3. Public Space Usership: Does the Built Environment Matter? A Case Study of the Historical Center of Santo Domingo
歩いて楽しめるサント・ドミンゴ：物的環境と公共空間の利用 —サント・ドミンゴ市の歴史的街区を例として—

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This study analyzes the impact of the built environment on usership of public space from a behavioral standpoint in the context of the historical center of the city of Santo Domingo, Dominican Republic. The concept of "usership of public space" was operationalized as a destination choice and a route choice model of pedestrian trips to urban parks. MNL model estimations results suggest that factors affecting destination choice are proximity to destination; commercial and institutional land uses in the immediate surroundings of parks, design attributes and number of events held on park grounds. The importance individuals place on these factors was found to vary according to the main activity individuals wish to engage in when visiting parks. Findings also suggest that some individuals might in fact get a positive utility not only from visiting the park but also from walking to it.

1. Introduction

1.1. Statement of the Problem

Rapid motorization of cities in developing countries has been a widely documented phenomenon contributing to the detriment of the livability of cities and its public sphere, and although the improvement of the built environment has been upheld as a key to increase pedestrian activity by architects and urban designers, in the transportation planning field, the evidence is still subject of debate.

This study will test under a behavioral approach, the claim by urban designers that high quality, pedestrian friendly urban design might affect pedestrian behavior; particularly, focusing on the use of public space by pedestrians.

For that purpose, the concept of "use of public space" is operationalized in two ways:

1. First as a choice of "places" in the form of a destination choice model to public parks and plazas and,
2. second, as a choice of "links" to those "places" in the form of a route choice model.

2. The Pedestrian Activity Issue from Different Professional Perspectives

The link between the built environment and pedestrian activity has been mainly addressed by three professional fields; transportation planning, architecture and urban design and more recently health; for each field, the theoretical and epistemological foundations, as well as the research objectives differ. We will focus on findings from two of these fields.

Transportation planners have mostly focused on walk trip frequency and modal share, and its main theoretical concept is usually the utility maximizing theory. Findings are somewhat ambiguous but evidence suggests that among the built environment factors, the ones that exert the strongest effect on pedestrian behavior are land use and density as accessibility measures (Cervero and Duncan, 2003).

On the other hand, urban designers have mainly focused on public space usership and suggest that besides land use and density, fine-grained, high-quality urban spaces attract pedestrian activity, that is, more people on the streets and on public places (Gehl,1986); in other words, attractive urban spaces influence destination choice behavior. There is however, less empirical research supporting this claim from a behavioral perspective, which will be the focus of this study.

3. Hypotheses Formulation

Based on the discussed above, the following hypotheses regarding pedestrians` uses of public space for discretionary activities are put forth:

1. The main factors affecting destination choice to urban parks and plazas are:
   1.1. Distance to destination
   1.2. Commercial and institutional land uses surrounding the parks, as indicators of closeness to other activities on the street.
   1.3. Design attributes and aesthetic features of both parks and immediate surroundings

2. The importance that individuals place on both accessibility factors varies according to the activities in which individual engage when using parks and plazas.
3. Besides getting utility from engaging in activities in public places, individuals might also get utility from walking to their destination.
4. The factors that might affect this utility are:
   4.1. Walking along streets with high commercial activity on their way to their destination.
   4.2. Design attributes and aesthetic qualities of the built environment along possible routes.

4. Methodology

To gather necessary data, two surveys were conducted. The first one consisted on a home survey on local residents regarding their park usership characteristics in terms of most visited parks, visit frequency, visit time and activities engaged in when visiting as well as chosen route; the second survey consisted on an audit of built environment qualities of both urban parks and as pedestrian infrastructure in the historical center. To evaluate destination and route choice a Multinomial Logit model was developed.

5. Model Characteristics and Estimation Results

5.1. Destination Choice Model:

5.1.1. Choice Set

Although there are in total 21 parks in the area, some of them registered very low choice frequencies, in that sense, the choice set was restricted to those parks which exhibited a relative frequency higher than 0.04, which as shown in table 1, accounted for 0.88 of total relative choice frequency.

Table 1. Choice Set and Frequency

Park Name	Frequency	Relative Frequency
PColon	68	0.362
PEspana	35	0.186
RSFco	16	0.085
PDuarte	14	0.074
SJose	14	0.074
SMiguel	10	0.053
PCastro	9	0.048
Total	**166**	**0.882**

5.1.2. Segmentation Criteria

The main criterion for sample segmentation was the main activity engaged in when visiting parks; this is based on the assumption that individuals place importance on different factors according to the desired activity they wish to conduct; based on the survey results, activities were grouped a priori according to their behavioral similarities as shown in table 2.

Table 2. Aggregated Activities Frequency

Activity Group	Frequency	Percentage
Rest & Contemplate	77	46.39%
Play with Kids	42	25.30%
Drinks& Snacks	28	16.87%
Temporary Events	19	11.45%
Total	**166**	**100.00%**

5.1.3. Parameter Estimation:

To understand the interaction of different parameters on destination choice four models were estimated as follows:

1. Distance Only model (Reference Model)
2. Distance, Land Use Model
3. All Variables, No Land Use Model 1
4. All Variables, No Land Use Model 2

The “Distance Only” model was estimated as a reference to understand the explanatory power of the models which include other factors assumed to have an effect on destination choice; the “Distance, Land Use Model” and the “All Variables, No Land Use Models” were estimated in order to compare the effect of those parameters that due to correlation among variables and multicollinearity cannot be estimated together.

Table 3 summarizes the destination choice model estimations. When compared to the “Distance Only Model”, all models performed better in terms of explanatory power, suggesting that although distance has a strong influence on behavior it is not the only determining factor. The effect of distance is twice as strong for activity “Drinks & Snacks” than for other activities, suggesting that individuals that visit parks for drinks might prefer local parks closer to home.

The “Distance, Land use Only Model” illustrates that commercial and institutional land uses, as indicator of closeness to other street activities was also found to have a strong effect on choice behavior. The land use coefficient was twice as strong for activity “Temporary Event” than for other activities; however, this might be a result of the fact that the majority of temporary events are held close to the old historical center and the touristic cluster where commercial and institutional land uses abound.

Table 3. Destination Choice Estimation Results

Parameter Name	Distance Only Model	Distance, Land Use Only Model	All Variables, No Land Use 1	All Variables, No Land Use 2
DLU1 (Constant)	**1.93706579**	**0.87996100**	**0.86950100**	**0.97804100**
	8.422	**2.698**	**2.001**	**2.363**
Distance				
Activity "Drinks & Snacks"	**-2.14177256**	**-2.29775000**	**-2.39349000**	**-2.42446000**
	-5.515	**-5.485**	**-5.716**	**-5.821**
Activity "Rest & Contemplate", "Play with the Kids", "Temporary Events"	**-1.04172982**	**-1.31194000**	**-1.28221000**	**-1.21578000**
	-7.901	**-8.182**	**-8.098**	**-7.885**
Commercial and Institutional Land Use				
Activity "Temporary Events"	-	**0.00014383**	-	-
	-	**3.942**	-	-
Activity "Drinks & Snacks", "Rest & Contemplate", "Play with the Kids"	-	**0.00007295**	-	-
	-	**5.172**	-	-
Shaded Area and Greenery				
Activity "Temporary Events"	-	-	-0.00001624	-0.00014843
	-	-	-0.0470	-0.449
Activity "Drinks & Snacks", "Rest & Contemplate", "Play with the Kids"	-	-	**0.00093114**	**0.00082835**
	-	-	**6.9090**	**6.687**
Architecture Quality				
All Activities	-	-	**0.82650700**	**0.91006200**
	-	-	**3.127**	**3.299**
Area				
Activity "Rest & Contemplate"	-	-	-	0.00002480
	-	-	-	0.801
Activity "Temporary Events", "Drinks & Snacks", "Play with the Kids"	-	-	-	**0.00010207**
	-	-	-	**4.565**
Event Days				
Daytime Visitor	-	-	**0.00832399**	-
	-	-	**2.341**	-
Nighttime Vistor	-	-	**0.01929280**	-
	-	-	**5.234**	-
Output Statistics				
N	166	166	166	166
No. Parameters	3	5	8	8
LOG-L* (0)	-323.0211	-323.0211	-323.0211	-323.0211
LOG-L* (C)	-276.1704	-276.1704	-276.1704	-276.1704
LOG-L	-225.8608	-202.4357	-188.5791	-193.0356
Rho-Squared (0)	0.301	0.373	0.416	0.402
Rho-Squared (C)	0.182	0.267	0.317	0.301
Adjusted Rho-Squared (C)	0.167	0.244	0.282	0.265

Value in Parenthesis is T-Statistic, **Bold** is Significant at the 0.05 Level

Activities that were not statistically different from each other were aggregated. To test this, the asymptotical T-Test was used.

Regarding the impact of other built environment features, as illustrated in the "All Variables, No Land Use Models" shaded area and greenery as well as architecture quality, as design attributes were significant in explaining choice behavior. Shaded area was a significant parameter for all activities but "Temporary Events"; the negative sign on the shaded area coefficient for temporary activities might be explained in part by the fact that the park that exhibited the highest frequency of temporary events also had the lowest shaded area in the choice set; at any rate, the vast majority of individuals that visit parks to participate in these events do so at night, hence the insignificant coefficient. The significance of the architecture quality coefficient suggests that individuals are in fact aware of the aesthetic features of its surrounding environment and that it might affect choice behavior.

As shown in the "All Variables, No Land Use Model 1" The effect of the event days coefficient was significantly different between visiting times, being twice as strong for nighttime visitors than for daytime visitors. One issue is highlighted as a result. Although there are events organized both during daytime and nighttime, daytime events usually consist of flea markets, antique markets etc., while nighttime events usually consist of musical events such as concerts and dance performances; this might be an explaining factor of the overall preference for nighttime events against daytime ones.

Finally, as illustrated in the "All Variables, No Land Use Model 2" the effect of park area is significant for all activities but "Rest and Contemplate". The implications of this finding is important when considering that "Rest and Contemplate" constitutes more than 45% of the total activity frequency.

Regarding safety perception, the safety variable was correlated with land use, architecture quality and event days. This begs the question of whether this correlation might always hold true and whether these variables can be used as proxies of safety. In this particular case, the correlation between safety perception and mixed land use might be explained in part by the fact that mixed land uses are observed in the old city center –that is also the city`s touristic cluster– which hosts the city government palace, the cathedral, a number of museums and cultural facilities and several other amenities both for tourists and locals, hence not only the high levels of activity but also the high level of security provided by the government. This might also explain the high levels of maintenance and architecture quality and the higher number of temporary events. Although from this evidence it might be difficult to ascertain that these correlations might hold true in other cases, findings from the literature suggests that mixed land uses induce more pedestrian activity and might in fact increase the sense of security; the link between safety perception and architecture quality however might not be as strong.

Regarding our stated hypotheses, these findings suggest, –coherent with the transportation planning literature– that accessibility exerts a strong influence on destination choice behavior. It was also found that the effect of distance varies according to the activity purpose. Among aesthetic and design features, shaded area, greenery and architecture quality were the strongest parameters.

The land use parameter, had –after the distance parameter– the strongest explanatory power in explaining destination choice behavior. However, it is also important to note that due to high correlation levels, land use parameters might obscure the effect of other factors such as architecture quality, park area or event days.

Regarding variables that did not enter the model, little variance of data among alternatives might be a cause for this. This is particularly evident In the case of noise level around parks where the standard deviation for weekdays was of 3.44 decibels and 3.77 for weekends from a mean of 64.11 and 63.41 for weekdays and weekends respectively.

5.2. Route Choice Model:

5.2.1. Model Specifications

For estimating the route choice model, the multinomial logistic model was used. There are two main assumptions for this model:

1. That the individual has full knowledge of the network.
2. That individuals will choose the route that maximizes his/her utility.

5.2.2. Choice Set Generation

Our modeling approach follows a similar methodology used by Tsukaguchi and Matsuda (2002) where the choice set consisted of links surrounding a specific node. In that sense, the choice set consisted in three choices: Go straight, Turn Left and Turn Right. In this case an individual would make as many decisions as nodes in his chosen route.

Regarding the alternative specific constants, the constant "Go Straight" was introduced in the model while the other alternatives were used as reference alternatives. Although It would be possible to introduce one of the remaining alternative specific constants into the model, the parameter estimated would make little behavioral sense, therefore, both turns were used as reference.

5.2.3. Sample Segmentation

The segmentation criterion considered for the route choice model was trip distance, based on the asspumtion that route choice decisions depend on the overall distance of the trip. A distance threshold of 600 meters was used to define a short trip.

To validate this segmentation criterion a cross-tabulation analysis was conducted between short trips and long trips and the choice of the shortest path or the path along the pedestrian boulevard.

As shown in table 4, on trips under 600m the shortest path accounted for 79.49% of the choices, as opposed to 20.51% on trips over 600m. When taking into consideration alternative routes fot the shortest path –as shown in table 5– 100% of indiviudals chose the pedestrian boulevard route for short trips and 60% on longer trips.

Table 4. Analysis of Trip Distance and Shortest Path Route Choice

Shortest Path		Trip Distance		Total
		Under 600m	Over 600m	
Chosen Route	Frequency	31	8	**39**
	% Chosen Rt.	79.49%	20.51%	**100.00%**
	% Trip Distance	63.27%	29.63%	**66.00%**
Not Chosen Route	Frequency	18	19	**37**
	% Chosen Rt.	48.65%	51.35%	**100.00%**
	% Trip Distance	36.73%	70.37%	**34.00%**
Total	Frequency	**49**	**27**	**76**
	% Chosen Rt.	**64.47%**	**35.53%**	**100.00%**
	% Trip Distance	**100.00%**	**100.00%**	**100.00%**

Table 5. Analysis of Trip Distance and Path through the Pedestrian Boulevard

Pedestrian Boulevard		Trip Distance		Total
		Under 600m	Over 600m	
Chosen Route	Frequency	9	21	**30**
	% Chosen Rt.	23.08%	53.85%	**76.92%**
	% Trip Distance	100.00%	60.00%	**66.00%**
Not Chosen Route	Frequency	0	14	**14**
	% Chosen Rt.	0.00%	100.00%	**100.00%**
	% Trip Distance	0.00%	40.00%	**34.00%**
Total	Frequency	**9**	**35**	**44**
	% Chosen Rt.	**20.45%**	**79.55%**	**100.00%**
	% Trip Distance	**100.00%**	**100.00%**	**100.00%**

However this table might be decieving for it does not account for path overlapping, meaning in many cases, the shortest path and the pedestrian boulevard path are in fact the same.

Table 6 ilustrates path overlapping percentages between shortest paths and pedestrian boulevard paths. In trips under 600m, 66% of the times the shortest path and the pedestrian boulevard path coincide as opposed to a 19% for trips over 600m, the possibility to separate the effects of distance from other possible factors is another important reason for using trip distance as a segmentation criterion.

Table 6. Overlapping of Shortest Paths and Pedestrian Boulevard paths

Overlapping of K-1 and Pedestrian Blvd. Path	Trip Distance		Total
	Under 600m	Over 600m	
Total Shortest Path	31	8	**39**
Total Pedestrian Boulevard	9	21	**30**
Total Overlapped Paths	6	4	**10**
% Overlapped Paths	66.67%	19.05%	**33.33%**

5.3. Parameter Estimation

The estimated model results are summarized in tables 7. For trips under 600m, the strongest parameter was the shortest path, suggesting that on such short distances individuals tend to prefer the shortest path over all other alternatives. The coefficient for architecture and environmental qualities of street was also significant, suggesting that aesthetic qualities of the streetscape might have indeed some effect on route choice behavior. The constant for going straight was also positive and significant, implying that individuals tend to reduce the amount of turns they make on a trip.

For trips over 600m, as expected the coefficient for the shortest path was of positive sign and significant, however, it was not the strongest predictor. The strong coefficients for both "Pedestrian Boulevard" and "link connecting to Pedestrian Boulevard" were of positive sign and significant, suggesting that individuals tend to deviate –up to 21%– from the shortest path to visit the pedestrian boulevard. The coefficient for going "Off Track" was as expected of negative sign. In terms of the built environment attributes, the impacts of architecture and environmental quality and conditions of streets –usually associated with pedestrian links level of service– and land use attributes were not significant; although this might be a result of correlation among alternatives, a possible explanation is that since individuals tend to reduce the amount of turns per trip

Table 7 Estimation Results of Route Choice Model

Parameter Name	Coefficient (T-Statistic)
Go Straight (Constant)	**1.11406561** **(6.909)**
On Shortest Path	
Trips Under 600m	**2.39438135** **(7.710)**
Trips Over 600m	**0.86523945** **(2.675)**
Off Track	
Trips Under 600m	- -
Trips Over 600m	**-3.69440742** **(-3.634)**
Link Connecting to Pedestrian Blvd.	
Trips Under 600m	- -
Trips Over 600m	**1.09667187** **(3.435)**
Architecture and Environmental Quality	
Trips Under 600m	**0.84021446** **(2.454)**
Trips Over 600m	-0.12087421 (-0.379)
Pedestrian Boulevard	
Trips Under 600m	- -
Trips Over 600m	**3.2784595** **(4.482)**
Output Statistics	
N	435
No. Parameters	5
LOG-L* (0)	-309.0942
LOG-L* (C)	-309.0942
LOG-L	-158.0769
Rho-Squared (0)	0.48858018
Rho-Squared (C)	0.48858018
Adjusted Rho-Squared (C)	0.482619576

Bold is Significant at the 0.05 Level

and go straight as much as possible, the effect of design attributes and environmental quality of streetscapes might be rather weak given a relatively standard level of pedestrian infrastructure quality, as in the case of the Colonial Zone.

6. Policy Recommendations

Based on the empirical findings presented, the following policy recommendations are put forth to support public space usership in the context of the city of Santo Domingo:

1. Define a pedestrian catchment area for urban parks and plazas at 400m of network distance for neighborhood parks, and at 550m if the park is located in commercial or institutional areas.
2. Planners and local governments should encourage activities that "interact" with parks such as bars, restaurants and open air cafes on the immediate surroundings of parks. In the case of new developments, land use regulations should be established to support the development of commercial and institutional activity around the parks.
3. Design attributes should be considered both in terms of the park itself as well as its immediate surroundings. Attention should be placed on shaded area provision, architectonic quality and maintenance.
4. Community organizations and local governments should also play a role on increasing the sense of safety in parks as well as developing citizen culture by encouraging park use through celebration of events and activities on park grounds.
5. The idea of the Main Street should be revisited as a way to increase livability of urban environments. It is suggested that for leisure trips, the trip itself might provide utility to some individuals, particularly on longer trips. In that sense, the existence of potentially attractive walking routes towards the park must be considered.
6. The issue of under-utilized parks deserves further attention; further research must be conducted to analyze how these specific parks can be improved in order increase its usership.

7. References

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