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MODELING CONSUMER PERCEPTION OF PUBLIC SPACE IN SHOPPING CENTERS

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ABSTRACT: This article presents a study of the effects of various shopping center design and management attributes on consumer evaluations of the public space appearance (or atmosphere) in shopping centers. Examples of such attributes are level of maintenance, area for pedestrians, window displays, street layout, and street activities. A model is estimated from responses to experimentally controlled descriptions of hypothetical shopping centers. This conjoint analysis or stated preference-based model is compared with a similar regression model estimated from a cross section of perceptions of existing shopping centers. The conjoint and cross-sectional models are tested for their external validity on a holdout sample of respondents. It is concluded that both models perform equally well, but that the approach using hypothetical alternatives allows more detailed insight in the effects of the various shopping center attributes.

Consumer perception of retail environments has been studied with a variety of methods, including repertory grid techniques, content analysis, self-stated importance ratings of researcher-defined attributes, factor analysis of attri-

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bute ratings of shopping alternatives, and multidimensional scaling of similarities between shopping alternatives (see, e.g., Finn & Louviere, 1990; Gentry & Burns, 1978; Lindquist, 1974; Mazursky & Jacoby, 1986; Steenkamp & Wedel, 1991; Timmermans, 1993; Zimmer & Golden, 1988). Most studies focused either on finding the major dimensions of retail image or on the assessment of the relative influence of these dimensions on retail patronage. In contrast, retail managers and urban planners typically are more interested in effects of the detailed and physically defined actionable attributes that are elements of the urban design or retail marketing mix than in these broadly defined dimensions. Although such attributes may have relatively small impacts on retail patronage (e.g., Nevin & Houston, 1980), they may be most actionable or cost-effective. For example, to assess the effectiveness of shopping center upgrading plans, interest may focus on the various attributes that underlie consumer evaluations of the public space appearance or atmosphere in shopping centers (cf. Brown, 1994; Davies & Bennison, 1978; Dawson & Lord, 1985; Loukaitou-Sideris, 1997; Robertson, 1994).

In spite of the large range of available methods, the relative influence of such attributes typically cannot be determined unequivocally, because the previously described methods usually are applied to cross-sectional data that were collected from existing shopping centers. Attributes of existing centers often are correlated to the extent that it is difficult to disentangle the effects of the separate attributes. For example, parking rates at shopping centers typically are correlated with the size of the shopping center, because inner-city shopping areas are the most expensive areas in which to park. Moreover, observations only can be obtained for attribute values that are currently available; hence, it is difficult to predict how consumers will perceive the appearance of totally new shopping center formats or designs. Finally, it is difficult to draw causal conclusions from cross-sectional data.

An efficient way to avoid these limitations and determine the effects of each of an object's attributes on the evaluation of this object is conjoint analysis, or stated preference modeling as it is called in other disciplines (for reviews, see Batsell & Louviere, 1991; Carson et al., 1994; Green & Srinivasan, 1978, 1990; Hensher, 1994; Louviere, 1988a, 1988b; Timmermans, 1984; Timmermans & Golledge, 1990). In conjoint experiments, responses are collected to hypothetical multiattribute alternatives. In the analysis, the overall response is decomposed into the separate contributions of the various attributes. These contributions can be estimated very efficiently because the researcher can use optimal experimental designs to generate the multiattribute stimuli.

Conjoint analysis typically is applied to model preference structures, but it also can be applied to study perceptions. This article describes one such

application, a conjoint experiment to study the relative influence of various physical aspects of shopping centers on the perception of the general appearance of the public space within shopping centers. The goal of the article is to investigate and illustrate the usefulness of conjoint approaches to measure the relative influence of such attributes in the perceptual process. We compare conjoint-based attribute weights with attribute weights derived from a cross section of attribute perceptions of existing centers. We also present results pertaining to the external validity of conjoint-based models, as the external validity of models based on responses to hypothetical stimuli are a recurring topic in discussions on the usefulness of conjoint models.

Thus, the major research questions of this study are: (a) To what extent do particular shopping center attributes influence the perception of the public space in retail environments? and (b) To what extent do the advantages of the experimental conjoint-based approaches over cross-sectional approaches apply in this context, in particular with respect to the validity of the model results?

To achieve our goals, the article is structured as follows. After quick reviews of the conjoint and consumer retail perception literatures, we describe our experimental procedure. Next, regression models are estimated from a cross section of perceptions of existing shopping centers and from the experimental data. Both models are used to predict perceptions reported by an independent sample of respondents; hence, we provide comparative tests of external validity. The article concludes with a discussion of results and some suggestions for further research.

CONJOINT RETAIL STUDIES AND SHOPPING CENTER ATTRIBUTES

Conjoint preference and choice analysis concerns the estimation of models from responses that are collected in experimentally controlled hypothetical situations. Descriptions of hypothetical alternatives are presented to participants who are asked either to rate their preference for these alternatives (usually profiles of attributes) or to choose from sets of alternatives. Because by design the attributes in the profiles are mutually independent and because the hypothetical alternatives are not restricted to participants' current domains of experience, this approach allows one to obtain estimates that are efficient and that are not confounded with characteristics of the current real-world choice situation. Numerous consumer studies have applied this technique in a large variety of research areas (e.g., Wittink & Cattin, 1989).

Although few of these applications concerned retailing problems, some studies made retail applications of conjoint approaches (Ahn & Ghosh, 1989; Louviere & Gaeth, 1987; Louviere & Johnson, 1990, 1991; Louviere & Meyer, 1981; Moore, 1990; Schuler, 1979; Timmermans, 1982; Timmermans, Borgers, & Van der Waerden, 1991; Timmermans, Van der Heijden, & Westerveld, 1982, 1984; Verhallen & De Nooij, 1982). Moreover, almost all conjoint applications in retailing have studied preference or choice instead of perception of retail destination.

Conjoint applications in retailing also have been limited in that most studies focused on stores instead of shopping centers. Mazurski and Jacoby (1986) reviewed 26 store image studies (as a follow-up to the review by Lindquist, 1974) and found that the following image aspects were most frequently examined in these studies: merchandise quality, merchandise pricing, merchandise assortment, general service quality, salesclerk service, location, and atmosphere or pleasantness of shopping at the store. They concluded that these aspects are among the most important components of store image.

Studies that focused on store choice and store image, however, typically have ignored the characteristics of immediate store environments, for example, the public environment within the shopping center. Though not the most important factor in determining consumer choice of retail destination, atmosphere and appearance of the immediate store environment may nevertheless contribute to the attractiveness of a store or shopping center. This is exemplified by Downs (1970), who proposed in his seminal paper that nine components constitute the image of urban downtown shopping centers. Among these nine, he distinguished four public space characteristics (structure and design, ease of internal movement and parking, visual appearance, and atmosphere).

Further support for the importance of appearance comes from a study by Timmermans et al. (1982). They identified atmosphere and physical layout as the third and fourth most frequently used dimensions to distinguish among shopping centers in Eindhoven, the Netherlands; the most frequently used dimensions were size and distance. This conclusion was derived from principal components analyses that were performed for each of 20 individuals separately on the ratings she or he had supplied of the personal constructs that had mentioned in a repertory grid task (Hallsworth, 1988; Kelly, 1955). The repertory grid methodology avoids drawbacks of conventional approaches, such as semantic differentials—for which results are highly dependent on the researcher's a priori specification of attribute items, and multidimensional scaling—for which the interpretation of scaling results typically is very subjective. This repertory grid study asked respondents to consider triads of shopping centers from the study area, and for each triad to name a construct

that distinguishes one center from the other two. This task was repeated using new triads until no new constructs were mentioned.

The personal constructs that were produced in the 20 interviews by Timmermans et al. (1982) illustrate the kind of detailed attributes that are related to atmosphere and layout issues: cozyness, care for maintenance, quietness, well organized, dark or light, safety, sheltered or windy, information sufficiency, coveredness, compactness, pedestrianization, quality of window displays, special activities, intimacy, cleanliness. Clearly, many of these personal constructs can be manipulated more or less directly by retailers and developers as well as by designers and planners. Indeed, these attributes are important features in shopping center renewals and restructurings, which increasingly are used as instruments to improve the attractiveness of shopping centers.

The relevance of public space characteristics also is confirmed by a study by Van Raaij (1983; see also Hackett, Foxall, & Van Raaij, 1993). In that study, a sample of 579 respondents evaluated shopping centers in Rotterdam on various attributes and provided ratings of the importance of these attributes. In a principal components analysis of the importance ratings, Van Raaij obtained five components that were labeled as follows: general evaluation, physical environment, efficiency, accessibility, and social environment. Of these five dimensions, three clearly reflect public space characteristics.

Though these image studies provide insight into the elements and dimensions that constitute perceptions of shopping centers, they do not give quantified insight into the relative importance of each of the separate features. They also do not allow causality tests of the effects of attribute changes on public space appearance. Our study, therefore, focuses on the use of conjoint approaches to study the influence of physical aspects of shopping centers on perceptions and evaluations of the appearance and design of shopping centers. In particular, our focus is on the effectiveness of conjoint approaches over approaches using cross-sectional data.

EXPERIMENTAL PROCEDURE

DEFINITION OF ATTRIBUTES

Based on the extant literature (e.g., Davies & Bennison, 1978; Maitland, 1985; Zimmer & Golden, 1988) and personal interviews and pilot tests with consumers, we generated a list of 10 attributes that we hypothesized to affect evaluations of the appearance, layout, and furnishings of shopping centers.

TABLE 1
**Attributes and Levels to Describe the Appearance,
 Layout, and Furnishings of Shopping Areas**

<i>Attributes</i>	<i>Levels</i>
Compactness (walking routes, interruption of storefronts, surveyability)	1 = dispersed 2 = compact
Proportion of shopping area indoors	1 = 0% 2 = 30% 3 = 60% 4 = 90%
Proportion of shopping area that is reserved for pedestrians	1 = 10% 2 = 40% 3 = 70% 4 = 100%
Crowding in shopping area	1 = very uncrowded 2 = moderately uncrowded 3 = moderately crowded 4 = very crowded
Decorations and furnishings in the shopping area (signs and displays, stalls, benches, flags, etc.)	1 = few 2 = many
Amount of greenery	1 = little 2 = much
Maintenance of streets, hallways, and buildings	1 = very bad 2 = moderately bad 3 = moderately well 4 = very well
Proportion of storefronts with attractive window displays	1 = 0% 2 = 30% 3 = 60% 4 = 90%
Number of activities in the streets (markets, musicians, parades, etc.)	1 = few 2 = many
Number of coffee shops, cafes, and restaurants	1 = few 2 = many

The list of attributes and their possible values, or levels, are presented in Table 1. Note that we discard the word *atmosphere* to separate as much as possible the effects of individual retailers' marketing mix strategies from variables that are instruments for shopping center designers and developers.

The 10 attributes in Table 1 describe the appearance, layout, and furnishings of shopping centers. If these attributes are combined into profiles, these profiles describe only one of the shopping center image dimensions identified in previous research. To give respondents at least some idea of the center's position on the other constituents of shopping center image and to avoid

	SH. CENTER 1	SH. CENTER 2
COMPACTNESS of shopping area (walking route, interruptions of store fronts, surveyability)	dispersed	compact
Part of shopping streets that is INDOORS	60 % indoors	90 % indoors
Part of shopping streets that is PEDESTRIAN AREA	70 % pedestrian area	100 % pedestrian area
CROWDEDNESS in the streets	usually moderately crowded	usually very quiet
DECORATIONS AND FURNISHINGS (signs and displays, stalls, benches, flags, etc.)	many furnishings	few furnishings
Amount of GREENERY	much green	little green
MAINTENANCE of streets, hallways and buildings	very well maintained	moderately well maintained
Proportion of store fronts with ATTRACTIVE WINDOW DISPLAYS	30 % attractive window-displays	90 % attractive window-displays
ACTIVITIES in the streets (markets, musicians, parades, etc.)	many activities	few activities
Number of COFFEE- SHOPS, CAFE'S AND RESTAURANTS	many coffeeshops etc.	few coffeeshops etc.
<p>(extremely unpleasant) --- = a</p> <p>--- = b</p> <p>--- = c</p> <p>--- = d</p> <p>0 = e</p> <p>+ = f</p> <p>++ = g</p> <p>+++ = h</p> <p>(extremely pleasant) +++ = i</p> <p>APPEARANCE, LAY- OUT AND FURNISHINGS OF SHOPPING CENTER IS</p> <p>Indicate your impression: => = ..</p>		
LOCATION AND ACCESSIBILITY (FROM YOUR HOME) IS	moderately favorable +	very favorable +++
SELECTION OF FOOD STORES IS	moderately bad -	moderately good +
SELECTION OF CLOTHING AND SHOES STORES IS	moderately bad -	very good +++

Figure 1: Example of Task, Showing Two Hypothetical Shopping Centers

NOTE: Respondents rated the appearance, layout, and furnishings of each center.

the possibility that respondents would make uncontrolled inferences on these positions, we included three additional attributes in our experiment, as shown in Figure 1. These three attributes describe in broad and evaluative terms the center's location (location and accessibility) and available selection of merchandise (selection of food stores and selection of clothing and shoe stores). In the conjoint experiment, the levels of the three added attributes were defined as hypothetical consumer ratings; that is, depending on the

experimental conditions, participants had to assume that they would have rated a shopping center as "very good," "moderately good," "moderately bad," or "very bad" on these attributes. In experiments that ran parallel to this experiment, we investigated the relation between five location and nine selection attributes and the perception of the location and merchandise selection; however, these experiments are beyond the scope of this article (cf. Louviere & Gaeth, 1987; Oppewal, Louviere, & Timmermans, 1994, 1997).

EXPERIMENTAL DESIGN

Profile descriptions of hypothetical shopping centers were generated from the 10 appearance, layout, and furnishings attributes and the three additional attributes. Five of the 10 appearance, layout, and furnishings attributes had four levels (possible values); the other five had two levels each. The three additional attributes had four levels each. In theory, this definition of attributes and levels allows the construction of $4^8 \times 2^5$, or 2,097,152 different profiles. However, only a small fraction of this total number of possible attribute combinations is required to estimate efficiently the effects of the attributes on the dependent variable if one assumes that the higher-order interactions among these attributes are negligible. This assumption is common to the majority of conjoint studies.

We used a main-effects-plus-selected-interactions plan to select a subset of 128 profiles to be presented to respondents. Sixteen sets were created of eight profiles each; each respondent received one such set. Thus, our design strategy required 16 respondents to produce one complete replication of the design.

STUDY AREA, SAMPLE, AND PROCEDURE

The conjoint task was part of a questionnaire that was administered in Maastricht, a city in the southern part of the Netherlands, population 117,000. In this city, 29 shopping areas can be distinguished, as shown in Figure 2. We randomly selected streets in each of the 18 residential zones in this city, using a stratified sampling strategy to ensure that experimental profiles were distributed equally across all zones. Locally hired and trained interviewers were instructed to randomly select households residing on these streets and to ask the person in the household who did most of the shopping to participate in the study. Of the 396 persons who completed all parts of the survey, 214 persons had been assigned to this experiment; their responses will be used for model estimation. The remaining 182 respondents received

Figure 2: Map of Maastricht Shopping Areas and Their Sizes (food sales area, in m^2)

NOTE: Numbers are area identifiers. For names and attribute perceptions, see Table 2.

treatments from other experiments; this is our validation sample, as discussed subsequently.

In the questionnaire, respondents first were asked about their shopping habits and perceptions of the shopping centers they frequent. Respondents evaluated these centers on all experimental attributes. For each attribute, participants indicated the level that best described a shopping center's position. These attribute perceptions served as predictors in our cross-sectional model; the appendix describes how these levels were defined. Respondents then reviewed a summary list of all attributes and received a few example profiles to familiarize them with the complete attribute space and provide a specific context for the experimental task.

Following this introduction and task warm-up phase, respondents evaluated the experimental profiles. Each individual evaluated 8 profiles from this experiment and 16 from another experiment, which focused on the perception and evaluation of the selection available in shopping centers. Results from this latter experiment are excluded from discussion in the present article. The order of the two experiments was randomized. The order of presentation of profiles within experiments also was randomized. Respondents evaluated each conjoint profile on a nine-category ratings scale that ranged from “----” (*extremely unpleasant*) to “++++” (*extremely pleasant*).

ANALYSIS AND RESULTS

MODEL SPECIFICATION AND ESTIMATION

We assume that appearance evaluations are an additive function of the attributes that we defined and that these evaluations are interval level data (cf. Louviere, 1988a). These assumptions are common in (metric) conjoint analysis and allow us to use ordinary least squares regression to estimate the parameters of our model of the perception of appearance, layout, and furnishings of shopping centers. We estimated two models, one from the experimental data and one from the reported perceptions of existing centers. Both models were estimated at the sample level for respondents who participated in the present experiment. The specification for both models was identical:

$$Y = \beta_0 + \sum \beta_i X_i,$$

where Y is the appearance evaluation, β_0 is a constant, β_i are parameters to estimate, and X_i are the (coded) attribute levels described in Table 1.

Orthogonal coding was used to represent attributes in design matrices for both models. This means that four-level attributes were recoded into a linear component $(-3, -1, 1, 3)$ and an independent quadratic component $(1, -1, -1, 1)$. Levels of the two-level attributes were coded as -1 and 1 , respectively. The reported attribute perceptions for the existing centers were recoded into this same metric for the analyses.

RESULTS FOR THE CROSS-SECTION MODEL

The cross-section model was estimated from the perceptions of the existing 29 shopping areas. The averages of these centers are shown in Table 2. Although the model fits the data reasonably well ($R^2 = .403$), only a few

TABLE 2
Average Attribute Perceptions of Existing Shopping Areas in Maastricht

<i>ID^a</i>	<i>Center Name</i>	<i>n^b</i>	<i>Appearance</i>	<i>Location</i>	<i>Food Stores</i>	<i>Clothing and Shoe Stores</i>	<i>Compactness</i>	<i>Indoors</i>	<i>Pedestrian</i>	<i>Crowding</i>	<i>Decorations</i>	<i>Greenery</i>	<i>Maintenance</i>	<i>Window Displays</i>	<i>Activities</i>	<i>Coffee Shops</i>
1	Binnenstad-West	408	6.9	7.0	6.5	7.3	4.7	18.9	70.4	4.8	4.1	1.7	5.4	75.8	3.9	5.3
2	St. Maartenspoort	50	5.4	7.1	6.6	4.4	4.5	14.4	24.0	4.3	2.4	1.4	5.4	37.0	2.1	1.4
3	Wyck	90	6.4	7.2	6.2	6.2	4.3	6.8	23.8	3.8	3.5	1.9	5.5	64.9	3.6	4.0
4	Jekerdal	38	5.3	6.9	6.3	4.6	3.8	21.4	22.4	2.8	1.9	2.3	4.5	33.6	1.8	1.5
5	Biesland	32	5.1	7.0	6.2	4.8	4.1	49.7	50.7	3.8	2.2	2.0	4.8	20.0	1.6	1.5
7	Wolder	10	6.1	7.4	3.5	1.0	2.6	0.0	11.4	1.6	1.4	3.2	5.7	23.8	2.1	3.1
8	Villapark	23	5.1	7.6	5.2	2.3	3.6	1.8	8.7	1.9	1.7	2.9	4.9	36.2	2.3	2.0
9	Brusselsepoort	221	6.4	6.9	7.2	6.1	5.3	94.4	89.8	4.2	3.5	1.7	5.4	55.1	3.7	2.7
10	Mariaberg	37	4.8	7.0	6.3	3.5	3.4	5.1	24.2	3.5	1.7	2.4	4.6	22.3	1.5	1.8
11	Belfort	10	5.7	6.3	6.3	5.6	4.2	32.5	47.8	3.3	2.7	2.7	4.5	53.0	2.5	1.4
12	Malpertuis	12	5.0	7.7	5.5	—	4.5	9.1	33.3	2.5	2.7	1.8	4.9	40.0	2.0	1.3
13	Caberg	17	5.4	7.1	5.2	5.0	4.4	75.0	43.8	3.4	2.4	2.7	5.8	58.0	2.8	1.5
14	Malberg	31	6.5	7.8	7.0	5.3	4.7	78.3	52.0	3.3	2.6	2.6	5.7	71.3	2.8	1.2
15	Pottenberg	12	6.5	7.5	6.8	4.0	4.3	20.0	41.8	3.2	3.1	3.2	5.3	56.4	2.6	1.6
16	Daalhof	35	5.4	7.1	6.4	5.6	4.7	70.8	70.0	3.1	3.0	2.2	4.6	44.5	2.5	1.2
17	Boschpoort	13	5.6	8.2	5.9	1.0	2.5	0.0	0.0	3.0	1.6	3.7	4.8	37.5	1.3	2.0
18	Borgharen	17	4.9	6.8	4.5	2.7	3.4	0.0	2.4	2.5	1.4	1.8	4.8	18.8	1.4	1.7
20	Limmel	7	5.2	6.4	5.8	—	4.0	0.0	0.0	2.3	1.2	2.8	4.7	22.0	2.6	1.7

(continued)

TABLE 2 Continued

<i>ID^a</i>	<i>Center Name</i>	<i>n^b</i>	<i>Appearance</i>	<i>Location</i>	<i>Food Stores</i>	<i>Clothing and Shoe Stores</i>	<i>Compactness</i>	<i>Indoors</i>	<i>Pedestrian</i>	<i>Crowding</i>	<i>Decorations</i>	<i>Greenery</i>	<i>Maintenance</i>	<i>Window Displays</i>	<i>Activities</i>	<i>Coffee Shops</i>
21	Nazareth	12	5.6	8.2	6.7	4.0	3.9	3.3	15.0	2.9	1.6	1.9	5.2	41.8	2.3	2.0
22	Amby	17	6.4	7.5	6.2	5.0	3.9	7.5	7.7	3.4	2.4	2.9	5.5	59.4	2.8	1.4
23	Wyckerpoort	4	6.7	6.8	7.3	5.5	4.3	22.5	47.5	3.0	2.3	2.5	5.8	43.3	1.3	1.0
24	Akerpoort	5	4.6	6.0	5.0	1.0	3.8	2.0	24.0	3.8	2.0	1.8	5.2	37.5	1.8	1.5
25	Oostermaas	64	5.4	7.2	6.9	4.3	3.7	13.9	19.8	4.1	2.1	2.2	5.1	37.8	2.0	1.7
26	Scharn	58	5.3	7.1	7.3	5.7	3.8	3.0	7.6	4.0	2.0	1.5	5.2	47.7	2.0	2.2
27	Heer	65	5.5	6.9	6.9	5.4	3.5	3.9	8.8	3.7	2.1	1.5	5.1	55.2	2.3	2.5
28	Heugem	23	5.1	7.2	5.4	2.0	3.8	2.3	5.9	2.8	1.4	1.5	5.1	24.8	1.2	1.1
29	De Heeg	16	4.1	7.8	5.1	1.0	5.4	65.0	86.3	3.8	1.6	1.8	3.5	15.3	2.9	1.2

NOTE: ID = identifiers. Attribute definitions are identical to the attributes that were used in the experiment (see Table 1). See the appendix for the definition of response categories for these attributes in the survey.

a. Center identifiers refer to map in Figure 2.

b. *n* = the number of respondents who evaluated the shopping area.

TABLE 3
Multiple Regression of Appearance Evaluations of
Existing Centers on Individually Reported Attribute Perceptions of Centers

<i>Variable</i>	<i>Coded Components</i>	<i>B</i>	<i>SE B</i>	<i>Tolerance</i>	<i>t</i>	<i>Significant t</i>
(Constant)		5.652	.226	—	24.910	.000
Location	L	.004	.070	.423	.062	.950
	Q	.002	.081	.421	.029	.976
Clothing and shoes	L	.094	.043	.461	2.186	.029
	Q	−.028	.056	.826	−.497	.619
Food stores	L	.095	.045	.675	2.088	.037
	Q	.175	.067	.671	2.592	.009
Compactness	L	−.044	.079	.727	−.556	.578
Indoors	L	−.001	.034	.448	−.031	.975
	Q	−.054	.082	.590	−.663	.507
Pedestrian	L	−.009	.036	.413	−.270	.787
	Q	.028	.065	.668	.430	.667
Crowding	L	−.030	.038	.811	−.802	.422
	Q	−.008	.085	.857	−.096	.923
Decorations	L	.094	.083	.546	1.140	.255
Greenery	L	.226	.087	.908	2.581	.010
Maintenance	L	.359	.064	.651	5.619	.000
	Q	−.270	.121	.676	−2.228	.026
Window display	L	.135	.043	.511	3.136	.001
	Q	.090	.068	.747	1.316	.189
Activities	L	.235	.071	.642	3.306	.001
Coffee shops	L	.077	.076	.393	1.008	.313
Multiple <i>R</i>		.634				
<i>R</i> ²		.403				
Adjusted <i>R</i> ²		.371				
<i>SE</i>		1.251				
<i>Analysis of Variance</i>	<i>df</i>	<i>Sum of Squares</i>		<i>Mean Square</i>		
Regression	21	413.065		19.669		
Residual	391	612.212		1.565		
<i>F</i> = 12.562; significant <i>F</i> = .0000						

NOTE: L = appropriately coded linear components of attributes; Q = appropriately coded quadratic components of attributes. Variable names correspond to attribute labels in Table 1.

attributes are statistically significant, as shown in Table 3. It appears that in the cross-section model both selection of stores attributes have large effects on the appearance evaluations. The better the selection, the more pleasant the appearance. Moreover, the significant quadratic component of selection of food stores indicates that appearance evaluations increase at an increasing rate with increasing qualities of the selection of these stores. This

Figure 3: Effects of Attribute Levels That Were Used in the Experiment, Predicted From the Survey-Based Model

NOTE: See Table 1 for variable label definitions.

is demonstrated in Figure 3, which displays the effects, as estimated in the cross-sectional model, of the attribute levels that were used in the conjoint experiment.

Figure 3 and Table 3 demonstrate that in the cross-sectional model, the maintenance attribute has the largest effect. Attractive window displays have the next-largest effect, followed by the number of street activities. Next are the selection attributes (the better the selection, the more pleasant the appearance), followed by the amount of greenery. The effects of the remaining attributes cannot reliably be assessed. If they have effects, these effects cannot be disentangled from the effects of the other attributes in the specification. Evidence for this comes from the tolerances reported in Table 3. The tolerances of window displays, the extent to which a center is indoors, and the extent to which it is pedestrianized are particularly low.

RESULTS FOR THE EXPERIMENTAL MODEL

Results for the experimental model are reported in Table 4. The fit of the experimental model is modest but acceptable, given the disaggregate nature of the data ($R^2 = .177$). As indicated in Table 4, the total model is significant by conventional criteria. All linear components of appearance-related attributes are significant, whereas none of their quadratic components is significant. Also significant is the quadratic component of the location and accessibility attribute, which is one of the three attributes that was added in

TABLE 4
Multiple Regression Results for Conjoint Experiment

Variable	Coded Components	B	SE B	Tolerance	t	Significant t
(Constant)		5.982	.037		160.355	.000
Location	L	-.008	.016	-.011	-.523	.601
	Q	.085	.042	.050	2.027	.042
Clothing and shoes	L	.010	.016	.013	.604	.545
	Q	.027	.037	.016	.726	.468
Food stores	L	.003	.016	.005	.237	.812
	Q	.021	.037	.012	.576	.565
Compactness	L	.077	.037	.045	2.071	.038
Indoors	L	.076	.016	.101	4.583	.000
	Q	.008	.037	.004	.220	.825
Pedestrian	L	.114	.016	.152	6.883	.000
	Q	-.030	.037	-.018	-.816	.414
Crowding	L	-.047	.016	-.063	-2.851	.004
	Q	-.031	.037	-.018	-.833	.405
Decorations	L	.087	.037	.052	2.352	.018
Greenery	L	.161	.037	.096	4.325	.000
Maintenance	L	.178	.018	.239	9.563	.000
	Q	-.039	.037	-.023	-1.063	.288
Window display	L	.175	.016	.234	10.574	.000
	Q	-.069	.037	-.041	-1.851	.064
Activities	L	.193	.037	.115	5.190	.000
Coffee shops	L	.137	.037	.081	3.675	.000
Multiple R		.421				
R ²		.177				
Adjusted R ²		.167				
SE		1.534				
Analysis of Variance ^a	df	Sum of Squares		Mean Square		
Regression	21	846.245		40.297		
Residual	1673	3937.744		2.353		
F = 17.120; significant F = .0000						

NOTE: L = appropriately coded linear components of attributes; Q = appropriately coded quadratic components of attributes. Variable names correspond to attribute labels in Table 1.

the design to specify the remaining perceptual dimensions of the hypothetical alternatives. Similar to the results of the cross-sectional model, the experimental results indicate that window displays and level of maintenance have the largest influence on the pleasantness of appearance of the public space in shopping centers. In contrast to the cross-sectional model, however, the experimental model also shows effects of area reserved for pedestrians, area indoors, street activities, amount of greenery, number of facilities like coffee

Figure 4: Effects of Attribute Levels on Appearance Judgments in Conjoint Experiment

NOTE: See Table 1 for variable label definitions.

shops, and compactness of the layout, in decreasing order of size and with most parameter signs as expected. The effects of the levels of these attributes are graphically displayed in Figure 4.

EXTERNAL VALIDITY

Although the conjoint-based model provides more insight into the effects of the various attributes, it is still unclear to which extent the model based on hypothetical stimuli is able to predict consumers' perceptions of real shopping centers. Therefore, to test the external validity of this model and compare it against the cross-sectional model, we used the estimated regression equations to predict an independent sample's judgments of the appearance, layout, and furnishings of the shopping centers they patronize.

For the experimental model, we obtained a Pearson product moment correlation of .586 and a mean absolute error (MAE) of .97 between (315 non-missing) predicted and observed judgments. When we applied the regression equation based on cross-sectional data to this validation sample, a correlation of .571 was obtained (MAE = .99). Hence, the conjoint-based model predicts the survey responses of the independent sample equally as well as the model based on cross-sectional data, even though the cross-sectional model has the advantage of task similarity. These results, therefore, not only demonstrate

the external validity but also the construct validity of the conjoint-based model.

CONCLUSIONS AND DISCUSSION

The aim of this article was to investigate and demonstrate the benefits of conjoint-based methods in studying environmental perception, in particular the perception of public space in shopping centers. For this purpose, we estimated a regression model to predict how pleasantness ratings of existing centers change with 10 attributes that we hypothesized to be of influence on pleasantness perceptions. It appeared that the level of maintenance, the attractiveness of window displays, the number of street activities, and the amount of greenery had significant impacts on the pleasantness ratings. For the remaining six attributes, no effects were found. We suggest that this may have been a consequence of large covariances among the attributes of existing centers.

We argued that the conjoint approach seems particularly fit to accommodate this limitation of the data collected from existing centers. We therefore presented an experiment in which the same 10 public space features were manipulated and their effects on perceptions analyzed. The results from this experiment confirm that the pleasantness of public space mostly depends on the level of maintenance of streets, hallways, and buildings and the attractiveness of storefronts. We found, however, that although to a lesser extent, the pleasantness also depends on the extent to which the public space is reserved for pedestrians and the extent to which the center is indoors. Similar to the cross-sectional model, the number of street activities was also significant, as was the amount of greenery. In addition, we found effects of the availability of coffee shops and cafes and of crowdedness. Results with respect to this latter attribute show that people tend to dislike crowded and very uncrowded areas, as moderately uncrowded shopping centers were perceived as most pleasant and very crowded centers were perceived as the least pleasant public space (cf. Eroglu & Machleit, 1990). Also significant, though less important, were street furnishings and decorations and the compactness of layout in terms of walking routes, interruptions of storefronts, and surveyability. So, by using the conjoint approach, we were able to distinguish effects of attributes that could not be detected from data collected in currently existing shopping centers.

Because the conjoint model is based on responses to hypothetical alternatives, we also investigated its external validity. We compared the conjoint and cross-sectional models for their ability to predict the judgments of an independent sample of consumers from the same study area. There was no significant difference in the performance of the two models. Considering the further advantages of conjoint approaches, this is a promising result that supports the further use of conjoint approaches to enrich studies of environmental perception.

Among the issues that warrant further research are the construct validity of conjoint tasks: How can we represent shopping center environments in conjoint tasks, such that experimental control is retained while the realism of the environment increases? An interesting extension for example would be to use the method to investigate microbehavior (e.g., route choice) within retail environments (cf. Lorch & Smith, 1993; Zacharias, 1997). Additional research also could focus on the relation between perceptions of the environment and choice behavior. Recent years have seen much progress in this area, as nowadays conjoint approaches are available that allow one to directly observe and model choices instead of preference or perceptual ratings (e.g., Carson et al., 1994). Additional developments have led to the emergence of conjoint methods that allow one to study perceptions and preferences or choices simultaneously (Oppewal et al., 1994). Much remains to be done, however, in the area of modeling consumer perception and preference of retail environments, which indeed is an area where there is a large potential for cross-fertilization of ideas and methods from the environmental, transportation, and marketing disciplines.

APPENDIX
Definition of Attribute Perception Response
Categories in the Consumer Survey

Appearance	1 = extremely unpleasant, . . . 9 = extremely pleasant
Location	1 = extremely inconvenient, . . . 9 = extremely convenient
Selection of food stores	1 = extremely bad, . . . 9 = extremely good
Selection of clothing and shoe stores	1 = extremely bad, . . . 9 = extremely good
Pattern	1 = very dispersed, . . . 6 = very compact
Indoors	0, 10, 20, . . . 100% of shopping area indoors
Pedestrian	0, 10, 20, . . . 100% of shopping area reserved
Crowdedness	1 = very quiet, . . . 7 = very crowded
Greenery	1 = very little, . . . 6 = very much greenery
Decorations	1 = very few, . . . 7 = very many
Maintenance	1 = very bad, . . . 7 = very well
Window displays	0, 10, 20, . . . 100% of all storefronts
Activities	1 = very few, . . . 6 = very many
Coffee shops	1 = very few, . . . 6 = very many

NOTE: Response categories in the questionnaire corresponded to the attribute levels used in the experiments, although in some cases intermediate and/or more extreme levels were used as additional response categories. Before the analysis, the attribute scores were recoded into the metric of the linear and quadratic attribute components that were used during model estimation.

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