

How do we get to causal clarity on physical environment-crime dynamics?

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I. Introduction: Organization and Slant of the Essay

Section I describes the focus of the current essay, relates it to past reviews of scholarship in this area, and highlights the crucial question of causality. Section II reminds readers of important meta-lessons from founding scholars. These are the giants upon whose shoulders current scholars stand. Section III introduces key stumbling blocks in community criminology that must be addressed before scholarship can advance on the crucial causality question. Environmental criminology in a deep sense represents a field within a broader field of community criminology. Section IV highlights just a few of the most important recent works in four select areas within the physical environment-crime scholarship: space syntax,

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facilities and land use, accessibility/permeability, and CPTED/defensible space. Scholarship in each of these areas has yet to address adequately several of the community criminology stumbling blocks outlined in III. Section V sketches one possible avenue for future research which can address these concerns.

A. What is in and What is Out

Research and theorizing about the crime impacts of the physical environment, at spatial scales from individual parcels, dwelling units, and facilities, up to sub-city or sub-jurisdiction neighborhoods merit scrutiny in the current essay. Questions about how successfully recent research has specified and documented causal impacts of physical environment features, alone or in combination with cultural, social, or structural features, receive particularly close inspection.

Four conditions bound the scope of the chapter. First, matters reviewed in detail in previous publications on physical environment which the first author here authored or co-authored, are not considered here. These include the origins and evolution of defensible space (Taylor, Gottfredson, and Brower 1980), meso-level built environment and implications for offender movement patterns (Taylor and Gottfredson 1986), models of resident or regular user dynamics and potential offender interpretations of environment features and behavior traces (Taylor 1987), calls for integrating different crime/design perspectives (Taylor and Harrell 1996), spatial scaling and questions around hot spots (Taylor 1998), concerns about the dynamics of the incivilities thesis (Taylor 1999, 2001), the causal claims specifically of CPTED (Taylor 2005), and public transportation, street network, and boundary land use links to crime at the jurisdiction level (Groff et al. 2014).

Second, links between physical environment and non-crime outcomes like fear of crime (Taylor 2002), perceived risk, behavioral avoidance; and other aspects of person-environment transactions such as perceived problems (incivilities), territorial behaviors or cognitions, sense of community, residential satisfaction (Robinson et al. 2003), or other person-place bonds are excluded as outcomes of interest. These processes merit attention if and only if strong claims can be made that they mediate or moderate environment-crime relationships. Despite considerable research, those claims remain in question.

Third, topic coverage is by design selective. Discussion considers only a handful of current sub topics within this broad field. Further, within each of these sub topics this chapter does not attempt a comprehensive summary of what has been learned. Rather it considers just a few of the most current findings and does so through the lens of specific stumbling blocks recently highlighted in community criminology (Taylor 2015). Community criminology addresses the causes and consequences of crime levels and patterns at the sub-city neighborhood geographic scale, and smaller geographic scales. Relationships at each geographic scale, and across different geographic scales (e.g., impacts of neighborhoods on streetblocks), and impacts of levels and patterns at these scales on individuals and groups are all of interest. How does this link to environmental criminology? Paul Cozens (2011b) routinely cites Bottoms' and Wiles' (1997: 305) definition of the latter. "Environmental criminology is defined as 'the study of crime criminality and victimization as they related first, to particular places, and secondly, to the way that individuals and organizations shape their activities by place-based or spatial factors.' "

Given this definition, environmental criminology focuses on community criminology dynamics which intertwine with crime- or victimization-linked spatial factors relevant to individuals or organizations. As such, environmental criminology represents place-linked dynamics operating

within the smaller geographic scales considered within community criminology. Fourth, impacts of crime on physical environment, an equally important and policy relevant and in some ways more intriguing set of questions (Taylor 1995), are ignored. That said, these impacts need to be separated out when longitudinal ecological dynamics are considered.

B. What's the Angle?

The perspective adopted here is deliberately critical, but with a specific goal in mind. The agenda here is not to scorn current and recent research. Clearly, enormous progress is evident in this domain of scholarship, in both theoretical and practical realms, as well as in the quality of many of the empirical studies. Researchers *have* come a long way since the 1960s or 1970s. At the same time, researchers have shied away from key critical issues for too long, and these gaps impede theoretical and practical progress in this area. The critical stance here seeks to inspire those just beginning in the field today, the graduate student or beginning assistant professor squinting in the sunlight at his or her kindle on some greensward someplace or while being jostled by commuters on a bus somewhere. The message is: ask the big questions and think about how to get there. What skills do you need or does your research team need? What do you need to think hard about? How do we bring theoretical clarity, accuracy, and precision to this area of scholarship? What new analytic and conceptual approaches might shed light on some of the recurrent tough questions in this arena of scholarship? Toward that end, a closing section comments on two possible avenues of scholarship.

C. The Goal

Environmental criminology is simultaneously and equally a theoretical and practical area within criminology. Consequently, whether we are talking about physical environment causal

impacts on crime or the reverse, the goal is both to understand, on the conceptual side, and to predict and prevent on the practical side. The ultimate goal on the conceptual side, leaving aside new streetblocks and new communities laid down wholesale, is figuring out what physical environment shifts have what impacts on what offending and/or victimization patterns. This makes it a matter of marginal impacts.

D. The Challenge

If we are to do that, to restate what is already well known by all beginning graduate students, we must move beyond correlation to causation (Hope 2008a, b). When we are talking about features of the physical environment, features which have been in place for some time, and at different geographic scales, that people are exposed to for different durations, during different periods of life or times of day, this is no simple task. At the same time, this is the crux of the matter.

II. Taking Heed from Our Forefathers and Foremothers

Crucial challenges confronting the field today are not new. Leading scholars in environmental criminology, and their predecessors in other fields that helped spawn the current approaches laid down key ideas that are all too often forgotten. Just a handful of the most cogent, given the current focus, appear here.

A. Jane Jacobs

The late Jane Jacobs promoted specific design solutions in a specific context. For example, she thought more “eyes on the street” would make urban streetblocks safer. This could be accomplished by having first floor commercial land uses on predominantly residential, but short length streetblocks, in dense urban neighborhoods (Fowler 1992). She also advocated other

design ideas that Oscar Newman later adopted into defensible space. But, as importantly, Jacobs (1961: 26) explicitly warned us against over generalizing from one type of community to another: "I hope no reader will try to transfer my observations into guides as to what goes on in towns, or little cities, or in suburbs which are still suburban." Further, the urban design solutions she promoted would not be appropriate practically or ideologically in suburban communities (Hummon 1985). So at bottom the extent to which her most widely promoted idea, mixed use on short predominantly residential streetblocks (Fowler 1987, 1992) would be appropriate across a range of communities, remains an open question, despite strong census tract crime connections for part of her proposal (Browning et al. 2010). She warns us against over generalizing.

B. Kevin Lynch

The late Kevin Lynch cautioned against a static perspective. Succinctly and cogently he stated "Environments change" (Lynch 1972: 3). Sometimes cities are remade wholesale, as San Francisco was after the 1906 earthquake and fire. But as crucially, physical features are constantly shifting: houses deteriorate and become vacant and maybe later become vacant lots or new construction for example. It is these shifts, whether planned or unplanned, whether smaller scale or larger scale, that represent the core conceptual concern for this area of scholarship. If we close off streets to vehicle traffic (Atlas and LeBlanc 1994) or gate alleyways (Armitage, Monchuk, and Rogerson 2011, Bowers, Johnson, and Hirschfield 2004), or just slow down traffic speeds (Craig and Appleyard 1980, Appleyard 1981), how is crime changed and via what attitudinal, cognitive, behavioral, or emotional mediating dynamics involving offenders, potential offenders, regular users, space managers, and/or residents?

C. Hal Proshansky

The late Hal Proshansky, one of the founding fathers of environmental psychology, described the field as “concerned with establishing empirical and theoretical relationships between the behavior and experience of the individual and his [/her] built environment” (Proshansky 1976: 305). A case can be made that the portion of environmental criminology concerned with individual-level behaviors like offending and individual-level experiences like being victimized lie within this field. Proshansky (1976) laid down five methodological axioms. Given the topics to be addressed below, the most relevant of these is what he called “the content orientation of environmental psychology” (Proshansky 1976: 307). “In the attempt to establish ... relationships” between individual experiences and behaviors and the built environment “we have to identify what physical settings are involved, what purposes they are being used for, and what specific kinds of behavior and experiences they elicit in the person. In other words, the actual character of a physical setting ... and broader environmental context, is important” (Proshansky 1976: 307). This warns us strongly against highly abstract representations of environment, a point to which I return later. Key is: what are people doing in the location, what are they using it for, and how do they see it?

D. Patricia and Paul Brantingham

The acknowledged founding mother/father duo Patricia and Paul Brantingham discerned almost four decades ago that relationships between physical environment and crime shift at different spatial scales (Brantingham, Dyreson, and Brantingham 1976). This is not just a statistical, analytical, or methodological artifact; it represents a conceptual and empirical reality that needs attention (Taylor 1998). The field has recently recognized the importance of this source of variation (Weisburd, Bruinsma, and Bernasco 2009). But, in this author’s view, the proposed resolution by focusing on just one range within a much broader range of spatial scales,

which is what place criminology does, has significant limitations (Taylor 2015: 124-129). The field should be wary of narrowing its view on these questions. In short, place criminology is not the answer.

E. Amos Hawley

Hawley's (1950) perspective on human ecology has been widely criticized for decades (Bursik and Grasmick 1993). Nevertheless, three key points he highlighted must be remembered. "The community may be conceived as a series of layers or strata" (Hawley 1950: 209). Further, at any spatial layer, there are interdependencies. "The relationship in which individuals are linked together to form communal units occur also as between such units" (Hawley 1950: 220). There are interdependencies within the same layer of community, as well as dependencies from higher level layers to lower level layers, and vice versa. Third, and more broadly, this creates a broader functioning ecosystem (Bursik 1986). Roles or niches served by individual communities arise because of their relative positions within that broader ecosystem. And, as will be discussed below, those roles can change. Hawley's points underscore the importance of paying attention to crime-relevant dynamics across a *range* of layers of community, from the parcel to the streetblock and up to sub-city neighborhoods (Suttles 1972).

III. Some Stumbling Blocks in Brief

If community criminology is to advance beyond knowing things we have known for close to a century (Burt 1925, McKenzie 1921b, a), scholars will need to squarely face four stumbling blocks. Those four impediments are spatial scaling, temporal scaling, ecological construct

validation, and selection dynamics (Taylor 2015). Conceptual and practical progress will prove limited until scholars take up these challenges. Those four concerns are briefly sketched below.

Each of these impediments is complex in that each *simultaneously* involves questions of theory, methods, and analysis. These are problems of *both* “conceptualization and measurement” and it is their hybrid nature which in part explains why they “have [for] far too long been neglected” (Blalock 1979: 882). If these are to be solved, teams of scholars with expertise in all three domains will need to work together.

A. Spatial Scaling

“Spatial scaling addresses both what shifts theoretically when examining variables and processes at different geographic scales, and how variables and processes connect across different spatial scales” (Taylor 2015: 7). Hannan (1991) drew sociologists’ attention to these matters, but to date community criminologists have overlooked them.

Graduate students imbibe warnings about avoiding the ecological fallacy or the individual fallacy. But they receive less instruction about how to think about how the same variable means different things at different spatial scales or how processes connecting variables at different spatial scales might represent related *but distinct* dynamics. This is not just a question of selecting the “right” level of aggregation or disaggregation for the data. It is a matter of thinking hard about how crime or victimization when compiled in different ways represents different things theoretically, as do the causes to which it is linked when those causes too are organized at different levels. A streetblock burglary count represents different dynamics and has different prevention implications than a burglary count at the level of a Chicago natural area.

B. Temporal Scaling

“Temporal scaling is about how long it takes for variables to shift significantly or to change other variables significantly. In community criminology, the two issues are the temporal interval required for significant change to accumulate on an ecological predictor or outcome and the period required for a single-level or multilevel ecological process to ‘cycle’” (Taylor 2015: 7). Abbott (2001) drew sociologists attention to these matters, but community criminologists have overlooked them to date.

How long will it take a change in physical environment to demonstrate an impact on a crime rate? Will it depend on the physical change in question? The crime in question? The broader community or cultural context?

Some physical environment changes, like alley gating or road closures one might expect to have relatively immediate impacts on crime because the spatial behavior of potential offenders is, presumably, directly affected. Other physical alterations like Newman-esque restrictions on the number of entrances into a neighborhood (Newman 1996) might – or might not - take longer to affect potential offenders’ behaviors, depending on the latter’s activity spaces, search spaces, journeys to crime, and residential locations. The key point is that many theories in community criminology, and in environmental criminology, lack specificity about timing (Taylor 2015: 154-158).

Meshing concerns about temporal dynamics with a Hawley/Bursik perspective on ecological change creates an even more severe problem. The short version can be stated simply: any cross-sectional analysis is extremely unlikely to illuminate causal dynamics (Taylor 2015: 158-162). At any point in time, any ecological indicator contains two components: a component reflecting ongoing ecological continuity, and a component reflecting recent ecological discontinuities (Bursik 1986). Cross-sectional analyses simply cannot pull these two components

apart for any one indicator. Therefore, all links in all cross-sectional models are inherently non-recursive, with dynamics going in both directions. Instrumental variables cannot fix this problem. The implications for numerous studies about physical environment and crime prove sobering. Put bluntly, cross sectional ecological work on crime and physical environment cannot shed light on causal dynamics. This may sound like a harsh conclusion, but it follows inevitably if we accept the Hawley/Bursik perspective on ecological continuity and discontinuity.

C. Ecological Construct Validation

Researchers investigating connections between physical environment and crime extract a dizzying array of physical environment indicators, via an equally dizzying array of physical environment indicators. Although the instruments, data extraction protocols and measurement properties of these various indicators may be clear, the meaning of them is not. There is a problem of ecological construct validation with a good number of environment indicators. In many instances, “key indicators are plagued by semantic ambiguity” meaning the indicator-construct linkages are unclear (Taylor 2015: 205). This is a problem of ecological construct validation. It can be addressed in different ways, including Messick’s unified perspective on construct validation (Messick 1995), but the field has yet to clear up these matters. In brief, Messick’s (1995) approach suggests moving away from restricted investigations of multimethod convergent and discriminant validities, although these are indeed useful, and considering a broader range of empirical evidence.

D. Selection Dynamics

“Selection effects refer to selectivity bias ... [the latter] ... can be created when some unidentified individual-level features, which correlate with the outcome, also correlate with

entering or exiting a specific spatial context” (Taylor 2015: 225). Selection is a huge problem in many areas of research, including work on establishing neighborhood effects (Sampson, Morenoff, and Gannon-Rowley 2002, Tienda 1991). It is a potentially sizable problem for some areas of physical environment/crime research.

E. And ... There is an Outcome Problem: Radical Operationalism and Crime Rates

This last concern is not a problem per se but just a feature of how researchers think about spatially located crime or victimization data. There are two points (Taylor 2015: 33-66). First, researchers ignore varying levels of intrusion by agents of criminal justice agencies into different neighborhoods and streetblocks, and the implications of these dynamics for generating crime data. Researchers overlook important roles of exposure differentials of residents or regular users across different settings or communities. In addition, the numerous factors affecting localized dynamics that can affect whether a victimization is reported or a crime is discovered or overlooked. This approach is tantamount to a radical operationalism perspective on the key outcomes in this area. The point here is not that crime statistics are biased or represent undercounts. Rather the point is that crime counts are outcomes of complex, spatially, organizationally, and socially dependent processes involving many agents.

IV. Selected Current Research Streams Meet the Stumbling Blocks

Attention turns to a small number of current active research areas. For each, just a few recent studies are noted on the presumption that they are emblematic of the best work in the area. Then research is critiqued in light of the theory/analysis/measurement stumbling blocks in community criminology just introduced.

A. Space Syntax

Graph theory based models of complex social behaviors have had varying degrees of popularity since Kurt Lewin developed topological field theory in the 1930s (Lewin 1966, 1951, 1938). Topological graph theory has returned to place-based studies of social behavior in the last twenty years with space syntax models (Banfa , Hillier 2004, Hillier and Shu 2000). For example, one of the processes relevant to space syntax “refers to the effects of the emergent spatial geometry on movement patterns” (Hillier 2012: 14-15). “In urban systems, configuration is the primary generator of pedestrian patterns” (Hillier et al. 1993: 31). The configuration of the urban grid generates “natural movement” which “is the proportion of urban pedestrian movement determined by the grid configuration itself. Natural movement, although not always quantitatively the largest component of movement in urban spaces, is so much the most pervasive type of movement in urban areas that without it most spaces will be empty for most of the time. It is also the most consistent ...” (Hillier et al. 1993): 32}.

In space syntax studies, different configurational properties of the urban street grid get measured. For example the “connectivity” of a node where lines representing street segments meet captures “how many other nodes are directly accessible from it” (Hillier et al. 1993: 25). In short there are three basic ideas with space syntax theory: first, the configuration of a street network or grid in an urban area is a primary determinant of how pedestrians move through that network. Second, that configuration generates properties of particular line segments, or nodes where line segments meet, and those properties such as connectivity can be quantified using topological graph theory. Third, those properties, because they have implications for pedestrian traffic, may shape the activity and awareness spaces of potential offenders, thereby creating implications for crime (Chang 2011).

Davies and Johnson (2015) sought to advance the space syntax scholarship by deriving a grid-based property of streetblocks keyed to the concept of journeys: the betweenness of street segments. This feature “measures the frequency with which street segments feature in the shortest paths ... for journeys through the [street] network” (Davies and Johnson 2015: 482). “The value for every segment depends entirely on its role in the [street] network as a whole” (Davies and Johnson 2015: 493). Further, for each streetblock the researcher can vary the radius of the surrounding network considered, thereby permitting an approximation to “journeys through the network that represent ‘local’ trips” (op cit).

The link to crime comes through the behavioral geography assumptions of crime pattern theory: “betweenness is particularly pertinent to the study of crime through the prism of pattern theory, since it approximates exactly those journeys through the network which would be expected to shape awareness spaces” (op cit). And, indeed, Davies and Johnson (2015) do find some indicators of betweenness do link as anticipated to burglary levels.

Summing up on the best of the space syntax/crime work suggests the following. Focusing measurement of graph-based, space-syntax derived features of streetblocks on journey-based concepts such as betweenness represents an advance in the space syntax/crime work. The link to behavioral geography and awareness spaces becomes clearer. Further, it aligns the work in this area more closely with the third principle of microecology, “Block life is conditioned by features of adjoining blocks” (Taylor 1997: 134). Here the feature of adjoining streetblocks is the number of paths they create leading to or away from the streetblock in question. Third, the methodological and analytic sophistication of work in this area has advanced enormously in just the past decade.

These advances notwithstanding, several features of work in this area prompt concern. Of the stumbling blocks mentioned earlier, two are especially worrying: ecological construct validation and temporal scaling.

Regarding the former, regardless of how precisely grid-based attributes of streetblocks or whole neighborhoods are captured, the scores still represent highly abstract indicators derived not from the environments and settings themselves but from *maps* of those places. Yes, scores on those attributes have implications for offender spatial behavior and thus offender awareness spaces. But they also may have implications for other groups, such as residents or law-abiding users or those streetblocks. How are the awareness spaces and surveillance activities of non-offenders affected? Does heavier foot traffic mean non-offenders pay less attention to other passersby? And what happens when we lose sight of documented (Roberts et al. 2014) intra-streetblock variations in foot traffic?

Further, what are the implications for land use patterns? Streetblocks with more non-residential land use draw more foot traffic (Taylor, Shumaker, and Gottfredson 1985) and more non-residential land uses affect physical deterioration (Taylor et al. 1995) and resident-based informal control dynamics (Kurtz, Koons, and Taylor 1998). Are offenders responding directly to the increased likelihood that a streetblock higher on betweenness makes them more familiar with potential targets, or are they responding to spatial behavior and anticipated reactions of other users of the locale? We just don't know. In Abbott's (2001) terminology, there is a lot of semantic ambiguity associated with space syntax indicators such as betweenness.

How could this be cleared up? Here is what is needed. Researchers working in multiple cities, and in multiple neighborhoods in each city, could identify streetblocks with varying scores on betweenness and, for each level of betweenness, burglary scores that are either significantly

above or significantly below the crime level predicted by betweenness, after taking other structural and land use factors into account. Once selection is made, researchers conduct on-site behavioral observations to derive use patterns for each streetblock at different times of day, different weeks, and different seasons. They conduct interviews with residents, regular users of the streetblock, and proprietors of facilities on the streetblocks. Interviews with potential offenders who are shown videos of the various streetscapes help clarify the offender perspective. Once all this is put together we will have a decent idea of what varying levels of attributes such as betweenness *mean*, because betweenness can be translated to specific features of streetblock behavioral profiles, and perceptions and expectations of different user groups, in specific contexts (Proshansky 1976).

Turning to the second matter, one of the questions emerging from a consideration of temporal scaling is: how long does it take for a change in a key predictor to affect a sizable change in a key outcome? Given the Hawley/Bursik perspective on ongoing ecological continuity and ecological discontinuity *causal* questions can only be answered through studies where physical environment features shift over time. This creates a particular problem for space syntax studies, where the attribute in question derives from the position of the streetblock relative to the broader street network. Entire portions of an urban street grid cannot be altered barring some type of cataclysmic event.

There are, nonetheless, natural experiments creating short term differences in betweenness that researchers might be able to capture. Temporary patterns of street closures provide one potential way to gauge impacts on crime and mediating dynamics (Atlas and LeBlanc 1994, Lasley 1996). This matter is discussed at more length in the section on permeability.

B. Facilities and Land Use

Two streams of research address links between facilities and crime. One looks at impacts of individual facilities thought to qualify as crime generators or attractors. Another looks more broadly at impacts of land use mixes on crime rates.

The facilities work has succeeded in substantiating links between crime and specific facilities. Many different types of facilities link to crime including “schools ... parks/playgrounds ... malls... fast-food restaurants ... hotels ... abandoned buildings ... halfway houses ... drug treatment centers ... check-cashing stores and public transportation stops ... among others” (Groff and Lockwood 2014: 281).

Perhaps the most widely studied and best understood type of facility is bars; see Groff & Lockwood (2014, Table 1) for a list of studies to date. Important features of the crime impact of this facility type include that it is spatially constrained (Groff and Lockwood 2014, Jennings et al. 2013, Ratcliffe 2012, Frisbie 1978). Ratcliffe (2012) for example finds the violence impacts drops sharply once one is more than 85 feet away from the facility.

Crime generating or crime attracting facilities by definition can concentrate or increase pedestrian or vehicular traffic within an area. These concentration effects broadly link to both crime pattern theory (Brantingham and Brantingham 1991) and some version of routine activity theory (Felson 1995). That said, the field needs to advance beyond these amorphous appeals to these broad theoretical frames. How to do this?

Longitudinal studies examining what happens when *specific* facilities open or close are needed (Taylor, 2015).² What happens to the streetscape when a new bar opens? How are regular users' or residents' views of streetblock life at different times of the day or days of the week affected? How do the patterns of who is on the street when shift? Is the issue the change in the volume of people on the street? Or is it the volume of drunk people on the street? Or is it infrequent but potentially violent altercations developing inside the facility but spilling out into the street? Or is it street robbers pulled by the higher volume of pedestrian traffic, sober or not, waiting for their prey a half block away or around the corner? Unless and until we have detailed studies examining the opening or closing of specific individual facilities in specific contexts, the needed theoretical sharpening of the relevant dynamics linking environment and crime is unlikely to occur.

Staying with bars, a second stream of scholarship in this area considers alcohol outlets, either in terms of the number of outlets or their density, as a property of a locale like a zip code or a census block group (Amie L. Nielsen 2005, Zhu, Gorman, and HOrel 2004, Gorman et al. 2001, White, Gainey, and Triplett 2015). This work proves extremely difficult to interpret theoretically given the spatial scaling mismatch. Work on specific outlets clarifies that the outlet-violence relationship is highly distance dependent (Groff and Lockwood 2014, Ratcliffe 2012). These are impacts that degrade quickly over distance. The shape of that distance function may

² There is one census block group level study of changing alcohol outlets on changing violent crime (White, Gainey, and Triplett 2015). Unfortunately, researchers appear to have applied an OLS regression model to a count outcome.

vary across contexts, but at least one study finds the effect washes out in less than a hundred feet. If so, then it makes little sense to think of alcohol outlet density as a uniform spatial attribute over a larger area like a census block group. In short, the point-based work in this area raises serious questions about how, or whether, the areal-based work can be interpreted meaningfully. According to at least some distance estimations, alcohol outlet impacts are confined to the sub-streetblock level. Only theories specifying dynamics at this spatial scale are appropriate. We are awaiting such theories specifying these dynamics.

The broader question of crime impacts of land use mixes in residential locales, whether those be strictly commercial land uses, or more broadly any type of non-residential land use, has been contested since Jacobs (1961) highlighted the virtues of first-floor commercial uses on short and predominantly residential urban streetblocks. Some works find expected connections with crime; some do not (Fowler 1992, 1987, Browning et al. 2010, Weisburd, Groff, and Yang 2012). Numerous cross-sectional, and therefore causally uninformative works have been done at either the streetblock or the areal (e.g., census block group or census tract) levels.

Clearly non-residential, commercial land uses concentrate pedestrian and/or vehicular traffic, thereby making individual parcels with a business, or groups of parcels such as found in a small commercial center, potential crime generators. “As they concentrate people, shopping centres also create potential for conflict and theft” (Kinney et al. 2008: 71). Although some shopping centers may concentrate crime, others may not (Kinney et al. 2008). Fast food facilities may elevate crime on streetblocks, but the impact may be spatially dependent (Perenzin et al., unpublished).

But land use mix variables like percent commercial or percent non-residential (Stucky and Ottensmann 2009), whether on a streetblock or in an area like a census block group or a grid

square is still an extremely broad abstraction. We have some extremely limited evidence linking such variations to variations in resident-based informal control and surveillance dynamics (Kurtz, Koons, and Taylor 1998, Baum, Davis, and Aiello 1978). We also know that crime generating or attracting land uses elevate residents' perceptions of local problems (McCord et al. 2007). But systematic studies in a broad array of residential contexts clarifying how *changes* in these *specific types* of crime generating or attracting *facilities* affect resident, regular-user, and potential offender behaviors and cognitions remain elusive.

Researchers looking at this topic have made extremely general appeals to routine activity theory. Unless significant further theoretical specification within routine activity theory, such appeals are not helpful for two reasons. . First, and as highlighted elsewhere, is the spatial and temporal mismatch issue (Eck 1995). To my knowledge, *no one* has addressed these. In addition, many researchers continue to work with variables that are only extraordinarily crude proxies for key constructs in routine activities.

That said, we are still a long way from understanding the meaning of the physical environment ecological indicators in question here, and how those meanings might prove context dependent. Eidson (2015)#12913} found that real offenders' views of robbery potential of streetscapes with varying levels and types of commercial land uses depended in part on assumptions made about the social class of the area.

Progress could be made on this problem of ecological construct validation if researchers were to systematically link streetblock behavior profiles, at different times of day, days of the week, and seasons, across a wide array of streetblocks in different neighborhood and city contexts, with degree of commercial mixing present in land uses on the streetblock. I know of

one study that gathered systematic behavioral observation data in small commercial centers (McPherson, Silloway, and Frey 1983).³ Hopefully there are more.

In sum, one point seems clear from the current work. Crime is worse quite close to bars or other types of alcohol outlets. Although important, this is something we have known since the 1970s (Frisbie 1978). Beyond that the work seems muddled by confusions arising from overlooking spatial scaling, and clarifying how the relevant dynamics shift at different geographic units. The point-based vs. area-based work on alcohol outlets just does not join up. Turning to broader land use classifications like commercial or even more broadly just non-residential land use mixes, problems of ecological construct validation surface. We don't know what these attributes *mean* for on-the-street dynamics and how those meanings might prove context dependent.

C. Accessibility / Permeability / New Urbanism / Cul de Sacs

This topic concerns a closely linked cluster of issues. The cluster of issues has different facets including permeability, walkability, and cul de sacs. It relates to but is distinct from spatial syntax-based streetblock features which concentrate on streetblock functions as determined almost completely by the surrounding street network. Here the features of the streetblocks themselves merit attention as do, to a lesser extent, features of the adjoining streetblocks. For a somewhat recent summary of studies on permeability and crime, see Johnson and Bowers (2010: Table 5). These ideas go back at least to Sir Ebenezer Howard's Garden City Movement in

³ These behavioral observation data are available in a reconstructed file at ICPSR, **DS2: Pedestrian Activity Data** in the dataset "Impact of Neighborhood Structure, Crime, and Physical Deterioration on Residents and Business Personnel in Minneapolis-St.Paul, 1970-1982." (ICPSR 2371)

England in the 1890s and, along related lines in the U.S., the neighborhood unit plans of the 1920s as city planners here took on auto traffic challenges (Dahir 1947, Lawhon 2009).

The new urbanism policy context, combined with urban health emphases on walkability, promotes the idea of readily accessible streetblocks and street networks. “Internal accessibility, such as an excellent public transport system, road network, and walkability is vital for creating an attractive city ... Well designed streets will encourage people to use them, and make the outside experience pleasant and safe” (Mulliner and Maliene: 148).

Unfortunately, the new urbanism framework which wants streets which are *both* safe and accessible/open, is at odds with environmental criminology (Schneider and Kitchen 2007, Cozens 2008). Although there are exceptions, and different studies measure accessibility/openness in different ways, the bulk of the research argues that accessibility is associated with higher crime (Schneider and Kitchen 2007).

The least accessible type of street is the cul de sac. There are different types of cul de sacs, e.g., “leaky” (Armitage 2007) vs. not, sinuous vs. straight. One strong study finds that this least accessible type of streetscape, especially if it is windy and does not have alternate exit points, seems to be the safest type of street form when burglary is considered (Johnson and Bowers 2010).

But even the best studies “leave unresolved the underlying explanatory mechanism(s)” (Johnson and Bowers 2010: 107). Broadly, whether the mechanism largely or solely involves offender spatial behavior and awareness spaces; or features of resident or regular user behavioral profiles including keeping an eye on things, variations in household composition and stage of the life cycle (Hindelang, Gottfredson, and Garofalo 1979), or a combination, remains an open

question. “Teasing apart the contribution of [various] ... explanations ... might ... necessitate the use of ethnographic methods, or possibly spatial econometric techniques” (Johnson and Bowers 2010: 107).

Closing off streets to vehicular traffic and *creating* cul de sacs appears capable, at least in some studies, and depending on the configuration of the closures, of creating crime reductions (Atlas and LeBlanc 1994, Matthews 1992, Lasley 1996) Studies in Miami Shores, Dayton (OH), Hartford (CT), Newark (NJ) and LA suggest all provide some evidence. (The closely related set of studies on alley-gating also provide supportive evidence (Bowers, Johnson, and Hirschfield 2004).) So observing impacts of physical environment changes on later crime changes is somewhat encouraging about causal impacts of physical environment changes. But there is a weakness in these studies. It appears that *none* of these studies to date have provided closely spaced longitudinal observations subsequent to a physical environment change, of subsequent changes in: residents’ and regular users’ cognitions and behaviors, streetblock behavioral profiles, potential offenders’ views, and organizational activities related to the physical changes. Consequently, questions of specific causal processes and temporal scaling remain open. We don’t know how these changes work. And we don’t know how long it takes for a sizable design change to lead to a sizable change in the outcome. Further, at least one study (Lasley 1996) suggests offenders cleverly adapt to such design changes, using them to decrease their chances of police apprehension. Who is doing what, where, and when, after such physical changes are put in place, becomes essential for figuring out the relevant causal dynamics.

Such studies also would help with the problem of ecological construct validation. Research has yet to learn what these changes mean to different user groups, including potential offenders.

Johnson and Bowers (2010) also raise two potential selection problems. First, households with life styles that are less burglar friendly, like households with young children, may be siting themselves on cul de sacs. Further, potential offenders may be selecting areas at a broader spatial scale. Selection effects have caused concern in the neighborhood effects and physical environment literatures for some time (Sampson, Morenoff, and Gannon-Rowley 2002). No ready remedy surfaces for discounting this alternate explanatory frame (Taylor, 2015).

In summing up, roughly speaking, low permeability, as reflected in low access streets such as cul de sacs, continues to be associated with lower rates for some types of crimes, even after taking features of surrounding context into account. (Schneider & Kitchen's (2007: 47) conclusion aligns with mine but only specifically for burglary.) Although this is a consistent finding going back to the 1970s (Bevis and Nutter 1977), researchers have yet to clarify the specific behavioral and cognitive dynamics, among different groups including potential offenders, that are affected by low permeability, or changes in permeability as happens when cul de sacs are created. So we don't know how long it takes for significant crime prevention impacts to emerge, nor the relevant specific dynamics involving different groups. Further, since such impacts may be completely dependent on social and structural conditions (Ward et al. 2014), systematic studies across a range of contexts are needed to understand the conditioning of the relevant dynamics.

D. CPTED / Defensible Space / Guardianship / Territorial Functioning

Resident and regular user behaviors and attitudes occupy center stage in physical environment/crime models concerned either with territorial functioning, or the impacts of design features like defensible space components or CPTED components on resident- or regular user-based behavior patterns, surveillance or informal control dynamics. Previous reviews of this

theory, and critiques of the theory, and some relevant evidence, have been presented elsewhere (Taylor 2005, Taylor, Gottfredson, and Brower 1980, Merry 1981, Reynald 2009). Cozens' (2011a) recent remarks prove particularly incisive and wide ranging.

Three substantial problems have bedeviled work in this area, and continue to do so. CPTED has become an extraordinarily broad catch-all category of physical design elements, like how quickly someone can enter or exit a parking lot at a mall (Crowe 1991); security add-ons like private or public CCTV (Ratcliffe, Taniguchi, and Taylor 2009, Welsh and Farrington 2009), target hardening, and public infrastructure enhancements like improved streetlighting. We have studies looking at the crime impacts of changes in a suite of CPTED features, or changes in individual components. The interested reader can start at the Problem Oriented Policing library data base for situational crime prevention to view studies on the impacts of different features [<http://www.popcenter.org/library/scp/>]. Searching on street lighting alone calls up 43 studies.

The problem is that because there are so many potentially relevant design elements, whose relevance varies depending on many features of context and the specific type of crime in question, policy makers and practitioners have no idea of the *comparative* benefit of one design component versus another in *specific* settings. For example, to reduce purse snatches in the parking lot adjacent to a medium size mall in a mixed income/mixed race suburban location, should the mall owner put in better street lighting or re-design the parking lot exit flow?

A second enduring challenge, despite broad and widely held assertions that CPTED works, is that we don't know *how* it works. Again, questions of relevant causal dynamics remain unanswered.

There is the issue of our limited understanding of how specific aspects of defensible space and CPTED work and in what context they are likely to work most effectively.

There remains a critical void in our understanding of how physical design manipulations suggested by defensible space and CPTED translates into crime preventive action by residents and other legitimate users of space (Reynald 2015: 81).

And, I would add, we don't know how the above unknown dynamics translate into impacts on potential offenders' expectations about ease of access, detection, and ease of exit (Taylor and Gottfredson 1986).

The third challenge, arising from the previous one, is confusion about temporal scaling. Again, as seen before in other areas, we don't know how long it takes for the design change to create intermediate changes that eventuate in crime reductions.

On a positive note, despite the longstanding and hard to resolve challenges in this arena, scholars are seeking to theoretically reinvigorate these conceptual frameworks. Recent efforts at theoretical cross fertilization propose connections between defensible space features, territorial functioning, and different varieties of routine activity theory; for the latter a focus on capable guardianship has been suggested (Reynald 2011, Hollis-Peel et al. 2011, Reynald 2010, 2009) (PLACEHOLDER – REYNALD CHAPTER). Connections between micro- and meso-level person-place dynamics and the wider surround are drawing interest as well (Reynald 2009).

Reynald's (2009) conceptual linkage of Newman's milieu idea with routine activities is an example of the latter. "If an area is highly accessible to outsiders, for example, and highly attractive because of the facilities located within it, this makes it much more difficult for

residents to exert control over it” (Reynald 2009: 40). This was exactly the relationship observed among residents at varying distances from small commercial centers in Minneapolis (Taylor 1997: Figures 1 & 2). Reynald’s suggestion calls for studies connecting site-level and streetblock design features with assessments of residents’ and regular users’ territorial behaviors and cognitions, and with broader profiles of streetscape usage driven by specific facilities.

Hopefully these efforts will lead to stronger theoretical integration with sociological frames on neighborhood crime (Bursik and Grasmick 1993) and place-specific informal control dynamics (Hunter 2003, Hunter 1985), and, as importantly, ecological construct validation efforts for all the key indicators in question in these different theories.

A question closes the discussion of CPTED. Researchers and planners might want to carefully consider whether CPTED “is a [series of] physical design concept[s] or a concept generating desired social outcomes” (Lawhon 2009).⁴ If it is the latter, then it is not clear how to validate indicators of the construct CPTED.

V. Forging Ahead

A. Given the Preceding

The selective review of just some of the key questions in physical environment in crime has highlighted the repeated relevance of two conceptual/analytic/methodological concerns: temporal scaling and ecological construct validation. Although mentioned explicitly only once by one of the studies noted, selection dynamics are routinely relevant. People are constantly

⁴ This question adapts Lewhon’s (2009) phrasing of a criticism of neighborhood unit planning into a question about CPTED. Given the number of disparate design elements involved in both, this is an important question to carefully consider.

deciding whether to turn here or there, what times of day to go to this place or that place, and of course, where to live and shop.

The review also has pointed out that cross-sectional work is non-informative from a causal perspective. This may sound like a harsh statement to some, but this conclusion *necessarily* follows if one accepts Hawley and Bursik's characterizations of continuity and discontinuity of ecological parameters (Bursik 1986). Any single measure of ecology or crime inextricably confounds of ongoing ecological continuity and recent ecological discontinuity into one indicator (Taylor 2015: 149-154). The two components cannot be separated. Longitudinal works gauging changes in both environment and crime are needed.

Further, studies of changes need to consider mediating and moderating dynamics (Baron and Kenny 1986). Mediating dynamics, behavioral, cognitive, and emotional, of regular users, residents (if applicable), and potential offenders all deserve attention. Constraining or facilitating factors at different geographic scales, whether this is called milieu or structural fabric, merit consideration (Ward et al. 2014, Reynald 2009). This author rejects architectural determinism, and strongly encourages readers to do likewise (Broady 1972). Given that rejection, the cognitive and emotional processing of perceived environments, as well as mediating and moderating dynamics, all prove essential for understanding causal dynamics in this arena. Given the relevance of perceived settings, situational action theory deserves close attention as a fruitful theoretic frame (Wikstrom et al. 2012).

B. How Do We Forge Ahead?

It seems extremely unlikely to this author that the empirical data structures required by the aforementioned conceptual/analytic concerns are likely to be obtained by researchers.

Despite the promises (O'Brien and Sampson 2015), it is unlikely this problem will be solved with big data. The temporal and spatial requirements of needed data, from different sources, are just unlikely to line up adequately.

This author recommends that beginning scholars immerse themselves deeply in computational criminology, more specifically, agent-based simulation models (ABMs) (Taylor 2015) (PLACEHOLDER – Birks chapter). This mode of scholarship has proven enormously valuable in many social science areas including environmental criminology (Birks, Townsley, and Stewart 2012, Berk et al. 2011 [1999], Yang et al. 2011, Townsley and Birks 2008, Liu and Eck 2008, Berk 2008, Groff 2007a, b, Wang 2005). The structure of the environmental criminological theories that are so often called upon in the environment-crime research area are framed in ways that make their testing quite compatible with ABMs (Johnson and Groff 2014).

The general strategy would be: ⁵

- Start with a specific crime outcome of interest,
- At a particular geographic scale
- Create a focus on a specified subset of physical features, whether those be design-based, user-generated, or behavior traces.

⁵ The above represents an enormous over-simplification of the process of ABM development and testing. For more see Gilbert (2005).

- Decide initial levels, then the rate and level of changes on those physical features of interest. Use empirical research and specific theoretical frames as touchstones where possible for each of these decisions.
- Use empirical research and specific theoretical frames to outline the most relevant classes of agents and for each class of agents, the most relevant attributes.
- For each class of agents and for each relevant attribute, use empirical research and theoretical frames to gauge impacts of specific attributes on other specific attributes, and to estimate the time horizon of such impacts.
- Use empirical research and relevant theoretical frames to estimate impacts of physical environment changes on different attributes of different classes of agents.
- Run models, examine patterns of crime impacts.
- Test ecological validity of the model.
- Progressively elaborate the model.

ABMs allow researchers to conduct experimental tests of changes in physical design features within the simulation itself. “The agents ‘lives’ can be restarted and allowed to play out under different assumptions. This might be used to test different theories or even interventions” (Johnson and Groff 2014: 515).

Take for example the question of creating cul de sacs. ABMs situated in real street networks (Groff 2007a) could gauge impacts of experiments that create varying numbers or arrangements of cul de sacs to gauge the number and arrangement needed to create a significant reduction in drive by shootings (Lasley 1996), for example.

At some point in the model development stage, such models should be situated in real geographies (Groff 2007a), whether those geographies be parcels on streetblocks, streetblocks in a street grid, or something different.

Such simulations, even though they represent methodologies radically different than those available to the forefathers and foremothers of research in this area, align with their concerns. Lynch would embrace the consideration of changes, especially changes at different rates, and how different types of agents might adapt to those. Along a related line, Hawley would be eager to learn how variations in the relative levels of ecological continuity vs. ecological discontinuity on key community attributes might shift over time in response to agents' actions. Proshansky would support basing simulation dynamics on processes taking place in specific contexts. Jacobs might express interest in the rich interplay between different classes of agents modeled in a shared context. The Brantinghams already have embraced this approach (Brantingham 2011, Brantingham et al. 2008, Brantingham et al. 2005)! Researchers can simultaneously embrace this new analytic approach while staying true to the important guiding lessons imparted by the founders in this field.

*

In the late 1960s and early 1970s empirical scholarship on environment and behavior, including crime and environment, unearthed many relationships. These gave policy makers and opinion makers hope that well understood design guidelines might help create safer places. “How could we not want urban design to inoculate us against bad things, including crime?” (Schneider and Kitchen 2007: 52). Much more is known today about how to make some kinds of places safer. Such achievements are notable. At the same time, we are still a long ways away from fully understanding the relevant causal or even transactional (Werner et al. 1987) dynamics

that connect physical environment and crime over time, for different types of individuals and groups, in different contexts. This author is not sure researchers are getting closer to such an understanding. Part of the problem, as outlined here, have been several overlooked stumbling blocks. Hopefully, in spite of always inadequate external funding sources, real world complexities arising with multi-site investigator teams, and pressures to publish as many pieces as possible in the shortest time, some significant cadre of scholars will take these stumbling blocks into account, and confront the challenge of directly investigating the dynamics underpinning these potential causal connections.

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