

SITUATIONAL CAUSES OF OFFENDING: A FIXED-EFFECTS ANALYSIS OF SPACE-TIME BUDGET DATA*

WIM BERNASCO

Netherlands Institute for the Study of Crime and Law
Enforcement (NSCR)

and

Department of Spatial Economics
VU University Amsterdam

STIJN RUITER

Netherlands Institute for the Study of Crime and Law
Enforcement (NSCR)

GERBEN J.N. BRUINSMA

Netherlands Institute for the Study of Crime and Law
Enforcement (NSCR)

and

Department of Criminal Law and Criminology
VU University Amsterdam

LIEVEN J.R. PAUWELS

Department of Criminal Law & Criminology
Ghent University

FRANK M. WEERMAN

Netherlands Institute for the Study of Crime and Law
Enforcement (NSCR)

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Situational theories of crime assert that the situations that people participate in contain the proximal causes of crime. Prior research has not tested situational hypotheses rigorously, either for lack of detailed situational data or for lack of analytical rigor. The present research combines detailed situational data with analytical methods that eliminate all stable between-individual factors as potential confounds. We test seven potential situational causes: 1) presence of peers, 2) absence of adult handlers, 3) public space, 4) unstructured activities, 5) use of alcohol, 6) use of cannabis, and 7) carrying weapons. In a two-wave panel study, a general sample of adolescents completed a space-time budget interview that recorded, hour by hour over the course of 4 complete days, the activities and whereabouts of the subjects, including any self-reported offenses. In total, 76 individuals reported having committed 104 offenses during the 4 days covered in the space-time budget interview. Using data on the 4,949 hours that these 76 offenders spent awake during these 4 days, within-individual, fixed-effects multivariate logit analyses were used to establish situational causes of offending. The findings demonstrate that offending is strongly and positively related to all hypothesized situational causes except using cannabis and carrying weapons.

Even the most active offenders do not commit crimes around the clock. Most of the time they abide by the law without getting involved in any criminal activity. Theories of crime must account for this phenomenon: If crime varies over time, so must at least some of its causes. Therefore, offending must have proximal causes that fluctuate over time much more quickly—from hour to hour rather than from year to year—than the more distal causes that are attributed to relatively stable characteristics of individuals and their social environments.

Situational theories of crime posit that many proximal causes of crime are to be found in the immediate situational context of behavior. This situational context includes where the individuals are, with whom, and what they are doing (Pervin, 1978). It usually varies considerably over the course of a day. Situational theories can help explain why some situations lead to crime while others do not, and why the same person offends in some situations but not in others.

Routine activity theory (Cohen and Felson, 1979; Felson, 1986) asserts that the convergence in time and space of a motivated offender, a suitable target, and the absence of capable guardians are sufficient conditions for crime to take place. Most applications of routine activity theory have emphasized the victim or the guardian rather than the offender (Birkbeck and LaFree, 1993). In contrast, Osgood et al. (1996) developed a routine activity theory of general deviance, theorizing a number of situational conditions that provide motivations and opportunities for offending and other deviant

activities. In short, the theory asserts that the likelihood of adolescent offending and deviance is heightened in situations where adolescents spend time in unstructured activities with peers and in the absence of authority figures. Osgood et al. tested the theory on a five-wave panel dataset, using a within-individual regression model that eliminated all stable between-individual factors as potential confounds, thereby providing a fairly rigorous test of the hypotheses. Osgood et al.'s theory has been elaborated in various ways, by adding specific criminogenic settings such as public space (Weerman et al., 2013) and entertainment areas and alcohol outlets (Miller, 2013), by contextualizing adolescent activities in community contexts (Maimon and Browning, 2010; Osgood and Anderson, 2004), by differentiating between boys and girls (Augustyn and McGloin, 2013), and by testing whether it is conditional on the deviance of peers (Haynie and Osgood, 2005; Svensson and Oberwittler, 2010).

Although Osgood et al.'s theory is certainly situational—it asserts that specific situations have a proximal effect on the likelihood of offending—in the original 1996 study as well as in those that replicated and extended it, exposure to criminogenic situations and involvement in offending were measured at the individual level, not at the situational. The studies demonstrated that adolescents who spend more unstructured and unsupervised time with peers display greater levels of deviance and offending. They did not test whether offending actually takes place during unstructured and unsupervised time with peers.

A rigorous test of situational explanations would require disaggregated data with measures that simultaneously apply to individual people, small places, and small slices of time (Eck, 1995). A unit of analysis that corresponds to this description can be defined as “the part of the environment (the configuration of objects, persons, and events) that, at any given moment in time, is accessible to a person through his or her senses (including any media present)” (Wikström et al., 2012: 15). As far as we are aware, only the recent work of Wikström and colleagues (Wikström et al., 2010, 2012) has explored situational explanations of offending using situational-level measures. They developed a space–time budget instrument to measure the time use and whereabouts of adolescents, recording hour by hour where they were, what they were doing, and with whom. Because the instrument also captures the exact day and hour of any offense committed, it offers a unique opportunity to assess with great precision the characteristics of situations in which the adolescents committed offenses, and to compare these with the characteristics of situations in which they did not offend. In other words, the space–time budget instrument is well suited to test situational explanations of crime.

Wikström and colleagues (2010) demonstrated that individuals committed 10 times more offenses when they were together with peers and

unsupervised by adults, 5.7 times as many offenses when they were unsupervised with peers in an area of poor collective efficacy, and 7.3 times more offenses when they were unsupervised with peers in a high entertainment area. These findings were replicated recently on more waves of data and expanded with more detailed tabulations of activity-based and place-based offending rates for varying subsets of adolescents (Wikström et al., 2012: 324–63). They, however, did not test for the effects of multiple situational characteristics simultaneously. More importantly, because they only calculated offending rates per 1,000 hours of time spent in specific situations, their findings do not constitute a rigorous test of the situational explanations, as they do not rule out individual characteristics as alternative explanations.

The key advance of the present study is that it combines situational data with an appropriate statistical methodology to test rigorously situational causes of offending. We identify multiple situational characteristics that are likely to affect offending; we disentangle their separate effects and test them rigorously in a multivariate framework that rules out individual characteristics as potential confounds. To this effect, we use a translated version of the space–time budget instrument developed by Wikström and his colleagues. We apply fixed-effects panel estimation to assess which situational characteristics affect the probability of offending among adolescents. Following prior literature (Osgood et al., 1996; Wikström et al., 2010, 2012), we consider presence of peers, lack of supervision, and involvement in unstructured activities as causal factors in crime, and we treat them as distinct situational features. In addition, our measures of situational variation also include other characteristics, namely, whether the situation is in public space, whether alcohol is being used, whether cannabis is being used, and whether weapons are being carried.

SITUATIONAL CAUSES OF CRIME

The situational perspective seeks the causes of crime not in the mind or the living conditions of the offender, but in the concrete situations in which crimes are perpetrated. The situational perspective on offending does not deny that the same situation may motivate some people to offend and others not; it aims to answer another question: Why does the same person offend in some situations but not in others?

In the remainder of this section, it is argued that seven elements of situations increase the likelihood of offending by adolescents: 1) presence of peers, 2) absence of adult handlers, 3) involvement in unstructured activities, 4) presence in public space, 5) use of alcohol, 6) use of cannabis, and 7) carrying weapons. The first three elements were theorized and investigated in Osgood et al. (1996) and have subsequently been studied by others (e.g.,

Table 1. Hypotheses

1	Adolescents are more likely to offend in the presence of peers than in the absence of peers
1a	Adolescents are more likely to offend in the presence of multiple peers than in the presence of a single peer
2	Adolescents are more likely to offend in the absence of adult handlers
2a	Adolescents are more likely to offend in the presence of adult family nonmembers than in the presence of adult family members
3	Adolescents are more likely to offend in semi-public and public space than in private space
3a	Adolescents are more likely to offend in public space than in semi-public space
4	Adolescents are more likely to offend when involved in unstructured activities
5	Adolescents are more likely to offend when alcohol intoxicated
6	Adolescents are more likely to offend when cannabis intoxicated
7	Adolescents are more likely to offend when carrying weapons

Maimon and Browning, 2010; Miller, 2013; Osgood and Anderson, 2004; Svensson and Oberwittler, 2010; Weerman et al., 2013). Substance use often is dealt with as part of the general concept of deviance and analyzed as a dependent variable, but we view it as a causal situational factor in the genesis of violent behavior and other offending, which is in line with many studies on the psycho-pharmacological effects of alcohol and drugs (e.g., Bushman and Cooper, 1990; Fals-Stewart, 2003; Moore and Stewart, 2005). Table 1 explicitly lists all hypotheses about the effects of these elements on offending.

PRESENCE OF PEERS

Although Osgood et al. (1996) were the first to theorize the effect of spending time with peers on individual offending from a situational (routine activity) perspective, Warr (2002) elaborated most extensively on the various ways in which the presence of peers makes offending easier and more rewarding, and he has been most outspoken by claiming that “peer influence is the *principal proximal cause* of most criminal conduct” (Warr, 2002: 136).

According to Warr (2002), the three most effective mechanisms of peer influence require the physical presence of peers in potential offending situations: fear of ridicule, display of loyalty, and status seeking. Each of these mechanisms is rooted in the individual’s need to be accepted as a group member and be respected by the other group members, a need that is most salient during adolescence. Offending can only disarm ridicule, prove loyalty, and confirm or produce status in the physical presence of peers who are aware of the act, and the peer group therefore provides a motivation to commit the offense.

The physical presence of peers also may enhance offending because it provides access to potential co-offenders. Collective offending requires that co-offenders converge in time and space. Some crimes actually require the active collaboration of multiple individuals; other crimes are facilitated by the presence of more than one offender. A group is more intimidating to a robbery victim than a single individual, for example, and a burglary is more easily accomplished when co-offenders divide elementary tasks between them. Thus, the presence of peers makes many more crimes possible, or at least more likely to be successfully completed (Felson, 2003; McGloin and Piquero, 2010; Warr, 2002).

In sum, various situational theories—in particular those articulated by Osgood et al. (1996) and by Warr (2002)—assert that the presence of peers in a situation increases the likelihood that the individual will commit an offense (hypothesis 1). The theoretical perspectives that support this hypothesis all provide support for an additional hypothesis that the probability of offending rises as the number of peers in the setting increases (hypothesis 1a). As experimental research in social psychology has demonstrated, conformity to group pressure generally increases with group size, in particular, in the low ranges of group size (Bond, 2005; Insko et al., 1985).

ABSENCE OF ADULT HANDLERS

Supervision is a situational form of social control. It is effective because the presence of other people deters offending. According to routine activity theory, the absence of a capable guardian or a *capable handler* is a necessary requirement for crime next to a motivated offender and a suitable target.

The *handler* is a role not included in the original formulation of the theory (Cohen and Felson, 1979) that took motivated offenders as given. It was added in later versions (Felson, 1986, 1995) through a linkage with control theory (Hirschi, 1969), and was included in Osgood et al.'s (1996) routine activity theory of general deviance. A handler is someone who knows the potential offender, who has been granted authority over him or her, who has been given responsibility for his or her conduct, and who has developed an emotional attachment to him or her. This combination of capability and responsibility allows the handler to exercise social control over the potential offender. Parents, teachers, and sports coaches are examples of handlers of young people. When present, handlers are particularly good in preventing offending because they know the potential offenders and the potential offenders know them. Handlers are usually important people in the lives of adolescents. It should thus be expected that the presence of adult handlers in situations reduces the likelihood of young people to offend in those situations, and that the *absence of adult handlers* increases the likelihood of offending (hypothesis 2).

An additional hypothesis is that supervision by parents and other family members is more effective than that by professional handlers such as teachers and sports coaches (hypothesis 2a). We suggest two reasons for the hypothesized difference. First, adolescents may be expected to give more weight to the judgment and potential sanctions of those with whom they have stronger bonds. Second, handlers with strong bonds typically carry responsibility for a few individuals only (e.g., parents for their own children) and can thus be more effective than professional handlers who have weaker bonds and larger groups to supervise (e.g., teachers for all pupils in their class).

PUBLIC SPACE

According to the extended version of routine activity theory, two other roles are important in the prevention of crime: guardians and place managers. A *guardian* is either a person who is willing and capable of guarding a potential target against victimization or an object (e.g., a lock, or a recording device) that plays a similar role. Owners often are guardians of their properties. Parents often guard their children against victimization. The *place manager* is another type of supervisor role. Place managers are individuals who have responsibility for managing the cleanliness, orderliness, and safety of a place (Eck, 1994). For janitors, doormen, and shop employees, place management is part of their job. Often, local residents and business owners also act as place managers when they keep an eye on the areas around their houses and businesses (Steenbeek et al., 2012).

The presence of guardians or place managers depends on whether a place is accessible to anybody (public space), accessible to limited groups of people (semi-public space), or accessible only to a few specific people (private space). Home is the main example of private space. Semi-public places are accessible to a limited number of people who are members of well-defined groups (such as the renters in an apartment building, the pupils of a school, or office employees) or who have paid for access or for the services provided (such as the visitors of movie theaters, restaurants, barber shops, and public transport). Public places are open to the general public (like streets, squares, train stations, parks, beaches, and shopping malls).

In private spaces, the users or owners exercise social control. In semi-public places, semi-formal social control is exercised by people who either explicitly function as place managers (janitors, doormen, and private security guards) and by people who are expected to exercise social control as part of another function (e.g., teachers, barmen, cashiers, and bus drivers). Both categories generally have authority but few resources for actual intervention. In public spaces, social control often is limited. Typically, social

control in public space is exercised by the police, but they are only present for limited amounts of time.

Furthermore, accessibility is correlated with anonymity: in private space, all individuals are generally known to each other; in semi-private space, some people are known to some other people; and in public space, most people are unknown to most others. This correlation adds to differences in social control: Situations that take place in *public space* are more likely to result in crime than situations in semi-public and private space because bystanders and victims of crime in public spaces are more likely to be strangers who are less able to identify offenders.

These arguments lead to the expectation that adolescent offending is more likely in settings in semi-public and public space than in settings in private space (hypothesis 3). In addition, offending seems more likely to occur in public settings—where social control is weakest and anonymity is highest—than in semi-public settings—where some social control is still being exercised alongside other functions (hypothesis 3a).

UNSTRUCTURED ACTIVITIES

Osgood et al. (1996) argued that situations also induce crime if they involve *activities that are unstructured*. The term “unstructured activities” applies to “activities that carry no agenda for how time is to be spent” (p. 640). “Hanging around” is a prototypical example because it is not planned or organized. Visiting friends and shopping are other activities that tend to be weakly organized and somewhat improvised.

Unstructured activities are presumed to stimulate offending, simply because they leave more time available for deviant activity. According to Osgood et al. (1996: 641), “greater structure means that more time will be spent in designated ways, and that this time will not be available for offending.” Thus, less structured activities leave more room for alternative activities, including opportunities for illegal conduct (hypothesis 4).

USE OF ALCOHOL

The situational explanation of the link between alcohol use and offending is that the immediate effects of alcohol induce or facilitate offending. Using alcohol causes psychomotor and cognitive impairment and lowers self-control, which is supposed to be an important psychological inhibitor of crime (Gottfredson and Hirschi, 1990). The temporary loss of self-control could make it more likely that small conflicts escalate into fights and that small opportunities for crime are reaped.

Most research has not been on the relation between alcohol use and offending generally but on how alcohol use relates to violence or aggressive behavior (and some research on alcohol use and nonviolent and

noncriminal risk-taking behavior). The evidence in favor of a positive and direct relation between alcohol use and violent and aggressive behavior is strong, as it is based on experiments with powerful designs, including randomized trials with experimental, placebo, nonplacebo, and control groups (Bushman and Cooper, 1990; Felson et al., 2008). Furthermore, the experimental evidence is supported by research findings from natural settings (e.g., Felson et al., 2008). For example, Fals-Stewart (2003) showed with diary data and a fixed-effects analysis that the odds of physical aggression are at least eight times higher on days when subjects use alcohol than on days when they do not.

Given the psycho-pharmacological mechanism and the empirical evidence, it is reasonable to hypothesize that alcohol use plays a role in generating violent crimes, and possibly nonviolent crimes (hypothesis 5). Note that the hypothesized situational criminogenic nature of alcohol use is unrelated to the legal status of the use of alcohol by minors. Although in the Netherlands the sale of alcohol to persons younger than 16 years of age is illegal, its use by minors is not sanctioned. In other words, alcohol use as such is not an offense. Because excessive alcohol use is a form of deviant behavior and likely to be stimulated by the four situational factors described earlier (presence of peers, absence of adult handlers, public space, and unstructured activities), alcohol use also may mediate the effects of these situational factors on offending.

USE OF CANNABIS

Like alcohol, cannabis distorts spatial and time perception and impairs cognitive and psychomotor performance, and it might therefore be expected to facilitate offending (hypothesis 6). Alternatively, because cannabis also has a sedative effect, its use might be expected to reduce violence, aggression, and criminal behavior in general.

Results of studies on the relation between cannabis use and violence are mixed (Abel, 1977; Fals-Stewart, Golden, and Schumacher, 2003; Haggård-Grann et al., 2006; Moore and Stuart, 2005; Moss and Tarter, 1993). A tendency exists for the methodologically better studies to find no or even an inverse situational effect of cannabis use on violence (Myerscough and Taylor, 1985).

Note that use of cannabis is legal in the Netherlands. Although the sale of cannabis is officially illegal, regulated sale is tolerated: Limited amounts of cannabis are sold to users in "coffee shops" that can be found in most towns and cities. In other words, cannabis use is not an offense. Like alcohol use, cannabis use is a form of deviance and might mediate the effect of the other situational factors on offending.

CARRYING WEAPONS

Although strong empirical evidence for the hypothesis that carrying a weapon is a situational cause of offending is lacking, carrying a weapon to school has been shown to be a risk factor for future violence perpetration (DuRant et al., 1995; Resnick, Ireland, and Borowsky, 2004). The motivation for carrying a weapon might be to reduce the risk of victimization or a wish to impress peers, but it is likely also an indicator of the willingness to use it if the need arises (Spano and Bolland, 2013). In addition, it also might be a situational cause because carrying a weapon creates the opportunity to use it in unforeseen situations of conflict. With regard to offending, it can thus be expected that individuals are more likely to offend in settings where they carry a weapon (hypothesis 7).

INTERACTION OF SITUATIONAL CAUSES

Some prior tests of situational theories of adolescent offending seem to assume that situational causes of crime, in particular presence of peers, absence of adult handlers, and unstructured activities, are consequential only in combination. Typically, items measuring routine activities combine various situational elements. For example, the item “getting together with friends informally” (Osgood et al., 1996) explicitly combines the presence of peers with unstructured activities, which makes it impossible to distinguish among the effects of the presence of peers (which can occur in structured and unstructured situations), the involvement in unstructured activities (which can take place with or without peers), and the effect of the combination of both elements. The space–time budget survey described in the next section allowed us to disentangle all situational causes and, thus, to test explicitly whether they have independent effects or whether they only affect offending in combination.

DATA AND METHODS

The present section documents the data collection procedures and the contents of the space–time budget interview. Subsequently we discuss the operationalization of variables and the statistical techniques applied in the data analysis.

SAMPLING PROCEDURES AND RESPONSE

The study is based on detailed data of 76 adolescent offenders. They were identified as offenders within a larger general population sample of 868 adolescents. Identifying offenders within a general population sample has the advantage of providing a more broadly representative sample of offending

behavior than a more selective sample such as arrestees or prisoners would. To explain how the 76 subjects were selected from the general sample, we first describe the general sample and the instruments used.

Forty secondary schools in The Hague and its suburbs were approached with the request to allow their students being recruited for interviews during school hours. Ten of these schools (25 percent) agreed to participate. The main reason for nonparticipation of schools was the (perceived) overload of research participation requests: Because schools provide an easy entry point to gain access to respondents, many research institutes attempt to recruit participants through schools. To limit the burden put on their day-to-day management, most schools restrict their participation to only a few studies annually. School response rates did not display any bias with respect to school size or with respect to geographical location, but there was a tendency for certain school types to be somewhat overrepresented.¹

In each school, all first graders (mainly 12–13 years of age) and fourth graders (15–16 years of age)² were selected, which comprised 943 adolescents. The parents were informed about the study and were asked to provide (passive) consent. The response was 93 percent (878 respondents).³ The respondents were asked to take part in two data collection sessions, a *space-time budget interview* and a *self-report questionnaire*, each of which took approximately 50 minutes to complete. Based on random assignment, approximately 50 percent of the respondents completed the questionnaire before they participated in the space-time budget interview. For the others, the order was reversed. Usually, but not always, the questionnaire and space-time budget were administered consecutively with a 10–15-minute pause in between.⁴ The space-time budget interview is the main source of data for the present analysis and is described in the subsequent discussion. The *self-report questionnaire* is only used to validate in part the space-time budget interview.

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1. The Netherlands has a free public school system characterized by multiple-track secondary education. Our sample contained relatively many schools with 4-year tracks (vocational training) and many schools with 6-year tracks (pre-university), and relatively few schools from the 5-year track middle category.
 2. The first grade is similar to the seventh grade in the United States; the fourth grade is similar to the tenth grade.
 3. Of the 943 sampled adolescents, 27 (2.9 percent) could not be reached because their school was too busy during the period of data collection; 15 (1.6 percent) were withdrawn by their parents; 13 (1.4 percent) did not show up at the appointment; 6 (0.6 percent) moved to another home address, school, or left school; and 3 (0.3 percent) were ill during the data collection period.
 4. The space-time budget interview was completed by 868 respondents and the self-report questionnaire by 853 respondents; 843 respondents completed both.

The first wave of the study started in October 2008 and was completed in April 2009. Two years later, the 616 adolescents that could be traced, and were willing to participate, again participated in the questionnaire and the space–time budget interview (all 616 completed both instruments). This second wave started in September 2010 and lasted until May 2011.

SPACE–TIME BUDGET INTERVIEW

The *space–time budget interview* is a structured personal interview that was conducted individually and face-to-face with the respondents by trained research assistants. The instrument was developed by Wikström and Butterworth (2006) in the Peterborough Youth Study and refined in its successor, the Peterborough Adolescent Delinquency Study (PADS+). For the current study, the instrument was translated and slightly adjusted to the Dutch situation. The procedures that are comprehensively documented in Wikström et al. (2012: 67–78) were followed closely, and our fieldwork coordinators and interviewers were trained by the PADS+ staff. The instrument required approximately 45–50 minutes to administer.

During the interview, the activities of the adolescents during 4 recent days (4×24 hours) were recorded. The interviews captured the previous Friday and Saturday, and the two most recent other weekdays (excluding Sundays), to ensure comparability of the data across the respondents. Detailed information was collected about the main activities of the adolescents for each hour of the day. The interviewers used a natural method whereby the interviewers guided the respondents to describe the chronology of events that happened over the course of a day, helped them recall activities and locations, and probed for information when necessary. The information recorded for every hour included the nature of the main activity (e.g., sports, learning, and sleeping), the function of the place where the activity was performed (e.g., home, school, shop, friend’s home, and bar), and any persons present in the setting (e.g., teacher, parent, and peers). Examples of the simple questions that respondents were asked are as follows: “Where did that happen?” “Who else was there?” “What were you doing?”

In addition, the interviewers always specifically asked whether at any time during the day the respondent had been involved in offending, whether he or she had used alcohol or used drugs, and whether he or she had carried a weapon. In case of a positive answer, the specific hours during which this had happened were recorded, as well as details about the offenses, substances used, or weapons carried. For example, if the respondent answered he or she had used alcohol, the interviewer would ask when he or she had been drinking and what he or she had been drinking, and if the respondent answered he or she had been involved in offending, the interviewer asked details about the characteristics of victims or targets of these offenses.

In sum, the space–time budget interview recorded very detailed information about *where*, *when*, and *what* respondents were doing *with whom*, during 4 days of the week before the interview. For each item in the space–time budget interview (such as place, activity, and people present), there were typically dozens of answer categories available to code the item. For example, the activity question “What were you doing most of the time during this hour?” had 121 answer categories, of which “sleeping,” “learning at school,” and “playing online games” are common answer categories (for a list of all codes, see Wikström et al., 2012: 423–36, from which our list of codes was translated). Two features of the space–time budget made it possible to collect so much information within 45–50 minutes. First, because it was a personal interview rather than a self-report checklist, the respondents were just asked to describe the events they had experienced by answering a few simple questions, while coding the answers was the responsibility of trained interviewers. Second, some activities (especially sleeping and learning at school) can be recorded relatively quickly because they tend to continue for multiple hours. The interviewers or field coordinators did not report respondent fatigue. Instead, they reported that most respondents enjoyed the space–time budget interview.

Although time use research is a well-developed and thriving area of scientific research (Harvey and Pentland, 2002), it has only recently been introduced in research on offending. In support of the external validity of offending measures derived from the space–time budget interview, Wikström and colleagues demonstrated that the spatial and temporal patterns of offenses reported in the space–time budget interview correspond very closely with police-recorded crimes for young offenders (Wikström et al., 2012: 325–7). In our own data, further support for the internal validity is provided by the correspondence between the items measuring substance use in the space–time budget interview and similar measures in the self-report questionnaire that also was administered.

As a first measure of correspondence, we considered the numbers of respondents that reported in the questionnaire that they never drank alcohol or never smoked cannabis but still reported substance use in the space–time budget interview, and those that displayed the reverse pattern by reporting daily use in the questionnaire but reporting no substance use in the space–time budget interview. The first inconsistency occurred in less than 2 percent of the respondents and the second inconsistency also was rare,⁵ suggesting that the space–time budget interview provides information that is

5. Of the 7 respondents who reported using alcohol almost every day in the questionnaire in wave 1, only 1 reported no alcohol use in the space–time budget interview. The same held for 0 of 6 respondents in wave 2. With respect to cannabis, of the 24 who reported almost daily cannabis use in the questionnaire in wave 1, 6 reported

compatible with a traditional data collection instrument. As a second measure of correspondence, we calculated Spearman rank correlation coefficients between the questionnaire items and space–time budget measures (number of days in which at least 1 hour involving reported alcohol use and cannabis use, respectively). These correlations were $\rho = .64$ and $\rho = .73$ for alcohol use in the first and second wave, respectively, and $\rho = .57$ and $\rho = .63$ for cannabis use in the first and second wave, respectively. The results of both consistency checks may be seen as an indication of the good quality of the space–time budget data.

Offenses and the seven hypothesized situational causes of offending were derived from the response categories in the space–time budget interview as described in the subsequent discussion.

PRESENCE OF PEERS

Peers are persons personally known to the respondent and equal in status, who were physically present in the setting: peers include friends and acquaintances (of both sexes), partners (girlfriend or boyfriend), and siblings (both sexes, only younger than 18 years of age). To operationalize the presence of peers, we distinguish 1) no peer physically present, 2) one peer physically present, and 3) two or more peers physically present. In the dichotomous version (models 1–3), category 1 is contrasted with categories 2 and 3.

ABSENCE OF ADULT HANDLERS

Adult handlers include adult family members: parents, stepparents, siblings, nephews, nieces, cousins, aunts, uncles, and grandparents, all 18 years of age or older. Professional handlers are other adult people who are personally known to the respondent: teachers, sports trainers, supervisors, peers' parents, adult neighbors, employers, adult colleagues, janitors, religious leaders, doctors, dentists, psychiatrists, barbers, professional caretakers, and homework counselors. In operationalizing the absence of adult handlers, three categories are distinguished: 1) adult family member(s) physically present (either with or without professional handlers), 2) professional handlers physically present but not family members, and 3) no adult handlers physically present. In the dichotomous version (models 1–3), categories 1 and 2 are contrasted with category 3.

no cannabis use in the space–time budget instrument. The same held for 2 of 15 respondents in wave 2.

PUBLIC SPACE

This variable refers to ownership of the place where activities take place and, by implication, its accessibility. Private space is restricted to home, second home, and someone else's home. Public space is space freely accessible to everyone and includes streets, squares, public parking places, bus stations, train stations, airports, parks, beaches, dunes, woodlands, public sports and recreation facilities, as well as malls and shopping strips. All space that is neither private nor public is defined as semi-public, which includes indoor and outdoor places that require some form of membership (e.g., school, sports club, and doctor's office) or payment for entry or service delivery (e.g., movie theater, football stadium, and restaurant). To categorize space, the following three categories are distinguished: 1) private space, 2) semi-public space, and 3) public space. In the dichotomous version (models 1–3), category 1 is contrasted with categories 2 and 3.

UNSTRUCTURED ACTIVITY

Activities are defined as unstructured when generally their timeframe is undecided so that they have no fixed end point or result. Although there is some arbitrariness involved in defining specific activities as unstructured, we counted activities as unstructured if they included socializing as their main activity during the recorded hour. For instance, break/pause (during school), hanging around, walking or biking around, visiting someone, socializing, talking (face to face), talking on the phone, e-mailing/chatting/texting, attending a birthday party or other party, and going out to a bar or club.

USE OF ALCOHOL

Any alcohol (beer, wine, or liquor) that was used by the respondent.

USE OF CANNABIS

Any cannabis (marijuana or hash) that was used by the respondent.

CARRYING WEAPONS

The respondent carried any weapon (knife or other sharp object useable as a weapon or other blunt object usable as a weapon). In 89.5 percent of cases, the weapon was a knife.

OFFENDING

In line with the results of the PADS+ study (Wikström et al., 2012: 324), most of the reported 104 offenses involved violence against persons (53 assaults) and against objects (41 cases of vandalism), and only a few were

property offenses (6 thefts) or traffic and other offenses (4 offenses). Because no offense-type specific hypotheses were formulated, and because of the relatively small number of offenses reported in the space–time budget interview, which limits the statistical power of the analysis, all four offense types were combined and analyzed as instances of generic offending.

Respondents who reported any incident of offending were assigned to the offender sample ($n = 76$), which is the sample analyzed in the remainder of this article. The mean age in the entire sample (14.1 years in wave 1) is almost the same as the mean age in the offender sample (14.3 years), but 54.9 percent of the entire sample are boys, whereas they are 80.4 percent of the offender sample. In addition, the level of delinquency (self-reported in the questionnaire) in the offender sample is much higher: In the entire sample, adolescents self-reported 3.7 offenses per year in wave 1, while in the offender sample, they reported 10.5 offenses per year. Note that focusing on the offender sample (rather than on the full sample of adolescents) is essential for the purpose of our analysis, that is, to test situational causes of crime by excluding differences between individuals as potential confounds.

TEMPORAL CONTROLS

It is well known that, for many types of offenses, offense rates vary between weekdays and weekends (Cohen and Felson, 1979) and over the course of the day (Felson and Poulsen, 2003). Although time itself is not a substantive explanation of offending, temporal cycles are strongly related to the daily activities and whereabouts of all organisms, and time of day and day of week may thus be correlated with unmeasured alternative situational causes of offending. To control for unobserved heterogeneity between days of the week and times of the day, two dichotomous control variables were included in the analyses. One variable indicates whether the hour was during the evening or night (6 P.M.–6 A.M.) and the other whether it was during the weekend (Friday 6 P.M.–Sunday 6 A.M.).

MISSING VALUES

Because trained interviewers were responsible for coding, the percentage of missing values in the data is negligible. There are no missing values at all regarding offending, alcohol use, cannabis use, carrying a weapon, and presence of peers, and for the other variables, numbers were extremely low: “absence of adult handlers” (.04 percent), “public space” (.02 percent), and “unstructured” (.01 percent). Any missing values were assigned to the categories “no handlers,” “private space,” and “structured” because these were the largest categories.

FIXED-EFFECTS PANEL REGRESSION

Experiments with randomized controls are the gold standard for testing hypotheses on situational causes of crime. The next best alternative uses individuals as their own counterfactuals and compares the situations in which they committed crimes with situations in which they did not. This strategy was the one taken in the present research to rule out measured or unmeasured differences between individuals as potential confounds.

For analytical purposes, the key feature of the space–time budget interview data is that they are panel data with the same measures on individuals repeated for every hour during 4 days. The main advantage of panel data is that they allow the analyst to remove time-invariant (un)observed heterogeneity between respondents (or other units of analysis) and thereby allow for stronger causal inferences than can be made from purely cross-sectional data. This study employs fixed-effects panel regression models (Dugan, 2010; Halaby, 2004). In fact, the first explicit application of the routine activity perspective to explaining individual offending from a situational perspective (Osgood et al., 1996) applied a fixed-effects model on five-wave panel data that were collected biannually. Others have used the model to study the role of gang membership, marital status, and employment status on offending over the life course (for a more comprehensive list, and references, see Bjerk, 2009).

Although fixed-effects estimators allow much stronger causal inferences than alternative estimators that use between-person differences to establish causal effects, they do not account for dynamic selection (Bjerk, 2009). Dynamic selection potentially results in an estimated effect of an observed independent variable to be spurious because the observed variable is correlated with an unobserved time-varying variable that contains the true cause of offending. Thus, we cannot rule out the possibility that other unmeasured variables, for example, the fluctuating emotional state of the individual, are more basic or additional causes of offending. The inclusion of the temporal control variables (day of week and time of day) does not entirely rule out this alternative explanation possibility, but it helps to make it less plausible.

Because the fixed-effects estimator only uses data from respondents who display variation in the offending variable, all respondents who did not report committing any offense in the space–time budget interview are excluded from the fixed-effects regression analysis. In the first wave, 54 of the 868 respondents reported having committed an offense. In the second wave, 25 of the 616 respondents reported committing an offense. Only 3 respondents reported offending in both waves, whereas all others reported offending in either the first or the second wave. Because apart from these 3 respondents there is no overlap between *offenders* between both waves, the two waves of space–time budget data can best be treated as a repeated cross

section rather than as a panel, and for this reason, the data were pooled over both waves.

In fixed-effects analysis, repeated observations are grouped if they can be assumed to share unobserved heterogeneity. In the present analysis, it seemed plausible to assume that unobserved features would be constant over the 4 days of a single individual that were recorded in the space–time budget interview, but it is not plausible to assume that these unobserved features would have remained unchanged when the same individual was interviewed again 2 years later in the second wave. Thus, the grouping of observations is over the 96 hours recorded for one person within a single wave, not over all recorded hours of one person across two waves. Because committing crime while asleep is not possible, hours spent sleeping were removed from the analysis. All other hours were included.

FINDINGS

The results of the analyses are presented in three steps. In the first step, we provide descriptive information about the relevant characteristics of the settings that the adolescents have been exposed to, and we present exposure-based offending rates. This approach allows us to assess tentatively the formulated hypotheses 1–7 and 1a–3a on the basis of bivariate relations. In the second step, we present a correlation table that documents the associations between all variables in the analysis. The correlations indicate which situational causes tend to go together and which ones not. In the third and final step, a series of multivariate fixed-effects logistic regression models is estimated and presented, allowing a simultaneous assessment of the unique contribution of all seven hypothesized causes to the explanation of adolescent offending behavior.

OFFENSES, HOURS, AND OFFENDING RATES BY SITUATIONAL CAUSES

Table 2 contains three pieces of information per situational cause for the subsample of 76 adolescents who reported committing at least one offense during the 4 days of the space–time budget interview.

The very first column (c) displays the absolute number of offenses. It demonstrates, for example, that 8 of the 104 offenses were committed in the absence of peers, 9 were committed in the presence of a single peer, and no less than 87 were perpetrated with two or more peers present.

The next two columns list the total numbers and percentages of wake hours spent in the situations defined in the first column. For example, the first row shows that there were 1,034 wake hours spent in the absence of

Table 2. Bivariate Relationships of Situational Variables to Offending and Time Use^a

Variable	Number of Offenses (c)	Number of hours awake (#)	Percentages of hours awake (%)	Number of offenses per 1,000 hours awake (λ)
1) Presence of peers				
No peers	8	1,034	20.89	7.74
One peer	9	441	8.91	20.41
Multiple peers	87	3,474	70.20	25.04
2) Presence of adult handlers				
Adult family member	9	1,691	34.17	5.32
Professional handler	17	1,619	32.71	10.50
No handlers	78	1,639	33.12	47.59
3) Public space				
Private	8	2,162	43.69	3.70
Semi-public	36	1,806	36.49	19.93
Public	60	981	19.82	61.16
4) Unstructured activity				
Structured	50	3,809	76.97	13.13
Unstructured	54	1,140	23.03	47.37
5) Use of alcohol				
No alcohol	85	4,723	95.43	18.00
Alcohol	19	226	4.57	84.07
6) Use of cannabis				
No cannabis	99	4,827	97.53	20.51
Cannabis	5	122	2.47	40.98
7) Carrying a weapon				
No weapon	93	4,737	95.72	19.63
Weapon	11	212	4.28	51.89
Total	104	4,949	100	21.01

^aOffenders only, wave 1 ($n = 51$), wave 2 ($n = 22$), and both waves ($n = 3$).

peers, and that this amounts to 20.89 percent of the total 4,949 wake hours recorded.

The column labeled “ λ ” contains the rate of offending per 1,000 wake hours in the applicable category. For example, it shows that adolescent offenders commit 25.04 offenses per 1,000 hours in the presence of multiple peers, but they commit only 7.74 offenses per 1,000 wake hours spent in the absence of peers. Overall, the adolescents in our The Hague study reported 1.15 offenses per 1,000 wake hours, a rate 64 percent higher than the rate of .70 reported in the PADS+ panel study in Peterborough (Wikström et al., 2012: 324). For the offender group studied here, the overall λ equals 21.01. This rate is more than 18 times the average in the full sample (i.e., offenders and nonoffenders combined).

The offending rates λ in table 2 clearly demonstrate that the likelihood that an adolescent offender perpetrates an offense is strongly elevated during time spent with peers, in the absence of adult handlers, in unstructured

Table 3. Tetrachoric Correlations (Below Diagonal) and Odds Ratios (Above Diagonal) among Offending and Seven Situational Variables^a

Variable	Offend	Peers	No Handlers	Public	Unstructured	Alcohol	Cannabis	Weapons
Offend		3.22***	6.31***	9.61***	3.74***	5.01***	2.04	2.73***
Peers	.24***		.90	2.01***	2.49***	12.31***	1.65 [†]	4.59***
No handlers	.44***	-.04		2.49***	4.42***	5.32***	6.50***	2.05***
Public	.47***	.25***	.33***		1.01	1.01	.88	1.22
Unstructured	.33***	.28***	.50***	.00		11.46***	5.64***	2.87***
Alcohol	.35***	.47***	.45***	.00	.62***		9.33***	3.02***
Cannabis	.13	.11 [†]	.45***	-.03	.44***	.50***		3.57***
Weapons	.21***	.33***	.20***	.05	.29***	.25***	.27***	

^aOffenders only, wave 1 ($n = 51$), wave 2 ($n = 22$), and both waves ($n = 3$). $N = 4,949$ hours awake.

[†] $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed).

activities, in public space, when under the influence of alcohol or cannabis, and while carrying a weapon. In other words, even among offenders, who spend considerably more time in situations hypothesized to facilitate offending than the average adolescent, the act of offending itself is strongly concentrated in criminogenic situations. In line with hypothesis 1a, the offenders' rate of offending increases with the numbers of peers present: λ equals 7.7 offenses per 1,000 hours awake in the absence of peers, 20.4 when in the company of a single peer, and 25.0 when in a group of peers. Also corroborating hypothesis 2a, λ equals 5.3 in the presence of adult family members, 10.5 in the presence of professional handlers, and 47.6 when no handlers are present. In sum, the rank ordering of the λ values exactly confirms not only the seven main hypotheses 1–7 but also the three additional hypotheses 1a–3a listed in table 1.

CORRELATIONS BETWEEN SITUATIONAL CAUSES

Although these findings all support the hypotheses, simple bivariate comparisons of situation-specific offending rates do not suffice for a rigorous test. Before moving to a multivariate evaluation based on within-person differences, table 3 presents two bivariate measures of association among offending and its seven hypothesized situational causes. The tetrachoric correlation is displayed below the diagonal. It is the correlation between two latent continuous variables of which it is only observed whether their values are below or above some thresholds (i.e., only a dichotomy is observed). Like the regular Pearson product-moment correlation coefficient, the value of the tetrachoric correlation coefficient ranges from -1

(indicating a perfect negative relation) through 0 (indicating no relation) to 1 (indicating a perfect positive relation).

Odds ratios are presented above the diagonal. The odds ratio is the ratio of the cross-products in a 2×2 contingency table, and it tells us how the odds of a positive outcome on the column variable depend on the outcome of a row variable, and vice versa. For example, the value of 3.22 in table 3 (first row, second column) means that the odds of offending are 3.22 times larger in the presence of peers than in the absence of peers. The odds ratio varies between 0 and infinity; values between 0 and 1 indicate that the odds decrease, a value of 1 indicates that the odds are unaffected, and values above 1 mean that the odds increase.

In table 3, all tetrachoric correlations in the first column are positive, and all odds ratios in the first row have values above 1, and all but the use of cannabis show statistically significant associations. This finding confirms that the hypothesized situational causes of offending do indeed co-vary in the expected direction. The correlations and the odds ratios in the other rows and columns document the associations among the situational causes themselves. All statistically significant associations are positive, indicating that situational causes are more likely to go together than not. Still, the associations are far from perfect, thereby allowing multivariate analyses to distinguish the independent effects of the seven hypothesized situational causes.

MULTIVARIATE FIXED-EFFECTS LOGISTIC REGRESSION MODELS

For the most rigorous test of the hypotheses, we estimated five fixed-effects logistic regression equations. The results are presented in tables 4 and 5. Table 4 displays the results of the three models that aim to test hypotheses 1–7. Note that the two temporal variables (indicating whether the situation was in the evening, and indicating whether it was during the weekend) are included as controls. Model 1 only includes the four basic situational causes that relate to people, places, and activities. Model 2 extends model 1 by adding use of alcohol, use of cannabis, and carrying a weapon as additional situational causes. It was decided to present separate models with and without substance use and carrying a weapon because other research (e.g., Miller, 2013; Osgood et al., 1996) has not included these as independent variables (instead, some have used substance use as a dependent variable, i.e., an indicator of delinquency or deviance). Estimating separate models with and without substance use and carrying a weapon allows us to assess the presence of any potential mediating effects of substance use on offending. Model 3 extends model 2 by adding a term for the full interaction among the four situational causes of model 1.

Table 4. Situational Causes of Adolescent Offending. Fixed-Effects Logit Model Estimates^{a,b,c}

Variable	Model 1			Model 2			Model 3		
	<i>b</i>	(SE)	OR	<i>b</i>	(SE)	OR	<i>b</i>	(SE)	OR
Situational Causes									
Peers (P)	.679 [†]	(.402)	1.972	.673 [†]	(.405)	1.960	.736 [†]	(.416)	2.088
Absence adult handlers (A)	1.263***	(.275)	3.535	1.290***	(.278)	3.635	1.370***	(.298)	3.934
Public space (S)	2.278***	(.393)	9.755	2.294***	(.395)	9.919	2.417***	(.433)	11.209
Unstructured activities (U)	.777**	(.251)	2.174	.655*	(.260)	1.926	.882*	(.400)	2.416
P · A · S · U (interaction)							-.340	(.467)	.712
Alcohol use				.840*	(.372)	2.316	.828*	(.370)	2.288
Cannabis use				-.442	(.664)	.643	-.399	(.659)	.671
Carrying a weapon				1.105	(.688)	3.019	1.081	(.683)	2.947
Controls									
Weekend	.342	(.239)	1.408	.239	(.247)	1.271	.231	(.247)	1.260
Evening	.841***	(.254)	2.319	.739**	(.267)	2.094	.745**	(.267)	2.107
AIC		658.753			656.851			658.330	

ABBREVIATIONS: OR = odds ratio; SE = standard error; AIC = Akaike information criterion.

^aOR = exp(*b*).

^bAll variables dummy (0/1) coded.

^c Offenders only, wave 1 (*n* = 51), wave 2 (*n* = 22), and both waves (*n* = 3). *N* = 4,949 hours awake. Min / Max / Mean hours awake per individual: 50 / 78 / 62.6.

[†]*p* < .10; **p* < .05; ***p* < .01; ****p* < .001 (two-tailed).

Source: NSCR Study of Peers, Activities and Neighborhoods (SPAN).

Thus, model 3 tests whether the combined presence of peers, absence of adult handlers, public space, and unstructured activity has an independent additional criminogenic effect.

We present point estimates of the parameters and significance levels, standard errors, and odds ratios. The estimates of model 1 confirm the expected positive effects of all four basic situational causes. All estimates are statistically significant (although the effect of the presence of peers only at *p* < .10), and all corroborate the hypotheses. Being in public space even increases the estimated odds of offending almost tenfold (odds ratio 9.755). Although some of the separate effects are already strong, the combined situational effects are dramatic: Multiplying the four odds ratios of model 1 shows that the odds of offending are 148 times higher when all four elements are present than when none of them are.

In model 2, we find that alcohol use (2.316) more than doubles the odds of offending, but we find statistically nonsignificant effects for cannabis use and carrying weapons. The other estimates of model 2 are close to those of model 1, which suggests that the use of alcohol creates additional risk, but

Table 5. Situational Causes of Adolescent Offending. Fixed-Effects Logit Model Estimates^{a,b,c}

Variable	Model 4				Model 5			
	<i>b</i>	(SE)	OR	Wald χ^2	<i>b</i>	(SE)	OR	Wald χ^2
Situational Causes								
Peers Present (none = ref.)				6.21*				6.11*
One peer present	.347	(.529)	1.415		.357	(.533)	1.428	
Multiple peers present	.910*	(.412)	2.483		.916*	(.416)	2.499	
One peer vs. multiple peers present				2.05				1.99
Handlers Present (adult family = ref.)				10.58**				9.63**
Professional handler present	-.455	(.515)	.635		-.502	(.518)	.605	
No handlers present	.730†	(.435)	2.075		.660	(.439)	1.935	
Professional vs. no handlers present				9.49**				8.90**
Space (private space = ref.)				37.26***				39.65***
Semi-public space	2.169***	(.481)	8.751		2.166***	(.480)	8.722	
Public space	2.804***	(.462)	16.509		2.894***	(.463)	18.068	
Semi-public vs. public space				4.78*				5.94*
Unstructured activities	.789**	(.263)	2.202		.679*	(.270)	1.972	
Alcohol use					.992**	(.377)	2.697	
Cannabis use					-.353	(.671)	.702	
Carrying a weapon					1.172	(.731)	3.227	
Controls								
Weekend	.292	(.241)	1.339		.176	(.249)	1.192	
Evening	.789**	(.252)	2.201		.666*	(.264)	1.947	
AIC		655.614				652.1639		

ABBREVIATIONS: OR = odds ratio; SE = standard error; AIC = Akaike information criterion.

^aOR = exp(*b*).

^bAll variables dummy (0/1) coded.

^cOffenders only, wave 1 (*n* = 51), wave 2 (*n* = 22), and both waves (*n* = 3). *N* = 4,949 hours awake. 76 offenders, Min / Max / Mean hours awake per individual: 50 / 78 / 62.6.

† *p* < .10; * *p* < .05; ** *p* < .01; *** *p* < .001 (two-tailed).

Source: NSCR Study of Peers, Activities and Neighborhoods (SPAN).

it does not mediate the other effects (the estimated effect of unstructured activities is somewhat weaker in model 2 than in model 1, which may be attributed to the fact that more unstructured than structured activities involve alcohol use).

As discussed in the subsection on the interaction of situational causes, prior research seems to have assumed that some of the hypothesized situational causes of crime, in particular presence of peers, absence of adult handlers, public space, and unstructured activities, are consequential only in combination. To investigate this assumption, model 3 in table 4 introduces an interaction effect for these four variables (presence of peers, absence of adult handlers, public space, and unstructured activities). Thus, it is a dummy variable that equals 1 only in hours during which all four conditions were satisfied simultaneously. In all other hours, its value was zero. This effect is thus added to the built-in interaction effect of model 1, which is multiplicative in the odds of offending. The added interaction effect is clearly statistically nonsignificant. This finding challenges the combined measurement of these situational causes in empirical studies asking respondents, for example, to report how often they spend time socializing with peers in the absence of authority figures.⁶

The results for the two temporal control variables show no statistically significant effect of the weekend (Friday 6 P.M.–Sunday 6 A.M.), but the evening or night (6 P.M.–6 A.M.) hours more than double the odds of offending in all three models, independent of the effects of the other variables. This latter variable thus taps unmeasured situational risks of offending between 6 P.M. and 6 A.M.

The models in table 5 provide a test for hypotheses 1a, 2a, and 3a. Both models also include the two temporal control variables but not the interaction variable that was introduced in model 3. The effects of alcohol use, cannabis use, and weapon carrying are only estimated in model 5. Because the outcomes of models 4 and 5 are very similar, we focus on the results of model 5 only.

The additional hypotheses imply a specific distinction within each of three general situational characteristics (presence of peers, absence of adult handlers, and public space). Hypothesis 1a predicts that offending is more

6. In each of four other models (results not presented), we included a three-way interaction term of three of the following four variables: presence of peers, absence of adult handlers, public space, and unstructured activities. The results of all four models were substantively equal to those in model 3, and none of the three-way interaction terms were significant. We also compared the Akaike information criterion (AIC) of model 1 with a model with only the interaction variable included. Model 1 had a much lower AIC and is thus superior to the model with the interaction variable only.

likely in situations with multiple peers than in situations with a single peer. With situations without peers being the reference category, the odds of offending increase by a factor 1.428 when a single peer is present and by a factor 2.499 when two or more peers are present. The difference between these two estimates, however, is not statistically significant ($\chi^2 = 1.99$, d.f. = 2), which refutes hypothesis 1a. Furthermore, the presence of a single peer does not significantly raise the likelihood of offending when compared with the absence of any peers, which demonstrates that only the presence of multiple peers facilitates offending.

An unexpected result emerges with respect to the absence of adult handlers. Hypothesis 2a states that the presence of adult family members has a stronger deterrent effect on offending than the presence of other adult handlers. The hypothesis is clearly rejected, as the estimated effect of supervision by professional handlers is actually in the opposite direction, albeit statistically nonsignificant. So, adult handlers have a deterrent effect, irrespective of their relationship to the adolescent.

Hypothesis 3a, which suggests that offending is more likely in public space than in semi-public space, is corroborated. The estimated odds of offending in public space (odds ratio 18.068) relative to private space are more than twice the odds of offending in semi-public space (odds ratio 8.722) relative to private space.

CONCLUSION AND DISCUSSION

CONCLUSION

To measure potential situational correlates of offending, Wikström and colleagues developed the space-time budget interview and used it to demonstrate that adolescent offending is associated with the presence of peers, lack of adult supervision, and unstructured activities, as well as time spent in areas with low collective efficacy and time spent in entertainment areas (Wikström et al., 2010, 2012). The present study used the same instrument among a sample of adolescents in The Hague, the Netherlands, but took the analysis two steps further. First, it identified additional space-specific and time-specific situational factors in criminological theories (in particular, use of alcohol, use of cannabis, and carrying a weapon). Second, to eliminate between-individual factors as potential confounds, our analysis applied a multivariate fixed-effects panel estimator to assess the unique crime-generating effects of each of these situational factors.

CONTRIBUTION TO THEORY

Despite the fact that the data analyzed in this study contain only 104 offenses committed by 76 offenders, the evidence strongly suggests that the

presence of peers, absence of adult handlers, presence in public space, involvement in unstructured activity, and alcohol use in situations strongly increases adolescents' likelihood of offending in those situations. The effects were surprisingly large, suggesting that these situational causes are fundamental in understanding time fluctuations in offending. Between-individual differences were ruled out as an alternative explanation by using the space–time budget hours as repeated observations and the adolescents as fixed effects.

The key innovation of this study is twofold: the use of direct measures of situational causes of adolescent offending at the spatial and temporal scale at which they were defined, and the analysis of their effects with a within-individual panel regression model that eliminated all stable between-individual factors as potential confounds. Wikström and colleagues (2010, 2012) developed the measure to gather similar situational data, but their analytical strategy was restricted to calculating offending rates per 1,000 hours in specific activities. Osgood et al. (1996) used the same analytical strategy, but their data were not measured at the level of situations.

Although our test of Osgood et al.'s (1996) routine activity theory of general deviance is more rigorous than their own because we use situational data, our findings do support theirs and those of others (Augustyn and McGloin, 2013; Haynie and Osgood, 2005; Maimon and Browning, 2010; Miller, 2013; Osgood and Anderson, 2004; Svensson and Oberwittler, 2010) with respect to the criminogenic nature of situations characterized by presence of peers, absence of adult handlers, and unstructured activities. We further improved on these studies because our data also allowed us to evaluate the independent effects of situational factors. Prior studies typically combined situational factors by asking respondents about the amounts of time they spent unsupervised with peers away from home in specific unstructured activities, a design that makes it impossible to isolate the effects of each factor separately. Our data and method allowed us to demonstrate that these factors do have independent effects, and that they are therefore not necessary conditions for adolescent offending to occur.

Our findings provide further insight into the situational role of substance use in offending. Whereas the role of alcohol use (and to a lesser extent cannabis use) in causing violence has been studied in experimental studies (Bushman and Cooper, 1990) and in observational studies with strong designs (Fals-Stewart, 2003; Fals-Stewart, Golden, and Schumacher, 2003; Felson et al., 2008), the situational role of substance use had not before been included in criminological research. Instead previous studies usually included substance use as a form of deviant behavior (e.g., Osgood et al., 1996). Our findings on substance use as situational cause are mixed: Alcohol intoxication is associated with offending, but cannabis intoxication is

not (i.e., our findings provide neither positive nor negative evidence with respect to cannabis use).

In sum, most of our findings are not only in line with those of prior research, they also empirically confirm the assumption that has been left implicit in most previous research, namely, that adolescent offending is strongly related to situational characteristics.

LIMITATIONS OF THE CURRENT STUDY AND SUGGESTIONS FOR FUTURE RESEARCH

The use of the activity-based data probably represents the most important contribution of this study to the literature; at the same time, these data have limitations, including the 1-hour temporal resolution of the space–time budget interview and the relative small sample regarding the number of offenses.

Although the 1-hour time slots used in the space–time budget interview are reasonably fine-grained and enable researchers to tap the major activities that adolescents are involved in, they may occasionally be too large to capture detailed situational causes of offending. Offending generally is a matter of seconds or minutes, not hours, and the situational causes of offending (places, people present, and activities) also can change very quickly. For an instrument that retrospectively collects time use information, we think 1 hour is the smallest temporal unit that respondents are able to recollect information on. If more detailed measurement is called for in future research, one would definitely need a prospective setup and the help of new technologies to tap information from respondents. For example, mobile (smart)phones can be used to ask research participants questions about the settings they are in, to answer these questions, and to track the whereabouts of the participants (Barrett and Barrett, 2001; Raento, Oulasvirta, and Eagle, 2009).

Furthermore, although the number of hours included in the fixed-effects analyses is substantive, they are based on a relatively limited sample of 76 subjects who reported on 104 offenses in total. Although our findings demonstrate that very useful patterns and effects can be demonstrated on the basis of this relatively small number of respondents, the effective sample size precludes more in-depth analyses. For example, it is possible that the effects of some of the situational causes vary across offense types (e.g., vandalism, assault, and theft). The effects of situational causes also might vary across individuals. In particular, it has been suggested that only individuals with low self-control and with permissive moral attitudes are affected by situational causes (Wikström et al., 2010). Susceptibility to situational causes may further vary across adolescent categories (e.g., by sex, age, or education). These questions are all interesting, but it would require larger

samples to provide sufficient statistical power. In future research on situational causes of crime along the lines described in this article, researchers might increase statistical power not only by increasing the total sample size but also by drawing samples of participants from high-risk populations or even from offender populations. In such populations, the number of reported offenses in the space–time budget interview will be higher. This approach also would potentially allow for the study of crime-type–specific situational causes of offending.

Despite these limitations, however, the importance of our findings should not be underestimated. It is the first time that situational characteristics have been studied independently as proximate causes of criminal conduct, instead of constituents of individual characteristics. Although most prior research has demonstrated that delinquent adolescents in general spend more time in the presence of peers, in the absence of handlers, in public space, and in unstructured activity; that they use more alcohol and cannabis; and that they are more likely to carry weapons, the present findings go further. They show that these situational factors are not only overrepresented among offenders, but also that they are overrepresented during the moments that offenders actually offend, that is, that they are genuine situational causes of crime. Our findings suggest that their effects may be very substantial, but continued research is warranted to obtain more detailed insights in where and among whom they are most important.

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Wim Bernasco is a senior researcher at the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR) and a professor in the Department of Spatial Economics at VU University Amsterdam. His research interests focus on spatial aspects of crime, including geographic variations in crime and delinquency, offender travel behavior, and target selection. More recent work addresses situational causes of offending and victimization.

Stijn Ruiter is a senior researcher at the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR) and an associate member of Nuffield College, Oxford. His research interests focus on environmental criminology, especially spatiotemporal aspects of crime and criminal target choice.

Gerben J.N. Bruinsma is the director of the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR), a national research institute of the Netherlands Organization for Scientific Research (NWO), and a professor of environmental criminology at VU University Amsterdam. His research interests are social disorganization, crime places, history of criminology, and criminological theory.

Lieven J.R. Pauwels is a professor of criminology in the Department of Penal Law and Criminology at Ghent University (Belgium), the director of the Institute of Urban Security and Policing Studies, and the president of the Flemish Society of Criminology. His research interests focus on neighborhood effects and urban crime, empirical tests of integrated theories of offending and victimization, and survey measurement issues. Recent work has focused on the relationship between lifestyles and violent youth group involvement.

Frank M. Weerman is a senior researcher at the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR). His publications have focused on the explanation of juvenile delinquency, on co-offending and youth gangs, and on the role of delinquent peers and peer-related activities.