Perceptual Mapping of Apples & Cheeses Using Projective Mapping and Sorting

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Introduction

One of the earliest methods for comparing products was the pairwise similarity rating method. This method provides rich information about the product system at hand. However, its major drawback is that it requires (N(N-1)/2) comparisons for N products, which may cause panelist fatigue as N grows. T-tests and ANOVAs are the traditional analysis method for pairwise attribute or similarity ratings.

To address this problem, sorting was introduced to the chemosensory community by Lawless (1989). Briefly, products are sorted into at least 2 and up to N groups based on similarity as judged by the assessor. Multidimensional scaling (MDS) is the traditional method of analysis for sorting.

Another method for rating similarity was introduced by Risvik et al. (1994) known as projective mapping (PM). In projective mapping, assessors place products in a two dimensional space based on their perceived similarity. Pagès et al. (2005) reintroduced PM as "napping" and advanced the analysis with the use of multifactor analysis (MFA).

This experiment compares sorting with MDS to napping with MFA. We predict that the napping method contains more information and provides richer results than sorting.

Experimental Design

The experiment was repeated with two different stimuli: Apples and Cheese (independent assessors). Half of the assessors conducted sorting first, and half conducted napping first. For both napping and sorting, panelists were asked to write down attributes that described either areas on the map (napping) or defined individual groups (sorting).

Table 1: Experimental Design and Analysis Methods

	Sorting	Napping
Analysis	Classical MDS Attribute regression Cluster Analysis	MFA Attribute regression Cluster Analysis
Panelists	Apples: 19 (6 males) Cheese: 21 (8 males)	
Product	10 Apples (2 blind pairs) 10 Cheeses (2 blind pairs)	

Figure 1: Apples used in the study.

Table 2: Stimuli

Apple	Code	Cheese (Age, months)	Code
Acey Mac	AM	Adams Reserve NY Extra Sharp (>12)	AR
Crispin	CR	Cabot 75% Light (unknown)	CL
Empire*	EM	Black Diamond Grand Reserve (24)	BG
Fortune	FN	Black Diamond Platinum Reserve (48)	BP
Golden Delicious	GD	Tillamook Extra Sharp (>9)	TK
Granny Smith	GS	Wegmans Mild (3)	WM
Ida Red	IR	Wegmans Sharp* (6)	WS
Jona Gold*	JG	Wegmans White* (unknown)	WW
Pink Lady	PL	Wegmans Extra Sharp (9)	WX
Red Delicious	RD	Yancey's Fancy XXX Sharp (>18)	YX

Table 2: * means the sample was used as a blind duplicate

Results

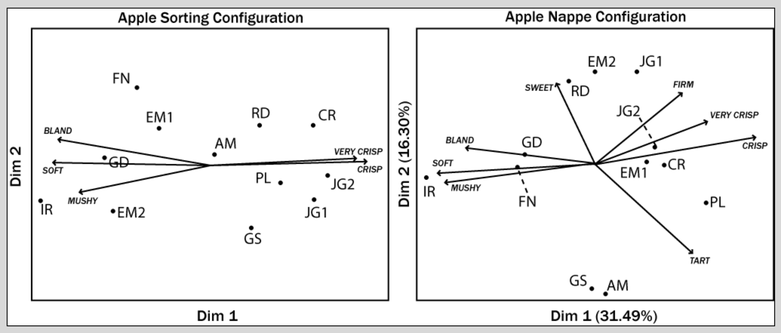

Figure 2: Multivariate configurations from napping (MFA) and sorting (MDS) analyses. Significant attributes are superimposed onto the consensus configuration. NRV=3.5.

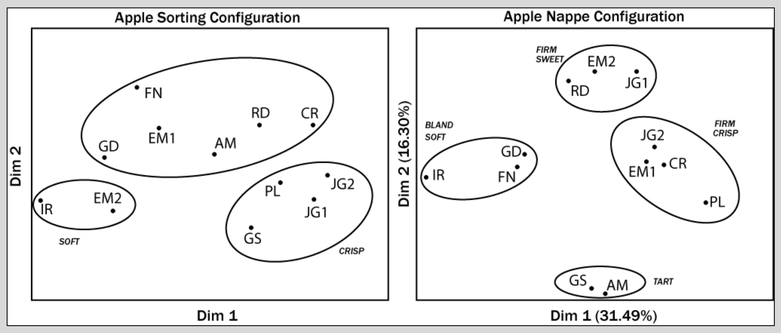

Figure 3: Multivariate configurations from napping (MFA) and sorting (MDS) analyses with interpreted clusters.

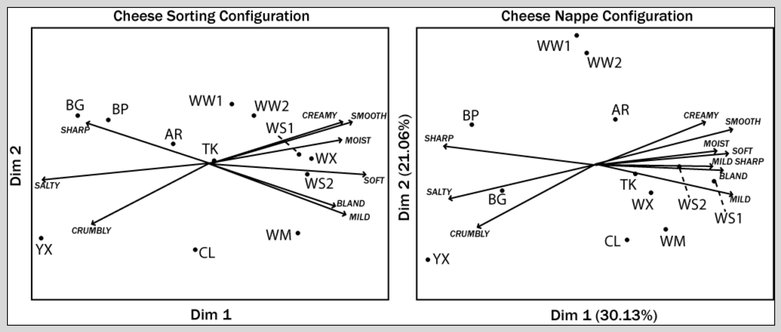

Figure 4: Multivariate configurations from napping (MFA) and sorting (MDS) analyses. Significant attributes are superimposed onto the consensus configuration. NRV=7.72

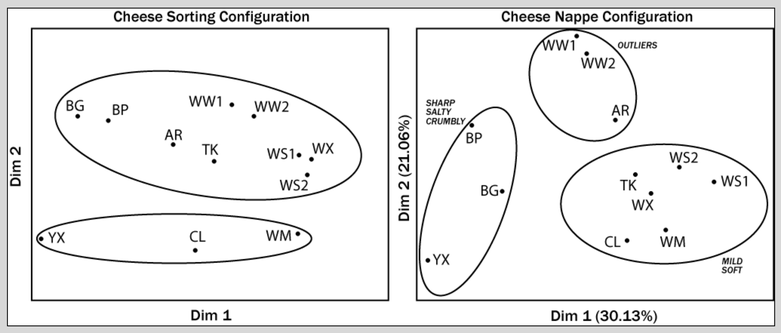

Figure 5: Multivariate configurations from napping (MFA) and sorting (MDS) analyses with interpreted clusters.

Apple Conclusions

- There was a crisp and very crisp vs. soft and mushy texture axis evident with both procedures (Figure 2)
- The nappe procedure also elucidated an opposing sweet and tart axes and an opposing firm and mushy axis
- Cluster (Figure 3) analysis calculated 4 meaningful clusters for napping, while only 2 meaningful and one ambiguous cluster for sorting

Cheese Conclusions

- Mild Sharp (Figure 4) was significant for napping but not sorting procedure
- Cluster analysis (Figure 5) calculated 2 meaningful groups and one group of outliers for napping
- Clusters for sorting were more difficult to interpret

Method Conclusions

- Napping had more significant attribute regressions
- Cluster analysis was cleaner and more meaningful for napping for both sets of stimuli and was useful in making categories

Discussion

One of the major issues with the napping procedure is that it needs supplementary attribute information to provide more meaningful results. By asking panelists about attributes, we were able to show that napping can elucidate rich information about stimuli. The reason that it provides more information than sorting is likely because sorting is a binary response method (stimuli either are, or are not, similar) while napping provides a gradient of similarity based on placement.

There are many questions that remain for the napping method. We do not know how many products are reasonable. Also, since there is only a 2D response surface, what psychophysical model are panelists doing to integrate product dimensions? Finally, the analysis method continues to be modified to extract the most information available out of the nappe maps.

References

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Pagès, J. (2005). Collection and analysis of perceived product inter-distances using multiple factor analysis: Application to the study of 10 white wines from the Loire Valley. Food Quality and Preference, 16(7), 642-649.

Risvik, E., McEwan, J. A., Colwill, J. S., Rogers, R., & Lyon, D. H. (1994). Projective mapping: A tool for sensory analysis and consumer research. Food Quality and Preference, 5(4), 263-269.