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Sensory analysis — Methodology — Duo-trio test

Analyse sensorielle — Méthodologie — Essai duo-trio

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 12, *Sensory analysis*, in collaboration with the European Committee for Standardization (CEN), in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 10399:2017), which has been technically revised.

The main changes are as follows:

— the document has been generalized beyond food and beverage applications;

— the description of how to test for similarity has been updated to best practices and some definitions and descriptions have been amended to also encompass this scenario;

— basic information on how to use the Thurstonian model in addition to the previously emphasized guessing model has been added;

— the principle has been expanded slightly to enhance clarity;

— R code has been provided in the tables of Annex A as one alternative option to derive exact results, which is exemplified in the examples in Annex B;

— the example in Clause B.2 has been modified to reflect state-of-the-art testing for similarity, whereas the example in Clause B.3 has been dropped as the confidence interval approach is now embedded into the earlier examples;

— the references have been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Sensory analysis — Methodology — Duo-trio test

1 Scope

This document specifies a procedure for determining whether a perceptible sensory difference or similarity exists between samples of two products. The method is a forced-choice procedure. The method is applicable whether a difference exists in a single sensory attribute or in several attributes.

The method is statistically less efficient than the triangle test (described in ISO 4120) but is easier to perform by the assessors.

The method is applicable even when the nature of the difference is unknown (i.e. it determines neither the size nor the direction of difference between samples, nor is there any indication of the attribute(s) responsible for the difference). The method is applicable only if the products are fairly homogeneous.

The method is effective for:

a) determining that either:

   1) a perceptible difference results (duo-trio testing for difference); or

   2) a meaningful perceptible difference does not result (duo-trio testing for similarity) when, for example, a change is made in ingredients, processing, packaging, handling or storage;

b) selecting, training and monitoring assessors.

Two forms of the method are described:

— the constant-reference technique, used when one product is familiar to the assessors (e.g. a sample from regular production);

— the balanced-reference technique, used when one product is not more familiar than the other.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5492, *Sensory analysis — Vocabulary*

ISO 8589, *Sensory analysis — General guidance for the design of test rooms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5492 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
alpha-risk
***α*-risk**
Type I error rate
significance level
false positive rate
α
probability of rejecting the null hypothesis by a statistical test when, in fact, the null hypothesis is true

Note 1 to entry: When testing for *product* (3.5) *differences* (3.3), the α-risk is the probability of erroneously concluding that a perceptible difference exists when, in fact, it does not. When testing for *similarity* (3.8), the α-risk is the probability of erroneously concluding that the products are perceptibly similar when, in fact, they are not.

3.2
beta-risk
***β*-risk**
Type II error rate
false negative rate
β
probability of failing to reject the null hypothesis by a statistical test when, in fact, the null hypothesis is not true

Note 1 to entry: 1 – β is also known as the power of the test.

Note 2 to entry: When testing for *product* (3.5) *differences* (3.3), the β-risk is the probability of failing to conclude that a perceptible difference exists when, in fact, the products are perceptually different. When testing for *similarity* (3.8), the β-risk is the probability of failing to conclude that the products are perceptibly similar when, in fact, they are.

3.3
difference
situation in which *samples* (3.6) can be distinguished based on their sensory properties

3.4
p_d
proportion of assessments in which a perceptible *difference* (3.3) is detected between the two *products* (3.5)

3.5
product
material to be evaluated

3.6
sample
unit of *product* (3.5) prepared, presented and evaluated in the test

3.7
sensitivity
< statistic> statistical parameters that measure the performance characteristics of the test

Note 1 to entry: In statistical terms, the sensitivity of the test is defined by the values of α, β and p_d (3.4) (or δ (3.9)).

3.8
similarity
situation in which any perceptible *differences* (3.3) between the *samples* (3.6) are so small that the *products* (3.5) can be used interchangeably

3.9
Thurstonian δ
δ
measure of the magnitude of the sensory *difference* (3.3) between two *products* (3.5)

Note 1 to entry: The true perceptual difference between two products is denoted δ. The estimate of δ from the data is denoted d' ("d-prime").

Note 2 to entry: For a given protocol, any value of δ is equivalent to a value p_d (3.4) so they can be used interchangeably, but the relationship changes with the test protocol.[4][6]

3.10
triad
three *samples* (3.6) given to an assessor in the duo-trio test

Note 1 to entry: In the duo-trio test, one sample is labelled as the reference, the other two are marked with different codes. One of the coded samples is the same *product* (3.5) as the reference; the other coded sample is the other product in the test.

4 Principle

The number of assessors is chosen based on the sensitivity desired for the test (see 6.2 and the discussion in Clause A.3).

Assessors receive a set of three samples (i.e. a triad), one sample of which is labelled as a reference and the other two samples have different codes. The two coded samples comprise one sample that is the same product as the labelled reference sample (i.e. the hidden reference) and one sample that is a different product than the labelled reference sample (i.e. the test sample). The presentation order of the coded samples is assigned to assessors based on balanced random schemes (see 7.1). The assessors are informed that one of the coded samples is the same as the reference and that one is different. Based on their training and the instructions given prior to the test, the assessors report either which of the coded samples they believe to be same as the reference, or which of the coded samples they believe to be different from the reference.

The number of correct responses is counted, and the significance is determined by reference to a statistical table or an applicable computer program or app.

5 General test conditions and requirements

5.1 Clearly state the test objective in writing.

5.2 Carry out the test under conditions that prevent communication among assessors until all the evaluations have been completed using facilities and booths that conform with ISO 8589.

5.3 Prepare the samples out of sight of the assessors and in an identical manner (i.e. same apparatus, same vessels, same quantity of product).

5.4 Assessors shall not be able to identify the samples from the way in which they are presented. For example, in a taste test, avoid any differences in appearance. Mask any irrelevant colour differences using light filters and/or subdued illumination.

5.5 Code the test samples in a uniform manner, preferably using three-digit numbers, chosen at random for each test. Each triad is composed of three samples, one labelled as the reference and two labelled with different codes. Preferably, different codes should be used for each assessor during a session. However, the same two codes may be used for all assessors within a test, provided that each code is used only once per assessor during a test session (e.g. if several duo-trio tests on the same or different products are being conducted in the same session).

5.6 The samples should be presented under the conditions at which the product is generally used (e.g. when tasting, present the samples at the temperature at which the product is generally consumed). The serving conditions of the three samples in each triad shall be identical, just as that of all the other samples in a series of tests on a given type of product.

5.7 The size, quantity or volume presented shall be identical for the three samples in each triad, just as that of all the other samples in a series of tests on a given type of product. The size, quantity or volume to be