offenders of the sample.

Table 4. Item-response for four-class model based on probability of endorsing item given latent class for the victim release stage

		Latent classes			
		Item Home <sup>a</sup> 43.7% (n=157)	Neighborhood <sup>b</sup> 28.5% (n=104)	Shopping center <sup>c</sup> 17.8% (n=63)	Unfamiliar site <sup>d</sup> 10.0% (n=37)
Victim release land area					
	Residential	0.97 (0.01)	0.51 (0.05)	0.10 (0.06)	0.98 (0.03)
	Commercial	0.03 (0.01)	0.03 (0.03)	0.75 (0.07)	0.00 (0.00)
	Park/wilderness/remote	0.00 (0.00)	0.40 (0.05)	0.02 (0.02)	0.02 (0.03)
	Institutional/Industrial	0.00 (0.00)	0.06 (0.03)	0.13 (0.05)	0.00 (0.00)
Victim release location					
	Inside	0.99 (0.01)	0.00 (0.00)	0.68 (0.07)	0.01 (0.01)
	Outside	0.01 (0.01)	1.00 (0.00)	0.32 (0.07)	0.99 (0.01)
Victim release site					
	Private	0.91 (0.02)	0.01 (0.01)	0.00 (0.00)	0.99 (0.01)
	Public/semi-public	0.09 (0.02)	0.99 (0.01)	1.00 (0.00)	0.01 (0.01)
Victim release site familiarity					
	Not familiar	0.00 (0.00)	0.02 (0.01)	0.00 (0.00)	0.83 (0.08)
	Offender	0.48 (0.04)	0.60 (0.05)	0.07 (0.04)	0.05 (0.05)
	Victim	0.46 (0.04)	0.05 (0.02)	0.10 (0.05)	0.07 (0.05)
	Both	0.06 (0.02)	0.33 (0.05)	0.83 (0.06)	0.05 (0.04)

Rho estimates and standard errors (in brackets) are presented; a data-derived prior was applied to the rho parameters to help avoid parameter estimates on boundary values of zero and one.

<sup>a</sup>Site used by 66.7% (n=48) of the offenders of the sample.

<sup>b</sup>Site used by 48.6% (n=35) of the offenders of the sample.

<sup>c</sup>Site used by 31.9% (n=23) of the offenders of the sample.

<sup>d</sup>Site used by 9.7% (n=7) of the offenders of the sample.

Table 5. Crosstabulation - % (n) - of the victim encounter site LCA model and the victim release site LCA model

Victim encounter Latent classes	Victim release latent classes			
	Home (n=157)	Neighborhood (n=104)	Shopping center (n=63)	Unfamiliar site (n=37)
Neighborhood (n=126)	21.4 (27)	58.7 (74)	2.4 (3)	17.5 (22)
Shopping center (n=110)	11.8 (13)	20.0 (22)	54.5 (60)	13.6 (15)
Victim's home (n=67)	94.0 (63)	6.0 (4)	0.0 (0)	0.0 (0)
Offender's home (n=58)	93.1 (54)	6.9 (4)	0.0 (0)	0.0 (0)

$X^2(9)=320.9, p<.001, \text{Contingency coefficient}=.69$ .

Table 6. Fit statistics for test of crime transition difference in latent class prevalence for victim encounter and victim release site LCA models

		Victim Encounter four-class model						Victim release four-class model					
		G <sup>2</sup>	df	AIC	BIC	ABIC	Entropy	G <sup>2</sup>	df	AIC	BIC	ABIC	Entropy
Crime transition 1 (crime 1 vs. 2+)													
	Freely estimated	19.67	33	143.67	384.78	188.08	0.88	64.11	57	204.11	476.33	254.26	0.93
	Measurement invariance imposed	42.40	61	110.40	242.63	134.76	0.92	87.21	89	163.21	310.99	190.43	0.93
	Difference	20.73(NS)	28					23.10 (NS)	32				
Crime transition 2 (crime 1, 2 vs. 3+)													
	Freely estimated	22.10	33	146.10	387.21	190.51	0.90	57.08	57	197.08	469.30	247.22	0.93
	Measurement invariance imposed	64.01	61	132.01	264.23	156.37	0.92	93.72	89	169.72	317.50	196.94	0.93
	Difference	41.91*	28					36.64 (NS)	32				
Crime transition 3 (crime 1, 2, 3 vs. 4+)													
	Freely estimated	20.63	33	144.63	385.74	189.04	0.91	159.60	57	299.60	571.83	349.75	0.90
	Measurement invariance imposed	86.44	61	154.44	286.66	178.80	0.94	131.30	89	207.30	355.08	234.52	0.93
	Difference	65.81**	28					28.30 (NS)	32				
Crime transition 4 (crime 1, 2, 3, 4 vs. 5+)													
	Freely estimated	22.89	33	146.89	388.00	191.30	0.91	160.00	57	300.00	572.22	350.15	0.89
	Measurement invariance imposed	83.88	61	151.88	284.10	176.23	0.93	132.41	89	208.41	356.18	235.63	0.93
	Difference	60.99**	28					27.59 (NS)	32				

\*p<.05 ; \*\*p<.001.