

Shame buffers and spatial risk-mitigation: Exploring the effects of social stigma on the locational strategies of illicit massage businesses and their customers

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ABSTRACT

Traditional locational analysis in urban retail/business geography begins with the assumption that customers will visit retail locations that are most convenient, and that businesses that locate close to their customers' residences or workplaces would be preferred to locations farther from those places. This assumption is problematic when applied to economic activities for which social stigma exists. In this article, we examine the influence of social stigma on the locational choices made by customers of illicit massage businesses in the Dallas-Fort Worth, Texas metropolitan area. We introduce the concept of *shame buffers* – zones around the places to which each customer is most deeply socially embedded, their home, workplace, and other community spaces, where the customer would not engage in stigmatized behaviors for fear of being observed and facing social shaming. We then examine the validity of the shame-buffer concept by analyzing customers' mobility patterns for both legal and illicit massage businesses in the Dallas-Fort Worth Metropolitan Area (DFW metro).

1. Introduction

The question of how and why people move through space is one of the central concerns of geography. In retail/business geography in particular, the question of how individuals select the locations where they purchase goods and services is of paramount importance. In what follows, we explore a way of viewing individual decision-making that extends and adds nuance to existing theories of locational selection in geography, crime-mapping, and behavioral geography. The central crux of our paper rests on a fairly simple question: how far would you go to avoid being caught doing something embarrassing? Not metaphorically, but quite literally, how long or far would you be willing to travel to reduce the chances of someone important in your life observing your participation in an activity for which a social stigma exists? This research examines these questions in the context of the location-selection behaviors of customers of illicit massage businesses (IMBs). IMBs are firms that purport to offer legal massage services, and in some cases, also advertise quasi-medical services, like reflexology, but that also provide illicit commercial sexual services to customers willing to pay for them. The locations of these businesses are now fairly easy to map, thanks to massage-review websites where providers can list their

businesses and customers, who commonly refer to themselves as “mongers,” provide reviews of their experience(s) at each particular IMB (Holt et al., 2014). These reviews typically include a description of the particular service received, the cost, and the purported name of the provider. In some cases, the reviews also include descriptions of the site and situational characteristics of the IMB. As such, these reviews provide insight into the locational selection process for IMB customers, which we discuss further in the methodology section.

IMBs are a subsegment of the personal services retail economy that, though technically illegal, operate largely without attention to legal issues. For a variety of reasons, traditional police tactics have not proved effective in controlling the IMB industry (de Vries and Farrell, 2023, and arrests at IMBs remain exceedingly rare. However, public awareness of IMBs has increased thanks to a few high-profile arrests, like the sting operation in Jupiter, Florida, in which police arrested Robert Craft, the owner of the New England Patriots NFL franchise, for receiving commercial sexual services (Mazzei et al., 2019).¹ IMBs received national media attention again in 2021, when a murderer targeted women working in IMBs as part of a mass shooting in Georgia (Fausset et al., 2021). The consistent effort of anti-human trafficking non-profit organizations, such as the Polaris Project and The Network Group, to

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¹ Robert Craft was eventually cleared of all charges. The publicity of the arrest nonetheless, increased awareness of IMBs within the United States general public.

publicize and link human trafficking with the illicit massage industry is also an important element of increased public awareness of the existence of IMBs, and the creation of social stigma connected to the industry. We argue that the public stigma associated with the IMB industry leads its customers to avoid visiting IMB locations near their home, place of work, or other places near which they are more likely to be observed entering or exiting an IMB by someone to whom they are personally connected: spouse, partner, boss, neighbor, etc. We call these zones, which surround the places to which each customer is most deeply socially embedded, and where each customer would not visit an IMB due to the higher likelihood of being observed by someone they know, “shame buffers” (See Fig. 1).

2. Project overview and general methodology

That researchers can estimate the prevalence of the illicit massage economy with confidence is the result of shifts in the commercial sex industry from street-based solicitation to online-solicitation via message and review boards (Venkatesh, 2013). Online platforms allow providers of commercial sex services to advertise their services, prices, and location to prospective buyers, without the necessity of physically locating in red-light districts to which customers travel with a place-based expectation of the availability of commercial sex services. In the case of illicit massage review websites, customers can also post reviews of the services received, much like the way [Yelp.com](#) or Google reviews work for legal goods and services. As part of this ongoing research project examining the spatial dimensions of the illicit massage industry, we collected locational, attribute, and text data from the largest online IMB review site.² We focus specifically on the DFW metropolitan area. The location was selected for several reasons. The DFW metro area is home to 7.7 million residents, making it the 4th largest metro region in the United States (US Census 2021). As of June of 2022, 591 IMBs were listed as “Open” on the IMB review website, making the DFW region one of the largest IMB markets in the United States. Focusing on the DFW metro area also allowed us to incorporate the typology of DFW IMBs established by [Crotty and Daku \(2023\)](#) in the research design and analysis. The DFW IMB typology reflects the first attempt to understand the heterogeneity of the IMB economy. Applying the shame-buffers concept in this region allows us to better understand how different types of IMBs might attract customers with differing tolerance for risk of being observed patronizing an IMB by people they know.

The manuscript proceeds as follows. First, we build the case for the existence of shame buffers within the context of IMB customers’ locational selection process. This conceptual foundation is based on qualitative analysis of a sample of 1300 customer reviews for IMBs within the Dallas-Fort Worth metro region (DFW). These reviews were coded and analyzed using grounded theory approaches ([Knigge & Cope, 2006](#); [Knigge, 2017](#)). The review content was analyzed to determine if it included information relevant to the overall research project exploring the locational strategies of IMBs and their customers. This includes whether the review mentions law-enforcement/police, distance/proximity to the customer’s home, place of work, or another co-located business, whether the IMB is located on a busy street or a quiet/side street, if the customer mentions the visibility of the IMB, if the customer mentions their desire for discretion/privacy, and positive or negative descriptors of the parking lot at the site. The majority of the reviews only include descriptions of the type of commercial sexual service provided and evaluations of the quality of the massage experience. Only twenty percent include reference to *any* of the attributes of interest. Nonetheless, the reviews that include content relevant for

understanding customer’s locational selection process provide considerable nuance that may be applicable to larger segments of the IMB customer population.

Though there are reliability concerns with volunteered geographic information, like the data collected from the IMB review website, these sources remain among the best sources of empirical data on the commercial sex industry, and in particular, for customers in the commercial sex industry who are “notoriously difficult to research because of the problems associated with accessing those who secretly go about their activities and do not want to be identified” ([Soothill & Sanders, 2005](#), p. 2.1). These qualitative findings are situated within the context of previous research on IMB locational patterns, as well as relevant theoretical perspectives from economic geography and criminology.

Once the theoretical and qualitative evidence for shame buffers is established, we present quantitative a case study designed to test the hypothesis that IMB customers would travel farther from their homes than do customers of legal massage businesses. In order to test this hypothesis, we use smart device geolocation metadata-based mobility data to help explore the locational practices of IMB customers, the details of which we cover in greater detail in the methods section.

All of the data used in this analysis is publicly-accessible and its use in this research was judged to be exempt according to the 45 CFR 46.101 (b) Exempt Category 2 by IntegReview IRB. Due to the potential for negative impacts on individuals involved in the IMB industry, we self-implement several data and visualization restrictions to ensure that individual and firm-privacy are maintained. First, qualitative data from IMB reviews is edited to remove any locational/geographic descriptors that could be used to identify the specific location/IMB being reviewed (e.g. names of nearby businesses, streets, etc). In the quantitative case-study, only results of mobility data analysis are presented. There are no maps of individual or group mobility patterns included to avoid accidental disclosure of customers’ homes or the business (es) they frequent. Finally, to protect IMBs from unwanted publicity, we only display IMB locational patterns aggregated into generalized hex bins, rather than point locations.

3. Shame buffers in context of illicit massage businesses

The importance of mobility for risk management in other contexts such as crime ([Valente et al., 2024](#)) and natural disasters ([Iwai, 2024](#)) is well established. Geographers interested in the spatiality of emotions have demonstrated the ways particular activities are facilitated or inhibited based on individual and group’s relational embeddedness to particular places or kinds of spaces ([Bosco, 2006](#); [Bosco et al., 2017](#)). We propose a new model for understanding the way that individuals select locations to engage in potentially embarrassing behaviors, which we call shame buffers. The foundation of the shame-buffers concept is that individuals may use their mobility to reduce the likelihood of being observed engaging in an activity which they would experience embarrassment, shame, or social ostracization about if their participation became known publicly. This concept alters the foundational assumptions of locational choice built into nearly all previous research on the locations of illicit massage businesses.

3.1. Understanding the locations of illicit massage businesses

IMBs are unique elements of the urban economy in a few important ways. First, because IMBs do not openly provide sexual services, they are not subject to municipal zoning regulations that have historically concentrated SOBs like strip clubs and adult bookstores in particular parts of the city – thereby helping to create vice or red-light districts ([Hubbard, 1997](#); [Hubbard et al. 2008, 2009](#); [Lyons et al., 1999](#)). Because IMBs purport to, and often do, provide legal massage and personal care services, their distribution is considerably less-constrained, and IMBs can be found throughout most of the metro areas in the United States. Second, though the commercial-sex act is a crime, little evidence

² Following the example of [de Vries \(2023a, 2023b\)](#) we are not naming the review site in this manuscript to better protect the confidentiality of commercial sex providers, website users, and locations where illicit events and potential victimizations occur.

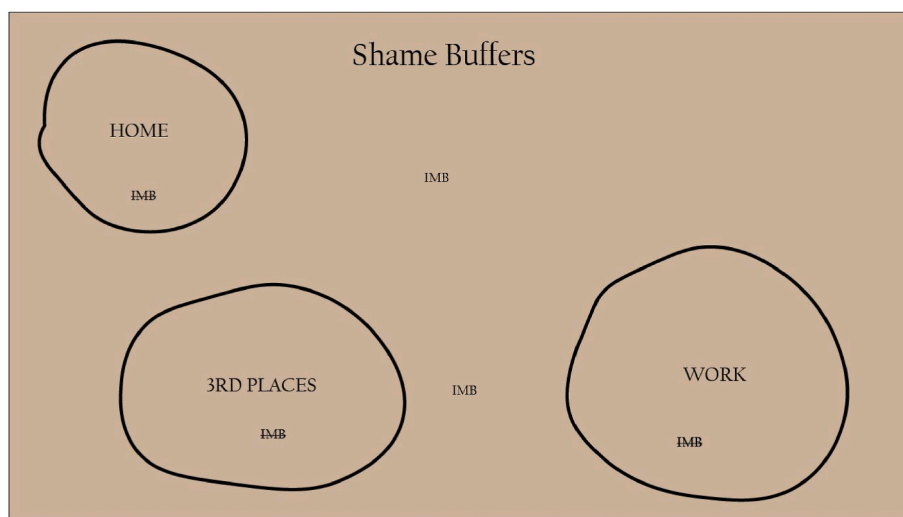


Fig. 1. Theoretical model of shame buffers around an individual monger's places of social and emotional embeddedness. Mongers would only visit the IMB locations outside of their self-defined shame-buffers.

suggests that the risk of arrest influences the locations where IMBs operate or their customers' patronage respectively.

The distribution of IMBs is not random; however, to use the four most populous cities of Texas as examples, there are clear areas of spatial clustering in each of the metro areas (See Fig. 2).

Clustering perhaps helps to explain relative levels of demand, but the relative accessibility of IMBs to residents of all four metro areas is also worth noting. 84% of DFW-metro area residents live within a 10-min drive of a suspected IMB. Similarly, 83% of Houston metro-area residents live within a 10-min drive of a suspected IMB. In the Austin metro area, 71% of residents live within a 10-min drive of a suspected IMB, and fully 94% percent of the residents of the San Antonio metro area live within the 10-min drive time of a suspected IMB. In all four of these metro areas, the vast majority of mongers are not forced to travel long distances to access IMB services; there are IMB services located conveniently for most of the metro-area population. As such, if mongers opt to travel longer distances to purchase IMB services, they are sacrificing spatial efficiency to meet some other need or goal.

3.2. Locational theory and spatial behaviors of IMB customers

Several theoretical perspectives regarding locational behaviors are relevant to this analysis of illicit massage customers. The first is traditional locational theories from retail geography. Perhaps best exemplified by the Huff model – this perspective argues that people will select a retail location based on a function of distance from the place where their journey begins (typically their place of residence) and the attractiveness of the retail location (Huff, 1964). As such, the total number of customers for a particular shopping location is estimated as a percentage of the base-population of the “catchment area”, the spatial extent of which is determined by the attractiveness of the shopping location. More attractive shopping centers will have a larger catchment area, meaning people are willing to travel farther to reach that location. The Huff model is well established within traditional retail geography, and recently was quantifiably tested using smart device geolocation data (Ballentyne et al., 2023).

Nearly 100 years ago, Copeland (1924) identified the two general types of retail goods: convenience goods and shopping goods. Convenience goods are products that customers purchase regularly, have minimal price differentiation, and are spatially ubiquitous – customers do not travel far to purchase these goods. In the contemporary retail environment, fast-food restaurants, and convenience grocery stores would be examples of these types of goods. Conversely, shopping goods

are products or services which consumers purchase infrequently, may exhibit high price differentiation, customers may comparison shop before making a purchase, and are less-spatially accessible – customers are willing to travel farther or expend more time/energy to acquire the good or service (Bucklin, 1963; Copeland, 1924; Creaven et al., 2020; Holton, 1958). Clothing, televisions and other electronic devices are common examples of shopping goods. The differences in willingness to expend resources to access the good or service are indicative of those products' attractiveness level. Therefore, convenience goods have a relatively low attractiveness-level, whereas shopping goods have a higher attractiveness level.

Establishing the correct ‘catchment area’ for a particular business is a critical element of consumer modelling in retail geography. Analysts routinely estimate the characteristics of a particular store's customers based on the demographic characteristics of the population within the catchment area. Most of the previous research examining the locational characteristics of IMBs have attempted to understand the characteristics of IMB customers using similar spatial analysis techniques. In all of the studies we can identify, the researchers defined the neighborhood around the IMB based on some variation of this weighted-distance threshold concept from retail geography (Chin et al., 2015; Chin et al., 2019; Crotty & Bouché, 2018; de Vries, 2023a; Mletzco et al., 2018; White et al., 2021). Some researchers use relatively short distances as the travel threshold to define the IMB neighborhood; for example, Crotty and Bouche define IMB neighborhoods as the census tracts located within 1 km from the IMB (2018). Research that defines the neighborhood this way implicitly assumes that IMB services are a convenience good. Conversely, the work by White et al. (2021) conducted analysis using the county of operation for the IMB as the “neighborhood”. Counties vary in size, the vast majority are larger than the neighborhoods as defined by Crotty and Bouche, Chin et al. and de Vries. The county-as-neighborhood approach is more consistent with a view of IMB services as a shopping good. We believe both of these approaches are somewhat problematic, as IMBs in the DFW metroplex exhibit spatial distribution that is consistent with a convenience good. But, the degree to which mongers review services available at one establishment versus another, debate cost and quality, etc. in online review boards is more consistent with a shopping good. As a result, it is quite challenging to make a compelling case for a particular distance threshold to use as the “catchment” area for each IMB, thus rendering neighborhood-based analyses of IMB locational characteristics somewhat unconvincing in terms of their ability to inform our understanding of the illicit massage economy, and, in particular, the spatial behaviors of IMB customers. We

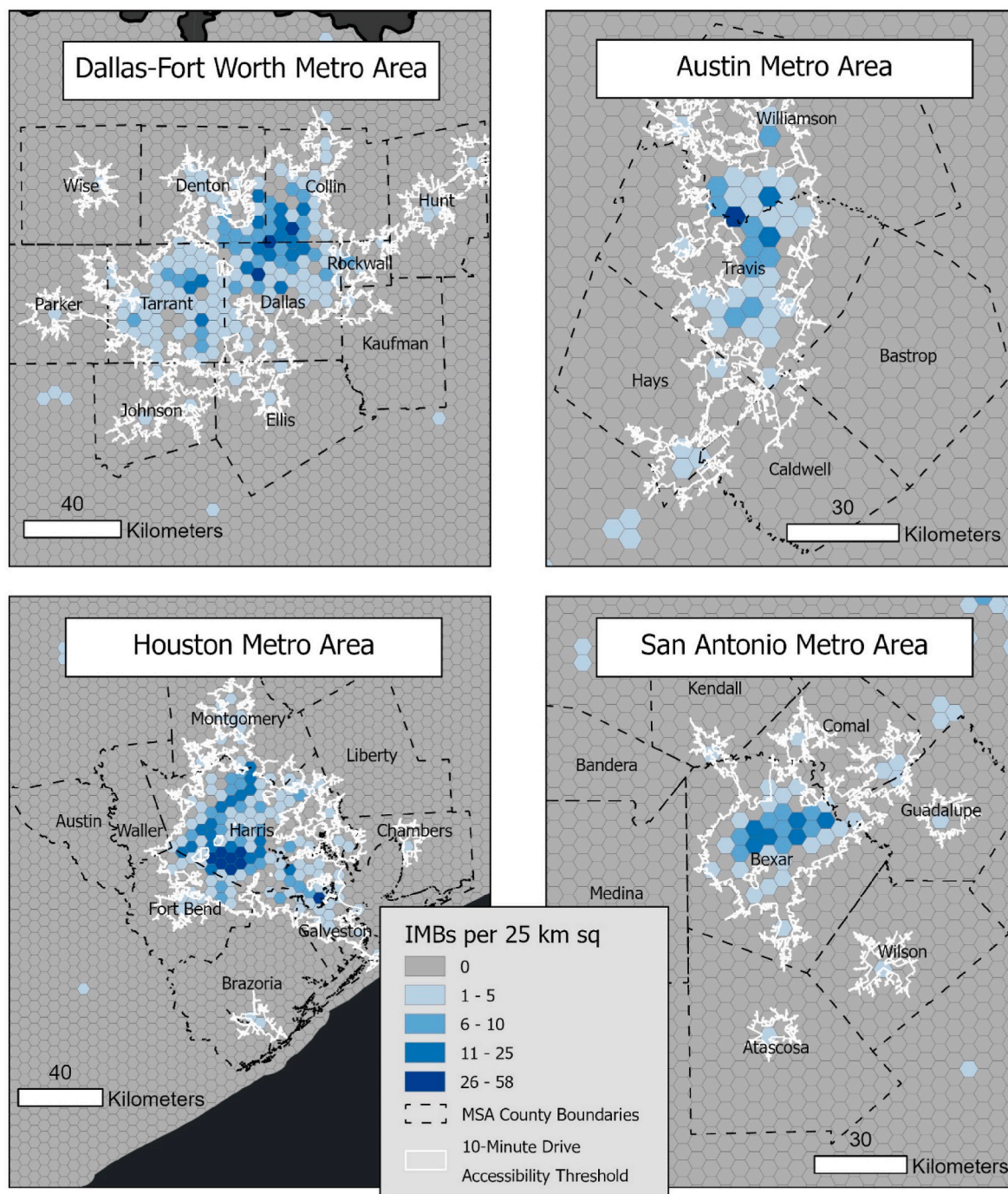


Fig. 2. IMB concentration and 10-min drive-time accessibility in Texas Metro areas (Census boundaries and 2021 ACS Population estimates accessed with the TidyCensus package (Team, R. C, 2023; Walker & Herman, 2023)).

believe it is partially due to this methodological shortcoming that the results of previous locational analyses of IMBs returned inconsistent and even directly contradictory results (These results are summarized in Table 1. See Crotty and Daku (2023) for an extended review of previous IMB locational analyses).

To date, few studies directly examine the spatial behaviors of IMB customers or customers in the commercial sex industry more broadly. The dearth of research is in part due to data-collection challenges, as mongers are unlikely to voluntarily participate in research regarding their illicit activities. There are two notable exceptions, however, which focus largely on the mobility of commercial sex-industry customers. Southill and Sanders published a study in 2005 that collected data from

online message boards created by and for the monger community in the United Kingdom (UK). The focus of this message board was the entire commercial sex industry, not exclusively IMBs, though several references to illicit massage appear in their data. From that collected data, they derived city-level locations of commercial sex activity for each message board participant. When extrapolated across all the repeat participants on the message board, the researchers can articulate an evidence-based, if low-resolution, geography of the commercial sex-industry in the UK.

de Vries (2023b) examined the interdependence of neighborhoods within the IMB economy, by analyzing patronage patterns of repeat IMB customers based on the IMB locations for which they posted reviews.

Table 1
Overview of previous IMB locational analysis research.

Author(s)	Geographic Focus	Primary Findings IMBs associated with ...	Methodology Notes
Chin et al. (2015)	New York City and Los Angeles County	More males aged 20-65 Higher avg family size More poverty families	Demographic Characteristics of IMB-Neighborhood Clusters
Chin et al. (2019)	New York City and Los Angeles County	In LA – Immigrant enclaves In NYC – Business districts and high income	Demographic Characteristics of IMB-Neighborhood Clusters
Crotty and Bouché (2018)	Houston, TX	Higher education, more renters, more non-family HH, more Asian residents, fewer Black residents	Spatial regression used to define demographic drivers of IMB clustering.
de Vries (2023a)	Cities with more than 50K residents in three US states	Higher racial/ethnic heterogeneity, residential instability (renters), income inequality	Demographic Characteristics of neighborhoods where at least one suspected IMB operates.
White et al. (2021)	IMB locations in 49 states, no Alaska. Census tract and County-level analysis	Higher pct White residents More religious presence State-level effects: NY, OH, TN, MI, TX, AL	Machine Learning approaches

The end goal of this research was to evaluate salience of several crime-location theories for explaining relative levels of network connectivity to other IMB-neighborhood census tracts based on each tract's demographic and spatial characteristics. However, by analyzing the locational purchasing patterns of IMB customers, the research demonstrated two key findings for this analysis. First, "spatial distance was a key impediment to the formation of connections between tracts, supporting the idea that buyers were substantially less likely to frequent IMBs in tracts that were further afield from one another" (de Vries 2023). From this research we understand that distance is a factor in monger's locational selection process, albeit not in relation to the distance they travel from home or work to an IMB, but in relation to the distance *between* IMBs that a monger is likely to visit. Second, "retail centers may feature in the routine travels of potential buyers, who may also be drawn to areas where their illicit behaviors blend into a legitimate context (de Vries 2023).

3.3. Risk mitigation in informal and illicit markets

Locational choice perspectives from criminology are also relevant for this analysis, as mongers are engaging in a criminal act and wish to not be caught doing so. Within criminology, rational choice theory explains the ways that criminals mitigate risk in response to police interventions (Cohen & Felson, 1979; Holt et al., 2014). In these cases, the risk of arrest and the associated penalties of jail time are weighed against the benefits of offending, and the resulting decision to commit an offense or not is based on the individual's own risk/reward assessment (Cherbonneau & Copes, 2005). In most of these criminal ventures, the risk of jail time or other criminal penalties provide the deterrent effect, which leads criminals to adjust their behaviors to reduce their risk of arrest. That the deterrent is part of the formal legal/criminal system means that law enforcement agents are the primary group that, for example, car thieves need to avoid. However, previous research shows that the risk calculation for the buyers of commercial sex-services is fundamentally different. "Johns are deterred by getting caught and the publicity and shame that might accompany being arrested, but not by the actual punishment for the crime." (Holt et al., 2014, p. 263). Because the risk for johns is the publicity and shame associated with the behavior becoming known, and not the criminal penalties, police are not the only group that can "catch" a john and create the publicity and shame which they want to avoid.

We know from qualitative examination of IMB reviews that some IMB customers are concerned about the visibility of their behaviors and the experience of shame associated with the activity. For example:

Very convenient location if you are near the area. **Also very discreet for us mongers that are all about discretion.** Parking is available and i got a good tug from (name redacted). didn't see any other girl because i arrived before work (around 10 am)

- Monger 1 (authors' emphasis).

*Had some extra time, went to *IMB NAME* on the way home from work. Clean, newer, upscale location. **Not at all private.** Busy strip mall on *LOCATION* across from *POPULAR GROCERY STORE*. Employees sitting outside the pharmacy next door wearing scrubs. **You better be confident because there is no avoiding the walk of shame at this location.***

- Monger 2 (identifiable locational information redacted, authors' emphasis)

Monger 1 highlights the subset of mongers who are concerned about discretion, presumably because they believe they would face negative consequences if particular people found out about their behaviors. Monger 2 highlights a more generalized definition of shame, wherein the concern is not that a person the monger knows would see them, but simply that people in general would see them, know what they had been doing, and the monger could experience shame and/or embarrassment as a result. In our qualitative analysis, discretion and visibility are the top two themes that we coded for, showing up in 4.64% and 4.09% of the reviews respectively. Taken together, a little under 9% of mongers who posted reviews showed a concern for observation of their engaging the in activity.

Rational choice theory suggests that for mongers, their behavioral adjustment must prevent observation of their behavior by police, but also, by a broader range of community members, including family members, neighbors, coworkers, etc., whose judgment regarding the monger's behavior creates areas of informal control where mongers would be less-likely to purchase commercial sex services. This sort of informal control is a foundational aspect of routine activity theory within criminology, which argues that three criteria must be met in a single time-space location for a crime to occur. There must be a crime target (person, business, building, car, etc.), an offender (person committing the crime), and an absence of "capable guardians" (Cohen & Felson, 1979; Hollis-Peel et al., 2011). Within criminological studies there exists a broad range of definitions of "capable guardians" that are deployed to explain hot spots of criminal activity. These capable guardians range from non-biologic agents like architectural design, to animal-actors like guard dogs, as well as a variety of human agents (Hollis-Peel et al., 2011). There are three "types" of roles that may act to deter crime from occurring: those that protect victims (guardians), those that protect offenders from choosing to offend (handlers), and those that protect places (managers) (Eck, 1994; Felson, 1995). There are a further four "steps" of crime discouragement, which reflect the varying levels of responsibility that particular actors might feel to act/intervene to prevent a crime in a given time or place (Felson 2005). Personal discouragement is exerted by friends and family. Assigned discouragement is exerted by actors who are employed specifically for the task of crime deterrence: law enforcement agents and private security forces would be most relevant in the context of the IMB economy. Diffuse discouragement is exerted by people employed in the area of a crime, but not assigned specifically to security work. This could be employees of nearby businesses that share spaces or parking lots with an IMB. And

finally, general discouragement is exerted by unpaid persons lacking a personal tie or responsibility to the victim or offender. Depending on the type of crime, time, place, and degree of responsibility a particular actor feels to intervene, the deterrent effect of their presence could vary substantially (Felson 2005).

Quantitative approaches used to test the validity of routine activities theory, and capable guardianship more specifically, generally map the presence or absence of these various types of guardians at the neighborhood scale in order to explain or predict criminal hot spots compared to areas of low-crime (Boivin, 2018; Jopp, 2016). By necessity, spatial analyses testing capable guardianship define capable guardians according to particular demographic profiles (Boivin, 2018; Groff, 2007; Harper et al., 2013). These analyses rely on an implicit assumption that all people meeting a particular demographic profile are equally likely to serve as guardians for all potential offenders, while an absence of people meeting the guardian profile will produce higher crime rates (Harper et al., 2013; Jopp, 2016). They unfortunately cannot account for the variability in an actor's likelihood of intervening, as described in the steps of crime discouragement (Felson, 1995). This is a really problematic shortcoming when applied to the IMB economy because IMB's are legally licensed businesses that provide illicit services secretly. As a result of their apparent legality, actors who might provide assigned, diffuse, or general discouragement are less-likely to feel a responsibility to intervene when a customer visits an open and apparently legally-operating business. The "employees sitting outside pharmacy next door wearing scrubs" referenced in the above quote from monger 2, provide a helpful example of actors who do not directly intervene to prevent a monger from visiting an IMB, and whose presence alone was not sufficient to deter him. That he felt compelled to mention the potential for a "walk of shame" does suggest that the busyness of the shopping center and presence observers could lead to diffuse discouragement for mongers with a lower tolerance for embarrassment or shame. Within the four-step framework, *personal discouragement* is the only step of crime discouragement remaining to prevent a monger from visiting an IMB. Mongers seeking IMB services choose to ignore any indirect guidance against the behavior from friends, family, and society more broadly. As such, successful offending for a monger is more or less assured if they select an IMB location where they are unlikely to be observed by friends and family. Our conceptualization of shame buffers addresses this specific dimension of the IMB customer's locational selection process.

The key distinction between the concept of capable guardians as deployed within routine activities theory, and our conceptualization of place-based emotional embeddedness, is that the zones where a particular monger would avoid are unique to that individual based on their own social, familial, and other connections. The capacity to exert *personal discouragement* is defined by the level of connection an individual has to a potential offender/customer, rather than the potential guardian's demographic characteristics (Felson, 1995). Each monger therefore has a unique set of capable guardians, who would not be capable guardians for people with whom they do not have a relationship. As such, it would be impossible to map those relationships in aggregate for use in predictive modelling. However, there is nothing in the conceptual framework of shame buffers that suggests that routine activities would not play a role in monger's locational selection process. The daily mobility patterns of each monger would certainly affect the particular IMBs that they would be most likely to visit. Moreover, by drawing on individual-level mobility data, it is possible to test the validity of the shame-buffers concept across a sample of IMB customers.

Shame buffer zones are unique to each monger based on their level of place-based embeddedness in multiple dimensions of their lives. For almost every monger, this would include what Oldenburg and Brissett called first places, or the place of the home (1982). Previous research exploring the demographic characteristics of commercial-sex-work customers vary in their findings and considerable geographic variation exists in the customer profile as well (Lowman & Atchison, 2006; Monto

& McRee, 2005). Allowing that there is some variability between locales, the findings from Lowman and Atchison's study in Vancouver, Canada provide a baseline for understanding the characteristics of mongers and exploring how those characteristics might shape their locational selection process. Of particular importance for this research is the finding that a reasonably large percentage of mongers are married or in long-term relationships (57%), have children (52.9%), and have full-time employment (75.9%) (Lowman & Atchison, 2006).

For a monger with these particular characteristics, getting caught by someone in his family, or connected to his family in some way, would likely have the highest degree of risk, as it could lead to the disintegration of his home life – divorce, reduced access to his children, financial loss, etc. (Allen & Atkins, 2012; Coop Gordon & Mitchell, 2020). For these mongers, a range of third-places would also become sites of informal social surveillance where IMB patronage would be too risky: near a place of worship they attend, their children's schools, etc. For other mongers, proximity to their place of work, the second-place, in Oldenburg and Brissett, 1982. We must note here however, that this effect may be muted compared to the effect near one's place of residence as emotional connections to co-workers are likely to be relatively weaker than to neighbors and other self-selected community members. IMB reviews like the one below suggest that some mongers discuss their IMB patronage with co-workers:

Went in on a whim, ***I just got off from work and a coworker recommended I check this place out so, I did.*** Called first, ask about availability and they had two ladies available. Walked in, and (name redacted) greeted me. She was wearing a mask, had a nice body with a big pair of twins. Looked attractive and was friendly so I gave her the money for the hour and we went to the room

- Monger 3 (Authors' emphasis).

Presumably monger 3 would be less concerned about a coworker 'catching' him at an IMB, if he was following that co-worker's recommendation to visit it in the first place. As such, the zone of informal control/surveillance around monger 3's place of work would be minimal. Indeed, analysis of online reviews suggest that *proximity to work* may be an important part of some mongers' locational selection process. There are references to place of work in only 1.34% of our coded reviews, but every one of those reviews indicate that the locational selection and timing of visit were related to the monger's work location and schedule. For example,

"Was going over some reviews online and well this one stood out mainly cause it was the closest one to me, ***I was at work and didn't have much time to spend on my break.*** So I headed over there on my break and grabbed me a quick session with (name redacted)."

-Monger 4 (Authors' emphasis)

If these reviews reflect a prevailing pattern amongst mongers in general, the shame-buffer concept would need to be adapted to negate, or perhaps even view the zones around a monger's workplace as *higher-likelihood spaces* for IMB patronage. We explore this possibility in greater depth in the concluding discussion.

3.3.1. Distance decay functions for shame

The dimensions and directionality of each monger's shame buffer is unique, but if the concept is part of a substantial number of monger's locational selection process, there would be particular predictable outcomes that we would observe in the distance between monger's home locations and the IMBs that they choose to frequent. Translated into distance decay functions, the expected number of customers for a traditional business would decrease with distance or travel time from the firm location. The slope function of this line would vary depending on the relative attractiveness of the firm, but the slope would unquestionably be negative as distance increases. However, when we consider the role of shame buffers in IMB customers' site selection process, we

hypothesize that the customer/distance profile for an IMB would initially increase with distance/travel time, up to some threshold, at which point it would decrease rapidly (See Fig. 3).

At this point, the idea of a shame buffer influencing the IMB selection process of mongers is supported qualitatively. However, due to the relatively small emphasis on any subject besides sexual services in the IMB reviews, it is not possible to determine the prevalence of these concerns amongst IMB customers from that data. In the following section, we begin to test the concept empirically, using a comparative case study of the customer mobility patterns of illicit and licit massage businesses in the DFW metro region.

4. Mobility data analysis: methodology

If customers of IMBs refrain from patronizing IMBs located near their homes due to their fear of getting caught, then we hypothesize that the distance between their homes and visited IMBs would be larger than would be the case for customers of legal massage businesses, who would have no fear of ‘getting caught’ and would select locations that are most spatially efficient.

Testing our hypothesis requires several types of data: locations of IMBs, locations of legal massage businesses for comparison, and mobility data for customers of both businesses. As mentioned previously, the locations of IMBs were collected from the largest online review site for illicit massage services. We next visited the website for a well-known licit massage franchise and collected address data for their 43 listed locations in the DFW region. The locations of both legal and illicit massage businesses were mapped using ArcGIS 3.0 as well (ESRI, 2023). We selected five locations from each group (illicit and licit massage businesses) as test-cases for a deep examination of customer mobility patterns. The cost of data from our mobility data provider required that we only select five locations rather than a larger sample of both illicit and licit massage businesses. As such, we were highly purposeful in selecting the five locations for each business type. The locations selected collectively include firms in the major population clusters in the region, have nearby comparison partners (illicit firm near-to a legal firm), and are all found in single-floor retail spaces, so we can be sure that the mobility data collected is for individuals who visited the test-case firms and not something located above or below in a multi-story building. To ensure that the IMBs included were likely to be providing commercial sexual services, we checked for customer reviews that included illicit sexual services for each test site during the study period of September 2022. All five of the IMB test sites had a least one review of illicit commercial sexual services during the study period. IMB

test-sites were further selected to include examples of different ‘types’ of IMBs following the typology created by Crotty and Daku (2023).³

Once our case-study locations were finalized, we needed to acquire mobility data to analyze the locational selection patterns of customers of both types of massage businesses. Geographers increasingly use mobility data better understand a range of actions and processes, from retail purchasing (Ballentine et al., 2023; Chang et al., 2022), to the use of parks and public spaces (Heikinheimo et al., 2020), to disease transmission (Vannoni et al., 2020). Each of these studies utilizes a slightly different source of mobility data, each with varying degrees of pre-processing, locational availability, locational accuracy, and in some cases, sampling methods. A complete examination of these issues is beyond the scope of this paper, however, in our examination of all possible sources of mobility data it became clear that there are very few options for research examining businesses that operate from small physical spaces and have small daily-customer counts (See Ballantyne et al., 2022 for a more comprehensive review of strengths and weaknesses of particular types of mobility data).

We worked with a private data supplier (<https://www.sightfoundation.ai/>) who provided minimally-preprocessed smart-device locational metadata. The data includes an anonymized device ID and randomly assigned device name, latitude and longitudinal coordinates, and a date-time for that locational entry. The data provider refers to each distinct data-point collected from smart-device applications as a ‘geo’. Geos are provided by locational services on device applications that users must voluntarily provide through an opt-in agreement. Each geo is created when a user opens an application with locational services enabled, at which point the application uses the device’s GPS to derive latitude and longitude coordinates for the device at that moment, which is recorded as a date-time. The data we were provided did not include a locational accuracy/error measurement. In conversations with the data provider about the geos’ locational accuracy, they explained that they only source geos with a maximum spatial error rate of 15 feet, and that their internal testing suggests the typical locational error rate is under 10 cm. As such, we are comfortable with the application of this data for identifying customers of massage businesses for the study.

In order to collect mobility data for the customers of our test-case locations, we manually digitized polygons that matched the building footprint of each retail location, with particular caution to not include any shared spaces in a shopping center, such as the parking lots or sidewalks. The conservatively-defined business polygons ensure that devices with locational data identified were physically inside the test-case business. We then sent these test-case polygons to our data provider, which then identified all of the geos located within our set of test-case polygons, within the month of September 2022.

This data search then required some refinement. For example, for the legal massage provider shown in Fig. 4, there are 577 total ‘geos’ across 36 unique devices. Just ten of those devices are responsible for 85% of the total geos for the site. These are likely employees and are not relevant for our particular research question. We then subset that data to only include the devices with fewer than 5 geos inside the polygon, on a single day, during that time period. This sub-setting process ensured that we only collected complete mobility data for firm customers and not firm employees. Once we identified the 71 likely customers of IMBs and 93 customers of legal massage businesses, we acquired mobility data for those specific devices for the entire month of September 2022.

In order to calculate the distance from each customer’s home to the business they visited, we first needed to analyze their mobility patterns to identify a likely home-location. To determine the home location for each customer/device, we considered both spatial and temporal dimensions. Initially, we converted all coordinate pairs into the UTM

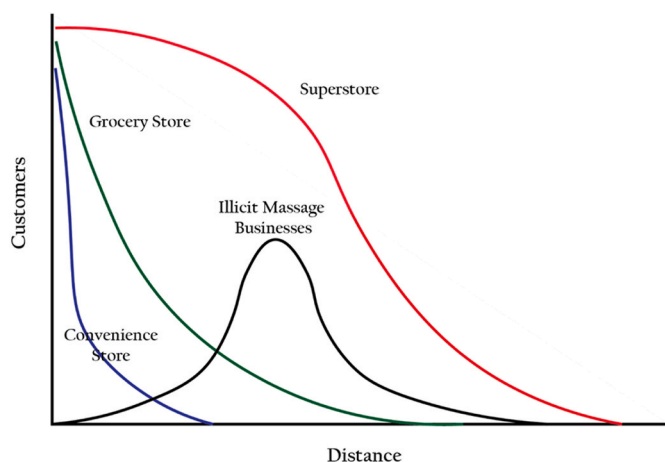


Fig. 3. Customer Distance Decay profiles for traditional retail types compared with hypothesized shame buffer effect for illicit massage businesses (Adapted from Rodrigue, 2020).

³ No examples of residence-based IMBs were included because it would be impossible to know if visitors to the residence were customers or people visiting for non-commercial purposes (friends, family members, etc.).

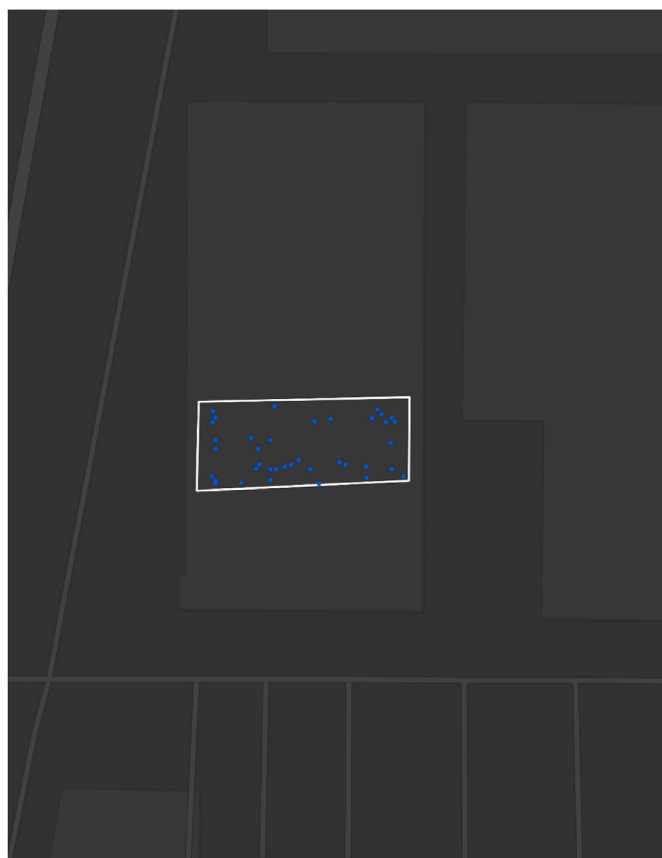


Fig. 4. Locational “geos” identified within a legal message provider.

system. Then, we utilized the DBSCAN approach to identify potential point clusters, considering parameters determined through experiments and experience (Ester et al., 1996). The optimal value for the maximum distance between two points to be considered neighbors (epsilon) was set to 100 m, and the minimum number of points required to form a dense region was set to 5 points. These parameter choices resulted in clusters that closely resembled home locations in terms of size and shape. For each device, multiple candidate home locations were identified using DBSCAN. We calculated the timespan for each cluster, and the geometric mean of the cluster with the highest timespan was selected as the likely home location for that device. For example, if the DBSCAN method identified three potential home-locations for a particular device, with cluster 1 having points spread across 12 days of the study period, cluster 2 with points spread over 18 days of the study period, and cluster 3 with points spread across 29 days of the study period, the cluster with point locations over the greatest time span: cluster 3 in this example, would be selected as the home location.

We did not attempt to identify secondary or tertiary locations of individual-importance in this test study, as the number of devices for which secondary or tertiary locations could be confidently established would be below the necessary threshold for tests of statistical significance. As discussed previously, we also expect that the shame-buffer effect would be more muted for work-place and third-place locations, so the effect would be less-easy to detect from aggregated data. Once the home location was established for each device ID, we calculated the distance between the home location and the test-case location where the device appeared in our initial search. Next, we ran t-tests to compare the mean distance between home and message business visited for each group of devices. As the following results make clear, IMBs have a much larger proportion of customers who traveled more than 100 km, who we are calling “tourists.” There is a well-established extant literature on commercial sex tourism, though IMBs do not feature prominently in that

research (Weitzer, 2009, 2014). Commercial-sex tourist’s behaviors can be interpreted through the shame-buffer lens, as they are well outside of spaces where they are likely to be ‘caught’ via informal surveillance. However, tourist behaviors are not the focus of the study. As such, we re-ran the t-tests removing all devices that had over 100 km between their home site and the visited message business.

5. Results

The data collected for our five suspected IMBs and five legal message franchise locations show rather stark differences in terms of the number of likely customers identified (See Fig. 5). The total number of customers identified ranges from 1 customer at IMB #3 to 43 customers at IMB #1. Indeed, the customers identified at IMB # 1 comprise fully 60% of the total customers in the dataset. Three of the five illicit parlors registered fewer than 10 customers for the entire month of September, so we may have failed to identify some of the customers due to our conservative methodology for defining the business boundaries. The range in total number of customers identified for legal message businesses is similar, from 4 customers at location #5 to 39 customers at location # 2. The variation between locations is smaller however for the legal message businesses; only one of the five locations had fewer than 10 customers in that month.

A considerably larger observable difference exists between the legal and illicit message dataset when examining the distance each customer traveled to each business. Fig. 6 shows the percentage of total customers for illicit and legal message locations aggregated to 5 km bins. Fully 40 percent of legal message customers travel less than 5 km from home to the location of their message provider. The number of customers continues to decrease as distance from home increases up to 35 km at which point it slowly increases to just under 10% of customers who traveled

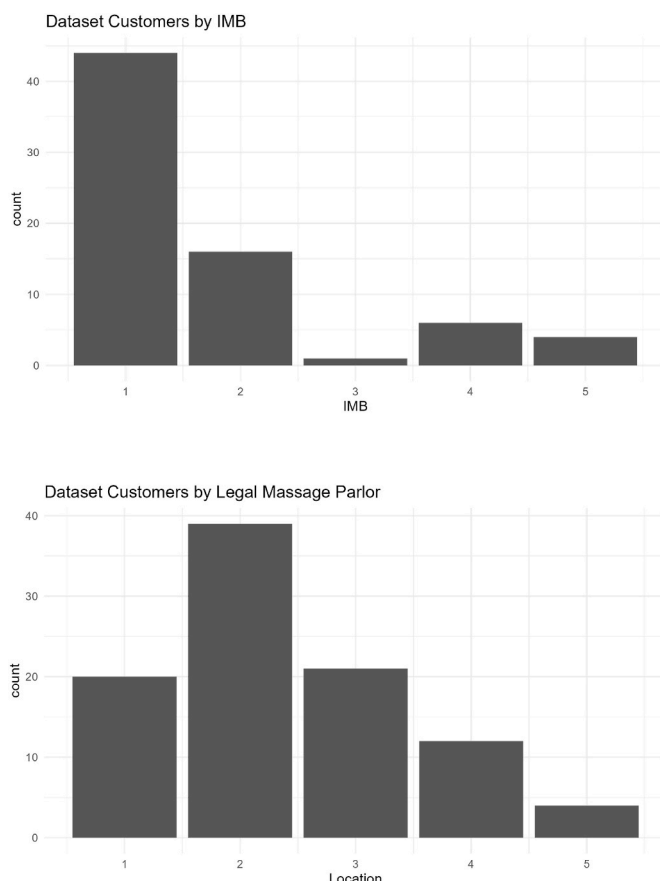


Fig. 5. Number of customers identified at each sampled business location.

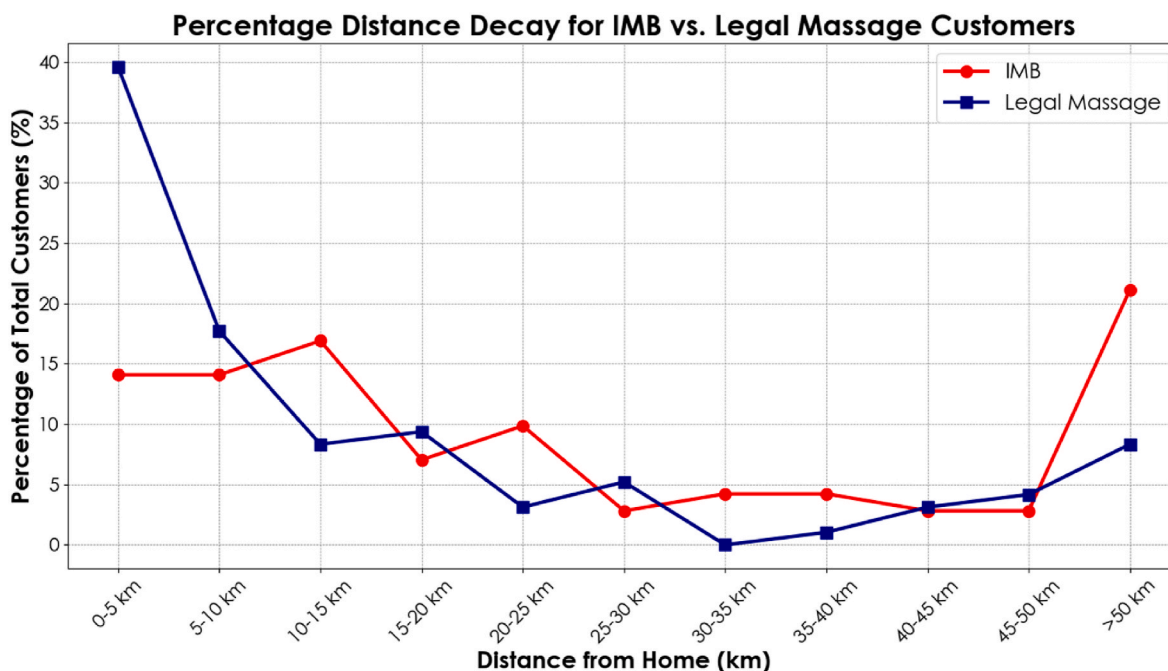


Fig. 6. Percentage of customers aggregated by distance traveled to massage business.

over 50 km.

For illicit massage, the pattern is quite a bit different. Though 14 % of the customers visited an IMB located within 5 km of their home, there is no immediate drop in customers per distance group as distance from the IMB increases. Indeed, the number of customers per distance group is level until 10–15 km, where the number of customers increases to just under 17% of the total. After 15 km, the number of customers declines with distance from the IMB until the over 50 km group, where it increases again. Tourists make up a much larger proportion of the total customers for the IMBs than is the case in the licit massage industry. 10 out of 71, or roughly 14% total IMB customers traveled more than 100 km to purchase commercial sex services. These exploratory results seem to support the hypothesis, but we conducted further analysis to evaluate the statistical significance of this observed trend.

We used a standard two-sample T-test measure the statistical significance of the differences in distance traveled between the groups. We elected to run the test twice. The first test included customers we identified as tourists, whereas the second test dropped the tourists from the data. The results from both tests proved significant though at marginally different levels (See Table 2). The mean distance traveled for IMB customers, including tourists, was 77 km, whereas for legal customers it was 28 km. When the tourists are dropped from the data, the mean distance traveled for IMB customers is 20 km, while legal customers mean distance traveled was 15 km, a difference of roughly 25%. Examined together, the distance decay-charts and t-tests provide support for the hypothesis that IMB customers use mobility to reduce the

Table 2
t-test results comparing distance traveled from home to business for illicit and legal massage parlors.

Group Comparison	T-Stat	P-Value	Statistical Significance	Comments
All Customers	2.087	0.04	Yes ($p < 0.05$)	Significant difference in distances traveled to illicit vs. legal massage businesses.
Local Customers	1.979	0.05	Yes ($p \approx 0.05$)	Marginally significant difference; shorter distances show potential variance in travel patterns.

risk of getting caught.

6. Discussion

The concept of shame buffers provides a theoretical linkage between traditional retail geography and routine activity theory from criminology. It infuses both with the concept of relational embeddedness, which have substantial effects on spatial behaviors in a variety of contexts (Bain & Landau, 2022; Bosco, 2006; Bosco et al., 2017; Deng et al., 2020; Hervas-Oliver & Albers-Garrigos, 2008; Knoblen & Oerlemans, 2008). Our qualitative analysis showed that a notable percentage of the mongers who write reviews about the IMBs they visit are concerned about the potential for being observed engaging in the behavior. It is less clear which people or places they most wish to avoid being seen by.

The qualitative analysis of IMB reviews shows that the shame-buffer effect, which can be understood as an individually-specific measure of the potential presence of capable guardians, is stronger near IMB customers' homes than their place of work. Indeed, all of the references to workplace in the reviews discuss proximity to workplace as a positive factor in their locational choice. As such, we could anticipate locational selection of IMBs based on routine activity theory as depicted in the adapted model shown in Fig. 7.

The adapted shame-buffers model in Fig. 7 is based on fictional data, overlaid on a basemap of the DFW region the purposes of this discussion. The model includes a variety of location types including the monger's home, workplace, place of worship, favorite coffee shop, and children's activity sites. Each of these locations has a shame buffer of varying size around it, within which the monger is unlikely to visit an IMB for fear of getting caught. Theoretically, any IMB found outside those zones would be acceptable options for a monger looking for a massage. However, when we examine the routine activity path between the fictional monger's home and his place of work, we can begin to see particular IMBs that he would be more likely to patronize. In particular, any IMB that is located conveniently along the routine path of travel, but outside of the shame-buffer zones around his home and place of work. That zone, which we called the zone of spatial anonymity, is depicted in green in the model. This is the most spatially efficient zone within which the monger has no social/emotional embeddedness. Finally, if in the context of IMB economy, the shame-buffer effect is minimal or the

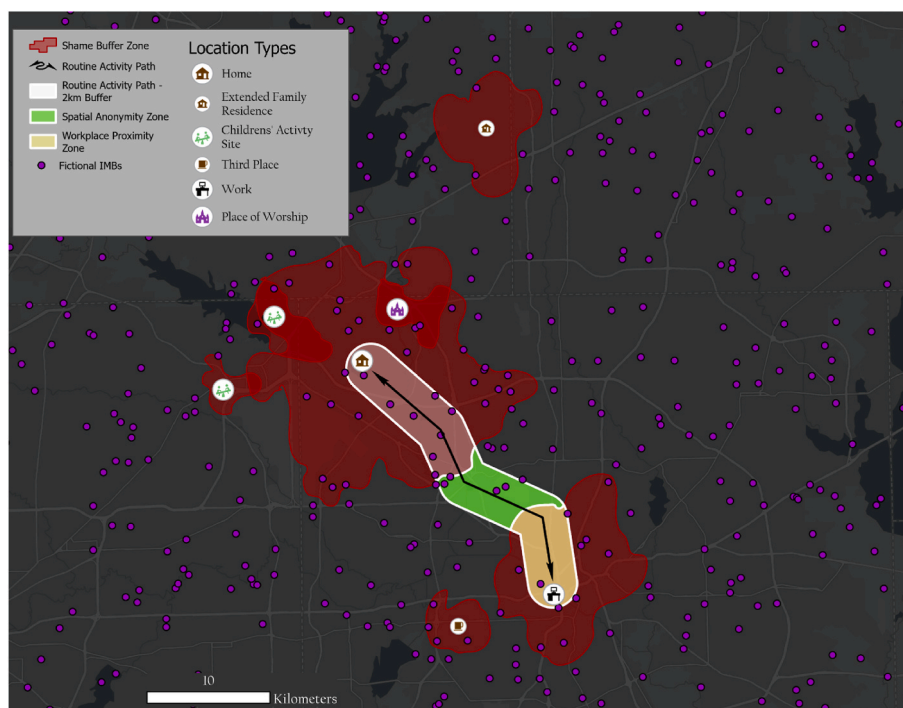


Fig. 7. Applied model of shame buffers incorporating routine activity theory. (Note: all content presented in this map is fictional).

relationship is even reversed such that mongers prefer IMBs in close proximity to their workplace, then the zone depicted in yellow which we call the workplace proximity zone, would be the area of highest likelihood for a monger to patronize. That each monger would likely visit IMBs located near to each other is supported by Ieke de Vries research that found that spatial distance was an impediment for individual mongers IMB patronage (2023b). That research showed that mongers visited IMBs located near to each other, but the data used cannot determine if the clusters of IMBs each monger visits are near their homes, places of work, or other locations where their level of place-based embeddedness and subsequent likelihood of observation is higher. Indeed, the theoretical model of shame-buffers presented in Fig. 7 would predict IMB patronage patterns similar to those reported by de Vries (2023b).

We feel it is important to note here that the basic concept of shame buffers is not exclusive to the IMB industry, and there may be other industries/contexts for which proximity to workplace is more of a concern than proximity to a person's home. For example, in states where recreational marijuana is legal, many workplaces still prohibit its use by employees. Those recreational marijuana users might view dispensaries near their workplace as high-risk, but locations near their homes as acceptable.

Returning to the exploration of shame buffers in the IMB economy, the quantitative analysis of legal and illicit massage customers' mobility supports the shame-buffers concept as well. The distance decay curve for legal massage follows the pattern predicted by traditional retail geographic theory, while the customer distance profile for IMBs is quite different, with relatively consistent percentages of customers at each distance band up from 0 to 20 km, then declining and staying relatively level until a dramatic increase at 50 km and beyond. It is still impossible to say for certain that mongers are travelling farther from their homes to avoid detection. Mongers' willingness to travel long distances could suggest that they view IMBs as shopping goods, worthy of greater time/resource investment to access, similar to luxury or specialty goods. Future research should explore the relationship between distance traveled to IMBs and characteristics of services described in monger reviews. It may be the case that mongers are willing to travel farther for

particular commercial sexual services, or for the services of particular sex workers who are mentioned in online reviews. Whether the motivation is avoiding detection, or accessing "specialty" commercial sexual services, the statistically significant difference between the locational choices of legal massage customers and IMB customers supports the idea that the illicit nature of the services provided alters the locational selection process in meaningful ways.

Further research will be necessary to explore the shame-buffer concept with fewer limitations than exist in this study. First and foremost, future research must include a larger sample of both IMBs and legal massage parlors. Our sample size is quite small, 5 of the region's 591 IMBs listed as open at the time of this data collection. It is quite possible that the results we found are not generalizable to the region/industry as a whole. Another limitation of the small sample size is that we cannot be certain that the customers who we tracked to one particular massage business did not visit other massage businesses, which were not part of our case study set, that happened to be closer to their homes. It is still impossible to assign motive for the higher level of mobility investment made by IMB customers relative to their legal massage counterparts. The relative prominence of visibility and discretion themes found in the IMB reviews certainly support the notion that many mongers are concerned about being observed engaging in this activity. And yet, the data collected also shows that our concept of shame-mitigation through mobility behavior is not uniform amongst all customers. Some identified customers visited IMB locations that were quite close to their place of residence. Six customers (~8% of total IMB customers identified) visited an IMB located less than 2 km from their place of residence. This speaks to the spatial variability of stigma, and raises interesting questions about non-spatial behaviors which might reduce mongers' likelihood of observation. In a case study examining IMB locational patterns in Los Angeles and New York City, previous research speculated that some of the differences in neighborhood characteristics could be the result of automobile-commuting, LA-based, monger's willingness to travel more out-of-their-way to avoid detection than was the case for non-automobile commuting NYC-based mongers (Chin et al., 2019). The mode of transport to an IMB is particularly relevant because automobile-based transit requires that the monger

leave a vehicle in a parking lot for the 30–60 min of massage service, thereby increasing the chances of detection by anyone who could identify the vehicle.

It is also possible that neighborhood-characteristics related to capable guardianship may indeed be influencing monger's site selection behaviors. Mongers who reside in neighborhoods with low levels of capable guardianship may not feel the need to travel far from their home to avoid meaningful consequences if observed patronizing an IMB, while mongers who reside in neighborhoods with high levels of capable guardianship may need to travel farther to achieve the spatial anonymity they require. Future research must examine those questions to develop a full and policy-relevant understanding of the IMB economy.

7. Conclusion

In this paper, we set out to determine to what extent IMB customers use their own mobility as a mechanism of risk-management from informal social control and surveillance. We proposed the concept of *shame buffers*: individualized zones where a high-degree of informal social surveillance would exist for each person due to their own place-based embeddedness, wherein they would be unlikely to engage in behaviors for which social stigma exists. This concept challenges traditional assumptions within retail geography, because unlike typical consumer behaviors, these customers prioritize anonymity over convenience, reflecting a complex interplay of stigma, risk, and spatial decision-making. We believe that the shame-buffers concept also provides important nuance to routine activities theory and the concept of capable guardians, by highlighting the spatially fluid nature of guardianship, and the challenges that poses for predictive modelling at the city or metropolitan scale. This research supports the reliability of the shame-buffer concept through both qualitative and quantitative evidence and highlights spatial variations in stigma and perceived risk as it relates to mongers' apparent willingness to visit IMBs near their place of work, but not near their residences. Further research, including a much larger number of IMB and legal massage businesses and their customers, over longer-periods of time, is needed to truly validate the concept within the context of the IMB economy. Future research should expand on this foundation, exploring the variability of "shame buffers" across different cultural contexts and activities for which social stigma exists.

Declaration of interests statement

The authors report there are no competing interests to declare.

CRedit authorship contribution statement

Sean M. Crotty: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Xiaolu Zhou:** Writing – review & editing, Methodology.

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