The Effect of Built Environments on the Walking and Shopping Behaviors of Pedestrians

- A Study with GPS Experiment in Sinchon Retail District in Seoul, South Korea -

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Ⅰ. Introduction

As shopping becomes one large part of leisure and entertainment activities in urban life universally, shopping districts are also becoming dynamic public spaces (Cachinho, 2014; Lehto *et al.*, 2004). Thus, it is critical to analyze retail districts to enhance visitors' experiences, as well as to boost retail sales by improving built environment in retail districts. Against this backdrop, we aim to identify built environmental components of retail environments that affect pedestrian behaviors and lead to their consumption, using GPS experiment and path analysis. In the studies associated with the built environment, GPS has been used to observe pedestrian activities mainly in the neighborhood settings (Hirsch *et al.*, 2016). Recently, however, GPS becomes a tool for more expanded studies of which topics include recreation and tourism (Beeco *et al.*, 2014), while has rarely been introduced in the retail studies (Moiseeva and Timmermans, 2010). This research aims to assess the components of built environments that affect pedestrians' choice of walking route and induce their consumption in a retail district, controlling for other variables related to characteristics of individual stores. We conducted a GPS experiment to observe visitors' walking patterns and surveyed their shopping records in the Sinchon retail district in Seoul, then analyzed the data using a path analysis.

Ⅱ. Methodology

The site is Sinchon, one of the representative campus-oriented retail districts in Seoul, South Korea. For our main data of pedestrian walking behavior, we conducted the GPS experiment from 1 p.m. to 6 p.m. over three days, from Friday, August 4 to Sunday, August 6, 2017. For the environmental characteristics, we used data from Korea National Geographic Information Institute, Korean Ministry of Land, Infrastructure & Transport and Daum Map and we also we carried out field investigation of the study site—319 streets and 1,292 buildings—in July 2017, to examine street environments in more detail. We employed path analysis to reveal which factors of the built environment in a retail district affect pedestrians' choices of walking route and influence shopping behavior, such as visiting stores and/or purchasing products or services there. In path analysis, effects can be discerned as direct or indirect relationships.

Ⅲ. Results

We show the path analysis results in Table 1 and Figure 1. In our final model, the built environment variables account for 68% and 14% of the walking behavior variables, pedestrian volume and staying time, respectively, according to squared multiple correlations. These two variables together explain 57% of visit, and then it accounts for 90% of the consumption. Ten variables reflecting the built environments—improved streetscape, standing signboard, bench, betweenness, gravity, lane, shared space, pedestrian-only, building height, and building age—have statistically significant relationships with pedestrian volume at 5% statistically significant level. On the other hand, only one variable—gravity—explains staying time at a 5% statistically significant level.

Table 1. Path analysis results of the built environment's effect on walking and shopping behavior

Effects walking behavior on shopping behavior					
Variable			Coeff.	S.E.	P.
Consumption	←	Visit	0.95	0.01	***
Visit	←	Pedestrian Volume	0.61	0.01	***
Visit	←	Staying Time	0.11	0.11	***
Effects built environment on walking behavior					
Variable	Coeff.	S.E.	P.	Coeff.	S.E.	P.
	Pedestrian Volume ←			Staying Time ←		
Design Element						
improved streetscape	0.34	1.55	***	0.03	0.23	0.67
bench	0.21	0.31	***	0.04	0.05	0.54
standing signboard	0.11	0.16	***	-0.01	0.02	0.91
street tree	0.05	0.15	0.35	-0.04	0.02	0.65
vendor	-0.04	0.26	0.38	0.11	0.04	0.13
electric pole	-0.04	0.70	0.29	0.00	0.10	0.97
Street Form						
shared space	-0.26	1.64	***	0.07	0.24	0.48
pedestrian-only	-0.15	1.99	***	-0.08	0.29	0.35
vehicular lane	0.14	0.48	**	-0.02	0.07	0.84
street length	0.01	0.03	0.82	0.01	0.00	0.89
Street Network						
gravity	0.18	0.01	***	0.22	0.11	**
betweenness	0.15	0.00	***	-0.05	0.10	0.56
closeness	0.06	143.01	*	0.04	0.08	0.50
Building Design						
building height	-0.11	0.27	***	-0.01	0.04	0.88
building age	-0.09	0.00	**	-0.04	0.00	0.54
number of buildings	-0.10	0.20	*	-0.02	0.03	0.83
improved sign	0.07	1.87	*	0.01	0.27	0.89
D/H	0.03	0.35	0.57	0.14	0.05	0.13
Transportation						
parking lot	-0.06	0.01	*	-0.08	0.00	0.17
subway	-0.08	0.01	*	-0.09	0.00	0.18
bus	0.02	0.01	0.61	0.10	0.00	0.17
Store-mix						
food and bar	0.00	2.06	0.99	-0.10	-1.54	0.12
coffee shop	-0.02	3.63	0.51	0.14	2.24	**
beauty and fashion	0.00	2.56	0.93	-0.08	-0.94	0.35
entropy	0.11	1.99	***	0.15	0.29	**

*** $p<0.005$, ** $p<0.01$, * $p<0.05$.

Ⅳ. Conclusion

Through this research, we reveal the effect of the built environment on pedestrian walking behavior, which is linked to shopping behavior, based on the case study of Sinchon retail district in Seoul. We conducted GPS experiment and a questionnaire survey to observe visitors' walking and shopping patterns, and analyzed the relationship to street environments using path analysis. Our findings empirically reaffirm that certain components of street environments can attract or deter pedestrian movement, and as such, walking behaviors can induce store visits and further induce consumption.

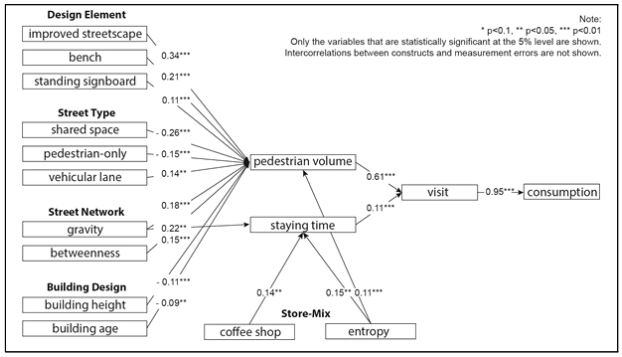

Figure 1. The path analysis result of the built environment's effect on walking and shopping behavior

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