



## List length has little impact on consumers' visual attention to CATA questions



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### ABSTRACT

Check-all-that-apply (CATA) questions continue to gain popularity and attract interest in developing guidelines regarding their implementation and analysis. The current research continues on this path and considers visual attention by consumers to CATA questions. This is a pre-requisite for elicitation of valid data. Extending previous research, we consider whether CATA question list length influences consumers' visual attention to the task when it moderately increases from 12 to 20 terms. In a study with six wheat crackers consumers ( $n \sim 120$ ) used a CATA questions with either a "short" list (12 terms) or a "long" list (20 terms). The main difference in visual processing was less attention to individual CATA terms when using "long" lists, but greater sustained visual attention to the task. The sensory characterisations for wheat crackers elicited by "long" and "short" lists differed only in minor ways, pointing to little practical impact of the observed differences in visual processing. Upon replication of the current results, consideration of how these findings generalise to test situations with longer CATA questions (30+ terms), tests with fewer/more samples and/or samples with more complex sensory characteristics is warranted.

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## 1. Introduction

The application of check-all-that-apply (CATA) questions to obtain consumer-elicited sensory product characterization continues to gain popularity (Varela & Ares, 2012). In their basic format, these questions consist of a list of terms from which consumers have to select all those that they consider applicable to describing the focal sample. CATA questions have already been applied to a wide range of natural and manufactured foods/beverages, as well as cosmetics (Ares & Jaeger, 2015).

Underpinning the uptake of CATA questions, methodological research is contributing to recommendations regarding best practise in implementation and data analysis (Ares, Etchemendy, et al., 2014; Ares & Jaeger, 2013; Ares, Tárrega, et al., 2014; Ares et al., 2013; Jaeger & Ares, 2014; Jaeger, Chheang, Yin, Bava & Giménez et al., 2013; Jaeger, Giacalone, Roigard, Pineau, & Vidal et al., 2013; Jaeger, Cadena, Torres-Moreno, Antúnez & Vidal et al., 2014; Lee, Findlay, & Meullenet, 2013; Meyners, Castura, & Carr, 2013).

However, recommendations regarding the number of terms that should be included in CATA questions are still lacking. The present research contributes to a closing of this knowledge gap.

Sensory product characterizations obtained using CATA questions are based on the evaluation of specific attributes, which are selected *a priori* by the researcher (Ares & Varela, 2014). For this reason, one of the key steps for the implementation of the CATA methodology is the generation of the lists of terms: specifically, how many terms and the wording of these terms.

As in any attribute-based methodology, the terms included in the question should enable a description of the main sensory characteristics of the focal samples and facilitate their discrimination (Lawless & Heymann, 2010). CATA questions with many terms can allow for a more complete description of the products and, at the same time, accommodate differences in the vocabulary that consumers use to describe the sensory characteristics of the products (Williams & Langron, 1984). However, increasing the length of the list of terms can cause a decrease in consumers' attention to the task, which can encourage satisficing response strategies and lead consumers to select the terms that easily catch their attention without thinking carefully about the sensory characteristics of the samples (Krosnick, 1999; Krosnick & Alwin, 1987; Rasinski, Mingay, & Bradburn, 1994).

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Previous research by [Ares, Etchemendy, et al. \(2014\)](#) has shown that visual attention to CATA questions is affected by the position of the terms on the list and test progression. These authors showed that consumers tend to visually process the list of terms as they normally read (i.e., from left to right and from top to bottom). Consumers were also found to pay more attention to the CATA terms located at the top of the first column of terms, which suggests the need to change the order in which the terms are included in the lists between assessors to mitigate bias. Due to inattention, consumers may, as the test progresses and they answer the CATA question repeatedly (i.e., evaluation of multiple samples), reduce the depth with which the CATA question is processed. This could imply that consumers, when evaluating subsequent samples may fail to select relevant terms, since terms considered not applicable for describing previous samples may be skipped when consumers visually process the list of terms.

Against this background, the aim of the present paper was to explore the influence of list length on consumers' visual attention to CATA questions, as a step towards building better understanding of factors to take into consideration when developing CATA questions. A moderate increase in list length from 12 to 20 terms was considered. Focus was directed towards the number of terms, not the wording of the terms (also a topic requiring further research).

## 2. Materials and methods

### 2.1. Participants

A total of one hundred and twenty four people participated in the study (50% female). Their ages ranged from 18 to 65 years old (average = 31.5 years old, standard deviation = 12.3 years old). Participants were recruited from the consumer database of the Food Science and Technology Department of Universidad de la República (Uruguay), according to their consumption of the target product category and availability to participate in the study. Specifically, all participants consumed plain crackers at least twice a month. All participants self-reported normal or corrected-to-normal vision and full colour vision. Participants signed an informed consent form and received a non-monetary gift for their participation.

### 2.2. Samples

Five samples of plain wheat crackers (named S1 to S5) were included in the study. The samples, which were commercial brands available in the Uruguayan market, were purchased from local supermarkets. According to the nutritional declarations on sample packaging, samples S2 and S3 had reduced salt content, compared to samples S1, S4 and S5, which had regular salt content. For each sample, one cracker (approximately 5 g) was served on white plastic plates (7 cm diameter) labelled with 3-digit random codes.

### 2.3. Experimental design

A between-subjects experimental design was used to explore the influence of list length on consumers' visual attention to CATA questions. Consumers were randomly assigned to one of two experimental treatments: (i) a "short" CATA list comprising 12 terms ( $n = 61$ ), or (ii) a "long" CATA list comprising 20 terms ( $n = 63$ ). The terminology of "short" and "long" lists used in this paper is relative and not intended to convey information about actual number of terms that define such lists.

The terms included in the "short" list were: light colour, crunchy, tasteless, hard, thin, greasy, light, brittle, off-flavour, tasty, salty and toasted. The "long" lists included all terms on the short list and the following additional terms: sour, bitter, dark colour,

sweet, thick, toasted odour, aftertaste, and greasy flavour. Terms were selected considering the words used by Uruguayan consumers to describe plain crackers in a projective mapping task ([Vidal et al., 2014](#)).

Based on recommendations by [Ares, Etchemendy, et al. \(2014\)](#), the order in which the terms were listed (both experimental treatments) was different for each product and each participant, following a design balanced for presentation order (Williams' Latin Square) ([Williams, 1949](#)).

### 2.4. Data collection

Consumers evaluated 5 commercial samples of plain crackers (S1 to S5) and a blind duplicate sample (S1'; which was identical to S1). A warm-up sample was not used and consumers did not see the list of words before they began the evaluation of the first sample. Samples were assessed monadically in a fixed presentation order (S1, S2, S3, S4, S5 and S1'). The rationale behind the first (S1) and the last sample (S1') being identical was to study how visual processing changed as the test progressed. Despite contradicting standard practise in sensory testing ([Lawless & Heymann, 2010](#)), this was necessary to evaluate the influence of test progression and list length on consumer visual processing of the CATA question in isolation from product effects. The same strategy was used in a previous study to evaluate the influence of test progression on visual attention to CATA questions ([Ares, Etchemendy, et al., 2014](#)). Samples could be tasted more than once. Still mineral water was used for rinsing between samples.

The test took place in a room equipped with a Tobii T60 eye tracker (Tobii Technology, Stockholm, Sweden), under white lighting, controlled temperature (23 °C) and airflow conditions. In accordance with standard practise, participants were asked to sit at a distance of 65 cm from the monitor and remain as still as possible. Before starting the task participants followed the 5-point calibration procedure of Tobii Studio Professional version 2.3 (Tobii Technology, Stockholm, Sweden). First, instructions for how to complete the CATA task were shown on monitor of the eye-tracker. As each sample was presented and immediately prior to consumers answering the CATA question a fixation cross appeared on the screen for 0.2 s to make participants fixate their gaze at a pre-defined point. This served the purpose of minimizing carry-over effects from sample to sample and is recommended practise when seeking to compare eye movement measures across treatments and participants ([Holmqvist, Nyström, Andersson, & van de Weijer, 2011](#)).

During the task, participants' eye movements were recorded at 60 Hz, using the remote eye tracker integrated with the screen on which the CATA questions were presented. The duration of each trial depended on the time that each participant took to evaluate the six wheat crackers.

For classification purposes participants' age, gender, and frequency of consumption of plain crackers were recorded after the eye-tracking test. The two groups of consumers who used CATA lists of different length did not significantly differ in distribution of age, gender and frequency of consumption of plain crackers ( $p > 0.76$ ).

### 2.5. Data analysis

#### 2.5.1. Eye-tracking measures of visual attention

Raw eye movement data were aggregated into fixations using Tobii I-VT Fixation filter of Tobii Studio 2.3 (Tobii Technology, Stockholm, Sweden). This filter classifies eye movements based on the velocity of the directional shifts of the eye ([Salvucci & Goldberg, 2000](#)). If the velocity is higher than 30 visual degrees per second, the eye movement is classified as a saccade; else it is considered as part of a fixation.

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