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**SWP 22/93 DIFFERENCES IN COGNITIVE MODELS  
OF BUYERS AND SELLERS**

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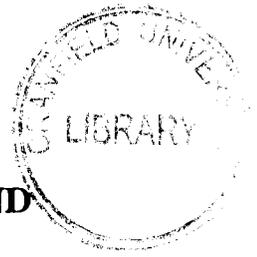
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# **DIFFERENCES IN COGNITIVE MODELS OF BUYERS AND SELLERS**

## **SUMMARY**

It is a dominant assumption in management science that strategic decision making and implementation is facilitated by managers sharing homogeneous cognitions of competition, an assumption that has surfaced in some cognitive studies of competitive industry structures. This paper tested this assumption, using a sample of 24 managers from the off-shore pumps industry, supplemented with information from 17 managers involved with the purchase of pumps. A variety of cognitive mapping methods were used, and maps were compared using a self-rating methodology. The results indicated that managers' mental models of competition are diverse rather than homogeneous. The results also indicate that this diversity increases as company boundaries are crossed, as functional boundaries are crossed and as industry boundaries are crossed into buyer/supplier relationships. The results also suggested that managers' ability to recognize others' mental models of competition follows a similar pattern, but that recognition of others' mental models may be more widespread than cognitive similarity. It is concluded that future cognitive studies of competitive industry structures assess recognition as well as similarity, and that recognition of others' mental models may play an important role in strategic decision making and implementation.



## INTRODUCTION

It is well documented that managers represent knowledge about a company, or a number of companies in memory in the form of mental or cognitive models (cf. Bartlett, 1932, Schank, 1982, Johnson-Laird, 1989). These mental models are simplifications, heuristics that may be used to circumvent the limited capacity of short term memory (Miller, 1956) in searching long term memory for relevant information. Thus, the structure and content of a manager's knowledge of his/her competitive environment influences the decisions s/he makes and the way s/he behaves (cf. Rips, 1975, Cherniak, 1984, Anderson, 1991).

It is implicit within the economic notion of the firm that managers arrive at coherent competitive strategies by sharing similar, if not the same, conceptions about whom the competition is, and the strategies that these competitors are following.

An alternative conception, not yet made in the management literature, is that managers may come to recognize each others' mental models through the processes of discourse (cf. Edwards, 1991). Thus managers may arrive at competitive strategy decisions through a process of understanding and recognition rather than necessarily through cognitive similarity. Similarly, marketing strategies may be implemented through an understanding of buyers' mental models rather than cognitive similarity with buyers.

Therefore, the aims of this paper are a) to examine the extent to which managers' mental models of competition are similar to each other and those of buyers b) to examine the extent to which managers recognize the logic underlying each others' and buyers' mental models.

*The structure of managers' mental models of competition.*

Categorisation theory (eg. Mervis and Rosch, 1981) has been used with some success to describe how managers think about their competitors (Porac and Thomas, 1990). According to this view, concepts that are similar are categorized together. Thus, information common to several concepts needs to be represented in memory only once. Hence, categorisation eliminates redundancy of information, therefore maximizing cognitive efficiency.

The way concepts are categorised has been implicated in the prediction of novel instances of a category (Anderson, 1991), decision making about concepts (Rips, 1975, Cherniak, 1984) and the way information about concepts is communicated (Edwards, 1991). Therefore, how managers categorise their competitors has very real implications for how managers analyse the competitive environment and how they make decisions about competitive strategy.

The contingencies surrounding the cognitive processes of categorisation are many and varied, thus leading to a great deal of debate in the literature about how categorisation actually takes place. However, a number of 'categorisation principles' can be gleaned from the literature, that are relevant to the study reported here. Firstly, categorisation is almost always probabilistic, with some members of a category being closer to the central tendency of a category than others (Smith and Medin, 1981). Secondly, category structures can be context dependent, such that different situations may lead a person to categorize the same objects in different ways (Barsalou, 1982). Finally, categorisation may take place by matching the features associated with category membership, or by applying naive theories about the nature of the world (Medin, 1989).

### *Homogeneity of mental models of competition ?*

Categorisation has been applied to competitive strategy through work on strategic groups (Hunt, 1972, McGee and Thomas, 1986). According to strategic groups theory, organisations within an industry may be categorised on the basis of similarities in their strategic characteristics, such that those companies that are following similar strategies are in the closest competition.

There are those who have argued for an examination of the cognitive bases of competition (eg. Thomas and Venkatraman, 1988). However, since strategic groups theory proposes that companies can be categorised by the application of objective economic indicators, it may imply that managers within one industry would categorise the companies operating in that industry in the same way. However, it is not clear whether strategic groups theory matches the implicit mental models possessed by managers (Thomas and Venkatraman, 1988).

Porac *et al* (1989) in an examination of the aggregate mental models of competition of managers in the Scottish knitwear industry asserted that the aggregate cognitive categories they surfaced corresponded to individuals' mental models, and thus that there was homogeneity of cognition in the industry as a whole (pg 405). However, since Porac *et al* assumed homogeneity, it is not possible to know to what extent the actual mental models of the participants are homogeneous, or whether homogeneity is an artifact of the methodology.

More recently, in a study of the Chicago banking industry, Reger and Huff (1993) concluded that cognitive categories of competition are widely shared by managers within an industry. However, their data indicate sufficient dissimilarity between managers for Reger (1990), in an analysis of the same data, to conclude differences in managers' cognitions of competition do exist. Similarly, data gathered by

Gripsrud and Gronhaug (1985) suggest there is little agreement about competition within even tight geographically defined markets. Therefore, although suggestive, the evidence is equivocal over homogeneity of managerial cognitions of competition.

Since mental models are determined, at least in part, by experience (eg. Schoenfeld and Herrman, 1982), and each individual's experiences will not be the same as other individuals, it may be expected that there should be divergence between individuals' mental models of competition. Indeed, some studies of managers' mental models of competition and other areas of management have demonstrated individual variability in managers' mental models (eg. Reger, 1990, Day and Lord, 1992, Langfield-Smith, 1992, Hodgkinson and Johnson, under review). Therefore, it possible to propose that:

Proposition 1) Managers' and consumers' mental models of competition are diverse, rather than homogeneous.

Notwithstanding this, it has been argued that managerial cognitions are influenced by the social and cultural environment in which managers work (Huff, 1982). Indeed, there is mounting evidence that this is the case, at least as far as managers' conceptions of the internal capabilities and strategies of an organisation are concerned. For instance, Spender (1989) considers each industry to have its own 'recipe'; a set of beliefs and assumptions common to most managers within that industry. Similarly to Spender, Johnson (1987) suggested that each organisation has its own set of beliefs and assumptions, to which he gave the name 'paradigm'. At a level even closer to the individual, Bowman (1991) found that the functional area of management that one occupies is a critical determinant of belief structures. Related to these findings, de Chernatony (1989) found divergence between the way marketers and consumers perceived competing grocery brands.

Therefore, although the available literature does not address the issue directly, it may be proposed that managers' mental models of competition will vary:

Proposition 2) across management functions (cf. Bowman, 1991).

Proposition 3) companies (cf. Johnson, 1987).

Proposition 4) and between managers within one industry and buyers (cf. Spender, 1991, de Chernatony, 1989).

*The bases of understanding others' mental models.*

Whilst previous studies may have assumed that cognitive similarity is the basis for strategic action, recent developments in cognitive psychology have begun to highlight the role of mental models in discourse (Edwards and Potter, 1992). Edwards (1991) considers mental models to be influential in conveying meaning during communication. Therefore, through the processes of communication managers may come to recognize, at least partially, the mental models of others, without necessarily exhibiting similarity. Thus, eventually managers may come to understand and recognize the logic underlying others' mental models with whom they regularly exchange information. Therefore, it may be expected that:

Proposition 5) managers within the same company recognize each others' mental models most readily.

Similarly, managers may also receive information from their competitors through trade magazines (cf. Spender, 1989). Thus, through the dissemination of information across an industry, it may be proposed that:

Proposition 6) managers recognize other managers' mental models from the same industry more readily than those of customers.

Managers oriented towards the external market may also receive information about buyers through either direct contact, sales force or market research (Assael, 1987). Therefore, through the dissemination of this information, it may be proposed that:

Proposition 7) Managers oriented towards the external market recognize the mental models of buyers more readily than managers oriented towards the internal organisational environment.

## METHODOLOGY

### *Participants.*

In order to control for individual difference variables, it was considered that an industry should be studied in which the managers and buyers had a) common career backgrounds, b) substantial tenure within that industry and c) who worked in strategic business units of approximately the similar size. On these bases, it was considered the North Sea off-shore pump manufacturers and their customers met these requirements.

Initially, ten pump manufacturing companies were approached at managing director level asking for co-operation. Five companies agreed to co-operate out of these ten, giving access to 24 managers. Between three to eight managers were interviewed per company, representing a wide range of senior managerial functions, such as managing director, sales and marketing director, manufacturing director and finance director.

Within these pump manufacturing companies, there existed little overlap in terms of job descriptions. Therefore, it was decided to operationalize management function by a simple dichotomy; whether the job focused upon the competitive environment (eg. tendering, sales and marketing, managing director was also included here) or whether the job was focused internally to the organisation (eg. engineering, finance, general manager).

A sample of customers was drawn from the off-shore contracts engineering industry and the oil industry. Companies operating in both these industries often have to purchase pumping equipment. Again, initial contact was made at the level of managing director, but interviews were conducted only with those people with knowledge of the off-shore pump industry. Out of 16 firms contacted, 10 agreed to participate, allowing access to 17 managers, who were either purchasing managers or engineering managers.

Therefore, a total of 41 managers were interviewed (although data from two of the buyers were discarded since they did not provide full information at the initial interviews). All the sample were male. They had been working in their present position for an average of 4.27 years (std dev = 5.12), working for their company for an average of 10.44 years (std dev = 6.66) and had been working for their industry for an average of 16.78 years (std dev = 7.93).

### *Mapping managers' mental models of competition.*

Each of the participants was administered a semi-structured interview, that typically lasted less than half an hour. The purpose of this interview was to uncover the participant's mental model of the relationships between competitors in the North Sea off-shore pump industry. In order to do this, cognitive mapping techniques were used.

Cognitive mapping techniques are methods used to assess the structure and content of individuals' mental models of given issues (Axelrod, 1976). In the present study, two empirically validated methods were used to elicit individual managers' cognitions of competitive industry structures; a simple visual card sorting technique (Daniels *et al*, 1993) and Kelly's repertory grid analysis (Kelly, 1955, Bannister and Mair, 1968). Visual card sort mapping and repertory grid can both be used to elicit an individual's cognitive categories (Brenner *et al*, 1985). By using more than one mapping technique, the robustness of the results are increased (Cook and Campbell, 1976).

Both techniques first required the participant to state which companies they perceived to be competitors in the North Sea off-shore pump industry. These names were written on cards. On the bases of these competitors, visual card sort mapping required participants to arrange the cards such that those firms in close competition were placed most closely together. The participant was then asked to state why the companies were arranged in the given manner in order to elicit the attributes of competition. Visual card sort maps are recorded by simply photographing the arrangement.

Repertory grid technique was used to elicit the attributes of competition from detailed comparisons between sub-sets of companies drawn at random, until the respondent could give no more novel bases of competition. After the interview, a postal questionnaire was mailed to each of the respondents, asking him to rate each of his named competitors on each of the attributes of competition he had previously (including attributes elicited by the visual card sort method). Two distinct repertory grid maps of the manager's mental model of competition were then derived by cluster analysis and principal components analysis of his questionnaire (Smith and Stewart, 1977). All managers from the pump companies returned these

questionnaires, and 10 out of 15 buyers returned the questionnaires, giving an overall response rate of 87.5%. Examples of visual card sort mapping, cluster analysis derived grid maps and principal components analysis derived grid maps are shown in figure 1.

INSERT FIGURE 1

*Rating the similarity and the extent of recognition of the maps.*

Since the maps were based on differing companies and differing attributes, standard statistical measures of similarity were not readily applicable to the data. Moreover, since a measure of the extent to which managers recognize the logic underlying each others' and buyers' maps was required, it was decided to ask managers to rate the similarity of the maps to their own mental model and the extent to which they recognized the logic underlying others' maps. Obtaining ratings of the similarity of two stimulus items is a common methodology in cognitive science (Bower and Clapper, 1989). Moreover, by averaging over 24 raters, the reliability of this self rating methodology may be considered robust. However, in order to check the validity of the procedure, randomly generated maps were included in the design. If participants can successfully discriminate their own maps from the random maps, the validity of the self-rating methodology is supported.

In order to investigate the extent to which similarity and the recognition of others' cognitive maps is dependent upon function, company, and whether the focal cognitive map is from a customer or not, a repeated measures experimental design was used. The twenty four managers were interviewed again, of which 23 provided useable data.

Each of these managers was presented with a booklet containing a selection of maps. None of these maps was identified to the participant. These booklets consisted of the visual card sort maps, the cluster analysis derived repertory grid maps and the principal components derived repertory grid maps from each of the following: a) the individual's own maps; b) a randomly selected member of the same company with the same management function; c) a randomly selected member of the same company with a different management function; d) a randomly selected member of a different pump company with the same management function; e) a randomly selected member of a different pump company with a different management function; f) a randomly selected pump buyer; g) a randomly generated map. Thus, the independent variable in the design is who the target map belongs to.

The maps were presented in blocks consisting of all the visual card sort maps, all the principal components analysis maps and all the cluster analysis maps. These blocks were presented in a random order across participants. Within these blocks, the maps selected were presented in a random order. This randomization procedure circumvents any confounding due to the order of presentation. Ratings for each level of the independent variable were averaged over the three different types of map in the analyses.

The participant was asked to rate each of these maps on two scales. The first scale asked the participant to rate the similarity of each of the maps to the participant's own mental model on a five point fully anchored Likert type scale (1= 'The same as my view of the competitive environment', 5='Not at all similar to my view of the competitive environment'). The second scale asked the participant to rate the extent to which the participant could understand the logic of the arrangement of the map on a five point fully anchored Likert type scale (1= 'I can easily understand

the logic underlying this map', 5 = 'I cannot understand any logic underlying this map').

## RESULTS

### *Checking the validity of the self-rating procedure.*

The mean similarity and recognition ratings for managers' own and random maps, averaged across all map types, are shown in table 1. Both sets of data were compared by related t-tests. Both results were found to be significant ( $t=3.27, df=21, p<.005$  for similarity data,  $t=2.54, df=21, p<.01$  for recognition data). As can be seen from table 1, managers' consistently rated their own maps as a) more similar to their own mental models and b) having more recognizable logic than the random maps. Therefore, both results indicate that the self-rating methodology used in this study has acceptable validity.

INSERT TABLE 1 HERE

### *Assessing the homogeneity/diversity of, and the influences upon the similarity and recognition of mental models of competition.*

Since the study used a repeated measures design over several levels of who the target map belonged to, the appropriate form of analysis is repeated measures analysis of variance (ANOVA, Hays, 1988). Therefore the similarity rating data and the recognition data, averaged across the three different map types, were independently submitted to ANOVA. In order to evaluate the significance of these tests, the degrees of freedom of the tests were adjusted by the Greenhouse-Geisser epsilon (Norusis, 1988, pg 268), in order to accommodate possible violation of statistical assumptions.

The results of both ANOVAs revealed a significant effect for who the map belonged to averaged over the three different types of maps presented (for the similarity ratings,  $F=6.44$ ,  $df=3.53/64.65$ ,  $p<.01$ , for the recognition ratings,  $F=5.37$ ,  $df=3.76/60.21$ ,  $p<.01$ ). The means and standard deviations for each of these scales are shown diagrammatically in figures 2 and 3 respectively.

#### INSERT FIGURES 2 AND 3 HERE

On the bases of the significant results shown in figures 2 and 3, it may be concluded that managers' mental models are diverse, rather than homogeneous, supporting proposition 1. It can be seen from figures 2 and 3 that the general relationship is the same for both scales. That is, as the social distance between the rater and the target individual increases, the degree of similarity/recognition of maps diminishes.

In order to examine differences between who the map belongs to and rated similarity/recognition, Helmert contrasts (Hays, 1988, pg 408-409) were applied to both sets of data. Helmert contrasts compare the mean of one level of a variable against the combined mean of one or more other levels of that variable.

Taking the similarity ratings first, the Helmert contrasts revealed the following significant results (these are marked on figure 1): a) managers' rated their own maps as significantly more similar to their own mental model than maps elicited from managers who share the same function and the same company ( $t=3.50$ ,  $p<.01$ ); b) on average, managers rated maps from within their own company, including their own, as significantly more similar to their own mental model than maps elicited from members of different companies but with similar management functions ( $t=3.43$ ,  $p<.01$ ); c) on average, managers rated their own maps, maps from people within their company or who shared a similar management function but

from a different company as significantly more similar to their own mental model than maps elicited from managers from different companies with different management functions ( $t=2.33, p<.05$ ); d) on average, managers rated their own maps and others from within their industry as more similar to their own maps than those elicited from buyers ( $t=2.62, p<.05$ ).

These results indicate that the similarity between two individuals' mental models of competition is a) greatest within the same company (supporting proposition 3); b) decreases across management functions (supporting proposition 2); c) is least between managers from within the industry and customers (supporting proposition 4). However, that managers were found to rate their own maps are significantly more similar to their own mental models than the maps of others lends more support to proposition 1, namely that managers' mental models of competition are diverse, even within the same management function in the same company.

A similar, but slightly different pattern of significant results emerged for Helmert contrasts with the recognition data (these significant results are marked on figure 2): a) managers' were able to recognize significantly more logic in their own maps than maps elicited from managers who share the same function and the same company ( $t=2.87, p<.01$ ); b) on average, managers were able to recognize significantly more logic in maps from within their own company, including their own, than maps elicited from members of different companies but with similar management functions ( $t=3.13, p<.01$ ); c) on average, managers were able to recognize significantly more logic in their own maps and others from within their industry than those elicited from buyers ( $t=2.72, p<.05$ ).

These latter results indicate that a) managers recognize least logic underlying buyers' maps compared to maps from managers within the same industry (supporting proposition 6); b) managers recognize significantly more logic

underlying maps from within their own company than from outside their company (supporting proposition 5); c) there is no influence of function upon recognition (unlike the similarity ratings, there were no differences between functions, either within or from outside the focal company); d) managers recognize significantly less logic underlying others' maps, even in their own company, compared to their own maps (again supporting proposition 1).

Proposition 7 stated that managers oriented towards the external market would recognize the logic underlying customers' mental models more readily than managers oriented towards the internal organisational environment. This proposition was tested by conducting a t-test between externally oriented and internally oriented managers for the recognition scale. A similar test was conducted for the similarity scale. The means and standard deviations for both analyses are shown in table 2. The t-test for the similarity scale indicated no significant differences between the two groups of managers ( $t=0.66, df=21, p > .25$  one tailed). For the recognition data, the result emerged as marginally significant ( $t=1.54, df=21, p < .07$  one tailed). Examining the means in table 2, it can be seen that this result is in the direction expected from proposition 6. The marginal significance of this result may be a function of the small sample size. However, the point biserial correlation for this analysis came to  $r = 0.32$ , which is a correlation of moderate magnitude (Cohen, 1977). Therefore, it may be tentatively suggested that the results provide support for proposition 7.

INSERT TABLE 2 HERE

## DISCUSSION

### *Summary of results.*

The results indicate that there is diversity, rather than homogeneity, of managers' mental models of competition, as rated by the managers themselves. The results also indicate that the similarity of these mental models are influenced by company (cf. Johnson, 1987), the managerial function (cf. Bowman, 1991) and whether the individual is a seller or buyer (cf. de Chernatony, 1989, Spender, 1989).

A similar pattern of results emerged for the recognition data, except that managerial function did not appear to influence these results. Importantly, some tentative evidence was found that suggests managers oriented towards the market recognize the logic underlying buyers' mental models more readily than managers oriented towards the internal company environment, although there is no difference between these two groups of managers in the similarity of their mental models to buyers' mental models. These results have a number of implications for managerial decision making, and will be discussed below.

### *Implications of the results.*

The results indicate that recognition and understanding of others' mental models is different construct to cognitive similarity, a distinction not previously made in the management literature. There are two bases for making this conceptual distinction: a) recognition appears to be influenced by company and industry only, although cognitive similarity appears to be influenced by management function, company and industry; b) externally oriented managers tend to recognize buyers' mental models more readily, rather than having significantly similar mental models to buyers. Thus the different forms of the relationships involving the similarity and the

recognition data suggest that recognition is a variable that should be included in future studies of management cognition, rather than just similarity, as has previously been the case.

It was noted in the Introduction that a dominant assumption in management science is that competitive strategies are formulated on the basis of homogeneous cognitions of competition within a team of managers. The results presented here question that assumption and raise issues concerning how managers formulate competitive strategies. Previous research in operations management, focusing upon the similarity of managers' mental models, has suggested that managers make decisions by sharing some aspects of their mental models in common (Langfield-Smith, 1992). Therefore, according to this argument, teams of managers formulate competitive strategies on the basis of the similarity of their mental models.

Some support for this argument is provided in this study, in that managers within the same company were demonstrated to have significantly more similar mental models compared to the mental models of managers from outside that company. However, the study provides no support for the contention that marketing strategies are implemented by a process involving similarity of cognition between managers and customers, since managers oriented towards the market do not have significantly more similar mental models to buyers than managers oriented towards the internal organisational environment.

A second way of formulating competitive and marketing strategies is by a shared recognition and understanding of others' mental models, which develops through the processes of discourse, thus allowing negotiation of strategic action. The study provides some support for this argument, in that managers most readily recognize the mental models of managers from the same company. Stronger support for the argument is provided by the results which suggest that managers oriented towards

the market place recognize buyers' mental models more readily than managers oriented towards the internal company environment.

*Conclusions and suggestions for future research.*

This research has focused upon one industry and a small number of variables, in contributing to the small but growing literature concerned with managerial cognitions of competition: therefore, future research might attempt to replicate and extend these findings across other industries and other demographic contingencies (such as industry experience).

Nevertheless, this paper has questioned the role of homogeneity of cognition in the formulation of competitive and marketing strategies, in that the results demonstrate significant differences between managers' ratings of the similarity of their own cognitive maps and those of others. The results show that cognitive similarity is conceptually distinct from recognition of others' cognitions. Two pathways of strategy formulation were proposed; one based on shared similarities between individuals' mental models of competition and one based on recognition of others' mental models. The results indicate that both pathways may be feasible for strategy formulation within a team of managers but that matching the strategy to the mental models of buyers is most likely to occur through recognition of buyers' mental models.

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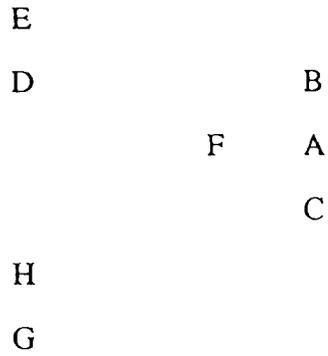
TABLE 1. Means and standard deviations for differences in rated similarity and recognition of managers' own and random maps.

Scale	Similarity		Recognition	
	Mean	Std dev	Mean	Std dev
Own maps	2.30	0.87	2.19	0.90
Random maps	3.27	0.75	3.00	0.92

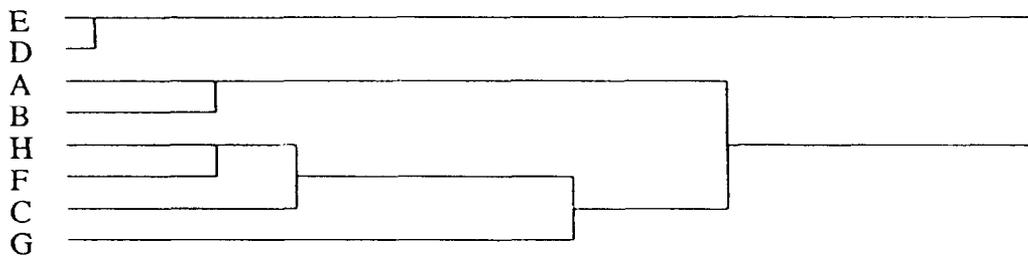
TABLE 2. Means and standard deviations for differences in rated similarity and recognition of customers maps for internally and externally oriented managers.

Scale	N	Similarity		Recognition	
		Mean	Std dev	Mean	Std dev
Internal orientation	10	3.57	0.89	3.67	0.83
External orientation	13	3.30	0.96	3.05	1.04

Figure 1. Examples of cognitive maps (letters replace company names).



1a) Visual card sort map.



1b) Cluster analysis derived grid map.



1c) Principal components analysis derived grid map.

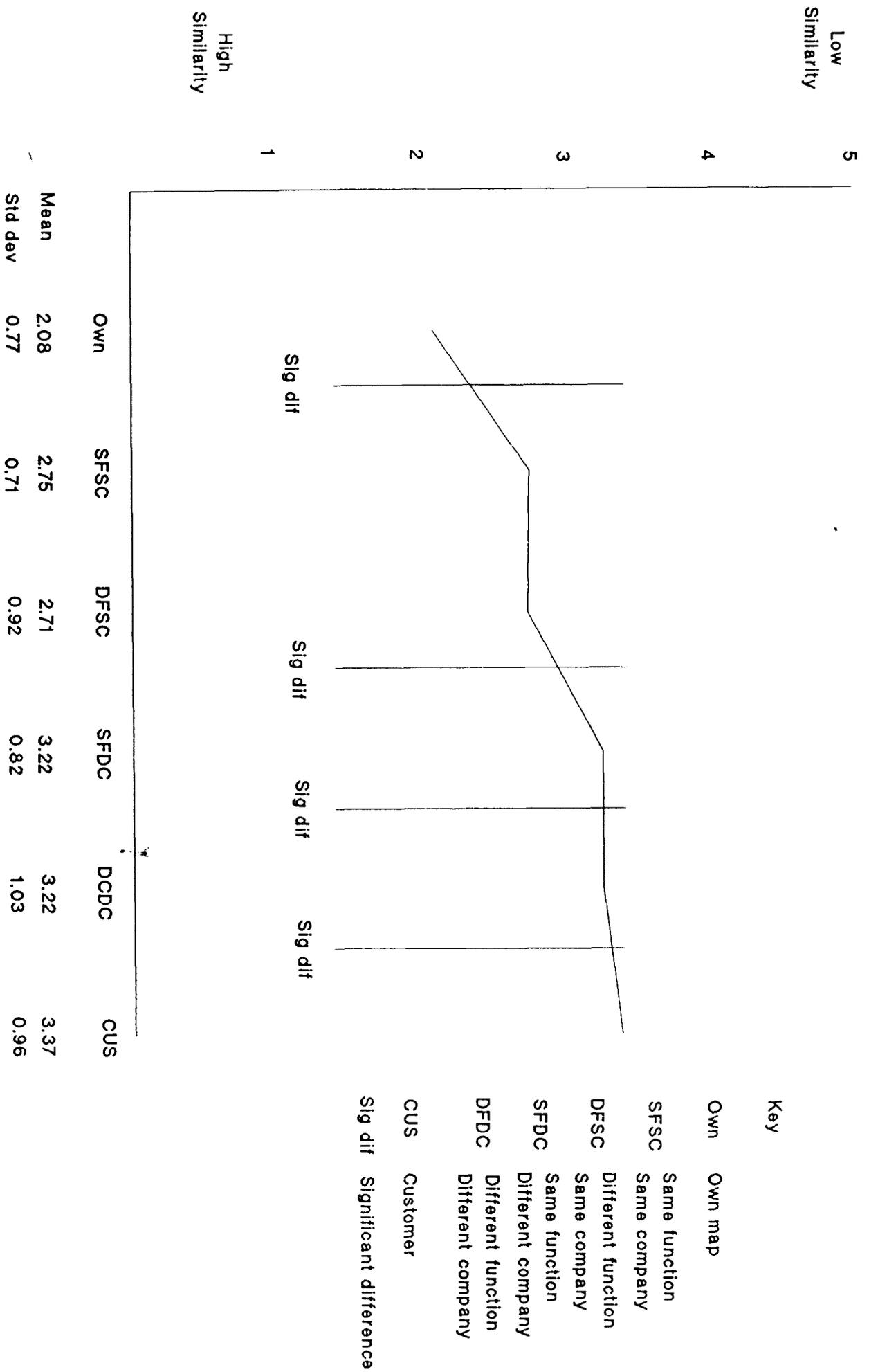


Figure 2. Mean similarity ratings with standard deviations. Significant differences are also shown.

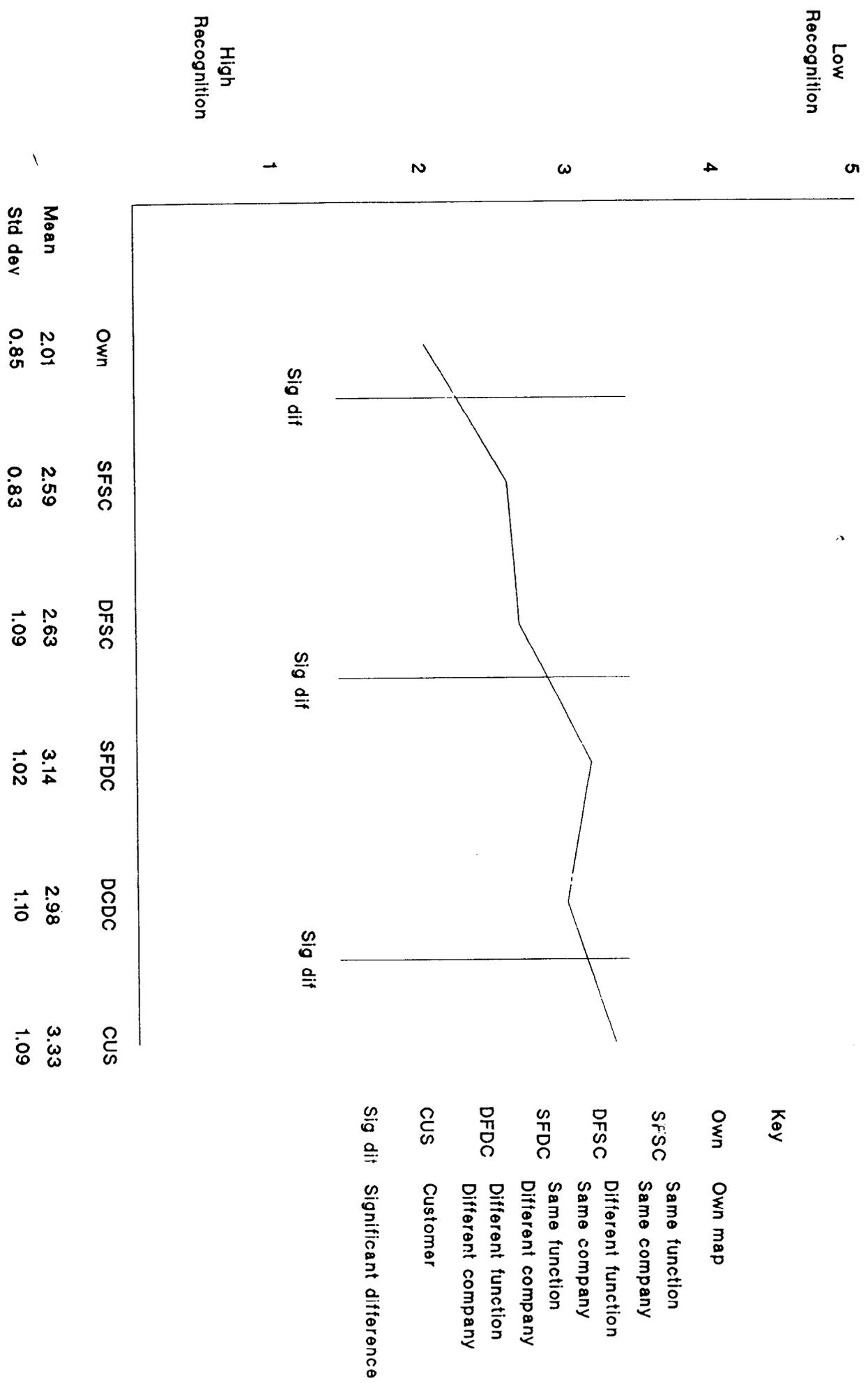


Figure 3. Mean recognition ratings with standard deviations. Significant differences are also shown.

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