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Short Communication

Number of terms to use in temporal check-all-that-apply studies (TCATA and TCATA Fading) for sensory product characterization by consumers

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ABSTRACT

Temporal Check-All-That-Apply (TCATA), and its variant TCATA Fading, are extensions of Check-All-That-Apply (CATA) questions that can deliver detailed descriptions of the dynamics of the sensory characteristics of samples throughout consumption. This research contributes to establishing guidelines for best practice of TCATA methods and focuses on the number of terms to include in the attribute list. In four consumer studies (n = 492), the influence of list length was assessed by comparing lists containing 9 and 15 terms ("short" and "long" lists, respectively). Specifically, results obtained for the 9 sensory attributes common to both lists were compared with respect to: citation proportions, dynamic sensory profiles, sample discrimination, and consumers' task perceptions. The key findings pertaining to list length were that: (i) increasing the number of terms was not detrimental in terms of sample discrimination, (ii) consumers were able to use all the 15 terms to discriminate among samples, and (iii) lists of 15 terms provided good data quality in both TCATA and TCATA Fading. The influence of list length on the results was similar for TCATA and TCATA Fading, although there was some evidence pointing to a slight superiority of TCATA Fading over TCATA when long lists of terms are used.

1. Introduction

Temporal Check-All-That-Apply (TCATA) is an extension of Check-All-That-Apply (CATA) questions, and was developed with the aim of providing a complete description of the dynamics of the sensory characteristics of samples throughout consumption (Castura, Antúnez, Giménez, & Ares, 2016). In TCATA methodology, assessors are asked to select all the terms that apply to describe the sensory characteristics of samples at each moment of the evaluation. In the original variant of the method, assessors were also asked to de-select the terms when they were no longer applicable. More recently, a variant — TCATA Fading — was introduced (Ares et al., 2016) wherein terms are automatically deselected after a pre-determined period of time, and assessors must re-select them if they still apply. Both of these TCATA variants provide a detailed description of the dynamic sensory profile of products when implemented with trained and untrained assessors (Ares, Antúnez, Giménez, & Jaeger, 2015; Ares, Jaeger et al., 2015; Ares et al., 2016).

One of the most important steps in the implementation of TCATA is the selection of terms, which should allow a detailed description of dynamic profile of samples (Lawless & Heymann, 2010). It is known from research on CATA questions that lists of 10–30 terms provide similar results (Ares et al., 2015; Jaeger et al., 2015). However, temporal methods usually rely on shorter lists since they are more cognitively demanding due to assessors having to continuously focus their attention on the sensory characteristics of samples during the whole evaluation period (Cadena, Vidal, Ares, & Varela, 2014; Pineau et al., 2012). Pineau et al. (2012) recommended that attribute lists contain 8–10 terms in Temporal Dominance Sensation (TDS) tasks as assessors are not able to pay attention to all the terms when a larger number is considered. Research on the influence of list length on results from T-CATA is lacking, but needed as part of establishing recommendations for best practice of this temporal method.

The influence of list length on results of TCATA is expected to depend on the variant being considered. In TCATA Fading, assessors can forget to immediately re-select attributes that fade away but still apply to the focal sample, giving rise to gaps in the dynamic sensory profile (Vidal et al., 2017). Increasing list length can increase assessors' tendency to forget to re-check the attributes and, consequently, the

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Table 1
Overview of the studies included in this research, which aimed to explore list length on Temporal check-all-that-apply (TCATA). In each study two experimental conditions were compared ("short" and "long" lists with 9 and 15 terms, respectively).

Study	TCATA task	Number of consumers (*)	Product category	Number of samples	List of terms in the "short" list	Additional terms included in the "long" list
1	TCATA	120 (59)	Canned pineapple	4	bland, crunchy, fibrous, hard, juicy, off-flavor, pineapple flavor, sour/acidic, sweet	artificial flavor, candy/lolly flavor, dry, metallic, stringy, tropical flavor
2	TCATA Fading	137 (69)				
3	TCATA	117 (58)	Crackers	3	bits in mouth, cheese, crisp, crunchy, dry, gritty, hard, oaty, salty	brittle, crumbly, dissolving, mushy, oily, toasted
4	TCATA Fading	118 (59)				

(*) Consumers who completed the task using the "short" list are shown between brackets.

number and duration of gaps in the temporal profile. However, imputation of gaps in the temporal profile recommended by Vidal et al. (2017) may minimize the influence of list length on results from TCATA Fading. In the case of the original version of TCATA, long lists of terms may make it more difficult for consumers to focus on selecting applicable terms while at the same time de-selecting terms when they are no longer applicable, which might decrease their ability to discriminate among samples (Ares et al., 2016). Thus, the influence of list length is expected to be larger in TCATA compared to TCATA Fading.

The aim of the present work was to evaluate the influence of list length on TCATA and TCATA Fading tasks performed by consumers. The empirical work comparing results obtained using lists of 9 and 15 terms ("short" and "long" lists, respectively). Specifically, results obtained for the sensory attributes included in both lists were compared with respect to: (i) citation proportions, (ii) dynamic sensory profiles, (iii) sample discrimination, and (iv) consumers' task perceptions.

2. Materials and methods

Four studies involving two product categories (canned pineapple and crackers) were conducted (Table 1). Two studies were conducted for each product category, one with TCATA and the other with TCATA Fading. In each of the four studies a between-subjects experimental design was used to evaluate the influence of list length on results from TCATA: half of the consumers completed the task using a "short" list of 9 terms, whereas the other half completed the task using a "long" list of 15 terms, composed of the 9 terms of the "short" list and 6 additional terms.

2.1. Consumers

Each study included 117–137 consumers from Auckland, New Zealand. They were recruited by a marketing research provider based on their consumption of the focal products, interest, and availability to participate in the study. Participants were aged between 19 and 67 years old and the percentage of female participants ranged from 52% to 64%. All participants were familiar with computers and using a computer mouse. They gave written informed consent and were compensated in cash.

2.2. Samples

Canned pineapple and crackers (based on wheat or oat), commercially available in the New Zealand marketplace were used. Samples were presented at room temperature in plastic odorless vessels labelled with random 3-digit codes. Serving sizes allowed a single bite per sample. In Studies 1 and 2, canned pineapple chunks were drained from their juice before serving and a wooden toothpick was provided as an eating utensil.

2.3. Experimental procedure

The experimental procedures were very similar for the four studies. A between-subjects experimental design was used. Participants were randomly assigned to one of the two experimental treatments: "short" and "long" lists of terms. In the four studies, differences in gender ($p > 0.11$), frequency consumption ($p > 0.21$), and liking of the focal products ($p > 0.44$) were non-significant between participants allocated to the "short" and "long" list of terms. In Studies 1,3, and 4, differences in the age were also not significant between the two groups of participants ($p > 0.32$). However, in Study 2 the random allocation of participants to experimental treatments resulted in the proportion of older participants being allocated to the "short" list was higher than that allocated to the "long" list ($p = 0.04$).

The "short" list of terms featured 9 sensory attributes, selected in pilot work to describe the main texture and flavor characteristics of the samples. This number of terms was selected considering the average number of terms in previous TCATA tasks (Ares, Antúnez et al., 2015; Ares, Jaeger et al., 2015; Ares et al., 2016; Baker, Castura, & Ross, 2016) and recommendations provided by Pineau et al. (2012) for TDS. The "long" list of terms comprised 15 sensory attributes, which included the 9 terms of the "short" list and 6 additional flavor and texture terms. The terms are shown in Table 1.

All participants received verbal instructions on how to complete the TCATA task and in a briefing room watched a demonstration on a large monitor. In the case of TCATA, participants were shown how to unselect terms, whereas in TCATA Fading they were shown that the terms would automatically fade away after 8 s and they must re-select terms that were still applicable to describe the focal sample.

Assessors clicked a start button concurrently with placing the whole sample in their mouth and then immediately begin term selection. Data collection continued until sensory sensations from the samples ceased (or the duration of the task — 60 s — was reached). Assessors were not given precise instructions about when to swallow samples. The terms were presented in balanced order between the assessors, following a Williams' Latin square design.

Testing took place in standard sensory booths (ISO, 2007) under artificial daylight at 20-22 °C. Samples were presented in sequential monadic presentation order according to a Williams' Latin Square design. Participants were asked to cleanse their palates with water crackers and filtered water between samples. Data were collected using Compusense Cloud (Compusense Inc., Guelph, Canada).

Immediately after completing the task, consumers answered two questions about the task: "It was easy to answer the questions about these samples" and "It was tedious to answer the questions about these samples" (1 = 'disagree extremely'; 7 = 'agree extremely').

2.4. Data analysis

Data analysis proceeded separately for each study following the procedures proposed by Castura et al. (2016) using R version 3.2.0 (R R Core Team, 2015). Analyses were performed considering only the terms