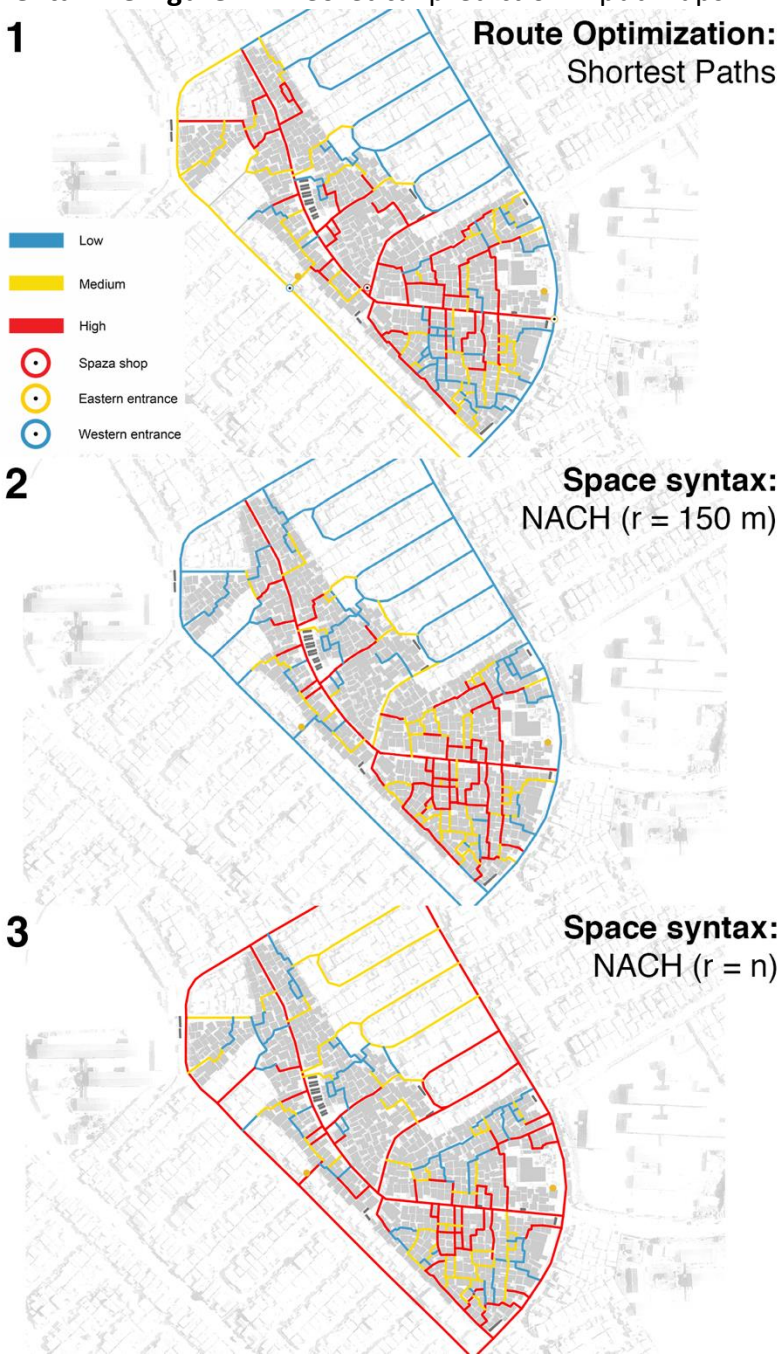
Supplemental Information:
"Predicting Pedestrian Activity Within Informal Settlements"

Supplemental File Figure 1: Theoretical prediction input maps.



Description: All route network elements included in the theoretical calculations.

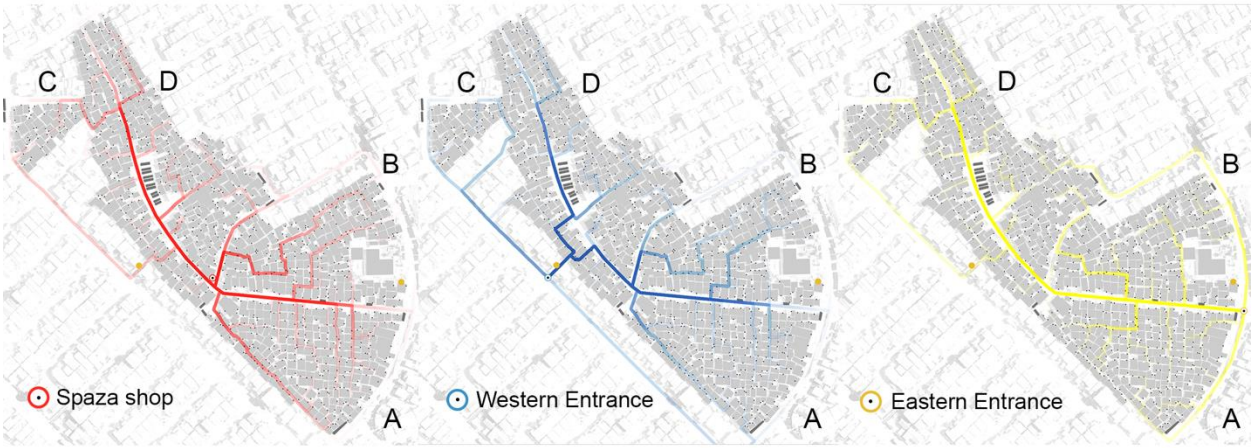
File name: SuppFile_Fig1_ShortPath_SpaceSyntax_InputMaps.png

Supplemental File Figure 2: Pedestrian motion sensor.

Description: Pedestrian motion sensor installed on a fence to monitor a path segment in the study area.

File name: SuppFile_Fig2_InstalledSensor.jpg

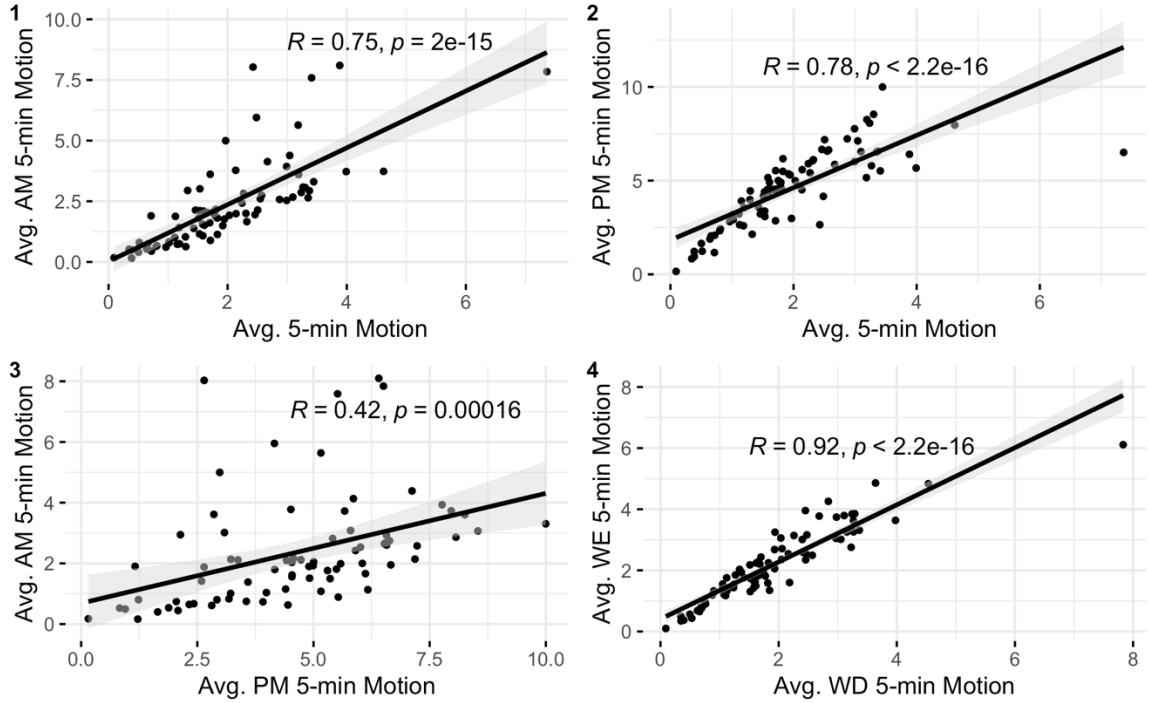
Supplemental File Figure 3: Shortest paths scenarios.



Description: Most frequently used paths based on a shortest-path analysis for three scenarios (from left to right): 1) The central Spaza shop, 2) Western entrance, 3) Eastern entrance.

File name: SuppFile_Fig3_ShortPathScenarios.png

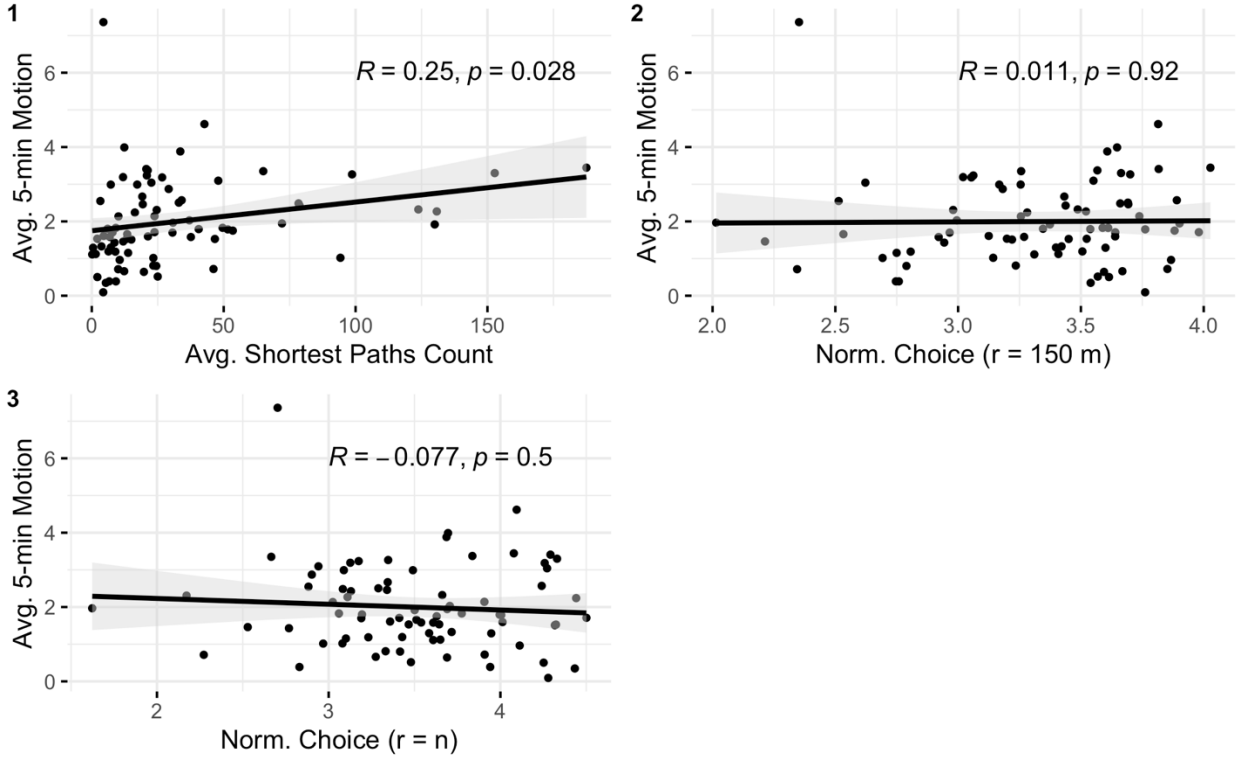
Supplemental File Figure 4: Time of day correlation plots.



Description: Correlation between average five-minute motion (all hours) and average five-minute morning motion (1), all-hours average motion and average five-minute evening motion (2), average evening and morning motion (3), and average weekday five-minute motion and average weekend five-minute motion (4).

File name: SuppFile_Fig4_SensorTime_Correlations.png

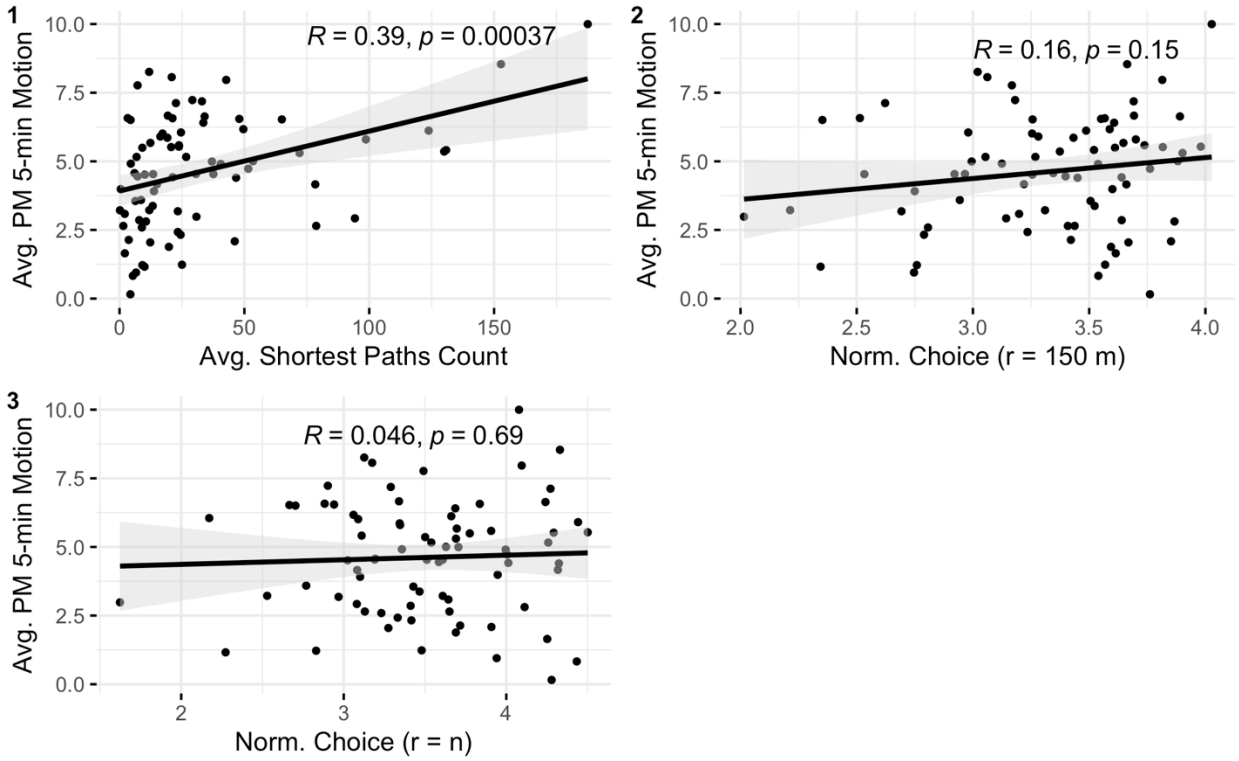
Supplemental File Figure 5: Theory-driven calculations and average motion correlation plots.



Description: Correlation between average five-minute motion (6:00 pm – 8:00 am) and theory-driven calculations.

File name: SuppFile_Fig5_Overall_Correlations.png

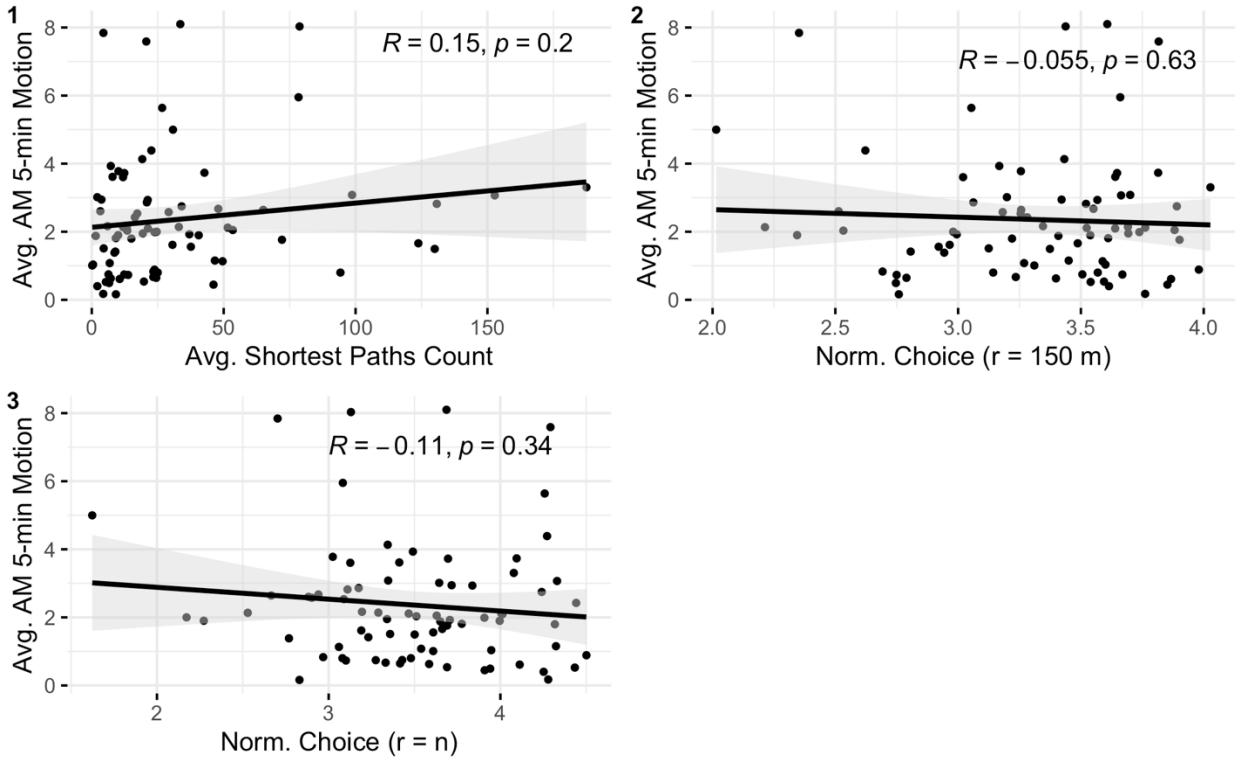
Supplemental File Figure 6: Theory-driven calculations and average evening motion correlation plots.



Description: Correlation between average evening (6:00 – 9:00 pm) five-minute motion and theory-driven calculations.

File name: SuppFile_Fig6_Evening_Correlations.png

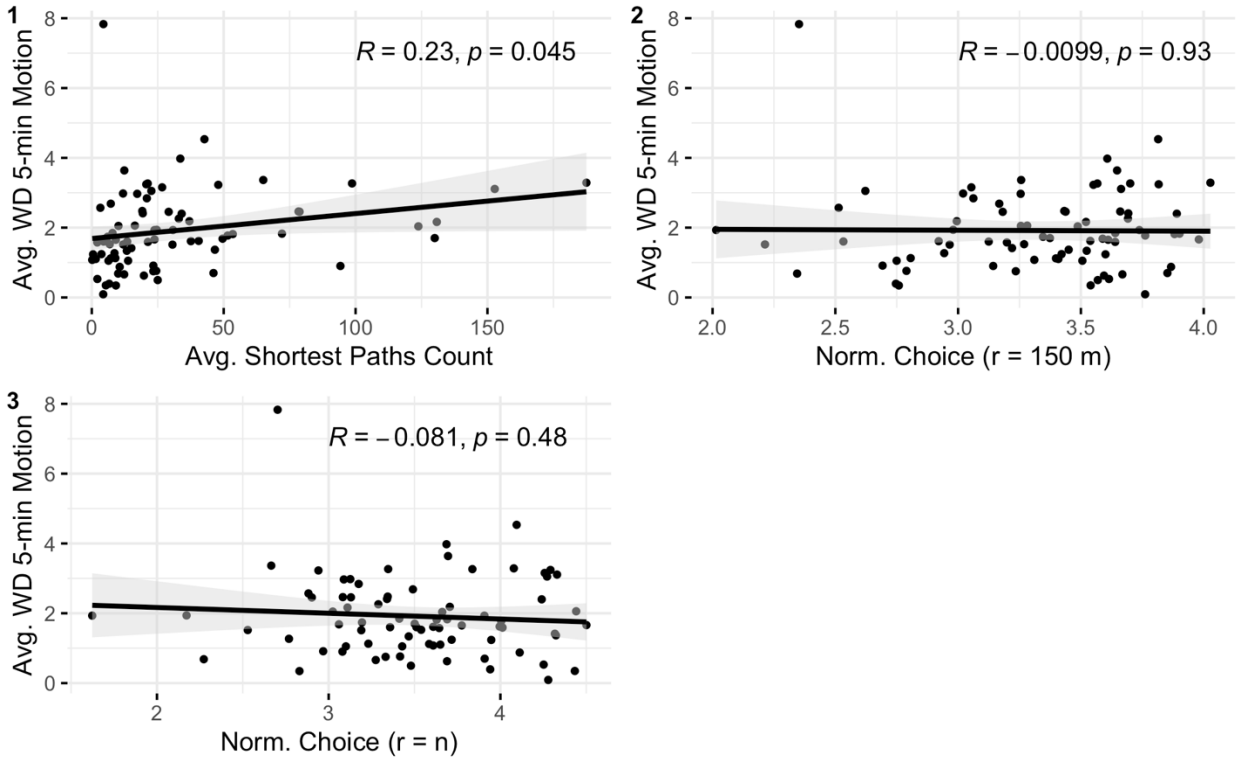
Supplemental File Figure 7: Theory-driven calculations and average morning motion correlation plots.



Description: Correlation between average early morning (5:00 – 8:00 pm) five-minute motion and theory-driven calculations.

File name: SuppFile_Fig7_Morning_Correlations.png

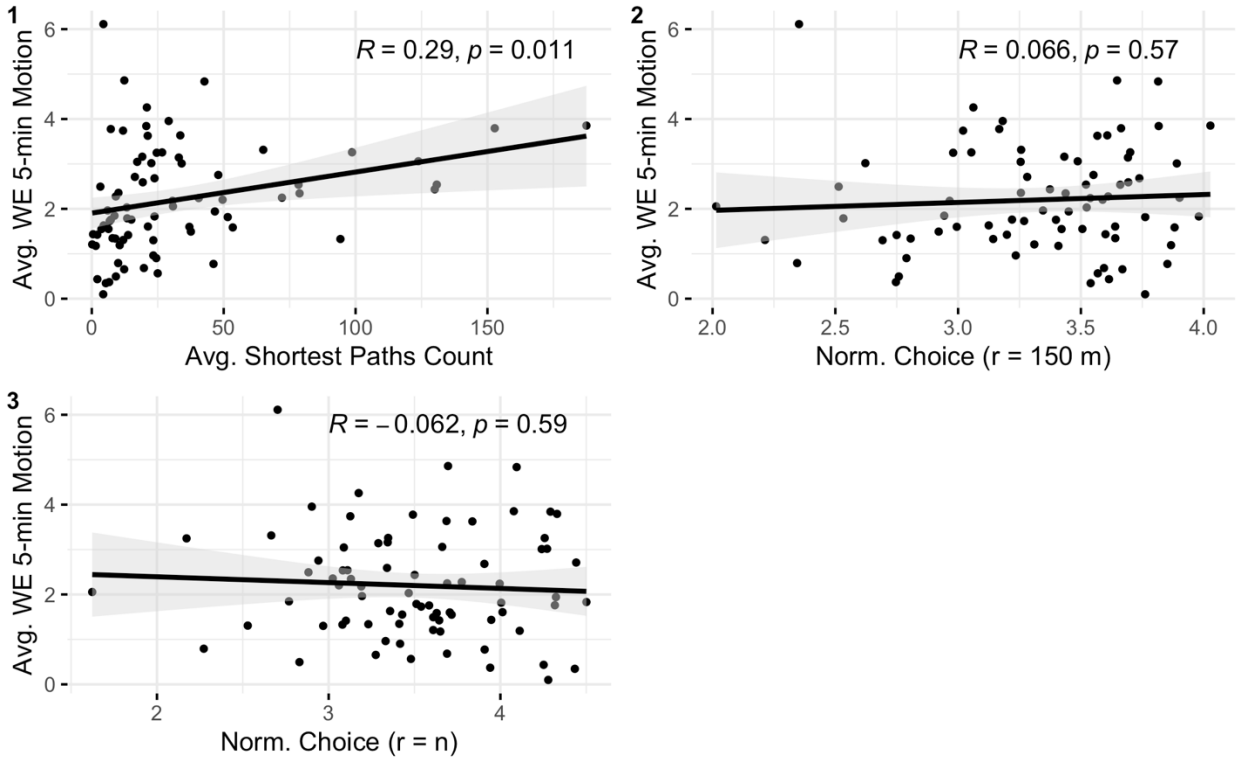
Supplemental File Figure 8: Theory-driven calculations and average weekday motion correlation plots.



Description: Correlation between average weekday (Mon - Fri) five-minute motion and theory-driven calculations.

File name: SuppFile_Fig8_Weekday_Correlations.png

Supplemental File Figure 9: Theory-driven calculations and average weekend motion correlation plots.



Description: Correlation between average weekend (Sat/Sun) five-minute motion and theory-driven calculations.

File name: SuppFile_Fig9_Weekend_Correlations.png

Supplemental Table 1. Summary statistics for theory-based calculations (shortest paths and NACH measures)

Statistic	Mean	St. Dev.	Min	Max
Shortest Paths				
Spaza Shop Count	34.77	48.59	0.167	247.25
Eastern Entrance Count	30.34	49.80	0.00	366.00
C Section (HML) Entrance Count	31.03	40.27	0.00	206.00
Total Count	96.14	111.41	0.50	562.50
Avg. Count	32.05	37.14	0.17	187.50
Space Syntax				
Avg. Choice (radius = 150 m)	2,080.23	2,365.16	101.50	10,645.00
Avg. Choice (radius = *n*)	6,403.55	7,420.59	40.00	31,701.33
NACH (radius = 150 m)	3.32	0.44	2.01	4.03
NACH (radius = *n*)	3.51	0.57	1.63	4.50

Notes: Summary statistics produced by the shortest paths analysis and the space syntax NACH analyses, respectively. These numbers are not directly comparable to the sensor data, which measures triggers (i.e., passers-by), however, we include these numbers here for transparency about the analysis.

Supplemental Information: More Details About the Pedestrian Motion Sensors

We collaborated with Sensen, a company that develops dataloggers, to design and implement the pedestrian motion sensors (see Supplemental Information Figure 2). So that the pedestrian motion sensors would suit the context of an informal settlement, we prioritized the following criteria: resistant to hot, sandy conditions and intense rain, simple to install, amenable to frequent data collection, and relatively low cost to enable full path network coverage.

Using a proximity infrared (PIR) sensor, the device recognizes a pedestrian by detecting differentials in thermal radiation (body heat). Every five minutes the sensor saves a trigger count and resets, recording no details about individuals. As mentioned in the main text, we only use data between 6:00 pm – 8:00 am because the PIR sensor's sensitivity prevents it from accurately measuring daytime motion, which is when thermal radiation from local building materials can cause false triggers. To verify data quality, we conducted manual counts between 5:00 – 7:00 pm, when people are outside and it is safe to work, then compared the human-observed counts to the data from the same time period.

Prior to installing the sensors, we held community meetings to describe the purpose and function of the sensors to residents and address concerns. Residents were concerned others might think the device was a camera and that sensors would be stolen. Otherwise, there was widespread support for the study. Since sensors were installed on the outside of houses, we sought informed consent from the household head of any potential installation site. If a household head did not consent, we selected another house on the same path segment.

To determine where to install sensors, we divided the path network into segments defined by turning decision. A path segment begins either at an entrance point from a formal area or at an intersection. Since segments emerge/disappear as people build/demolish houses, path segments do not have uniform length or width.

To collect data, three trained residents used a Bluetooth-enabled mobile phone application to connect to each sensor and download the data. They uploaded data to the Sensen server over an internet connection. The team collected data every other week during daytime.

Supplemental Information: More Details About the Household Survey

The overarching research project, from which this article emerged, is part of a larger three-year inter- and transdisciplinary research project studying the experience of life and public light at night in informal settlements. At the time of the project, Y. Borofsky and S. Briers were PhD students who collaborated on this project with the supervision of I. Günther, along with the leadership of the informal settlement, the Social Justice Coalition (a local NGO), and a local lighting engineer.

The project involved extensive community engagement and local participation. In particular, both the researchers and the informal settlement leadership agreed a household survey was necessary to develop a baseline understanding of the area for research purposes and to serve as an enumeration of the settlement for the leaders to use to further their development goals for the neighborhood.

The survey questionnaire contained modules on socio-economic characteristics, housing, employment, services and infrastructure, daily activities and time use, perception of safety and risk, experience of crime, as well as organizational capacities and political engagement. In addition to questions developed for research purposes, the survey was also designed to follow the enumeration guidelines put forward by the Western Cape Government Department of Human Settlements — including detailed questions about the number and types of structures, number and demographic characteristics of residents, as well as details about businesses and public services — such that it would be consistent and comparable with other enumerations conducted by other organizations throughout the Western Cape province. Data from the instrument modules that correspond to the standard recommended enumeration questionnaire were formally submitted to the City of Cape Town's Department of Informal Settlements and Backyarders in February 2020.

The survey was carried out over three weeks in March 2019 by local, unemployed residents who were trained by the authors to conduct surveys. All questions were available in both English and IsiXhosa, both official languages in South Africa and the two most commonly spoken languages in this informal settlement. All work was overseen by the informal settlement leadership committee with the support of the local ward councillor and representatives of the City of Cape Town's Department of Informal Settlements and Backyarders. In total, 763 household heads were surveyed, 793 structures were counted, and 2,280 residents were documented. Three household heads refused to participate, the occupants of two structures were not eligible, and the remaining structures were either unoccupied or the building was only for non-residential purposes.