POTENTIAL FOR RETAIL LOCATION: THEORETICAL ESTIMATION AND EMPIRICAL EVIDENCE

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A main subject of the conference deals with the contribution of the internal structure of a retail agglomeration to its attractivity. Within this paper some measures for this contribution will be put forward and results of theoretical calculations compared with those including the observed consumer behaviour.

1. Introduction

Beginning at a micro-scale level, two questions have to be answered:

1. Which circumstances determine the attractivity of a retail location?
2. To what extent does the attractivity of a retail location depend on for instance, service and purchasing facilities within its surroundings?

The answers to these questions are combined to produce a means of measurement for the potential of a retail location.

Methodological framework

In mathematical notation the desired measurement is derived from a potential model

$$(1)\quad P_i := \sum_{j \in N_i} f(A_j) * g(d_{ij})$$

with:

P_i : index of attractivity for location i

N_i : Set of locations within the neighbourhood of i

$f(A_j)$: a suitable measurement of the attractivity (question 1)

$g(d_{ij})$: a suitable measurement of the distance between i and j (question 2)

With regard to the distance measurement, Popien's proposal of a city-block metric with a range of 150 m (POPIEN, 1989) will be adopted throughout the following statements.

That means:

(2) $g(d_{ij}) := d_{ij}^{B} := |x_i - x_j| + |y_i - y_j|$ with (x_i, y_i), (x_j, y_j) coordinates of locations i, j

d^B : L_1 - Norm (block metric)

(3) $N_i := \{j \in U: d_{ij}^{B} \leqslant 150\ m\}$ U: = universe of all retail locations in the research area

Only facilities within a block's distance of 150 m contribute to the attractivity of a certain location, and the amount of this contribution does not depend on a distance function. This choice is also supported by the findings of BROWN (1987) in delimiting the activity space of a retail outlet. The second question is therefore answered.

With regards to the measurement of attractivity, three proposals will be offered later.

In order to compare the results obtained with those of POPIEN (1989), we will follow his procedure of standardizing the calculated potential values by types of location within the town. That means:

1. Calculating the (absolute) potential value for each outlet/location;
2. Classifying all locations within the research area into types;
3. Calculating the relative potential value for each outlet/location by computing the type-specific z-scores;
4. Cartographic presentations and verbal interpretation of relative potential values P^r refer to the following scheme:

SYMBOL	INTERPRETATION	CLASSIFICATION
-	very low	$p^r < -1.5$
^	low	$-1.5 <= p^r < -0.5$
o	medium	$-0.5 <= p^r < 0.5$
o	high	$0.5 <= p^r < 1.5$
●	very high	$p^r >= 1.5$

Empirical framework

Empirical data stem from a research project dealing with the organizational changes and their space-relevant impacts on the retail structure of three German towns: Darmstadt, Oldenburg and Regensburg. Their sizes - about 130,000 inhabitants - and relative locations in interurban competition are nearly comparable. But the locations of the second-highest ranking centre in the retail centre hierarchy differ.

Within this paper the research area is restricted to Oldenburg, paying particular attention to the city centre. A total inventory of the retail trade including the location, floorspace, assortment, turnover and economic organization of the retail trade of the whole town, and in addition a survey of city centre shoppers on the first and second of March, 1991, form the data basis for the calculations which will be presented.

Table 1 shows the absolute number of retail outlets and the total amount of selling floorspace in 1990. The classification of their locations with respect to similar types of operational characteristics yields four classes. The number of outlets within classes varies considerably, while the selling floorspace is more evenly distributed.

Tab. 1: Retail Trade in Oldenburg 1990

TYPE OF INNERURBAN RETAIL LOCATION	NUMBER OF OUTLETS	TOTAL AMOUNT OF SELLING FLOORSPACE (1000 sqm)
1 city centre	391	85.4
2 prior road network	491	88.1
3 intermediate loc. within resid. areas	170	55.1
4 urban periphery	68	85.0
Oldenburg	1120	313.6

Source: Own survey in 1990

Focussing on the city centre, figure 1 reveals four remarkable features:

(1) the compactness of the old core (750 x 300 m);

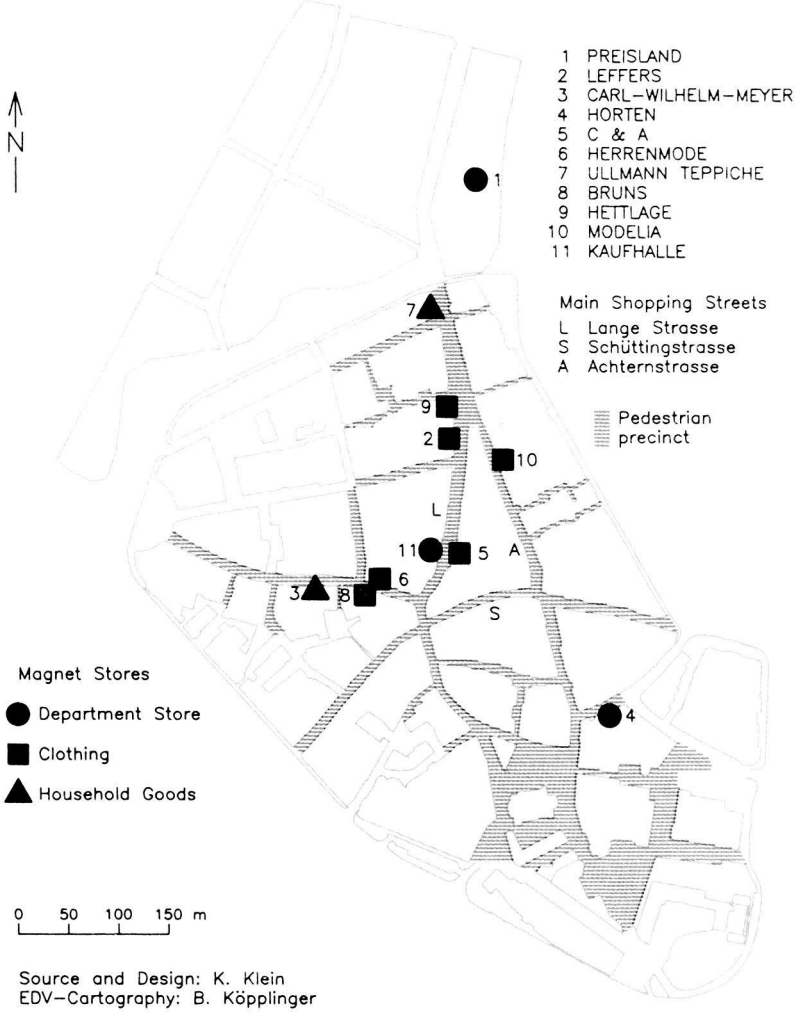
(2) the shape and size of the oldest pedestrian precinct in the Federal Republic of Germany;

(3) the round course for pedestrians, created by the routing of the main shopping streets; and

(4) the "natural" gradient of tension with two department stores at the edges, and a further topic (clustering of clothing shops) in the middle.

The discussion of the introductory questions will be continued in section 2 with three theory-guided proposals for a possible solution to the first question. In section 3 the pattern of actual consumer behaviour is used to test their reliability, whereas in section 4 some conclusions are drawn and further lines of investigation suggested.

Figure 1: Oldenburg City Centre: Retail Structure



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2. Theoretical Estimation

According to NELSON (1958), the potential of a retail location includes various sources:

TYPE OF BUSINESS	DEFINITION
generative business	sales attracted by the store itself
shared business	sales secured by the store due to the customer-attracting ability of neighbouring establishments
suscipient business	sales generated by neither the store nor its neighbours

Generative business is conditioned by properties of the single outlet, for example, its size, absolute location, or amount and intensity of its advertising. In contrast to this, the shared and suscipient business of a single outlet has its origins in the whole cluster of shopping and service facilities within the neighbourhood. Therefore, when considering the potential of a retail location, only the latter two sources of business will serve as a starting point in the search for basic dimensions to describe the attractivity of a retail location.

2.1 Dimension of Attractivity: Density

Obviously, the amount of **suscipient business** depends on the sheer existence of further retail and service facilities within the neighbourhood of a retail location. The passing trade generated by adjacent retail and non-retail facilities is more important than their mix of goods and services.

Reformulating this in respect to the first introductory question leads to the following statement:

> "The number and density of retail outlets within the neighbourhood of a store increase its attractivity".

In mathematical notation:

$$(4)\quad P_i := \sum_{\substack{j \in N_i \\ j \neq i}} 1$$

with P_i : number of adjacent outlets of outlet/location i

$$N_i := \{j \in U: d^B_{ij} \leqslant 150\ m\}$$

The statistical parameters (tab. 2) for the absolute potential values obtained show that within the city centre there are an average of 78 outlets within the block's distance of 150 m and a maximum of 144 outlets. These are almost exactly the values reported by POPIEN (1989, p. 149) for the inner city of Munich.

Tab. 2: Density: Statistical Parameters for Absolute Potential Values

INNER-URBAN TYPES OF LOCATION	NUMBER OF OUTLETS	x	s	min	max
1 city centre	391	77.6	35.0	1	144
2 prior road network	491	6.3	5.4	0	21
3 intermediate loc. within resid. areas	170	2.8	3.0	0	14
4 urban periphery	68	18.5	13.8	0	32

Of course, there are marked differences in the locational and clustering behaviour of the branch groups. These can be traced back to general influences such as the assortment structure or the degree of specialization, and local features such as the progress of organizational change within the retail trade of the research area. All these effects are reflected in the ranking of the branch groups according to their mean relative potential value (fig. 2). Therefore, stationery - one of the classic branch groups with a high amount of suscipient business - ranks second, while the space-consuming branch group furniture/carpets ranks last.

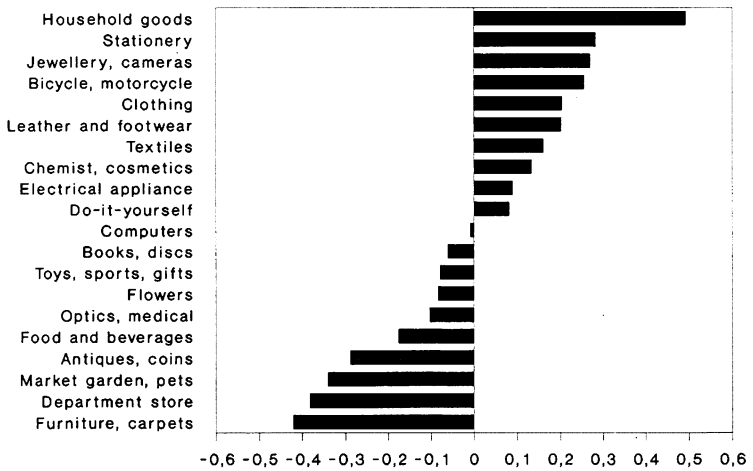
Changes in the retail trade, and in particular the appearance of the specialized discount store, are responsible for the low ranking of toys, sports, gifts, while the local affinity of the population for the bicycle leads to an increase in the appropriate outlets.

On the whole there is a remarkable agreement between the rankings of Popien's results and those for Oldenburg.

Figure 3 shows the distribution pattern of relative density potential within the city centre. The field-like impression is created by very high values near the mean centre of coordinates (Schüttingstraße), high values along the main shopping streets, and a decrease in values towards the centre periphery.

POPIEN has introduced this approach to geographical literature. Argueing within the framework of activity-space research, he interprets it as a measurement of combination potential. The objection might be raised that if a customer wants to realize effort-minimizing benefits he or she has to pay particular attention to the mix of goods and services in his or her shopping stop.

Figure 2 Branch-groups: Comparison of mean relative potential values



2.2 Dimension of Attractivity: Interaction

To explain suscipient trade, Nelson refers to the attraction of any nodal point, e.g. retail, services, traffic, or anything else.

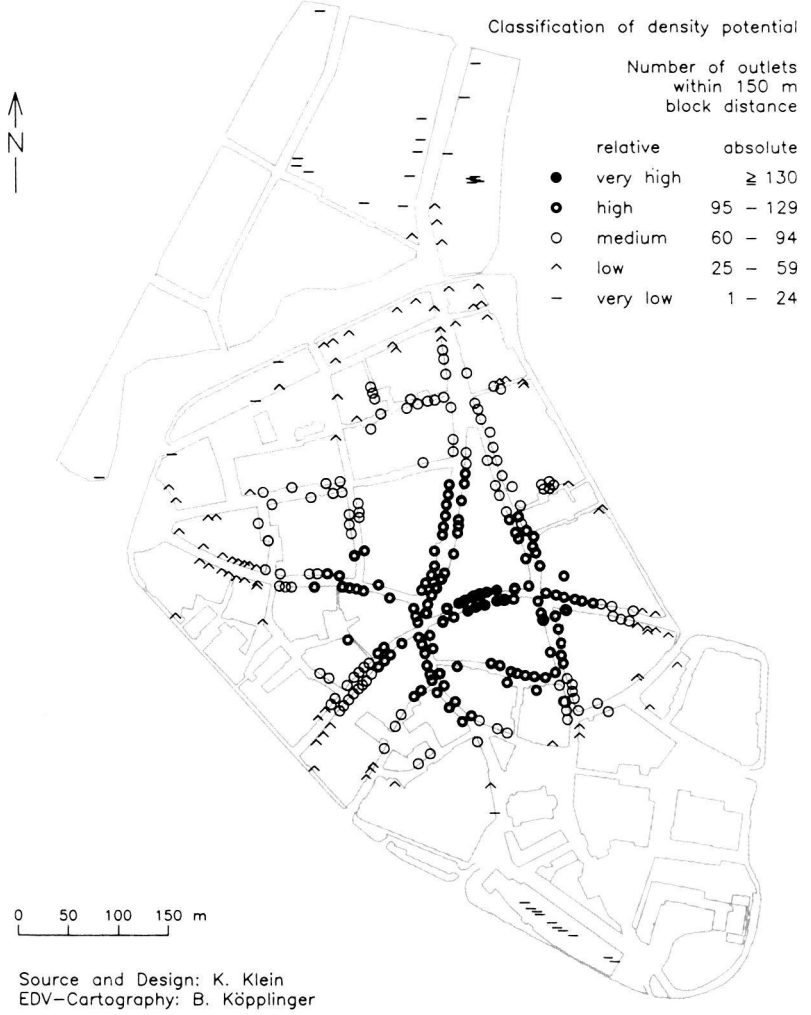
If we concentrate on retail locations, we find that their ability to attract customers depends on the quality of the branch to which they belong, and the quality of the single retail outlet within the whole branch. Similar considerations led SEDLACEK (1973) and GUSTAFSON (1973) to define centrality of a node as the amount of interaction which it can attract.

As a measurement of the quality of the single retail outlet, its selling floorspace is subdivided according to the branch groups offered. Each share is measured in average terms of the corresponding branch group.

As a measurement of the quality of a branch, the maturity of demand is frequently used. SEDLACEK operationalizes this indicator by estimating the number of visits to shops of a certain branch within a given period of time. But this procedure is only possible if the catchment area of retail locations is delimited first. Even then, the frequency of visits will vary due to locational and socio-economic boundary conditions.

In order to overcome this problem, the close relationship between the frequency of demand and stock turnover is used.

Figure 3: Oldenburg City Centre: Density Potential of Retail Locations



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Values for stock turnover have been surveyed directly from the retail shops, or - where missing - estimated with the aid of a time series from data published by the Institute of Trade Research in Cologne (INSTITUT FÜR HANDELSFORSCHUNG, 1981-1991). They vary with the size of floorspace and the organizational form of the establishment.

These considerations lead to a second basic dimension of the attractivity of a retail location, called interaction potential. With regard to the definition of centrality made by SEDLACEK and GUSTAFSON, the underlying statement can be formulated as follows:

> "The attractivity of a retail location depends on the degree of centrality for itself and adjacent locations".

Operationalization:

$$(5)\ I_i := \sum_{j \in N_i} \sum_{k \in BG} s^k(j) * \frac{F_j^k}{F^k}$$

I_i : potential of interaction for outlet/location i

$s^k(j)$: stock turnover for k-th branch group of shop j

F_j^k : selling space of k-th branch group of shop j

F^k : average selling space of k-th branch group

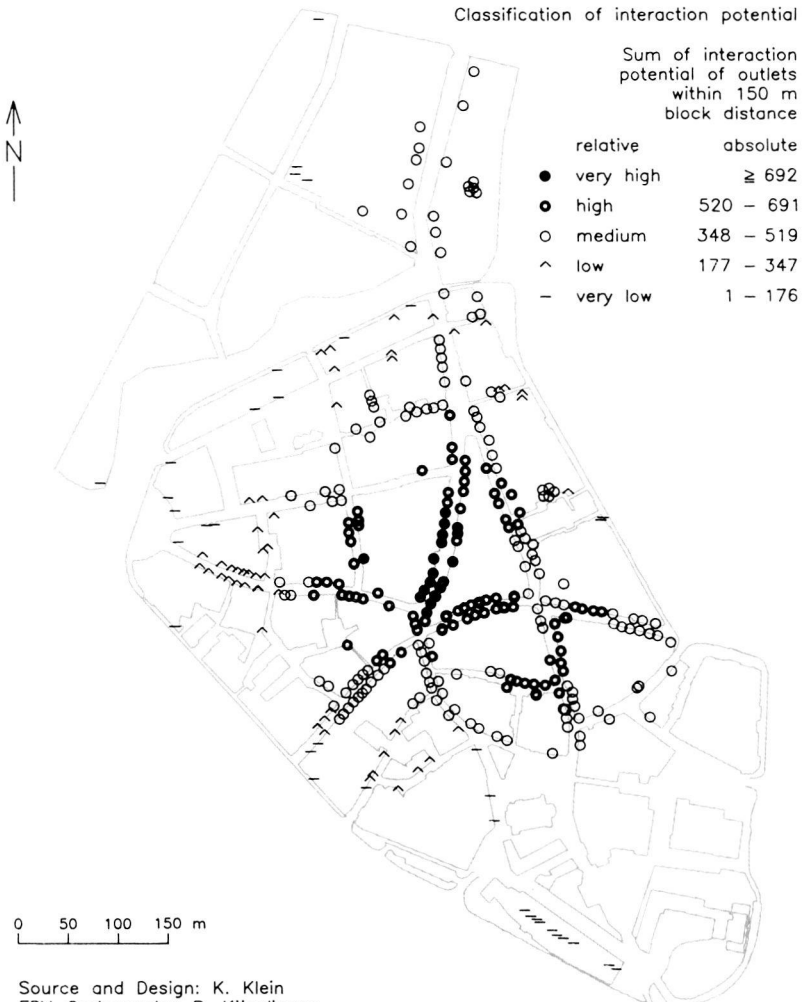
BG : Set of branch groups (fig. 2)

Statistical parameters (tab. 3) reveal the superiority of traffic-orientated locations at the urban periphery to those in the city centre, a situation which is borne out by reality.

Tab. 3: Interaction: Statistical Parameters for Absolute Potential Values

INNER-URBAN TYPES OF LOCATION	NUMBER OF OUTLETS	x	s	min	max
1 city centre	391	434	173	1	807
2 prior road network	491	74	79	1	364
3 intermediate loc. within resid. areas	170	27	35	0	156
4 urban periphery	68	552	353	3	855

Figure 4: Oldenburg City Centre: Interaction Potential of Retail Locations



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The pattern of relative potential values within the city centre (fig. 4) shows two significant differences from the former approach. First, the concentration of very high values has shifted from Schüttingstraße to Lange Straße because of the cluster of clothing shops on the latter. Second, there is not necessarily a decrease in values from central locations to periphery, as can be shown in the surroundings of the northern department store.

It must be noticed that this measurement takes into consideration the assortment structure within the surroundings of a location, and can be seen as an attempt to evaluate the potential of shared business.

2.3 Dimension of Attractivity: Mix of Goods

The origins of shared business in a retail location can be traced back to the property; either

- the outlet belongs to a set of **complementary** units - that is, compatible units with a high incidence of customer-interchange, or
- the outlet belongs to a set of **similar** units, which together can draw more business than individually.

The third answer to our first question "Which circumstances stipulate the attractivity of a retail location" then has to consider two different aspects with regard to the retail line:

- in branches satisfying the basic demand, the completeness of the assortment within the neighbourhood increases the attractivity;
- while in branches offering goods for non-basic demand, the existence of shops with similar or extended assortment-lines increases the attractivity.

The combination of these aspects gives a third answer to the introductory question:

> "The attractivity of a retail location depends on the degree of completeness of the assortment-structure within the neighbourhood" (mix of goods).

Problems of its operationalization will now be discussed: There are many empirical approaches to the definition of catalogues for the complete assortment structure corresponding to centre hierarchies (e.g. BORCHERDT, 1976; DIETSCHE, 1984 for Stuttgart), or to the estimation of the appropriate supply under planning aspects (e.g. BUGMANN, 1980 for St. Gallen) or the intra-trade linkages, as perceived by retailers (BROWN, 1987 for Belfast).

Another empirical approach was chosen here. Analyzing with cluster and discriminant analysis the purchases of shoppers in the Regensburg survey (KLEIN, 1988) in 1987/ 1988, 12 distinct shopping clusters (or trading groups) were isolated.

One of these trading groups contains grocery, bakery, butcher, and forms together with pharmacy and stationery the basic demand.

For calculation purposes, the whole assortment of each outlet has to be split up into trading-group components. Only those components of adjacent shops which are also offered by the location under investigation will be considered here. In order to evaluate the degree of completeness for components within the basic demand assortment, complementarity was sought, while for the remainder similarity was looked for.

Now the operationalization of the given statement can be tackled:

$$(6)\quad M_i := \left[\sum_{j \in N_i} \left(\sum_{t \in T_i} \frac{C_j^t}{C^t} + \frac{S_j^t}{S^t} \right) \right] * ON_i \quad \text{scaled}$$

with:

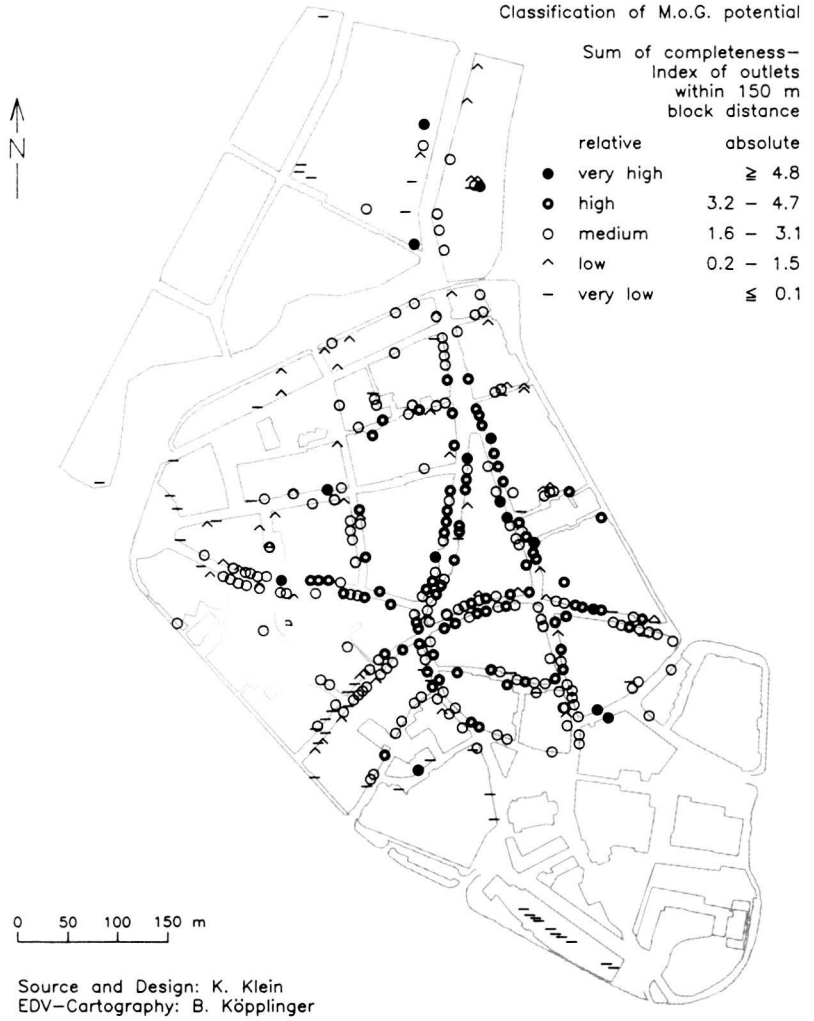
M_i :	potential of mix of goods for outlet/location i
C_j^t :	index of completeness for the t-th trading-group share in **basic demand** assortment of shop j
C_t :	minimum completeness level for t-th trading group
$S_j t$:	index of completeness for the t-th trading-group share in **non-basic demand** assortment of shop j
S^t :	minimum completeness level for t-th trading group
O_N :	index for choice of different organizational forms of retail trade; $1 \leqslant ON_i \leqslant 2$
T_i :	{ trading groups }

The attractivity of a retail location also depends on the possibility of choosing between different organizational forms of the retail trade (KLEIN, 1988, chap. 5.4). Thus, the value within the brackets is multiplied by an index dependent on the number of different organizational forms of retail trade within the neighbourhood of location i.

Tab. 4: Mix-of-Goods: Statistical Parameters for Absolute Potential Values

INNER-URBAN TYPES OF LOCATION	NUMBER OF OUTLETS	x	s	min	max
1 city centre	391	2.3	1.5	0	11
2 prior road network	491	0.2	0.4	0	3
3 intermediate loc. within resid. areas	165	0.2	0.3	0	1
4 urban periphery	68	1.8	1.9	0	11

Figure 5: Oldenburg City Centre:
Potential of Mix of Goods of Retail Locations



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The obtained statistical parameters (tab. 4) show the dominance of city centre locations, but also the efforts of centre managers in the urban periphery to achieve a well-balanced assortment structure. Figure 5 differs considerably from figures 3 and 4: there is no longer a concentration of very high values, but high values still appear along the main shopping streets. Also, the continuous decrease in values from the middle towards the periphery has disappeared due to the fact that completeness of assortment structure is to be found selectively.

3. Empirical Evidence

3.1 Introductory Remarks

A straight procedure would be to test the theoretically-deduced measures of attractivity against an appropriate empirical indicator. For example, if standardized according to organization and branch-group, affects the annual turnover per unit of selling-space, it could be used as a testing variable.

Here a different approach will be followed. The offered measures have been deduced on the assumption that each retail location is perceived by the potential customer, and therefore can contribute to the attractivity of adjacent locations. But it is well-known that shoppers possess complete information neither about all retail facilities nor even about all components of assortment of a shop visited.

The question then is how the pattern of attractivity changes if the perceived instead of the actual distribution of store locations is taken as a basis for the calculations. Stability can be interpreted as a broad hint that the underlying statement implicitly includes behavioural aspects.

The following representations are restricted to the circumstances within the city centre. They include some remarks about the actual consumer behaviour and a brief discussion of the results of the various attractivity measures after recalculation.

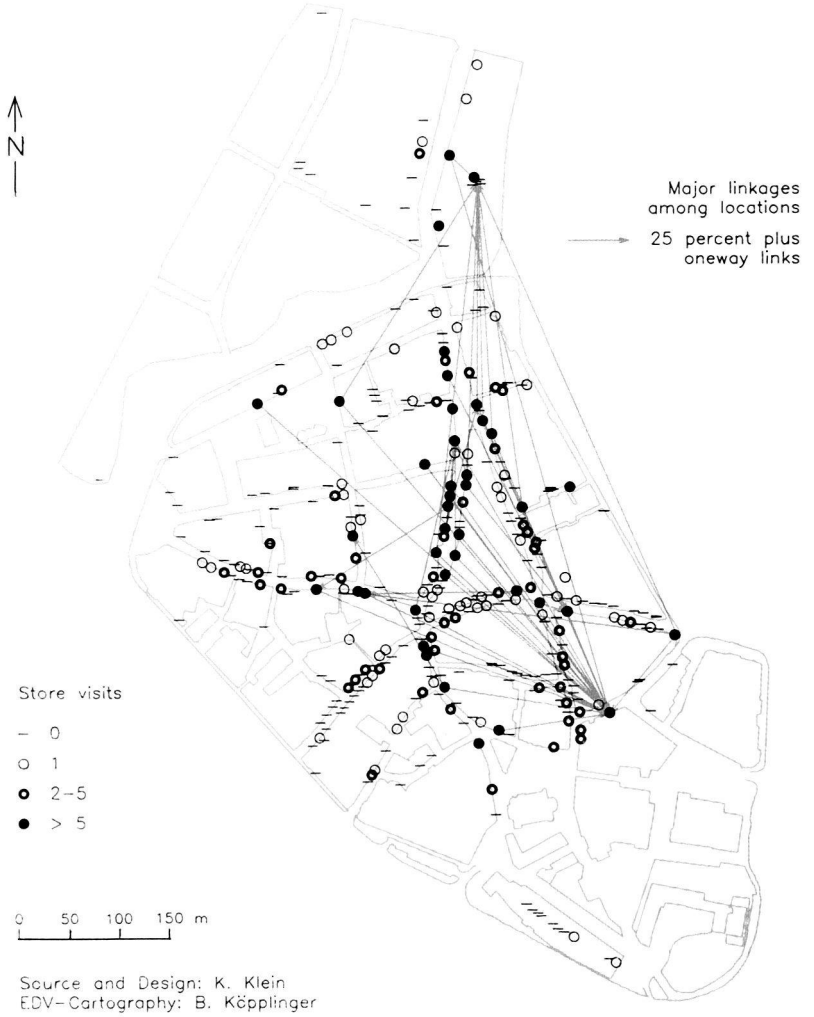
3.2 Consumer Behaviour

Figure 6 has been derived from the data of a street-interview questionnaire survey. One question which visitors were asked dealt with their shopping efforts on the actual shopping trip, including all shops visited with or without purchases. This sub-sample consists of 589 responses from visitors.

160 separate establishments were visited by the interviewees, which is 41% of the total establishments. An average of 2.2 shops were patronized during each trip.

The three shops most frequently patronized are the two biggest department stores and a local trendsetter clothing shop. Among the 11 establishments visited very often there

Figure 6: Oldenburg City Centre: Store Patronage



are, in addition to the dominating clothing shops, a bookshop, a drug-and-perfume discounter, and a fancy variety shop.

From the store patronage shown, three special features can be discerned:

- the selectiveness of choice with respect to spatial connectivity, as well as to frequency of visit
- the dominance of the high street (Lange Straße)
- and the isolation of supermarket locations with no effects on adjacent locations (with the exception of the food basement within the department stores).

As mentioned above, the unplanned city centre of Oldenburg has a favourable gradient of tension. This appears in the linkages in store patronage. The locations of the key trading stores and their interrelationships dictate the general directions of movement inside the city centre. This pattern is superimposed by the links between attractor stores and smaller shops belonging to the same trading group.

Incidentally, links seldom cross the circular tour of visitors which is predetermined by the two main shopping streets.

3.3 Recalculation of Attractivity

The combined effects of generative, shared, and suscipient business are reflected in the reported consumer behaviour. In order to separate them, the proposed measures of attractivity are recalculated. Thereby, it is assumed that all shops visited with a frequency above the expectation value approximately constitute the perceptional image of city centre visitors.

Density

Reformulation of the statement:

> The number and density of consumer-perceived retail outlets within the neighbourhood of a store increase its attractivity.

This seems plausible because it is the facilities belonging to the information field of the visitors which attract passers-by, and therefore cause suscipient business.

Recalculation shows a general decrease of absolute values. The spatial pattern of relative values shows the shift of concentration of very high values from the mean centre of coordinates of retail locations (Schüttingstraße) to the high street (Lange Straße), and a marked decrease in potential values for outlets on Schüttingstraße. The impression of a gravity-field-like decline from the core of the city to its periphery is interrupted by isolated attraction points (locations with food and beverage stores).

Comparison of theoretically-estimated values with recalculated ones gives a Chi-square-based standardized coefficient with a contingency of 0.73, which does not indicate a very strong relationship.

Interaction

Reformulation of the statement:

> The attractivity of a retail location depends on the degree of centrality possessed by itself and its adjacent locations, which are stored in the consumer perception image of the centre.

The difference from the former approach consists in the changed valuation of the quality of a single outlet within the whole branch: the criterion for this has been the selling floorspace measured in average terms of the appropriate branch group. Now this objective measure has to pass through the subjective filter of consumer perception to be relevant for the attractivity of adjacent shops.

The effect can be best highlighted by comparing the spatial distribution of relative interaction potential values in the surroundings of two large stores before and after recalculation. Thus, the department store in the north, together with two adjacent outlets, turned out to be key traders and are now increasing the values within the neighbourhood. In contrast, a very exclusive clothing store with a selling space which is above average has not caught the attention of centre visitors, and interaction potential within its surroundings is therefore decreasing.

Although the overall pattern does not reveal a great difference at first glance, the standardized coefficient of contingency is the same as in the previous case of density potential.

Mix of Goods

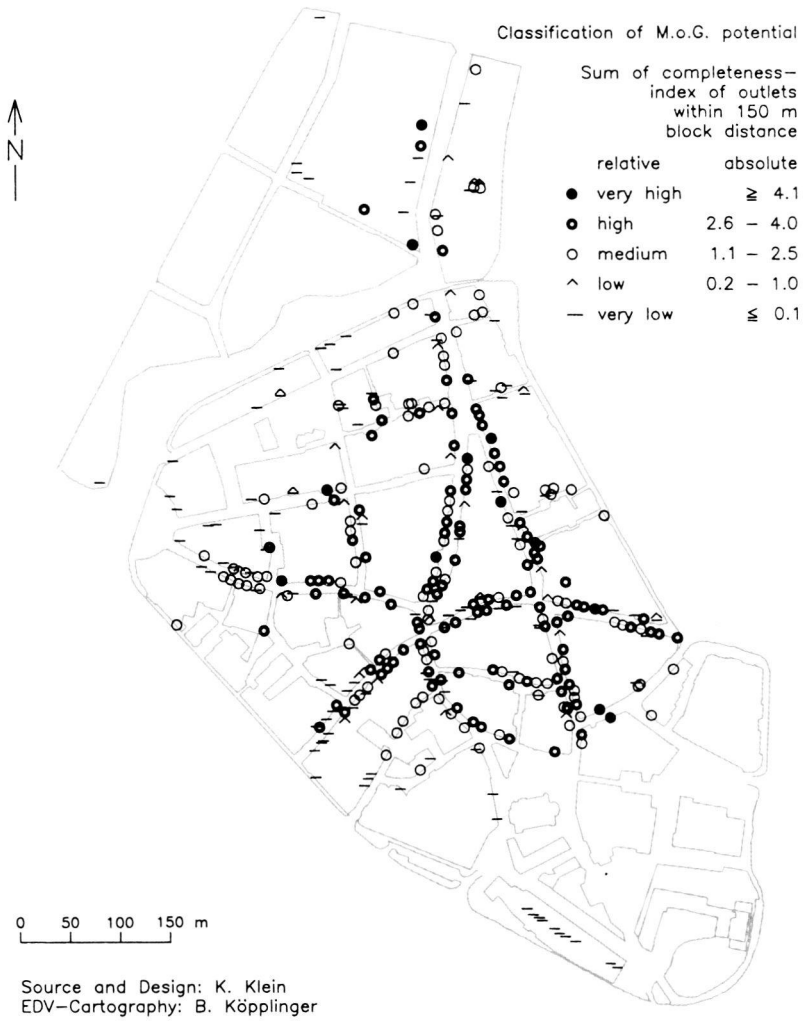
Reformulation of the statement:

> The attractivity of a retail location depends on the degree of completeness of the perceived assortment structure within the neighbourhood.

Compared with the former statements, this one assumes the highest degree of information: not only do existence and relative importance play a role, but some knowledge is also required about the adequate and proper clustering of store types. This is essential for making the desired purchases (convenience goods) or comparisons (shopping goods), or obtaining further information (speciality goods).

Although in contrast to former days most shoppers seem to be well-informed regarding fashion trends and purchasing facilities, the resulting information landscape will be highly distorted. This distortion is moderated in its effects on the attractivity of locations because city-centre trade undergoes a continuous specialization, leaving only a few dominant

Figure 7: Oldenburg City Centre:
Potential of Mix of Goods of Retail Locations
in consideration of consumer behaviour



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trading lines. Among them are clothing, shoes, leather, jewellery, and bookshops, with a very high density of locations.

Thus, comparison after recalculation reveals a close coincidence with a standardized coefficient of 0.95 (fig. 7).

4. Conclusion

Within the theoretical considerations given by Nelson about different types of retail locations and their relationships to business types, the question of contributions towards the attractivity of a retail location was tackled.

Three dimensions of attractivity were isolated:

- the **density of shops** within the neighbourhood of a given retail location as a basic requirement for passing-trade, that is suscipient business;
- for shared business, the **interaction potential**, and
- the **mix-of-goods** potential.

The **interaction potential** is additive in the sense that all components of assortment present in the neighbourhood increase the attractivity of a given location. In contrast to this, while measuring the completeness of the **mix of goods** within the neighbourhood of a given store location, only those parts of adjacent assortment will be considered which correspond to the trading group(s) offered by the store itself. On the level of single branches this is then an integral approach to measuring the potential of a retail location.

The testing of the theoretical approaches has been conducted under the assumption that only consumer-perceived locations within the neighbourhood of a certain retail location contribute to the potential value. Comparison of the calibrated pattern of relative potential values with those presented in section 2 shows a satisfactory contingency only for mix of goods. This confirms the findings about store choice as a consequence of the attractivity of store location (KLEIN, 1988, p. 214; SCHNEIDER, 1989; TIMMERMANS, 1980).

Further investigations were aimed to determine the relationship between the three different approaches. In addition, the basic assumption about the maximum distance over which one establishment can influence the success of another has to be discussed. It is possible that this activity range and the pedestrian's critical walking distance differ considerably.

In a wider research perspective, the effects of the pattern of attractive locations on the restructuring of retail trade has to be examined. There is considerable evidence that - in contrast to Garner's model of retail location - shops with a specialized assortment meeting a high elasticity of demand will be forced out of the most attractive locations by those which earn their profit from volume rather than margins. They can not afford intense

advertising and therefore need attractive locations. Their disappearance will be a further step towards the simplification and uniformity of inner-urban retail structure.

The development of practicable measures for the attractivity of retail locations therefore remains a worthwhile task within retail geography.

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