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Sensory memory and food texture

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Abstract

Memory for texture plays an important role in food expectations. After fasting overnight, subjects (41 women, 35 men, age 19–60 years) received a breakfast including breakfast drink, biscuits and yoghurt. Subsequently, they rated their hunger feelings every hour, and returned for a taste experiment in the evening. When unexpectedly confronted with five texture variations of each breakfast item, they were asked to recognise the samples they had eaten earlier. Signal detection showed that subjects could recognise the drinks and yoghurts, but not the biscuits. In a second test with newly coded samples, subjects rated liking and compared their perception of the sample with the remembered target on different attributes. Memory was not related to liking and it was poor for fat (biscuits and yoghurt), but good for thickness (drinks and yoghurt) and crispiness (biscuits). Levels of fat were not remembered as such, but showed some indirect distinctiveness in related attributes as crispiness, thickness or crumbling (biscuits) and thickness or creaminess (yoghurt).

Keywords: Incidental learning; Memory; Perception; Food texture; Food expectations

1. Introduction

Texture is an important factor in the appreciation of food products and most people seem to have a clear idea on the expected texture of a product, based on their memory of past experiences. Much of our common everyday knowledge about the things we eat and drink has been acquired incidentally and without any explicit attention or learning. Such knowledge is also stored implicitly and in most cases we are not even aware of its existence, although it may influence our behaviour quite substantially. Thus, memory plays an important role in the formation of food expectations. Evidence for non-intentional or incidental learning has been found in a number of studies on olfaction (Aggleton & Waskett, 1999; Baeyens, Wrzesniewski, De Houwer, & Eelen, 1996; Degel & Köster, 1999; Degel, Piper, & Köster, 2001; Kirk-Smith, Van Toller, & Dodd, 1983). In the food area, only recently attention has been given to the unintentional remembrance of food products (Garcia, Simon, Beauchamps, & Menella, 2001; Haller, Rummel, Henneberg, Pollmer, & Köster, 1999), showing that the early exposure in infants influences food preferences later in life.

In a previous experiment on incidental learning and memory for foods, the present authors (Mojet & Köster, 2002) used stimuli varying in texture and flavour. Under the pretence of a study about ''hunger feelings'' people were asked to come, without having had breakfast, to the laboratory where a standard breakfast containing a number of target items was served to them. They ate these target items without any knowledge of the fact that at the end of the day they would be asked to recognise them amidst a number of distractors. It was shown that there was a clear memory for texture alone, although in cases where a contribution of flavour could not be avoided, the memory was substantially improved. In the present experiment, which is basically carried out along the same lines, two shortcomings of the previous experiment have been taken into account. In the first place, the incidentally learned memory was tested for variations in texture alone and has been measured in two ways: as ''absolute memory'' (recognition of the

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targets amidst the distractors) and as "relative memory" for specific attributes (judging whether the stimuli presented in the memory session were more, equally or less pleasant, fat, thick, etc. than the one eaten at breakfast). Secondly, an absolute measurement of the liking for both the remembered items and the variations used in the memory test has been included.

2. Material and methods

2.1. Subjects

Seventy six subjects (41 women, 35 men, age 19–60 years), partly employees of the TNO institute and partly externally recruited subjects, were invited to take part in a study on hunger feelings and to come to the institute without prior eating. All subjects were naïve with regard to the purpose of the study. At the end of the test day the subjects received a fee for participation.

2.2. Stimuli

All stimuli were model foods prepared at the institute. Breakfast drink was chosen as an example of liquids, yoghurt as an example of semi-solids, and biscuits as an example of solids. Of each of the three types of breakfast items five variants were made. The breakfast drinks differed in added thickener, the biscuits in fat content and in crisping agent, and the yoghurts in fat and added thickener. The samples were varied in texture, while keeping the flavour as constant as possible. This was quite successful in all three cases as was shown in an evaluation by a sensory panel trained in quantitative descriptive analysis (QDA) and by a consumer panel that rated the samples on the most prominent ten of the twenty five mouthfeel attributes used by the QDA panel and obtained an almost identical distribution of these attributes and products in the sensory space. Table 1 gives an overview of the characteristics of the three product types.

Half of the subjects received one of the targets; the other half of the subjects received the other targets. The targets for the different products were balanced over 8 groups of subjects, which each received different combinations of targets. For instance, group 1 had target T_1 of each of the products (1 1 1), group 2 had target T_1 of the drinks, target T_1 of the biscuits, and T_2 of the yoghurts (1 1 2), etc. The other stimuli served as distractors in the recognition test.

2.3. Procedure

The subjects were invited to come to the laboratory early in the morning after fasting overnight for a so-called test on hunger feeling. Upon their arrival they started by rating their hunger feelings.

Table 1
Texture variations of the breakfast items

Product			Liking (second session)
Breakfast drink	*Thickener (%)*		
0.0	**0.0**		**3.7**
0.4	**0.4**		**2.7**
0.1	0.1		3.9
0.2	0.2		3.0
0.3	0.3		2.1
Biscuits	*Fat*	*Crisping agent*	
LF	**Low**	**None**	**3.1**
HF	**High**	**None**	**2.3**
MFC1	Medium	Type 1	4.3
LFC2	Low	Type 2	4.7
HFC2	High	Type 2	3.8
Yoghurt	*Fat*	*Thickener (%)*	
LF	**Low**	**0**	**4.5**
HF	**High**	**0**	**4.1**
MF	Medium	0	4.6
LFT	Low	20	1.5
HFT	High	20	2.0

The variants used during the breakfast (targets) have been printed in bold type. Drinks are coded by their added percentage thickener, Biscuits and Yoghurts are coded by the fat levels low (LF), medium (MF) and high (HF) and the addition of crisping agent or thickener respectively.

Subsequently, a standard breakfast including the three experimental items was presented containing slices of bread (2 for the women, 3 for the men), standardised portions of margarine, cheese, and jam, *100 ml breakfast drink (either with 0.0% or with 0.4% thickener), 2 biscuits (either low or high fat), 50 ml yoghurt (either low or high fat)* and a glass of milk or buttermilk. The subjects were asked to eat all that was provided in order to standardise their caloric intake. All subjects agreed to this and consumed the full breakfast.

After this breakfast, the subjects received a timer that produced a signal every hour and a small booklet with questions about their hunger feelings, which they were asked to answer every hour, just as they had done before breakfast. Thus, the subjects were led to believe that it was the aim of the experiment to obtain an insight in the development of their hunger feelings over the day.

At the end of the day the subjects returned for debriefing and a "small taste experiment". Upon their return, the subjects were first asked to answer the question "what they thought was the meaning of the experiment" and then were unexpectedly submitted to a recognition experiment. They received a series of eight randomised stimuli (four times their target and four distractors) for each of the three breakfast items and were asked, each time after tasting a sample, to say