

# **The mental map of Dutch entrepreneurs**

## **Changes in the subjective rating of locations in the Netherlands, 1983-1993-2003**

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### **Abstract**

Empirical studies on firm location and migration show that actual location decisions are often based on incomplete and inaccurate information about potential locations. Decision makers seem to be guided by their subjective interpretation of reality, not so much by reality itself.

Twenty years ago this fundamental idea was the starting point for a research program of the Faculty of Spatial Sciences of the University of Groningen that focussed on the subjective rating of locations by Dutch entrepreneurs. The first picture of this subjective valuation, based on an extensive postal enquiry, was taken in 1983 (Pellenbarg 1985) and repeated by an identical project in 1993 (Meester 1999). A third enquiry, again identical to the first and second, was held in 2003. On the basis of the three projects a true comparison can now be made of the mental maps of Dutch entrepreneurs in the years 1983, 1993, and 2003.

This paper describes and analyses the three mental maps. Moreover, the data are used in a factor analysis, to try to establish the basic influences that form the entrepreneurial mental maps. It shows that the basic shape of the mental maps (a dome with centrally located Utrecht as a summit) did not change much in twenty years. A closer look however, reveals that the dome is flattening. In the first period (1983-1993) we witness a decrease of appreciation of the locations on its West flank (the 'old' Randstad) while in the second period (1993-2003) this decrease extends to the Eastern parts of the Randstad. The factor analysis suggests that three fundamental dimensions determine the entrepreneurs' judgments: potency, activity, and evaluation. Potency may be understood as centrality of location. Activity is correlated to agglomeration. It is hypothesized that landscape and culture determine the evaluative dimension.

## **Introduction**

The central issue in neo-classical location theory is what the best place would be for a firm from an 'objective' standpoint – that is, from an economic point of view. Much attention is given to finding the optimum location for a plant, determined by spatial differences in costs and revenues. In the neo-classical approach to firm behavior, decision makers are considered to be fully informed and acting rationally. Actual location decisions, however, are often based on incomplete and inaccurate information about potential locations. Simon (1957) and Pred (1967) point out the limited information that entrepreneurs have and their limited ability to use this information. Decision makers seem to be guided by their subjective interpretation of reality, not so much by reality itself, and because of this, a behavioral approach to location decisions seems to be more appropriate than the neo-classical view.

In a study of firm migration in the northern part of the province of North Holland, Pellenbarg (1977) found a large number of entrepreneurs who regretted their choice afterwards. In many cases, the information that had played a role in the decision-making process turned out to be incorrect. This finding, supporting the behavioral approach of firm location decisions, has been the concrete impetus behind the investigation of the subjective rating of locational environments by entrepreneurs, carried out by the authors of the present paper. A survey in 1983 was the point of departure for a line of research that has been followed at our Faculty ever since. Several reports about these studies have been published (e.g. Pellenbarg & Meester 1984; Pellenbarg 1985; Meester 1994, 2000, 2004).

An important element in this line of research is a number of postal surveys of firms that were carried out for various study areas, particularly the Netherlands, the northern Netherlands, and Germany. These surveys were designed to measure the locational preferences of entrepreneurs, and they were all set up in a similar fashion. The survey in the Netherlands that was carried out in 1983, was followed by similar surveys in 1993 and 2003. The fact that the locational preferences of Dutch entrepreneurs have thus been recorded in an identical manner three times, with ten year intervals, creates a unique opportunity to study the development of locational preferences over a rather long period of time.

In this paper, attention will be focused on the data collected by way of these three surveys. In each case, the questionnaire essentially consisted of a map mentioning 70 locations in the Netherlands. Respondents were asked to rate each of these locations on

a five step ordinal scale, thus expressing its suitability as a location for the firm in question. The research population was confined to those firms that would be capable of judging locations in the entire country. Manufacturing industries and several lines of service industries (wholesale, transport, construction, etc.) were selected. Non-profit organizations, branch plants, and companies with less than ten employees were excluded. For every survey, a systematic sample of firms was drawn from this population.

1800 firms were approached per survey. The rate of response was 36, 40, and 30 % for the three surveys, respectively. Forms from companies with a market area covering only a part of the research area were skipped. Forms with more than 10 % missing data were also excluded. The outcome is a number of 388, 370, and 271 usable forms, respectively.

### **Average rating of locations**

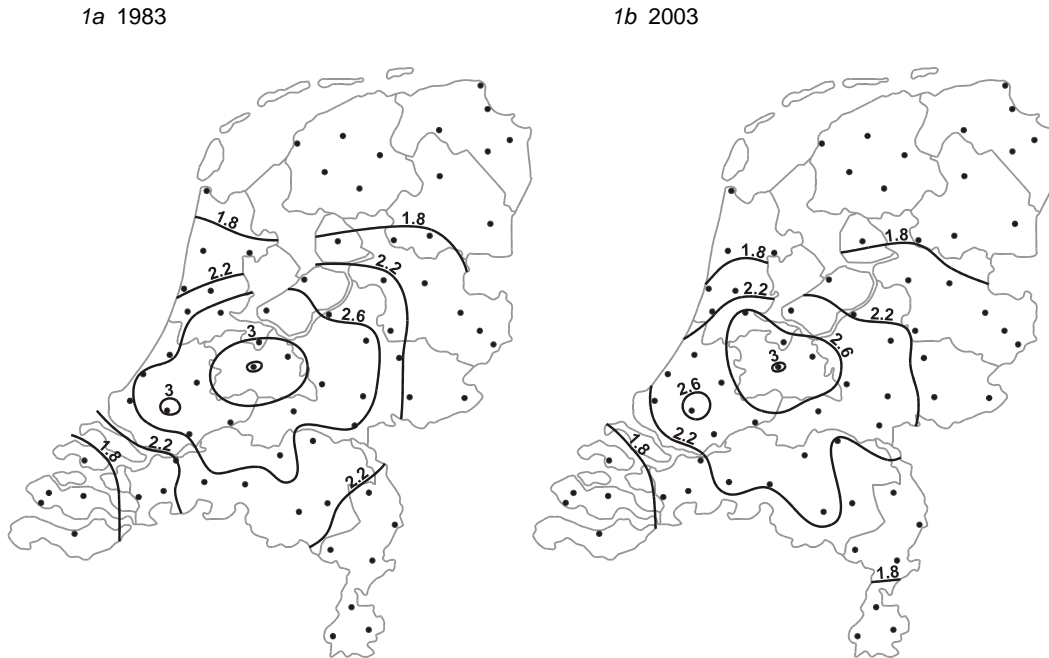
The general pattern of ratings that emerges from the 1983 survey in the Netherlands is characterized by a fairly simple structure. The center of the Netherlands – specifically, the province of Utrecht – gets the highest ratings, and from there the rating declines in all directions (Figure 1a). The course of the isopleths also indicates the existence of a number of zones with a relatively high rating, radiating out from Utrecht in the directions of Rotterdam, Breda, and Eindhoven.

Additional inquiries and analyses show that the pattern of ratings, as shown in the map, can largely be explained by the interaction of a limited number of elements. One of these elements is a general preference for the center of the country, which can be explained in terms of access to the national market. The second element is the tendency of entrepreneurs to prefer their own environment as a location area, a phenomenon that can be referred to as ‘locational self-preference’ (Meester 2000, 2004). Yet another element is a preference for larger agglomerations. The pattern of ratings that is revealed by Figure 1a, thus reflects the importance of centrality and existing economic activity as location factors for firms.

The pattern of ratings in 2003 is largely identical to the one found twenty years before: high scores for places in the central part of the country and low scores for the peripheral regions, particularly the three northern provinces and Zeeland (Figure 1b). At first sight, few changes in the rating landscape seem to have occurred during the period under consideration. Even the secondary peak of Rotterdam shows up on both maps. A closer

inspection of the two maps, however, reveals that there actually was a shift in the locational preferences of Dutch entrepreneurs: the rating of places in the central areas has decreased.

Figure 1 Average rating of locations



A more detailed impression of the process of shift is given by Figure 2. It shows the changes in the rating of individual locations in the period 1983-1993 and 1993-2003, respectively. In the decade following the first survey, the decrease in the rating of places was concentrated in the Western Netherlands (Figure 2a). The results of *t* tests per place reveal that the decrease was significant for 10 locations, concentrated in the western part of the Randstad Holland and in the new province of Flevoland. In the second half of the study period, the area of decrease has shifted eastward, covering the eastern part of the Randstad and adjacent areas in the provinces of Gelderland and North Brabant (Figure 2b). The *t* tests show a significant decrease in rating for 25 locations, concentrated in these areas, within and just outside the -0.2 isopleth. Upward shifts in ratings have been relatively small during the first decade, and they were not statistically significant for any of the places covered by the survey. In the second decade, they were practically nonexistent.

Figure 2 Changes in the rating of locations

2a 1983-1993

2b 1993-2003



A direct comparison of the results of the first survey with those of the last one shows that no less than 30 of the 70 locations have decreased significantly in rating. They are concentrated in an east-west zone that covers the provinces of Gelderland, Flevoland, Utrecht, North Holland, and South Holland. The city of Amsterdam is an important exception in this respect. Its decrease in rating is not significant, suggesting that its competitive position within the Randstad area has become stronger during the period under consideration.

A plausible explanation for the decreased rating of the Randstad would be the increased congestion on the roads in that region. Entrepreneurs look upon accessibility as an important location factor. Therefore, it should be expected that the problem of congestion has a negative effect on the rating of the Randstad as a possible location area. The fact that the decrease started in the western part of the Randstad makes sense: this particular area was the first to be confronted with the consequences of congestion. Here, the distance that one has to travel through congested areas in order to reach less congested areas, is larger than elsewhere. The increasing scarcity of land and the rise in land prices in the Randstad, as mentioned by Kemper and Pellenbarg (1993), may also have played a part in the decreased rating of this area.

The decrease of the ratings in the adjacent areas during the second half of the study period should be seen in the same context. The problem of congestion has become

worse, and it has spread to other areas. Relative scarcity of land also is not limited to the Randstad any more. The provinces of Gelderland and North Brabant have to deal with these problems to an increasing extent.

### **Distance and rating**

The general preference of entrepreneurs for their own environment has been mentioned above as one of the main elements determining the rating of potential locations. A comparison of the Figures 1a and 1b shows that one of the most important changes in the rating pattern during the last two decades is that the difference in rating between the center and the periphery has become smaller. An obvious question, then, is whether this change is related to changes in the degree of locational self-preference. It is conceivable that firms in the Randstad area are less satisfied with their locational environment than they were in the past. Another possibility is that Dutch firms generally show a stronger locational self-preference, which would also result in a flattening of the rating pattern.

To gain insight into this matter, we need to quantify locational self-preference. In other words, the relationship between distance and the rating given to locations should be expressed in the form of a mathematical function. For this purpose, a new file was created for each of the surveys, in which every single combination of respondent and rated location represents a case. These files contain only two variables: the rating given to the location by the respondent, and the distance between the respondent's actual location and the rated location, calculated from their map coordinates.

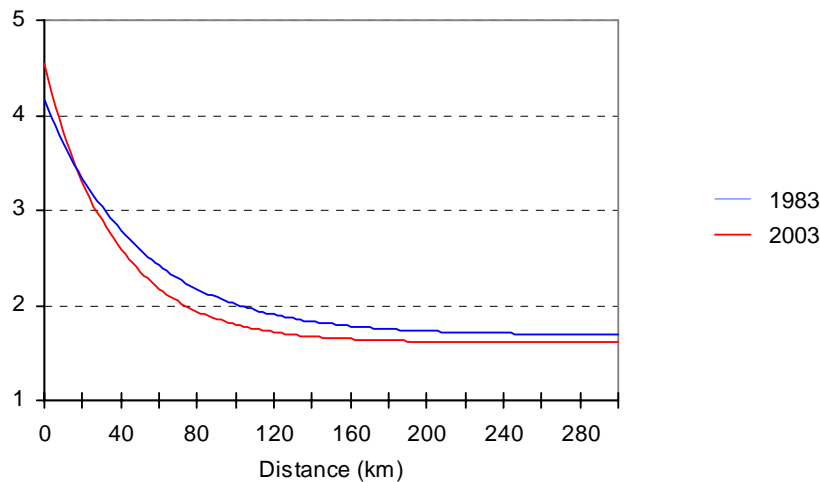
Several types of function have been examined. The modified exponential, a function which has been applied in time series analysis (Croxtton et al. 1969), was chosen because it describes the relationship between distance and rating very well. It explains a large proportion of the variance in the ratings, and graphically, it closely approximates the observed values (Meester 2000, 2004). Typical of the modified exponential is its horizontal asymptote or base level (Figure 3). In our analysis, the base level coincides with the average rating that is given to places that are far away. The function can be written as  $k+a.b^d$ , where  $d$  stands for distance. The three coefficients of the model,  $k$ ,  $a$ , and  $b$ , can be determined by nonlinear regression, in an iterative process.

The function coefficients of the modified exponential and the corresponding function curves can be used to examine whether or not changes in the relation between distance and rating actually have occurred. Figure 3 and Table 1 show the results. Clearly,

locational self-preference has increased in the Netherlands during the period under consideration.

The starting value of the function, representing the rating of the firm's own location, has increased for instance. At the same time, the end value, representing the rating of distant places, has decreased (Figure 3, Table 1). In other words, the difference between the rating of nearby and that of distant places has become larger. Function coefficient  $a$  expresses the difference between the starting value and the end value of the curve. Calculated on a collective basis, it increased from 2.49 in 1983 to 2.93 in 2003 (Table 1). Worth mentioning is also the turning point, defined as the distance for which a neutral rating is predicted. It has come closer to the firm's location, which is another indication of an increasing degree of locational self-preference.

Figure 3 Rating of locations and distance



Scale: 1 = very unfavorable, 3 = neutral, 5 = very favorable

Table 1 Coefficients and indicators of the modified exponential

	1983	1993	2003
$k$	1.686	1.697	1.607
$a$	2.489	2.646	2.931
$b$	0.980	0.977	0.973
Starting value* ( $d=0$ )	4.17	4.34	4.54
End value* ( $d=\infty$ )	1.69	1.70	1.61
Turning point (km)	31	31	27

\* Scale: 1 = very unfavorable, 3 = neutral, 5 = very favorable

The proportion of variance in the ratings that is explained by the modified exponential has increased from 0.40 in 1983 to 0.48 in 2003. Therefore, the development of this statistic points in the same direction as the development of the function coefficients: an increase in the degree of locational self-preference for the Netherlands as a whole.

Analysis of the function curves for entrepreneurs in the Randstad provinces leads to results that are less consistent. The rating of distant places by entrepreneurs in the Randstad has increased, which seems to support the assumption of decreasing self-preference in that area. On the other hand, just like elsewhere, the starting value has increased and the turning point has come closer to the firm's location. The increase of the starting value is considerably larger than the increase of the end value, so we may conclude that even in the Randstad area, locational self-preference has actually become stronger.

### **Patterns of thought**

Studying average ratings, interesting as they may be, does not give much insight into the differences between the individual survey questionnaires, or into the patterns that these questionnaires have in common. Individual respondents tend to distinguish groups of places that they give a common rating to. By calculating mean ratings, these patterns are hidden from view. Factor analysis is a technique that lends itself well to revealing patterns that are hidden in the data material.

Holvoet (1981) put the technique to good use in his analysis of the rating of locations in Belgium. He had a group of economics students rate locations in Belgium as possible sites for firms, and applied principal components analysis to the data. The three components that he identified represent important and recognizable oppositions, namely Flanders versus Wallonia, the old industrial areas along the rivers Meuse and Sambre versus the rest of Belgium, and the opposition between the large agglomerations Antwerp and Brussels versus the periphery. These oppositions can be seen as patterns of thought that are apparently related to location factors.

In our research, we have applied factor analysis as well. For each of our surveys, the respondents are treated as cases, and the variables are linked to the places subject to rating. The type of factor analysis that we chose to apply is principal components analysis with varimax rotation. To determine the optimal number of components to be rotated, Dirkzwager's (1966) hierarchy model was used. This model implies that separate rotations are carried out on successively larger numbers of factors. In this



manner, one sees new factors arise, either by splitting a factor or by forming new factors alongside the existing ones. By following this process step by step, one gains insight in the structure of the factors. In factor analysis, the identity of the factors is usually determined on the basis of the matrix of loadings. In this case, the interpretation of the results is facilitated by the fact that each of the variables is linked to a location. This makes it possible to depict the factor loadings in maps.

For the 1983 and 1993 surveys, the principal components analysis led to similar results. In both cases, the result of the rotation of three components lends itself best to interpretation in terms of location factors. For that reason, this variant was selected for further analysis (Meester 1994). Figure 4 shows the loadings on the three rotated components for the 1993 survey. The patterns for 1983 are almost identical.

The first component, depicted in Figure 4a, expresses an opposition between the center of the country and the periphery. If we want to interpret this component in terms of location factors, an interpretation as 'relative location with respect to the national market' is self-evident.

The second component shows an opposition between the coastal provinces and the East and South of the country (Figure 4b). The pattern displayed here shows remarkable similarities to the pattern of residential preferences in the Netherlands. Therefore, an interpretation as 'residential environment' seems appropriate.

The third component displays a pattern of high loadings in the West of the Netherlands and low loadings in the eastern periphery (Figure 4c). The area that is bounded by the 0.6 isopleth coincides almost precisely with the Randstad. Apparently, agglomeration effects manifest themselves in this component as a location factor. Under this heading fall the advantages of agglomerations but also the disadvantages, such as congestion, lack of space, high land prices, etc.

The correspondence of the results of the surveys of 1983 and 1993 is remarkable. The identity and the order of the three rotated components are the same. Also the proportion of explained variance is virtually unchanged (59 and 61 %, respectively), and even the factor loadings are essentially the same. All these results must be interpreted in light of the fact that the respondents in the second survey are not the same ones as in the first.

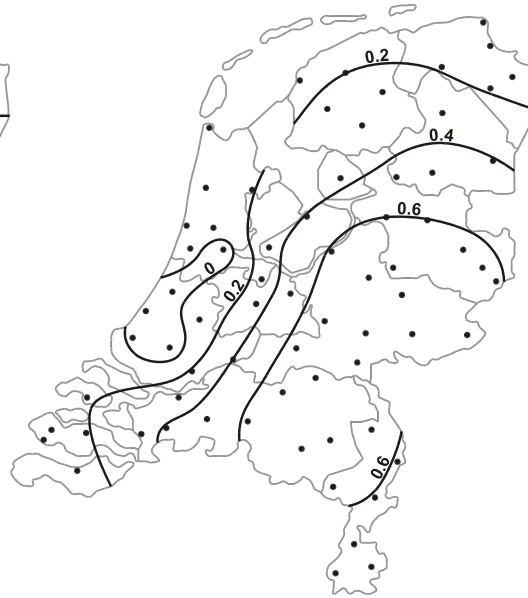
Because the general pattern of locational preferences is still the same in 2003, one might expect to see similar results for the principal components analysis as well. This turns out not to be the case, however. The main results, which are not shown in maps here, can be summarized as follows.

Figure 4 Principal components analysis, rotation of three components, 1993

4a Loadings on factor 1



4b Loadings on factor 2



4c Loadings on factor 3



In 2003, component 1 and 3 seem to have changed places. At the same time, their patterns of loadings have changed substantially. The opposition between center and periphery is represented by the third component now. Its central point has shifted westward. The first component in 2003 shows an opposition between an area consisting of South Holland, Utrecht, and North Brabant, on the one hand, and the northeastern

periphery on the other. If it would represent agglomeration effects, this would mean that its center of gravity has shifted southward.

The second component seems to be new. It expresses an opposition between the southern provinces of North Brabant and Limburg, on the one hand, and the central and northern Netherlands on the other. The lowest loadings for this component are found in an area that includes Amsterdam, Utrecht, and Almere, with Hilversum as its central point. It is not easy to interpret this opposition in terms of location factors.

Rotation of three components has yielded results that lend itself rather well to interpretation, not only for the first two surveys in the Netherlands, but also for similar surveys that were held in the northern Netherlands and Germany (Meester 2004). The same is true for Holvoet's research in Belgium. Thus, the results for the Netherlands in 2003 seem to deviate rather strongly on this point.

Again, it is Dirkzwager's model that helps to gain more insight in the matter. The choice to rotate three components for the survey of 2003 was made for reasons of consistency. Applying the method of Dirkzwager to the data for 2003, it turns out that in this case, rotation of four components uncovers patterns that are easier to interpret. Figure 5 shows the loading patterns for these components. It is interesting to note that, if we rotate four instead of three components for 1983 and 1993 as well, the results prove to be basically the same for all three surveys. Apparently, the identity of these four components has not changed during the period under consideration.

Component 1 and 4 look familiar. The first component expresses the opposition between center and periphery, and can be interpreted as 'relative location with respect to the national market' (Figure 5a). Its center of gravity is close to the city of Utrecht. Component 4 represents the opposition between the densely populated Randstad area, and therefore, interpretation as 'agglomeration effects' is appropriate (Figure 5d). The loading patterns of these two components resemble the ones shown in Figure 4a and 4c, respectively.

The pattern that is displayed by the third component (Figure 5c), shows a number of characteristics that are also found in Figure 4b. Particularly, the high loadings in the province of Gelderland and the low loadings in the western Randstad should be mentioned. Since Gelderland is one of the most highly rated residential areas in the Netherlands, there might be a relation with residential attractivity as a location factor here, but the pattern is different in some respects.

Figure 5 Principal components analysis, rotation of four components, 2003

5a Loadings on factor 1



5b Loadings on factor 2



5c Loadings on factor 3



5d Loadings on factor 4



Component 2 expresses the opposition between the southern provinces, on the one hand, and the central and northern Netherlands, with Hilversum as the center of gravity, on the other (Figure 5b). The pattern of loadings is the same as the one that was found for the second of three rotated components for this survey, the one that seems to be new. As mentioned, it is difficult to interpret in terms of location factors. It is a fact that

North Brabant and Limburg constitute a catholic area within the mainly protestant nation of the Netherlands. The mentality of the inhabitants of this southern region is considered to be different, more exuberant than elsewhere in the Netherlands. Therefore, a relation with aspects of culture can not be excluded.

### **Dimensions of meaning**

The application of principal components analysis to the rating of potential firm locations in the northern Netherlands and Germany uncovers components of a similar nature as the ones revealed in Figures 4 and 5. For each of these areas, we find components that can be interpreted as relative location and as agglomeration effects, in addition to components of a subjective nature that seem to represent the quality of the residential environment and language and/or culture (Meester 2004). Some of these components can also be found in the outcome of the research by Holvoet (1981) in Belgium. In combination with their apparent general validity, the nature of the identified components allows them to be linked up to the results of research in psychology, especially those obtained by Osgood et al. (1957).

Osgood et al. used factor analysis to explore the relation between various types of scales, in general but also as applied to individual concepts. They analyzed a wide range of data matrices. The most surprising outcome is the consistency of the results: no matter which concepts are being analyzed, the resulting factors are essentially always the same. The three most important factors that result, time and again, are identified by Osgood et al. as 'evaluation', 'potency', and 'activity'.

The first factor (evaluation) represents moral judgments and subjective evaluations such as pretty-ugly. The second factor (potency) refers to oppositions such as large-small and strong-weak. It covers all types of scales that can be used to determine the position of an object by means of objective measurements. The third factor (activity) is the dynamic element of the set. This factor consists of typical oppositions such as fast-slow and active-passive. Together, these three factors comprise the main dimensions of the meaning of any concept.

The research described in the present paper also deals with the meaning of concepts, specifically towns, as interpreted by individuals, specifically entrepreneurs. An important difference with the research by Osgood et al. is that the study of the locational preferences of entrepreneurs is one-dimensional in a sense. It is about the suitability of places as a firm location, a characteristic that is comparable to the evaluative dimension.

Nevertheless, the nature of the oppositions expressed by the components that we have found makes it possible to recognize all three dimensions in these components.

The dimension which has been denoted as potency can be identified in the component that has been interpreted as relative location with respect to the national market (Figure 4a and 5a). Relative location, interpreted as distance to the market, can be measured in objective terms. Formulated as the opposition close-far, it is a clear representative of this particular dimension.

The dimension of activity is represented by the component that has been interpreted as 'agglomeration effects' (Figures 4c and 5d). Agglomeration effects are obviously associated with differences in dynamics and activity.

The evaluative dimension is recognized in its purest form as residential environment – the personal, most subjective element in the rating of locations for their suitability for firms. When three factors are rotated, this dimension is represented by component 2 (Figure 4b).

It is an interesting question whether the parallel may be extended to those components that are the most difficult ones to interpret, i.e. the second and third component of the four depicted in Figure 5. In that case, at least one of these two components, and perhaps both, would represent the evaluative dimension. The interpretation of component 3 as 'residential environment' and the suggested relation of component 2 with aspects of culture support this view. Both components would represent an aspect of the evaluative dimension. Component 3 can be associated with landscape (Figure 5c) and component 2 with culture (Figure 5b), two major aspects of residential environment as a location factor for entrepreneurs. In the results of the rotation of three components for the surveys of 1983 and 1993, these two oppositions are combined in the component representing residential environment (Figure 4b).

## **Conclusion**

A comparison of the mental maps of Dutch entrepreneurs in 1983, 1993, and 2003 shows that the basic shape of the mental maps – a dome or 'mountain' with centrally located Utrecht as its summit – has not changed much in twenty years. This supports the conclusion that the basic structure of mental maps does not change much over time. A closer look however, reveals that some details of mental maps do change significantly. The central dome is clearly flattening. In the period between 1983 and 1993, we witness

a decreasing appreciation of the locations on its west flank while in the period between 1993 and 2003, this decrease extends to the eastern flank.

The results of factor analysis on the survey data suggest that three fundamental dimensions determine the rating of possible firm locations by entrepreneurs: potency, activity, and evaluation. Potency may be understood as centrality of location. Activity is correlated to agglomeration size. Landscape and culture probably determine the evaluative dimension.

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