FOOD PAIRING FROM THE PERSPECTIVE OF THE 'VOLATILE COMPOUNDS IN FOOD' DATABASE

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Summary
The late Dr Weurman started the database 'Voltaile Compounds in Food in 1963. In the edition released in November 2007, a 'compare' function is offered as a new option. The database is used to evaluate the food pairing theory: if the major volatile molecules of two foods are the same, they might taste (and smell) nice when the foods are eaten together. Three students developed a basic approach for a sensory test to prove whether the hypothesis of food pairing is valid. Seven different ingredients were mixed in all combinations to a puree. It was tested whether the score for the two combined ingredients was higher than the average score for the two separate ingredients. On basis of this experiment the food pairing theory can be rejected.

Key Words: Food pairing, database, volatile compounds

1 Database

The late Dr Weurman started the database 'Volatile Compounds in Food' (VCF) in 1963. With this database he wanted to show that many different food products contain the same volatile compounds. From the very start he felt that this database could be of use to many other scientists in the field of flavour research. The database became commercially available in cooperation with International Organisation of the Flavour Industry (IOFI) in the form of books. When personal computers became common instruments the database was made available in the form of disks. Since 2000 researchers can consult the database sitting on their desk via Internet (1) on a subscription basis. New software is still being further developed to offer scientists more possibilities in making use of this new technology.
In the edition released in November 2007, a 'compare' function is offered as a new option as shown below.

Compounds in A **AND** in B
Compounds in A **OR** in B
Compounds in A **AND NOT** in B
Compounds in B **AND NOT** in A

Next to other possibilities, this 'compare' function offers the use of the database as Dr Weurman had in mind.

2 Food pairing theory

Based on the fact that aroma of foods is so important for the way we perceive them, a hypothesis can be put forward: if the major volatile molecules of two foods are the same, they might taste (and smell) nice when the foods are eaten together. The concept was first appreciated by the Firmenich scientist François Benzi. He got the idea that jasmin and pork liver, which both contain indole, might work well together; it proved to be true.

Flavour pairing has most been described for the combination of wines with food products. In fact, almost every wine label gives menu suggestions. Heston Blumenthal is top chef of the restaurant The Fat Duck in Berkshire (England), which offers very exotic dishes. Examples of successful combinations of ingredients he made, based on the food pairing theory, are described in articles in the Guardian (2).

Bernard Lahousse and Lieven de Couvreux from Belgium also are supporters of the flavour pairing theory. They are making a list of 250 food products, each with its main flavour components. The similarity between a certain product and others are shown graphically (Figure 1) on his Internet site (3). The more flavours food products have in common, the shorter is the distance between the food products.

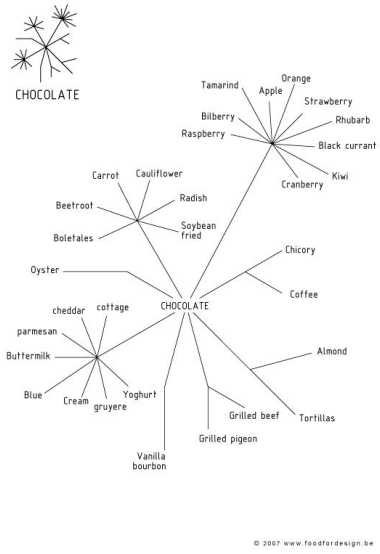

Figure 1. Tree for chocolate.

The theory was elaborated with the hypothesis that one can reconstruct, for example, a flavour from basil without using any basil. The reconstruction can be done as follows. Search for a combination of other food products with one containing linalool (e.g. coriander), and one oestragol (e/g tarragon), and so on. That way you can reconstruct basil by combining coriander, tarragon, cloves and laurel.
Blumenthal and Lahousse use the food pairing theory as a tool to inspire. The craftsmanship and experience of a chef is still needed to translate this inspiration into a good recipe.

3 Sensory test

Three students from the Junior College of Utrecht developed a basic approach to prove whether the hypothesis of food pairing is valid (4). The experiment was set up as follows. A panel of 50 students were asked to evaluate the taste of 7 ingredients. These ingredients were evaluated as such and as combinations of two ingredients. When the score for the two combined ingredients was higher than the average score for the two separate ingredients, the combination was accepted as successful. According to food pairing theory, this should be the case when the two ingredients share some characteristic flavour compounds.

The following ingredients were used in all their combinations: pear, tomato, potato, chocolate, beef, cauliflower and anise. Beef, potato and cauliflower were cooked first and then cooled. Each combination was mixed to a puree. In a separate experiment the best ratio to which the

two ingredients should be mixed was determined. In the best ratio the taste of both ingredients should be recognizable. A panel of 8 persons were used for this experiment. These persons were not used in the other evaluations.

The panel members involved in the sensory test were not informed about the ingredients used. During the panel session they were blindfolded. The samples were offered on a spoon by a panel leader. The evaluations were spread over three days. After every sample the panel member had to drink water and eat a cracker. The order in which the samples were offered was varied per panellist. Scores were given in a range from 1 (awful) to 7 (very nice).

Table 1 shows the actual scores (averaged over all persons) for the individual ingredients and the average scores for the combinations calculated from the two combined ingredients. Table 2 shows the actual scores (averaged over all persons) for the individual ingredients and their combinations.

	Pear	**Tomato**	**Potato**	**Chocolate**	**Beef**	**Cauliflower**	**Anise**
Pear	3.7						
Tomato	2.8	2.0					
Potato	2.8	1.9	1.8				
Chocolate	3.6	2.8	2.7	3.6			
Beef	2.8	2.0	1.9	2.8	2.0		
Cauliflower	2.5	1.7	1.6	2.4	1.7	1.3	
Anise	3.2	2.4	2.3	3.1	2.3	2.0	2.7

Table 1. Actual scores for individual ingredients and calculated average scores for combinations.

	Pear	**Tomato**	**Potato**	**Chocolate**	**Beef**	**Cauliflower**	**Anise**
Pear	3.7						
Tomato	2.8	2.0					
Potato	3.4	1.5	1.8				
Chocolate	2.6	1.2	2.5	3.6			
Beef	2.5	1.9	2.2	2.1	2.0		
Cauliflower	3.2	1.7	2.0	4.0	1.7	1.3	
Anise	3.5	2.0	2.4	3.8	2.3	2.0	2.7

Table 2. Actual scores for individual ingredients and their combinations.

In Table 2 the combinations with a score higher than the calculated average score are highlighted. To determine whether a higher appreciation can be considered as significant, another approach was used. It was determined how often the combination of two ingredients was scored higher than the average calculated score. According to a one-tailed standard nominal distribution the taste is nicer than expected when the percentage of panel members with a higher score is above ca. 60 %. This proved to be the case for 5 combinations:

- anise-chocolate (97.2 %)
- cauliflower-pear (85.3 %)
- cauliflower-chocolate (83.3 %)
- potato-pear (79.4 %)
- cauliflower-potato (73.5 %)

Except for cauliflower-potato, these are also combinations with a higher actual score.

The validity of food pairing theory was evaluated by the students together with the flavour experts of TNO. The absolute numbers of common compounds for all ingredient combinations were extracted from the VCF database (Table 3) and their common characteristic compounds were determined on the basis of experiences of TNO (Table 4).

	Pear	Tomato	Potato	Cocoa	Beef	Cauliflower	Anise
Pear	85						
Tomato	25	392					
Potato	9	66	97				
Chocolate	25	157	52	557			
Beef	15	145	97	154	488		
Cauliflower	5	34	23	26	28	48	
Anise	1	15	5	13	2	1	44

Table 3. Absolute number of common compounds for all ingredient combinations.

	Pear	Tomato	Potato	Cocoa	Beef	Cauliflower	Anise
Pear							
Tomato	16						
Potato	3	42					
Chocolate	2	43					
Beef	0	21	34	24			
Cauliflower	0	21	20	15	17		
Anise	0	11	6	7	0	0	

Table 4. Percentage of common characteristic compounds. Highlighted are the successful combinations according to the sensory evaluation.

From Table 4 it can be concluded that food pairing theory is not valid when based on the principles of this experiment.

4. Discussion

The discrepancy between the supporters of the food pairing theory and the results of the sensory test is striking. The sensory test can be commented in several ways. In the first place, the circumstances under which the panel members had to evaluate the samples (blindfolded) and the way the products were served (cold puree) will not be found in practice. Furthermore, the assumption that 'the combination of two ingredients is considered successful when the score for the combination is higher than the average of the scores of the separate ingredients' can be debated. Nevertheless, this sensory test can be considered as an attempt to test food pairing theory in an objective way.

The way cooks use food pairing theory is almost the opposite of the basis of the sensory test. They do not use a panel or statistics. The combination of ingredients is given a nice appearance to influence the eater. The portions of ingredients are balanced to the preference of the cook and, last but not least, more ingredients are used to improve overall taste.

We do not want to discourage playing with food pairing theory. This was just an attempt to discuss the theory in a scientific way.

References

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