'Sticky Flows' and 'Productive Frictions': Untangling the Mechanisms of Street Urbanism

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Abstract: Streets are the ultimate 'places of movement.' Adopting a mobility perspective on street urbanism, this paper analyzes how the interaction of movement, places, and people explains the range of activities and socioeconomic opportunities supported by the streets of Ho Chi Minh City (Vietnam). The context is one of a tangible transition from motorbike to car mobility. This paper aims at identifying mobility-specific mechanisms through which a mobility transition brings about socio-spatial change. Mixed methods served to analyze data collected through participant observations, video recordings of street life, and interviews with street users. The results show a consubstantial relationship between today's dominant motorbike mobility and vibrant street activity. In contrast, car mobility is negatively correlated with street life. Motorbike mobility is characterized as a 'sticky flow' – low speed, thickness, and propensity to seep in and out of the curb. It is argued that such flow is conducive to 'productive frictions' between movement and the built environment. By connecting people on the move and people in places, these frictions play a significant role in the production of streets as integrative spaces of opportunities. The mobility transition in HCMC is one towards fewer and fewer points of productive frictions in the urban space.

Keywords: Mobility, Street Urbanism, Ho Chi Minh City

Introduction

Ho Chi Minh City (HCMC), the economic engine of Vietnam, has a rather unique *'transportation signature,'* or *'mobility image:'* there are about as many motorbikes sharing the road (8.5 million) as there are people living in the city (H.K. Kim, 2017). On average, every household owns two of these light, small, and quite affordable vehicles[1] that provide the flexibility of a bicycle coupled with the comfort of motorized transportation (Truitt, 2008). The fact that the vast majority of the population (83% in 2014) relies on this transportation mode for all mobility needs (JICA, 2016) gives the city's streets and other public spaces a rather fast pulse, an active feel, that some may describe as loud and relentless. The mobility image of the city was radically different less than three decades ago, when the picture of any busy street or intersection would include many more bicycles than motorbikes. Like other Asian cities, most trips were non-motorized at the time (Replogle, 1992: Tiwari, 2002), the main reason

[1] The typical vehicle is either a semi-automatic motorbike or an automatic scooter. The engine capacity usually is either 110 or 125 cc.

being that years of war and restrictions under communist rule had left the population unable to afford anything else.

As for the city of tomorrow, there are signs indicating a possible transition towards either cars, transit, or both, as the dominant forms of mobility. After three decades of market economy, the emergent middle class has been increasingly tempted with the comfort, safety, and symbolic status they can now afford through automobile ownership (A. Hansen, 2017; Thu, 2016; Tuan, 2015). The number of private cars remains low compared to motorbikes. In 2017, there were one million cars registered in the city (H. K. Kim, 2017). Automobile ownership is growing at an alarming rate (15% per year since 2014 according to Hansen, 2017), which significantly contributes to traffic fatalities, pollution, and congestion. Cars now fill up entire lanes in certain places at peak hour, they generally occupy a disproportionate share of road space, forcing motorbikes to squeeze in the leftover road space. Meanwhile, public policies have been paving the way for more cars on the roads; the local government is considering a complete ban on motorbikes in the city center by 2030. The rationale is that motorbikes should soon become a thing of the past. By then, public transit should have become a viable alternative for the carless. This is assuming that the rail transit network continues to expand at a faster pace than the first metro line, supposedly about to open in 2020, but nearly one decade behind schedule. Nevertheless, whether it is towards the car, transit, or both, what societal changes will the shift away from motorbike mobility entail?

Minute observations of street urbanism dynamics, of the micro social and spatial arrangements unfolding on the streets, can help anticipate the larger societal transformations led by a mobility transition. The street is where mobility problematics meet public sphere challenges. The objective is to first gain an understanding of the ways in which present mobility practices explain everyday social interactions, and long-term social integration, or lack thereof. I do so in HCMC drawing on five months of fieldwork, including participant observations, systematic video recordings of street life, in-depth interviews with urban dwellers about their mobility practices, with informal street vendors and conventional store owners about their business activities. I develop a theoretical framework that elaborates on Henri Lefebvre's theory of the social production of space. I adopt an ecological approach to the street environment in order to grapple with the complex interactions between its two major functions, as traffic corridor and public space.

I argue that the nature of movement through urban space influences both short-term social interactions on the streets and long-term socioeconomic integration in the city. In HCMC today, I first highlight some significant correlations between mobility practices and street activity. Then I shed light on the ways in which the dominant motorbike flow, an offspring of bicycle mobility, explains the vibrant street life typical of HCMC's public spaces. I qualify motorbike traffic as a *'sticky flow'* because of its propensity to irrigate the banks of the roadbed. Furthermore, I demonstrate that a mechanism of *'productive friction'* between such sticky flow and the built environment produces both social interactions on the streets and economic opportunities to live off the connection to the street. At the core of the lived space of urban mobility, productive frictions bring together people 'on the move' and people 'in places'. The mobility transition from motorbikes to cars in the case of HCMC for example can then be interpreted as a shift towards a less sticky flow traversing the urban space, therefore leading to fewer opportunities for productive frictions, in other words to a growing disconnect between people's trajectories, both literally as they move in the city, and figuratively as they proceed in life.

Literature Review

1) 'Mobility Transition' Research Agenda and 'New Mobilities' Paradigm

In a recent effort to theorize 'mobility transitions', Temenos, Nikolaeva, Schwanen et al. (2017) define the concept as a process, a shift from one 'particular moment of assembled technologies, infrastructures, societies, and economies' to another. They ask: 'What kind of societal changes will this entail?' Geels' (2002) multi-level perspective on socio-technical transformations has driven the mobility transition research agenda. The multi-level perspective is concerned with the interactions between technology, industrial innovation, market mechanisms, policy, culture, and civil society. The normative imperative of environmental sustainability has been the primary motivation for the multi-level framework. As a result, existing studies applied in the transportation sector focus on transitions away from automobile dependence, towards low- to no-carbon societies, in places like the Netherlands or the United Kingdom (Geels, 2012). The 'Mobility Transition' research agenda has yet to embrace the question of the societal changes entailed by transitions that occur in reverse, away from sustainability, towards automobile dependence. Most countries of the developing world are experiencing such transitions (e.g. Kenworthy, 2011). Globally, the total vehicle stock has been projected to grow from 800 million in 2002 to over 2 billion units in 2030, with the bulk of the increase taking place in emerging economies; China's increase will have been nearly twentyfold for example (Dargay, Gately and Sommer, 2007). To complicate the matter, several transitions may be occurring concomitantly in such contexts, towards both sustainable and carbon-based mobilities (Jones, 2016), like it is the case in Vietnam, against a backdrop of rapid urban and economic development. Yet, little is known about non-Western mobilities in general, Asian mobilities in particular (Cresswell, 2016), and none of the existing studies adopt a new mobilities perspective (e.g. Cervero, 2013; Cervero & Golub, 2007; Mateo-Babiano & Ieda, 2007; 2009).

The 'new mobilities' paradigm, on which the 'mobility transition' research agenda draws substantively, has marked a mobile turn in the social sciences (Sheller & Urry, 2006). It followed on earlier work concerned with the structuring effect of the automobile on societies (Sheller & Urry, 2000; Urry, 2000). Mobility is considered meaningful, as opposed to being thought of as an abstract line between two points on a map, a derived demand from the need to reach destinations, as it is usually the case in transportation research. It is conceived as an 'entanglement of movement, representation, and practice' (Cresswell, 2010). Mobility is a sensual and social experience, and therefore should be considered from the perspective of the people on the move, not that of the locations in which movement lands. The 'new mobilities' paradigm therefore advances a mobile ontology to explore social phenomena, arguing that after the spatial turn of the 1980s, as initiated by Soja (1980) in particular, the social sciences have remained static and location-based in their way of addressing dynamics of exclusion. In her latest book *Mobility Justice*, Sheller (2018) makes the case that by focusing on the spatial distribution of transportation resources, costs, and opportunities, studies on destination accessibility and environmental justice have failed to consider the injustices rooted in uneven mobilities. Mobilities are uneven at all levels, and all levels are interconnected, from everyday bodily moves constrained by individual capabilities, gender, sexual and racial circumstances, to cross-country migrations bound by international relations and climate change. Sheller demonstrates how a mobile ontology helps explain power dynamics in the contemporary world. Nevertheless, the sustained effort to supersede a spatial perspective in mobility research has led to a situation where *places* now tend to be overlooked. It seems important to bring the focus back on the social production of 'places of movement' (Sheller & Urry,

2006) as originally conceived in mobility research, as part of a dynamic relationship between movement, space, and people (Cresswell 2006; 2016).

2) Street Urbanism from a Mobility Perspective

Urban streets are the ultimate 'places of movement.' Yet, scholars interested in street urbanism have been most concerned about its function as public space than its other defining feature as the stage of mobility. Public space is civic by nature, it is the physical space of the abstract notions of civility and public realm. It is 'the common ground […] that binds a community' through a common sense of belonging, not only to a place, but also to a group (Carr, Francis, Rivlin, & Stone, 1992). Streets have been posited as the 'quintessential public space' (Mehta, 2013)—Kostof went as far as to claim '[t]he only legitimacy of the street is as public space. Without it, there is no city' (Kostof & Castillo, 1992, p. 194). Sidewalks, a contested space, are the 'most important and the most overlooked public space' (Kim, 2015). Regulating sidewalk uses is an exclusive practice, it is a way of controlling who has access to public space (Blomley, 2007). In their study of the homeless of New York whose livelihood depends on sidewalk access, Duneier and Carter's (1999) depicted the sidewalk as a space that 'reveals today's urban life in all its complexity: its vitality, its conflicts between class and race, and its surprising opportunities for empathy among strangers.' Both in the global North and in the global South, the act of vending on sidewalks is instrumental to migrants' social and economic integration in the city (Bell & Loukaitou-Sideris, 2014; Donovan, 2008; Eidse, Turner, & Oswin, 2016; A. M. Kim, 2015). The major difference is regulation. Western streets are known for being more regulated than Asian streets for example, where the culture of the street has often been depicted as one of great social and economic diversity, where the space is used for private, public, and domestic uses alike: vending, meeting, squatting, gossiping, eating, exercising, and so forth (Edensor, 1998; Drummond, 2000; Kim, 2015; Mateo-Babiano, 2009; Mateo-Babiano & Ieda, 2010).

However, the modernization of transportation infrastructure might be signing the "death of the street" (Holston, 1989), by systematically giving priority to traffic flows over public life. Focusing on their function as infrastructure (Ehrenfeucht & Loukaitou-Sideris, 2010), modern planning practices aim at regulating and controlling the streets in ways that bring order (Scott, 1998) to a complex, seemingly 'messy' environment (Hou & Chalana, 2016), in ways that clarify the blurry boundaries between public and private space, between movement and non-movement. Such efforts are occurring in HCMC, as attested by repeated sidewalk clearing campaigns justified by a need to give sidewalks back to pedestrians, street widening projects and parking investments motivated by a need to tackle congestion (Gibert, 2018; Nguyen et al., 2015). The death of HCMC's street may be around the corner. Harms (2009) has already documented the retreat of street life into airconditioned private spaces in what used to be an active public space filled with people sitting outside coffee shops. The paradox is that if civic life as it unfolds in public space where to slowly disintegrate, it would be in the name of a 'civilizing process' (Harms, 2009).

HCMC has long been known for its vibrant street life. Streets and sidewalks have been described as an extension of people's living space—their house or their store—and characterized by a blurry boundary between public and private uses (Drummond, 2000; Mateo-Babiano and Ieda, 2007). Like other Asian cities such as Bandung, Bangkok or Manila, non-movement has precedence over movement on HCMC's sidewalks (Mateo-Babiano, 2010). At any time of the day people will be eating, exercising, praying, selling or buying goods on the sidewalks. On the streets she surveyed in HCMC, Kim (2015,

p. 103) found that most of the sidewalk space that is not reserved for pedestrian movement is used for motorbike parking (42%), followed by merchandise spillover from conventional stores (26%), leisure (13%), outdoor sitting from restaurants and informal food vendors (12%), and other uses such as motorbike taxis and services. The extensive network of narrow streets and alleys is another indigenous feature of HCMC. The city shares many built environment characteristics with other places of the developing world, including a high density, and a mostly non-gridded and poorly hierarchized street network (Cervero, 2013). Alleyways serve the densest neighborhoods in the city (more than 80% of the urban population lives in the maze of alleyways) and are used alternatively for access to private residences, as people's back kitchen, outdoor business, or other private activities, or for socializing. Totaling to the city's largest public space (85% of the street network), narrow alleyways are being progressively upgraded and modernized to give priority to traffic over other uses (Gibert, 2018). In sum, urban scholars have thoroughly documented the richness of HCMC's street life, but have internalized a dichotomy between the two functions of the streets, as spaces of mobility on the one hand and spaces of activity on the other.

More generally, the normative idea that streets should be 'for the people,' and not 'for cars,' is at the core of western-based discourses on street design and urbanism, sustainable mobility, and accessibility (Cervero, Guerra, and Al, 2017; Jacobs, 1958; Tiwari, 2017; Wallström, 2007). Such premise has crystallized an antagonism between motorized traffic and street life, between private mobility and inclusive public spaces. On the contrary, non-motorized transportation and public transit are commonly associated with more vibrant urbanisms (e.g. Calthorpe, 1993; Ewing et al., 2013; Mehta, 2008). Pedestrian counts are typically used as a proxy for measuring street life and the vibrancy of public spaces (Gehl & Svarre, 2013; Whyte, 1980). Over the last decade a growing number of studies has explored the relationships between streetscape characteristics and pedestrian activity (e.g. Boarnet et al., 2011; Ewing & Handy, 2009; Ewing, 2016; McDonald et al., 2018), and have typically found a positive and significant relationship between street activity and walkability. In many regards, HCMC appears as a counterexample. A city that is not particularly walkable, in part due to the weather (hot and humid year round), in part because the sidewalks are so busy, where only 1% of the population typically travels on foot as a result, where transit is on the way but not developed yet, and where 83% of all trips use a private motorized transportation mode (JICA, 2016), still supports a particularly rich, vibrant, and active street life. This apparently idiosyncratic case, and yet similar to many other cities of the developing world, suggests that urban design scholars may want to pay more attention to the ways in which different forms of mobility contribute to shaping and preserving the street as 'quintessential public space.'

Conceptual Framework and Research Questions

I propose to look at HCMC's streets as 'places of movement,' from an ecological perspective. By focusing on Asian street spaces known for a blurry boundary between movement and non-movement, I bring to the fore a core idea of the 'new mobilities' paradigm, according to which there is no substantial difference between travel and activities. 'Activities occur while on the move' thus producing and reproducing places (Sheller & Urry, 2006). A similar idea was previously developed by French transportation planner Georges Amar (1993) in his article promoting an ecological approach to transportation systems. He argued that there is a consubstantial relationship between movement and the built environment, that the type of movement traversing space informs the diversity of land uses and social encounters, and reciprocally. He proposed a typology of 'urban transportation ecologies' based on the extent to which movement 'adheres' (sticks) to the built environment. Typically, walking is the type of movement with the highest level of *adhérence*, whereas airplane travel only 'lands' in 'places' but is otherwise disconnected from the built environment. It is the level of 'adherence' that makes the difference between a street and a highway. In practice, Amar made land use and transportation planners responsible for organizing human movement and encounters as one system, as opposed to a system of connections between locations. Borrowing from natural ecology, he defined the planning goal as a 'climax' of optimal diversity of movements associated with an optimal diversity of human encounters.

Henri Lefebvre's (1974) spatial production theory inspires a framework to analyze urban transportation ecologies as the 'lived space of urban mobility', in relation with broader process of socio-spatial change. Lefebvre defined space in general, and the urban space in particular, as both socially produced and means of social reproduction, through dialectical relationships between the *conceived space* of planners and technocrats, the order they impose through abstract signs and codes (p. 43); the *perceived space* or dominated space that people experience through the senses without contesting it, the stage of all moves and activities, such as the movements between work, private life, and leisure (p. 48); and the *lived space* that users, artists, and philosophers appropriate through resistance to or contestations of dominant representations of space (conceived space). In this paper, I draw on Lefebvre's socio-spatial theory to analyze the dialectical relationships between the lived space and the conceived space of urban mobility. I focus in particular on the everyday tactics through which people appropriate and at times contest an imposed order through urban design and planning regulation of the street space. I relate this dialectic as it unfolds in everyday life to its equivalent at the level of broader processes of socio-technical transformations. The mobility transition is conceived as dialectical relationship between planners' conceptions of movement in the city of tomorrow, and people's lived experience of the transition.

Therefore, adopting an ecological perspective on HCMC's streets, I propose to explore how the interaction of movement, people, and places, influence not only street life and public interactions, but also socio-spatial transformations. More specifically, this paper addresses the three following research questions:

- In HCMC. to what extent does street activity depend on the nature of transportation flows traversing the street space?
- What are the mechanisms explaining the relationship between transportation flows and street activity?
- How do these mechanisms inform the socio-spatial transformations that the mobility transition brings about?

Methods

1) Data collection

I answer these questions using a range of quantitative and qualitative methods, drawing on data collected during five months of fieldwork (August-December 2018). In addition to participant observations of street life, I conducted 32 structured interviews in Vietnamese with people of different socioeconomic backgrounds about their mobility practices and life trajectories; 36 non-structured interviews with street vendors and conventional retailers; and 200 systematic recordings of traffic flows (traffic videos) and street activity (side videos) on 19 different street segments. More information about the data collection protocol is provided in Appendix 1.

2) Measurements

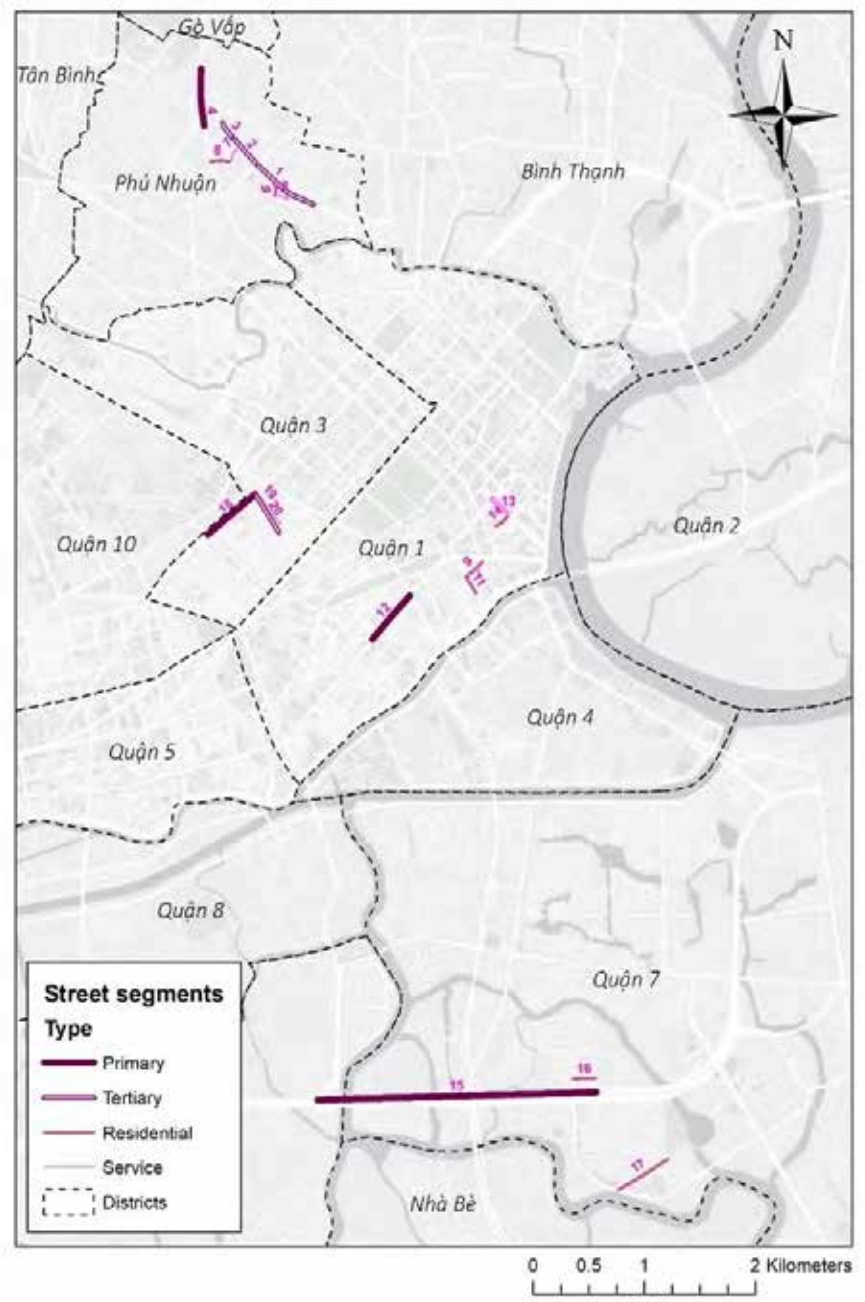
The map in Figure 1 shows the 19 streets on which observations were made. On the map, the streets are classified as per OpenStreetMap typology, but another classification was used for the analysis. Type '1+1' corresponds to two-way streets with one lane in each direction; 'Type 2+2' to streets with two lanes in each direction; 'One-way' streets, 'Market' and 'Alleyways' are self-explanatory; 'Segregated' streets have hard medians separating different traffic flows (typically, cars and trucks do not have access to outside lanes). The unit of observation is a 'street segment,' each observation including the ground-floor of the buildings, the sidewalk in front, and the traffic lanes between curb and median. In other words, when a two-way street was observed on both sides, each side counted as one observation. Segregated streets led to two observations per side (one for the inside lane[s], and one for the outside lane[s] with adjacent sidewalk and property line). An exception was made for alleyways, where properties on both sides and traffic in both directions were counted as part of the same observation. Pedestrian street Nguyễn Huệ was excluded from the analysis conducted in this paper, as well as Hẻm 440 Nguyễn Kiệm as it did not fall in any of the categories described above.[2] All street segments in District 3 were missing the 12:00PM observations. A total of 163 observations were included in the analysis (see Table 1).

With the support of a Vietnamese research assistant, a methodology was developed to count and classify all the street uses present on the video recordings. The same research assistant was responsible for all the counting, first under the supervision of the lead researcher, then alone, in order to avoid inter-rater reliability issues. The 5-step counting methodology is described in detail in Appendix 2.

Table 1 – Frequency of street observations by district and by type

Street type	**District 1**		**District 3**		**District 7**		**Phu Nhuan**		**Total**	
	Streets	*Obs*	Streets	*Obs*	Streets	*Obs*	Streets	*Obs*	Streets	*Obs*
1+1	2	*24*	1	*10*	2	*18*	1	*12*	6	***64***
2+2	0	*0*	0	*0*	0	*0*	1	*12*	1	***12***
Alleyways	0	*0*	1	*5*	0	*0*	3	*18*	4	***23***
Market	0	*0*	0	*0*	0	*0*	1	*6*	1	***6***
One-way	0	*0*	1	*10*	0	*0*	1	*12*	2	***22***
Segregated (inside)	1	*12*	0	*0*	1	*6*	0	*0*	2	***18***
Segregated (outside)	-	*12*	0	*0*	-	*6*	0	*0*	-	***18***
Total	**3**	***48***	**3**	***25***	**3**	***30***	**7**	***60***	**16**	***163***

[2] It is an alleyway in the city's nomenclature but it is too large and too busy to fall in the same category as other alleyways, but too residential to be considered with other '1+1' streets.



NAMES
1. Phan Xích Long (1)
2. Phan Xích Long (2)
3. Chợ Nguyễn Đình Chiểu
4. Nguyễn Kiệm
5. Hẻm 257 Phan Xích Long (1)
6. Hẻm 293 Phan Xích Long (1)
7. Hẻm 419 Phan Xích Long (2)
8. Hẻm 440 Nguyễn Kiệm
9. Nguyễn Thái Bình
11. Phó Đức Chính
12. Trần Hưng Đạo
13. Nguyễn Huệ
14. Tôn Thất Thiệp
15. Nguyễn Văn Linh
16. Đường số 6
17. Tôn Dật Tiên
18. Điện Biên Phủ
19. Nguyễn Thượng Hiền
20. Hẻm 419 Điện Biên Phủ

TYPES
1. Type 2+2
2. Type 1+1
3. Market
4. One-way
5. Alleyway
6. Alleyway
7. Alleyway
8. Unknown
9. Type 1+1
11. Type 1+1
12. Segregated
13. Pedestrian
14. Type 1+1
15. Segregated
16. Type 1+1
17. Type 1+1
18. One-way
19. Type 1+1
20. Alleyway

Figure 1 – Surveyed Street Segments

3) Analysis

The development of the measurement strategy led to a typology of street uses along the spectrum from movement to activity, and the definition of corresponding variables. The video data was used to calculate some descriptive statistics by type of street and by district. Several *t*-tests were ran to compare the statistical significance of the difference in means of key variables between a type of streets and the whole sample for example (one-way *t*-tests) or between two measurements of one construct (paired *t*-tests). Similar statistical analyses were conducted while focusing on one type of streets only (Type '1+1) as a way to control for the type of street and tease out the neighborhood effect. Using this sub-sample of observations, correlation coefficients were calculated between a selection of built environment-, mobility-, and activity- variables. The interview data on mobility practices served to further explain the relationships identified quantitatively between mobility and activity variables. Photographs of street activity and the interview data from street vendors and retailers mostly served triangulation purposes to ensure the validity of the results.

4) Limitations

The measurement strategy has some limitations. Due to resource constraints, both side and traffic videos were recorded by the same person in most cases, not simultaneously but consecutively (traffic video immediately after the side video). This means a risk of double counting, as a person sitting on the sidewalk at the time of the side video recording could have been counted as stationary, but then also on the move on the traffic video if she happened to leave in the meantime and pass in front of the camera. Another limitation is that the gender of street users was not recorded in the people's counts, which prevents any gender interpretation of the results. Finally, when building the database, the traffic counts were converted into motorbike-equivalent units using Cao and Sano's (2012) conversion rates, which were estimated based on traffic observations in Hanoi (Vietnam),[3] but the article did not include a conversion rate for trucks. The bus rate was applied, which is an approximation.

The proposed analytical methods have some limitations as well. First of all, the statistical methods proposed for analyzing the data are quite rudimentary at this stage, focusing mostly on the means of all variables. Further analyses will consider more elaborate modeling techniques (e.g. Poisson regression models), but additional control variables will be needed, relative to the built environment in particular (e.g. population density, sidewalk width). Second, most variables included in the analysis are count variables, which means that correlation coefficients are probably biased due to skewed distributions of the data. Third, there is no elaboration on observed variations between different times of the day. Finally, the video data includes a significant amount of qualitative data that is not analyzed in this paper.

Results

1) Typology of Street Uses

Street uses were classified along a spectrum from movement to activity. Strictly about movement are all the traffic variables, as they correspond to counts of people and vehicles on the move. A sub-set of mobility practices was classified as 'non-compliant tactics.' These include practices such as driving the wrong way, riding on the sidewalk, and walking on the traffic lanes. At the other end of the spectrum are street activity variables that are strictly about static uses. These include variables such as the number of open commercial locations, people hanging out in public space, street vendors. The total count of street vendors was broken down into three categories, including vendors on the sidewalks, vendors on lanes, and motorbike taxis *(xe om)* or cyclos waiting for customers (those on the move were counted as 'motorbike' traffic for motorbike taxis, and 'other' for cyclos). Finally, there is a subset of variables that are neither strictly about movement nor strictly about activity, or both at the same time. Such *'mobility-activity' variables involve mobility means that are temporarily static*. In the case of HCMC,

[3] Car = 3.4 MEU; Bus = 10.5 MEU; Minibus = 8.3 MEU; Bicycle = 1.4 MEU (Cao & Sano; 2012)

typical mobility-activity variables include motorbikes parked on the sidewalks, motorbikes or cars parked in traffic lanes, and *'motobuyers.'* The act of '*motobuying'* designates a common practice in Vietnamese cities where a motorbike rider pauses movement for a short amount of time (less than five minutes in general), puts one foot down on the ground, and without stepping down of the vehicle, makes a purchase to take away from a street vendor, which can be either formal or informal (see Figure 2). In what follows, 'mobility-activity' variables fall under the broader category of street activity.

Figure 2 – 'Motobuyers' purchasing drinks from a street vendor (left) and from a store (right)

2) General Description of Streets, Flows, and Activity

a. Built environment

Most recordings were made on commercial streets and boulevards. On average, the sampled street segments were lined with 15.33 locations per 100 meters. A large majority were commercial locations (68%), followed by housing (21%). The share of commercial locations approached or even exceeded 80% along two-way streets of type '1+1' and '2+2', and along the outside lanes of segregated streets. The share of ground-level housing locations was small on these commercial streets (less than 10%). However, the ratios were inversed in alleyways, where the majority of ground-floor locations were used for housing (76%), followed by commercial (18%). On all types of streets, very few locations were classified as institutional, mixed-use buildings, or parking lots (less than 2% in each category). Finally, the selected street segments were mostly continuous blocks. A negligible share of all locations consisted of intersecting streets (0.3%). A relatively larger share (5%) were entrances of alleyways, but such block discontinuities were nearly inevitable given the density of the network of alleyways in HCMC. See Appendix 3 for a summary of built environment characteristics by type of street.

b. Street flows by type of street segment

Against this backdrop, the transportation flow of all surveyed street segments was largely dominated by motorbikes (see Table 2). A major share of all traffic counts (71%) were motorbikes driving on the lanes. The share approached 90% of all counts on '2+2' streets and on the inside lanes of segregated streets. Only in the market was it lower than average in the market (64%).

Table 2 – Means of movement variables by type of streets

	All	1+1	'2+2'	Alley	One-way	Seg. Outside	Seg. Inside	Market
Traffic counts (/ 5 min)								
Total counts	153,96	76,73	259,58	45,43	508,38	22,94	326,17	113,83
% Motorbikes in lanes	71,0%	73,4%	88,1%	77,2%	76,8%	24,8%	86,4%	64,1%
% Cars in lanes	11,2%	12,7%	7,8%	0,9%	13,0%	26,5%	7,9%	0,9%
% Bikes in lanes	1,9%	2,3%	0,9%	4,1%	0,3%	0,7%	0,7%	3,7%
% Ebikes in lanes	0,2%	0,1%	0,3%	0,1%	0,5%	0,3%	0,2%	0,3%
% Buses in lanes	0,3%	0,4%	0,0%	0,0%	0,3%	0,6%	0,7%	0,0%
% Trucks in lanes	0,9%	0,6%	0,8%	0,0%	1,4%	0,4%	3,6%	0,0%
% Others in lanes	0,4%	0,4%	0,4%	0,7%	0,3%	0,2%	0,3%	0,9%
% Pedestrians on sidewalks	4,7%	4,1%	0,8%	0,0%	1,3%	24,5%	0,0%	0,0%
Sub-total compliant uses	*90,6%*	*94,0%*	*99,1%*	*82,9%*	*93,7%*	*78,0%*	*99,9%*	*69,9%*
% Motorbikes wrong way	3,0%	1,8%	0,1%	0,0%	5,5%	14,6%	0,0%	0,0%
% Car wrong way	0,0%	0,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
% Bikes wrong way	0,4%	0,2%	0,1%	0,0%	0,2%	2,3%	0,0%	0,0%
% Motorbikes on sidewalks	0,5%	0,4%	0,4%	0,0%	0,1%	2,5%	0,0%	0,0%
% Bikes on sidewalks	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
% Ebikes on sidewalks	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
% Pestrians in lanes	5,4%	3,4%	0,2%	17,1%	0,5%	2,6%	0,1%	30,1%
Sub-total non-compliant tactics	*9,4%*	*6,0%*	*0,9%*	*17,1%*	*6,3%*	*22,0%*	*0,1%*	*30,1%*
Modal shares (MEU)								
Total MEU (/ 5 min)	196,18	93,24	319,00	41,14	630,17	33,21	497,62	70,03
% Motorbikes MEU	67,9%	62,3%	71,9%	90,2%	61,7%	65,6%	58,0%	87,7%
% Car MEU	22,1%	29,2%	20,9%	3,0%	26,5%	28,1%	18,1%	3,7%
% Bike MEU	2,7%	2,4%	1,1%	6,7%	0,3%	2,3%	0,7%	8,2%
% Ebike MEU	0,2%	0,1%	0,3%	0,1%	0,4%	0,5%	0,2%	0,4%
% Bus MEU	2,0%	2,4%	0,0%	0,0%	2,5%	1,8%	4,9%	0,0%
% Truck MEU	5,0%	3,5%	5,9%	0,0%	8,6%	1,7%	18,1%	0,0%

In terms of modal share, cars represented the second largest share of all traffic counts (11%). Unsurprisingly, the car share was almost negligible in narrow alleyways (less than 1%). The share was equally low in the market, which was not accessible to cars either, not because of width but due to the market activity itself. When converted into MEU, the average car share on all surveyed street segments (22%) turned out to be twice as large as that measured in terms of traffic counts (11%). The results of a paired t-test indicated that, at the .05 critical level of statistical significance, the mean MEU car share was significantly higher than that measured as counts, $t(155) = 12.51$, $p = .00$. The difference between the two measurements was of particular importance for '1+1' streets. Compared to all streets, the mean share of cars as proportion of all counts was not significantly different, as shown by the result of a one-way t-test, $t(62) = 0.95$, $p = 0.17$. However, the difference in means was significant when car shares were calculated as MEU, $t(62) = 2.55$, $p = .01$. In other words, although the share of cars out of all moving objects was not particularly higher on this type of streets, the share of road space cars occupied was significantly higher, relative to other transportation modes.

In third and fourth positions in the modal split came the shares of pedestrians walking on the sidewalks (5% of all traffic counts), and that of bicycles riding in lanes (2%). After segregated streets, which had an exceptional share of pedestrians (26%, see below), '1+1' streets appeared to support relatively more pedestrian traffic (4%) than any other type of streets. Naturally, the share of pedestrians walking on sidewalks was null on street segments that did not have a sidewalk, i.e. on alleyways and on the inside lanes of segregated streets. As for bicycle traffic, alleyways and the market were supporting a relatively larger bicycle share than average (4%).

The outside lane(s) of segregated streets appeared to be an exception when looking at the average modal shares. The recorded motorbike share was much smaller than average (25%). The car share was quite high numerically (27%), but the difference in means was not significant at the specified alpha level. Finally, a rather large share of all traffic counts were pedestrians walking on the sidewalk (25%). This most likely due to the fact that one of the street segments of this type—Tran Hung Dao—was located in the heart of the backpacker district of HCMC. On that street, pedestrian counts mostly included tourists, who are generally more likely to walk on the streets than their local users.

People and vehicles engaged in non-compliant mobility tactics represented a total of 9% of all traffic counts. The most common of these tactics consisted in walking in the lanes (7% of all traffic counts). A particularly large share of moving users were counted as such in the market (30%), where sidewalks were too busy to be discernable, and in alleyways (17%) where, if any, sidewalks were not continuous and extremely narrow. The second most common tactic was to ride a motorbike the wrong way (3%). This practice was significantly more prevalent on the outside lanes of segregated streets, where motorbikes driving the wrong way represented 15% of all traffic counts, $t(17) = 3.66$, $p = .00$. The share was numerically higher than average on one-way streets as well (5%), but the difference was not statistically significant. Non-compliant uses were almost inexistent on streets of type '2+2' and on the inside lanes of segregated streets (less than 1%).

c. *Street activity by type of street segment*

Of all locations recorded along the surveyed street segments, an average of 8.19 per 100 meters of property line were formal commercial locations that were open to customers at 3:00 PM (Table 3). Streets of type '1+1' were the most active type of commercial streets along this variable (M = 10.81) and segregated streets the least (M = 6.02). Alleyways had even fewer stores open at 3:00 PM (M = 3.62), given the large majority of housing locations (see above).

A 'mobility-activity' variable, 'motorbikes parked on sidewalks' outnumbered all other measurements of street activity. All street observations considered, there were nearly 20 parked motorbikes per 100 meters of street segment. The mean number of parked motorbikes was the highest on the sidewalks of segregated streets (M = 26.57), followed by '1+1' streets (M = 25.61), and '2+2' streets (M = 23.67). Of all commercial streets, one-way streets had the fewest motorbikes parked on their sidewalks (M = 10.64). In addition, some motorbikes were counted as parked in the traffic lanes. For reasons mentioned above, this practice was most common in alleyways (M = 5.63) and in the market (M = 6.14), but motorbike parking in traffic lanes also occurred on ‘1+1’ streets (*M* = 3.42). In comparison to motorbikes, the average number of parked cars was very small on all streets (*M* = 1.22).

Table 3 – Means of activity variables by type of street

	All	1+1	2+2	Alley	One-way	Seg. Outside	Seg. Inside	Market
Commercial open at 3:00PM	8,19	10,81	8,25	3,62	9,19	6,02	-	-
Motorbikes parked on sidewalks	19,83	25,61	23,67	1,55	10,64	26,57	-	0,00
Cars parked (street parking)	1,22	2,15	1,12	0,29	0,26	0,43	-	0,00
Total street vendors	2,29	2,41	1,13	0,99	0,98	0,73	-	17,54
- Street vendors on sidewalks	2,07	2,32	0,78	0,25	0,89	0,63	-	17,54
- Street vendors on lane	0,19	0,09	0,19	0,74	0,00	0,10	-	0,00
- Xe om (and cyclo)	0,03	0,01	0,16	0,00	0,09	0,00	-	0,00
People on sidewalks (not walking)	9,27	13,43	9,07	3,97	3,78	7,62	-	0,11
People on lane (not walking)	2,30	0,86	0,80	2,51	0,35	0,86	-	30,81
Motobuyers	0,53	0,35	0,35	0,57	0,22	0,00	-	5,48
Motorbikes parked on lane	3,04	3,42	0,91	5,63	0,91	1,19	-	6,14

The average number (*M* = 9.27) of people sitting or standing on the sidewalks (not walking) was about half that of parked motorbikes. Moreover, some people were doing the same in the traffic lanes (*M* = 2.30). Streets of type ‘1+1’ were the most active of all streets along the former variable as well (*M* = 13.43). Segregated and ‘2+2’ streets were closer to average, whereas the mean was much lower along one-way streets (*M* = 3.78).

The mean number of street vendors was higher on ‘1+1’ streets (*M* = 2.41) than almost any other type of street. All streets considered, the mean number of vendors (*M* = 2.29) included a majority installed on the sidewalks (*M* = 2.07), few vendors in the traffic lanes (*M* = 0.19), and very few motorbike taxi drivers or cyclos (*M* = 0.03). There were no street vendors in the lanes of one-way streets. The market constituted an exception with a much higher number of street vendors (*M* = 17.54), and also a greater mean number of ‘motobuyers’ (*M* = 5.48) than average (*M* = 0.53). Nevertheless, ‘motobuyers’ were recorded every 200 meters on average in alleyways (*M* = 0.57), and every 300 meters approximately on ‘‘1+1’’ and ‘2+2’ streets.

3) Street Flow and Street Activity in a ‘Modern’ Environment

The results presented in this section aim to tease out the Phu My Hung (District 7) effect, where the selected streets were planned according to an ideal of modern city life. The analysis builds on a subset of data (*N* = 64) that includes only observations made on Type ‘1+1’ streets. This is a way to ‘control’ for the variations due to street type, while focusing on streets that have appeared so far to be the most active, and where the car effect can be expected to be most tangible. Moreover, ‘1+1’ streets are the only ones for which the distribution of observations enabled a comparison between neighborhood environments. A striking figure when comparing the street flow variables (see Appendix 4) was the very low mean number of all traffic counts on the ‘1+1’ streets surveyed in District 7 (*M* = 13.94) compared to the average for all such streets (*M* = 76.73). The motorbike share as proportion of traffic counts (*M* = 56%) was also much lower than average (*M* = 73%), and the difference in means was statistically significant, $t(17) = -3.13$, $p = .00$. In contrast, the car share ($M = 24\%$) was twice as large as average and the difference in means was also statistically significant, $t(17) = 2.64$, $p = .01$. The contrast was even larger with the car share measured in MEU ($M = 49\%$). Streets of District 7 were the only one where the mean car share ($M = 49\%$) was larger than the mean motorbike share ($M = 45\%$). However, neither the mean share of pedestrians on the sidewalks nor that of bicycles riding in lanes were significantly different from those measured on similar streets in more typical districts.

Most street activity variables involving people on the streets had lower means than average on '1+1' streets of District 7. It was the case for the number of commercial locations open at 3:00PM ($M = 7.23$ as opposed to $M = 10.81$); the number of street vendors ($M = .15$ as opposed to $M = 2.40$); the number of people sitting or standing on the sidewalks ($M = 7.50$ as opposed to $M = 13.43$) or in the traffic lanes ($M = .43$ as opposed to $M = .86$); and the number of 'motobuyers' ($M = .06$ as opposed to $M = .34$). The mean numbers of motorbikes parked either on sidewalks or in the lanes were smaller than average. In contrast, the mean number of cars parked next to the curb ($M = 4.51$) was higher than in any other districts.

4) Correlations between Street Flows and Street Activity

Continuing the analysis using the small dataset ('1+1' streets only), this section highlights some correlations between street activity, built environment, and street flow variables (Table 4). The number of sidewalk vendors was more strongly correlated with the number of ground-floor housing locations ($r = 0.50$, $p < .05$) than with that of open commercial locations ($r = 0.31$, $p < .05$). As for the number of street vendors located in the lanes, there was a positive, yet not significant, relationship with the number of housing locations, but no correlation with the number of open stores. The number of motorbikes parked on the sidewalks, however, was strongly and positively correlated with the number of open stores ($r = 0.60$, $p < .05$).

The number of people hanging out (sitting or standing) on the sidewalks was strongly, positively, and significantly correlated with the number of sidewalk vendors ($r = 0.66$, $p < .05$). Similarly, it was strongly correlated with the number of motorbikes parked on the sidewalks ($r = 0.60$, $p < .05$). However, the relationship with the number of open stores was weak and non-significant. The number of *'motobuyers'* was positively correlated with the number of vendors in the lanes ($r = 0.45$, $p < .05$), and that of people in the lanes ($r = 0.38$, $p < .05$). However, the relationship with the number of sidewalk vendors was weak and not significant. It was weak as well, but significant, with the number of open stores ($r = 0.30$, $p < .05$).

P*edestrian traffic* appeared strongly and positively correlated with the number of sidewalk vendors ($r = 0.63$, $p < .05$) and with the number of people hanging out on sidewalks ($r = 0.75$, $p < .05$). Although quite weak and not statistically significant, the relationship between the *motorbike share* and the number of street vendors was positive, both with those on sidewalks and those in the lanes ($r = 0.19$ and $r = 0.20$, respectively, $p > .05$). On the contrary, the *car share* (in MEU) was negatively correlated with the number of street vendors. The relationship was statistically significant with the number of sidewalk vendors ($r = -0.31$, $p < .05$). The signs were negative for all correlations between car share and street activity variables. The relationships between other modal shares and street activity were not statistically significant. Similarly, there were no significant correlations between non-compliant mobility tactics and street activity variables.

Table 4 – Correlation matrix of built environment, street activity, and mobility variables

	Built environment		*Street activity*					*Mobility tactics*			*Parking*	
	1	2	3	4	5	6	7	8	9	10	11	12
Built environment												
1 Stores open	1.0000											
2 Housing (/ 100m)	0.4189*	1.0000										
Street activity												
3 Vendors on sidewalks	0.3092*	0.5031*	1.0000									
4 People on sidewalks	0.2326	0.2379	0.6597*	1.0000								
5 People on lane	-0.0200	0.1229	0.2800*	0.0529	1.0000							
6 Vendors on lane	0.0586	0.1993	0.2737*	0.0215	0.419*	1.0000						
7 Motobuyers	0.2991*	0.3948*	0.2093	-0.0940	0.3838*	0.4450*	1.0000					
Mobility Tactics												
8 Motorbikes wrong way	-0.0238	-0.1243	0.1447	0.2335	0.2236	0.1107	0.0343	1.0000				
9 Bikes wrong way	-0.1196	0.0137	0.0231	0.0611	0.0079	0.0368	-0.1527	0.0837	1.0000			
10 Motos driving on sidewalk	0.1577	-0.1081	0.0399	0.0758	-0.1072	-0.0997	-0.1299	0.1682	0.2378	1.0000		
Parking												
11 Motos parked sidewalk	0.6009*	0.1073	0.3713*	0.5961*	-0.0694	-0.1003	-0.1515	0.0730	0.0718	0.3336*	1.0000	
12 Cars parked	-0.1185	-0.3405*	-0.0673	0.2583*	-0.1650	0.0286	-0.2711*	0.0001	-0.1389	-0.0633	0.1623	1.0000
Modal Shares												
13 Pedestrians (traffic)	0.1430	0.2175	0.6269*	0.7458*	-0.0315	-0.0846	-0.1980	0.0232	0.0962	-0.0065	0.5370*	0.1174
14 MEU Motorbike share	0.2297	0.5367*	0.1901	-0.0018	0.2200	0.1983	0.4140*	-0.0068	-0.0292	-0.0358	-0.0723	-0.4785*
15 MEU Car share	-0.2565*	-0.6053*	-0.3146*	-0.0459	-0.2175	-0.2076	-0.4133*	0.0997	0.0699	-0.0085	0.0650	0.4951*
16 MEU Bike share	-0.0329	0.1397	0.0716	-0.1133	0.0876	0.2205	0.0750	-0.0588	-0.0370	-0.1706	-0.2369	0.0791
17 MEU Ebike share	0.3147*	0.2426	0.0406	-0.1858	0.1234	0.0082	0.0557	0.0097	-0.0882	-0.1217	0.0391	-0.1908
18 MEU Bus share	-0.0781	-0.1096	0.2362	0.0759	-0.0507	-0.1687	-0.1373	-0.0757	-0.0243	0.0708	-0.0576	-0.0119
19 MEU Truck share	0.0704	0.0488	0.0704	0.1350	-0.0719	-0.0084	-0.0407	-0.1575	-0.0588	0.1624	0.1916	0.0523

5) On the Relationships between Everyday Uses of the Streets

The next series of results draws on qualitative data in order to explain the differences in means and correlations highlighted so far. The overall maneuverability of the motorbike seems to provide a crucial explanation for the observed associations between motorbike mobility and street activity. Parking on the sidewalks (or in the traffic lane next to the curb) is the typical preliminary step before entering a store, sitting down at the terrace of a café, or having a noodle soup from a street vendor, hence the strong correlations with commercial activity and street vending. Such parking habit is made possible by the small size, light weight, and little encumbrance of the motorbike (Truitt, 2008), coupled with the fact that the curb is purposely designed as a 45-degree ramp for motorbikes (and bicycles) to step up and down between the roadbed and the sidewalk. Furthermore, the maneuverability of the motorbike is also what makes the act of 'motobuying' possible. When reflecting on their travel diary the day prior of the interview, most motorbike users seemed to conceive such practices neither as full stops nor as complete activities. For example, one respondent started the section of the interview about his activities the day before as follows:

> Interviewer: *'Let's now talk about the places you went to yesterday'*
> Respondent (a motorbike user): *'Oh, I didn't go anywhere. I only went to work in the morning, and then back home.'*
> Interviewer: *'On your way to work, did you stop anywhere?'*
> Respondent: *'No, I didn't stop anywhere'*
> Interviewer: *'Did you buy anything?'*
> Respondent: *'Yes, I bought breakfast.'*
> Interviewer: *'How did this happen?'*

While in most places around the world window-shopping on a commercial street gives pedestrians the possibility to make spontaneous stops and purchase decisions; 'sidewalk-shopping' and 'motobuying' are the equivalent for motorbike users in Vietnamese cities. Most respondents who typically commute by motorbike reported such practices being part of their everyday routine. They would 'motobuy' to buy breakfast in particular.[4] A respondent explained: *'[As I drive,] I look. I see what options there are. If I see something I want [to eat], I buy it.'* The transportation mode people use, and whether they make a full stop or not, are decisions they also make on the go. Another respondent described how she has different mobility means associated to different breakfast options (and breakfast places):

> *'There is pho near the apartment building where I live. [If I feel like eating pho], I just walk out of the building and go. Banh gio [a steam rice cake wrapped in banana leave], I buy on the way. Banh cuon [rice paper steamed raviolis], it's also on the way. For vegetarian food [she is vegetarian 10 days a month for religious reasons], it has to be inside a restaurant. So I park.'*

[4] Vietnamese people tend to have quite elaborate breakfasts that they typically do not cook at home. *Pho*, the famous Vietnamese beef noodle soup, is a breakfast favorite for example. It takes eight hours to simmer a flavorful broth and it cannot be cooked in small quantities.

There is in fact a strong co-dependence between street vending, and motorbike mobility. The correlation coefficient was not significant in earlier analysis for reasons most likely related to the fact that all streets had a very large share of motorbike traffic, with very little variation from one observation to another (no effect to pick up). The co-dependence between motorbike mobility and street vending is as real as the one between pedestrian traffic and street vending. Both relationships are most apparent when observing street vendors' tactics as they seek to 'catch' customers. All street vendors interviewed for this study reported that the vast majority of customers reached either by motorbike, or on foot. Street vendors appeared to use different location tactics depending on the type of traffic flow they want to catch. Those who primarily target pedestrians sit low near the ground, facing the sidewalk, and possibly turning their back to traffic, as in vignettes 1 and 2 below (Figure 3). Vignette 3 shows a typical stall targeting 'motorbuyers.' The vendor (not-visible on the picture) is standing behind a stall facing traffic, and the merchandise is at eye level for people on motorbikes. In this case, the stall is in the traffic lane of a narrow alleyway. Finally, vignette 4 shows a specific case where a watch vendor has positioned his stall at ground-level, on the sidewalk, not to catch pedestrians but motorbike users in a particular situation, when they wait at the traffic light (light not visible on the picture). Many formal businesses use similar tactics as informal street vendors to catch the motorbike flow in particular. Some conventionnel cafés for example position a cart similar to the one shown in Vignette 3 right next to the curb in order to catch sell to 'motorbuyers' in additional to seated customers.

Figure 3 – Four street vending location tactics by type of flow

In contrast, car mobility goes against street activity because of its lack of flexibility. Current motorbike users who said they were considering shifting to the car in the near future were asked to reflect on all the stops they had made the day before (including the quick ones they would not have considered stops outside the interview), and whether these would have been possible had they been going by car. Typically, the first answer would be *'Yes, why not?'* but, admitting they had never thought about this question, they would then correct themselves: *'No, I guess not.'*:

> '*There is nowhere to park near the market [where the interviewee had purchased ingredients from four different sellers the day before, in 'motobuying mode']. I will have to buy everything from Coop.Mart [a supermarket]. There is underground parking.'*

Current automobilists confirmed that their range of options was constrained by their mobility. They almost never buy anything anymore from a street vendor, rarely stop for a coffee on the sidewalk. While it seemed to be a matter of choice for one of the interviewed car users, all others said it was by constraint, because of limited parking options, coupled with the impossibility to stop spontaneously like motorbikes do without seriously disrupting traffic. Nevertheless, they accept the tradeoffs as compared to driving a motorbike, they enjoy being sheltered from the surrounding environment, being protected from the dust, the heat, the rain, and the exhaust fumes, and knowing their children are safer in case of an accident.

Knowing that they cannot catch it, street vendors avoid contact with the automobile flow. This is most evident when observing one-way streets, where traffic regulation requires that motorbikes drive on the right lane(s), cars and other larger vehicles on the left lane(s). Typically, street vendors will be concentrated on the right side of the street. As a robustness check, this hypothesis was tested comparing the counts of street vendors on both sides of the one-way streets included in the sample (Nguyen Kiem and Dien Bien Phu). The result of a *t*-test showed a significant statistical difference for Nguyen Kiem. The result was not significant for Dien Bien Phu, but the surveyed street segment had large hospitals on the left side, which attract street vendors. A left-side street vendor selling *chào* [rice porridge] confirmed that she very never has cars stopping by, and rarely has customers reaching by motorbikes. The vast majority of her customers are relatives of hospital patients who walk out of the hospital to buy lunch for themselves and the patient.

Findings

Two complementary concepts have been identified to further explain the consubstantial relationship between transportation flows and social interactions in HCMC's streets: the 'stickiness' of the motorbike flow and resulting 'productive frictions.'

1) 'Sticky Flows'

Borrowing from Amar's (1993) ecological perspective on transportation flows and the built environment, first of all HCMC's motorbike traffic can qualified as particularly 'sticky.' As per Amar's definition of *adhérence*, the flow is integrated in the built environment. It has its own content and space, it enables spontaneous stops and a number of activities while on the move, it opens up possibilities of improvisations and detours. A high-level *adhérence,* or stickiness, is high, is longitudinal: there is an uninterrupted relationship between movement and the built environment, a consubstantial relationship between movement and what it leads to. On the contrary, when the adherence is punctual, the movement 'sticks' to the built environment only at origins and destinations but it disconnected otherwise. The observations made in this paper invite to qualify motorbike mobility as a 'sticky flow.' Furthermore, the case of motorbike mobility enabled to identify some mobility-related technicalities to further conceptualized **'sticky flows:' a rather low speed, a certain thickness (or density of users on the move), a propensity to seep through the banks of the road bed, to overflow the built environment, typically the sidewalks, and the direct contact between its participants and the environment through the senses.** Based on this definition—low speed, thickness, propensity to infiltrate, and direct environmental perceptions—pedestrian mobility definitely ranks highest on the stickiness ladder, whereas car mobility falls to the bottom rung.

2) 'Productive Frictions'

Moreover, this study proposes a complementary concept, that of 'productive frictions,' to explain how 'sticky flows' relate to a density and diversity of human interactions in the built environment. The mechanical notion of 'friction' is one of the components in Cresswell's mobility definition. The friction is conceived here as socially produced, and as critical to the production and reproduction of the 'lived space of urban mobility.' Permitted by the resistance of a sticky flow as it traverses the built environment, **'productive frictions' are the interactions between street users 'on the move' and street users 'in place,' thus producing opportunities for social interactions. They necessitate a temporary inversion of movement and non-movement—only when movement pauses do places become activated.** In the case of HCMC, the sticky flow relentlessly rubbing against the banks of the roadbed creates opportunities for strangers and semi-strangers with different socioeconomic backgrounds to remain in constant interaction with each other. They would hardly every meet otherwise. The 'productive frictions' highlighted here are at the core of the symbiotic relationship that exists between motorbike mobility and street activity (Piazzoni and Jamme. Forthcoming 2020). They play a critical role in shaping HCMC's streets as the vibrant public spaces they are. Moreover, they participate in the production of a fertile ground of socio-economic opportunities on the banks of the streets, as sidewalks present possibilities to live off the connection to the street.

3) Mobility Transition and the Social Production of Space

In a rapidly changing context like HCMC, the concept of 'productive frictions' enables to anticipate the socio-spatial transformations that the on-going mobility transition brings about. On the one hand, evidence from Phu My Hung (District 7) and from current car users suggest that HCMC's street spaces will undergo a radical transformation if car mobility is to supersede motorbike mobility. The explanation being the consecutive loss of frictions points in the system of movement. On the other hand, HCMC's streets and sidewalks may remain a vibrant public space if the mobility transition were to turn predominantly towards sustainable mobilities: walking and biking coupled with mass transit. Non-motorized mobilities are even 'stickier' than motorbike mobility in fact, so at least as conducive to the 'productive frictions' and the production of places in the urban space.

These foreseeable consequences associated with different modalities of the mobility transition are not groundbreaking: cars have caused the 'death of the street' in other modernizing cities of the developing world, while car-oriented cities in the Global North know that promoting non-motorized mobilities is key to activating the streets. Nevertheless, the contribution here is an explanation for these assumed processes, a theoretical underpinning to substantiate urban discourses that have internalized a dichotomy between motorized traffic and public sphere. The mechanism that almost inexorably links car mobility and the 'death of the street' can be described as follows: a non-sticky flow becomes the dominant form of mobility, therefore contact between people on the move and people in places becomes more and more punctual, movement through space loses its spatial production function, the density and diversity of human interactions dwindle, social disintegration ensues. On the contrary, promoting non-motorized mobilities is re-injecting some stickiness in the system, creating friction points.

Conclusion and Discussion

This paper built on a case study of HCMC's street urbanism, where the street network can be thought of as an endless drive-through that people on the move traverse with unlimited options and opportunities to take part in street life. Formal or informal, most street vending places are 'third places' as defined by Oldenburg (1999): places than enable people to stay in touch, to support each other, to develop a sense of belonging to a place and to a group.

I highlighted two mechanisms that help understand how spatial transformations of street urbanisms relate to broader processes of social change led by a mobility transition. The level of 'stickiness' of movement that traverses the urban space informs the possibilities for 'productive frictions' between people, movement, and places, thus shaping opportunities for everyday interactions and long-term opportunities for integration.

Based on this premise, the issue in practice becomes a matter of arranging human movement in the city in ways that care for a diversity of levels of friction in the transportation system, knowing that all forms of mobilities have their own level of friction. The two concepts advanced here invite to planners and urban designers to work with the complexities of multi-modal environments. In places like HCMC that are highly-multi-modal, the goal should not be to simplify the mobility landscape, by banning one form of mobility to force another one through for example; simplifying, one way or another, only leads to creating discontinuities in an existing system of movement. The loss of friction points is a social cost associated with a mobility transition, one that impact societies even more directly than social costs commonly considered: congestion, pollution, and traffic fatalities. Ultimately, as Manuel Castells put it (Castells, 1989, p. 353): *'What we must prevent at all costs is the development of the one-sided logic of the space of flows while we keep up a pretense that the social balance of our cities has been maintained.'*

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References

Amar, G. (1993). Pour une écologie urbaine des transports. *Les Annales de la recherche urbaine, 59*(1), 141-151. doi:10.3406/aru.1993.1736

Anderson, E. (2013). *Streetwise: Race, class, and change in an urban community* University of Chicago Press.

Bell, J. S., & Loukaitou-Sideris, A. (2014). Sidewalk informality: An examination of street vending regulation in china. *International Planning Studies, 19*(3-4), 221-243.

Blomley, N. (2007). How to turn a beggar into a bus stop: Law, traffic and the'function of the place'. *Urban Studies, 44*(9), 1697-1712.

Boarnet, M. G., Forsyth, A., Day, K., & Oakes, J. M. (2011). The street level built environment and physical activity and walking: Results of a predictive validity study for the irvine minnesota inventory. *Environment and Behavior, 43*(6), 735-775.

Calthorpe, P. (1993). *The next american metropolis: Ecology, community, and the american dream* Princeton architectural press.

Carr, S., Francis, m., Rivlin, L. G., & Stone, A. M. (1992). *Public space* (Cambridge Series in Environment and Behavior ed.) Cambridge University Press.

Castells, M. (1989). *The informational city: Information technology, economic restructuring, and the urban-regional process* Blackwell Oxford.

Cervero, R. (2013). Linking urban transport and land use in developing countries. *Journal of Transport and Land Use, 6*(1), 7-24.

Cervero, R., & Golub, A. (2007). Informal transport: A global perspective. *Transport Policy, 14*(6), 445-457. 10.1016/j.tranpol.2007.04.011

Cresswell, T. (2006). *On the move: Mobility in the modern western world* Taylor & Francis.

Cresswell, T. (2010). Towards a politics of mobility. *Environment and Planning D: Society and Space, 28*(1), 17-31.

Cresswell, T. (2016). Afterword–Asian mobilities/asian frictions? *Environment and Planning A, 48*(6), 1082-1086.

Dargay, J., Gately, D., & Sommer, M. (2007). *Vehicle ownership and income growth* worldwide: 1960-2030. The Energy Journal.

Duneier, M., & Carter, O. (1999). *Sidewalk* Macmillan.

Edensor, T. (1998). The culture of the indian street. *Images of the Street: Planning, Identity and Control in Public Space,* , 205-221.

Ehrenfeucht, R., & Loukaitou-Sideris, A. (2010). Planning urban sidewalks: Infrastructure, daily life and destinations. *Journal of Urban Design, 15*(4), 459-471.

Fyfe, N. (2006). *Images of the street: Planning, identity and control in public space* Routledge.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy, 31*(8), 1257-1274. 10.1016/S0048-7333(02)00062-8

Geels, F. W. (2012). A socio-technical analysis of low-carbon transitions: Introducing the multi-level perspective into transport studies. *Journal of Transport Geography, 24*, 471-482.

Gibert, M. (2016). *Le réseau de ruelles de HO CHI MINH VILLE au défi de la modernisation : projets locaux, enjeux métropolitains.*

Gibert, M. (2018). Rethinking metropolitan production from its underside: A view from the alleyways of hồ chí minh city. *Environment and Planning A: Economy and Space,*

Glaeser, E. L., Kahn, M. E., & Rappaport, J. (2008). Why do the poor live in cities? the role of public transportation. *Journal of Urban Economics, 63*(1), 1-24. 10.1016/j.jue.2006.12.004

Hansen, A. (2017a). Hanoi on wheels: Emerging automobility in the land of the motorbike. *Mobilities, 12*(5), 628-645. doi:10.1080/17450101.2016.1156425

Hansen, A. (2017b). Transport in transition: Doi moi and the consumption of cars and motorbikes in hanoi. *Journal of Consumer Culture, 17*(2), 378-396. doi:10.1177/1469540515602301

Holston, J. (1989). *The modernist city: An anthropological critique of Brasilia* University of Chicago Press.

Hou, J., & Chalana, M. (2016). Untangling the "Messy" asian city. *Messy Urbanism: Understanding the "Other" Cities of Asia,* , 1.

Jensen, A. (2011). Mobility, space and power: On the multiplicities of seeing mobility. *Mobilities, 6*(2), 255-271. 10.1080/17450101.2011.552903

Jones, P. M. (2016). (2016). The evolution of urban transport policy from car-based to people-based cities: Is this development path universally applicable? Paper presented at the

Kenworthy, J. (2011). An international comparative perspective on fast-rising motorization and automobile dependence. In H. T. Dimitriou, & R. Gakenheimer (Eds.), *Urban transport in the developing world: A handbook of policy and practice* (pp. 71-112)

Kim, A. M. (2008). *Learning to be capitalists: Entrepreneurs in vietnam's transition economy* Oxford University Press on Demand.

Kim, A. M. (2015). *Sidewalk city*. Chicago: University Of Chicago Press.

Kim, H. K. (2017, August 29,). Ho chi minh city's urban transport challenges – analysis. *Eurasiareview*

Kostof, S., & Castillo, G. (1992). *The city assembled: The elements of urban form through history*. London: Thames and Hudson.

Lefebvre, H. (1974). *La production de l'espace*

Lisa B. W. Drummond. (2000). Street scenes: Practices of public and private space in urban vietnam. *Urban Studies, 37*(12), 2377-2391. 10.1080/00420980020002850

Lofland, L. H. (1998). *The public realm: Exploring the city's quintessential social territory* Transaction Publishers.

Mateo-Babiano, I. (2009). Redefining the asian space: A comparative view of evolving street culture and pedestrian space development in bandung bangkok and manila. *Asian Transformations in Action, 214.*

Mateo-Babiano, I., & Ieda, H. (2007). Street space sustainabilit in asia: The role of the asian pedetrian and street culture. *Journal of the Eastern Asia Society for Transportation Studies, 7*, 1915-1930. 10.11175/easts.7.1915

Mehta, V. (2008). Walkable streets: Pedestrian behavior, perceptions and attitudes. *Journal of Urbanism, 1*(3), 217-245.

Mehta, V. (2013). *The street: A quitessential public space*. GB: Routledge Ltd.10.4324/9780203067635

Merriman, P., Jones, R., Cresswell, T., Divall, C., Mom, G., Sheller, M., & Urry, J. (2013). Mobility: Geographies, histories, sociologies. *Transfers, 3*(1), 147. 10.3167/tranS.2013.030111

Nikolaeva, A., Adey, P., Cresswell, T., Lee, J. Y., Novoa, A., & Tenemos, C. (2018). *A new politics of mobility: Commoning movement, meaning and practice in amsterdam and santiago.* Unpublished manuscript.

Oldenburg, R. (1999). *The great good place: Cafes, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community* Da Capo Press.

Replogle, M. (1992). Bicycles and cycle-rickshaws in asian cities: Issues and strategies. *Transportation Research Record,* , 76.

Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed* Yale University Press.

Sheller, M. (2018). *Mobility justice: The politics of movement in an age of extremes* Verso Books.

Sheller, M., & Urry, J. (2000). The city and the car. *International Journal of Urban and Regional Research, 24*(4), 737-757.

Sheller, M., & Urry, J. (2006). The new mobilities paradigm. *Environment and Planning A, 38*(2), 207-226.

Soja, E. W. (1980). The socio-spatial dialectic. *Annals of the Association of American Geographers, 70*(2), 207-225.

Temenos, C., Nikolaeva, A., Schwanen, T., Cresswell, T., Sengers, F., Watson, M., & Sheller, M. (2017). Theorizing mobility transitions: An interdisciplinary conversation. *Transfers, 7*(1), 113-129.

Tiwari, G. (2002). Urban transport priorities: Meeting the challenge of socio-economic diversity in cities, a case study of delhi, india. *Cities, 19*(2), 95-103.

Truitt, A. (2008). On the back of a motorbike: Middle-class mobility in ho chi minh city, vietnam. *American Ethnologist, 35*(1), 3-19. doi:10.1111/j.1548-1425.2008.00002.x

Urry, J. (2004). The ‘system’of automobility. *Theory, Culture & Society, 21*(4-5), 25-39.

Appendices

Appendix 1 – Data Collection Protocol

Interviews: The interviews about individual mobility practices lasted about one hour and included five sections. First, interviewees answered question about their past and present personal circumstances (age, family size, job, income, education, housing situation, and so forth), and their projects, expectations and preferences in these regards. Second, they described their past, present, and anticipated mobility means. The third section aimed at revealing the relationship between everyday mobility practices and urban activities. Following the template of a typical travel survey, interviewees first described their trips and activities the previous day. Then they were asked whether these activities would have been possible with the mobility means they had in the past and those they anticipate (or hope) to have in the future. They also spoke more generally about things they commonly do, especially leisure activities, and associated mobility means. The fourth section aimed at revealing perceptions and meanings attached to different streets. Finally, open-ended opinion questions addressed three major policies likely to transform the urban space in HCMC: the metro project, the ban on motorbikes by 2030, and the sidewalk clearing campaigns. The interview guide was approved by the Institutional Review Board of the University of Southern California. Eligible participants were 18 years or older and had lived in HCMC for at least one year. The final sample 32 of participants included a diversity of profiles in terms of common transportation mode (moto, electric bicycle, bicycle, walking, car, motorbike taxi, and bus), age, gender, and income, but was not representative of HCMC's population.

Video recordings: The video recordings were conducted on 19 streets located in different urban environments, including typical districts characterized by a dense network of alleyways (Phu Nhuan and District 3), the historical and institutional center (District 1) planned according to a grid pattern during the colonization era, and the Phu My Hung neighborhood (District 7) was planned and developed in the last two decades in ways supposed to offer the comfort of modern life to those who can afford it (Harms, 2012; 2016; Kim, 2008). Several types of streets were included, ranging from narrow alleyways to large boulevards. With the exception of alleyways, which by definition cut through residential neighborhoods, all selected streets were lined with 3- to 6-story mixed-use buildings typical of HCMC's urbanism, with stores on the ground floor and additional commercial or residential space in the upper floors. Using an action camera, each street was filmed six times over the course of one day (at about 6:30 AM, 9:30 AM, 12:30 PM, 3:30 PM, 6:30 PM, and 10:30 PM). First, a tracking shot was used to record 'side videos' of the sidewalk and background properties, by following the curb either on foot or on the back of a motorbike; second, a static shot was used to record 5-minute 'traffic videos' (motorized and pedestrian). All videos were recorded in November, during the dry season, so the weather was quite similar from one day to another (approximately 30°C in the afternoon, no rain). Finally, the waiting times between recordings were used for participant observations of street life, photographs, and short interviews with vendors and retailers. Thirty-six interviews were conducted, including 25 with informal street vendors.

Appendix 2: Counting Methodology (Measurements using Video Data)

For each street segment, the methodology included the following steps:

- Step 1: Using the 6:30 AM video, list all activities in anchor 'locations' along the property line. Each location was attributed a location number, a name (e.g. the store's name), a type (e.g. store, house, alleyway, parking lot, institutional use) and a short description.
- Step 2: Using the same video, add to the list all activities happening in front of anchor locations. For example, the screenshot in the Figure below shows a street vendor in front of location #3. This vendor was recorded under the same location number (#3), the type was 'sidewalk vendor,' and the description said, 'lottery ticket seller.'
- Step 3: Using the same video, indicate whether the listed activities are 'active' (open) or not at the time of observation.
- Step 4: Count the number of stationary people and parked vehicles (by type) in front of each location. People (or vehicles) on the sidewalk were counted in another category than people (or vehicles) in the traffic lanes, provided that the distinction could be made. Pedestrians on the move were excluded.
- Step 5: Using the 6:30 AM traffic video, count the traffic exited the shot by transportation mode. Each pedestrian was counted as one in the pedestrian traffic category. For vehicular traffic (motorbikes, cars, trucks, buses, bicycles, e-bikes), each vehicle was counted as one in respective categories.
- Step 5: Repeat steps 2-5 for all other videos recorded on the same segment (other times of the day).

Appendix 3: Built environment characteristics of selected street segments by type

	All	1+1	2+2	Alley	One-way	Seg. Outside	Seg. Inside	Market
Built environment								
Length (m)	514	269	612	203	521	1170	1170	152
Sidewalk	0,71	1,00	1,00	0,00	1,00	1,00	0,00	0,00
Lanes	1,47	1,00	2,00	1,00	1,73	1,33	3,33	1,00
Locations (/ 100m)	15,33	15,51	13,64	33,34	14,93	8,61	0,00	
% Commercial	68,2%	80,5%	76,7%	17,8%	72,1%	78,7%	-	-
% Housing	20,8%	10,4%	6,6%	75,7%	12,7%	6,8%	-	-
% Institutional buildings	1,7%	1,9%	1,5%	1,0%	2,2%	1,4%	-	-
% Mixed-use building	0,3%	0,3%	1,3%	0,0%	0,0%	0,6%	-	-
% Alleys	4,8%	4,9%	7,2%	1,4%	7,6%	3,5%	-	-
% Streets	0,3%	0,0%	0,6%	0,0%	0,0%	1,9%	-	-
% Parking lots	0,1%	0,1%	0,0%	0,0%	0,0%	0,6%	-	-
% Other	3,9%	2,0%	6,2%	4,1%	5,4%	7,1%	-	-

Appendix 4: Built environment characteristics of selected street segments of '1+1' streets by district

	All districts	District 1	District 3	District 7	Phu Nhuan
Built environment					
Length (m)	269	179	386	304	300
Sidewalk	1.00	1.00	1.00	1.00	1.00
Lanes	1.00	1.00	1.00	1.00	1.00
Locations (/ 100m)	15.51	13.67	25.91	9.88	19.00
% Commercial	80.5%	85.8%	83.0%	82.9%	64.0%
% Housing	10.4%	12.4%	14.0%	1.3%	17.3%
% Institutional buildings	1.9%	2.8%	0.7%	0.0%	3.6%
% Mixed-use building	0.3%	0.5%	0.0%	0.0%	0.5%
% Alleys	4.9%	5.0%	0.5%	3.5%	10.5%
% Streets	0.0%	0.0%	0.0%	0.0%	0.0%
% Parking lots	0.1%	0.0%	0.5%	0.0%	0.0%
% Other	1.9%	-6.6%	1.3%	12.3%	4.1%

Appendix 5: Street flows and activity on '1+1' streets, by district

	All	District 1	District 3	District 7	Phu Nhuan
Traffic counts (/ 5 min)					
Total counts	76.73	88.71	119.00	13.94	111.75
% Motorbikes in lanes	73.4%	73.6%	92.9%	55.8%	85.1%
% Cars in lanes	12.7%	13.1%	3.4%	23.5%	2.9%
% Bikes in lanes	2.3%	1.2%	1.5%	3.5%	3.2%
% Ebikes in lanes	0.1%	0.0%	0.5%	0.0%	0.3%
% Buses in lanes	0.4%	0.7%	0.0%	0.3%	0.0%
% Trucks in lanes	0.6%	0.9%	0.4%	0.4%	0.3%
% Others in lanes	0.4%	0.1%	0.5%	0.6%	0.6%
% Pedestrians on sidewalks	4.1%	7.2%	0.0%	3.3%	2.4%
Sub-total compliant uses	*94.0%*	*96.8%*	*99.2%*	*87.3%*	*94.8%*
% Motorbikes wrong way	1.8%	0.7%	0.0%	5.0%	0.7%
% Car wrong way	0.1%	0.2%	0.0%	0.0%	0.0%
% Bikes wrong way	0.2%	0.3%	0.0%	0.3%	0.0%
% Motorbikes on sidewalks	0.4%	0.7%	0.0%	0.4%	0.4%
% Bikes on sidewalks	0.0%	0.0%	0.0%	0.0%	0.0%
% Ebikes on sidewalks	0.0%	0.0%	0.0%	0.0%	0.0%
% Pestrians in lanes	3.4%	1.4%	0.8%	7.0%	4.2%
Sub-total non-compliant tactics	*6.0%*	*3.2%*	*0.8%*	*12.7%*	*5.2%*
Modal shares (MEU)					
Total MEU (/ 5 min)	93.24	121.45	132.69	19.69	114.30
% Motorbikes MEU	62.3%	56.1%	84.9%	45.2%	83.4%
% Car MEU	29.2%	31.8%	9.9%	48.8%	9.3%
% Bike MEU	2.4%	1.2%	1.9%	2.9%	4.5%
% Ebike MEU	0.1%	0.0%	0.4%	0.0%	0.3%
% Bus MEU	2.4%	5.3%	0.0%	1.4%	0.0%
% Truck MEU	3.5%	5.6%	2.9%	1.7%	2.5%
Street activity counts (/ 100m)					
Commercial locations open at 3 :00PM	10.81	10.72	17.48	7.23	9.66
Motorbikes parked on sidewalks	25.61	34.44	22.98	19.90	18.72
Cars parked (street parking)	2.15	2.16	0.23	4.51	0.17
Total street vendors	2.41	3.61	1.79	0.15	3.92
- Street vendors on sidewalks	2.32	3.61	1.71	0.07	3.61
- Street vendors on lane	0.09	0.00	0.08	0.08	0.28
- Xe om (and cyclo)	0.01	0.00	0.00	0.00	0.03
People on sidewalks (not walking)	13.43	21.96	5.36	7.50	12.00
People on lane (not walking)	0.86	0.84	1.53	0.43	1.03
Motobuyers	0.35	0.02	1.14	0.06	0.78
Motorbikes parked on lane	3.42	1.67	5.70	5.92	1.25