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Sensory analysis — Methodology — General guidance for conducting hedonic tests with consumers in a controlled area

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Analyse sensorielle — Méthodologie — Lignes directrices générales pour la réalisation d'épreuves hédoniques effectuées avec des consommateurs dans un espace contrôlé

AMENDEMENT 1

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This document was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 12, *Sensory analysis*.

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Sensory analysis — Methodology — General guidance for conducting hedonic tests with consumers in a controlled area

AMENDMENT 1

Annex F, F.2, NOTE 2

Replace the note with the following:

NOTE 2 In this document, the value of δ is equal to the difference between the preference proportions of the two samples (e.g. if $p_a = 0{,}60$ and $p_b = 0{,}40$, then $\delta = 0{,}60 - 0{,}40 = 0{,}20$). Some authors express the value of δ as the magnitude of the difference between the observed preference proportion and the preference proportion assumed in the null hypothesis (e.g. $p_a = 0{,}60$, $p_b = 0{,}40$ and $p_0 = 0{,}50$, then $\delta = |0{,}60 - 0{,}50| = |0{,}40 - 0{,}50| = 0{,}10$). The reader is expected to be careful not to confuse the two ways of defining δ.

Annex F, F.2, EXAMPLE

Replace the example with the following:

EXAMPLE For the following conditions:

p_0	δ	p_a	α	$u_{\alpha/2}$	β	Power	u_β
0,5	0,2	0,6	0,05	1,960	0,1	0,90	1,282

Formula (F.1) leads to $n = 258{,}6$, i.e. 259 consumers.

If the laboratory questions 259 consumers and there is a difference in proportion of preference equal to 0,2 between products A and B, it is certain to conclude a difference of preference on average in 9 out of 10 tests.

Annex F, F.2, NOTE 3

Replace the note with the following:

NOTE 3 In the case of a unilateral hypothesis with A > B, Formula (F.1) leads to $n = 211$.

Annex F, F.3, EXAMPLE

Replace the example with the following:

EXAMPLE For the following conditions:

$\Delta = |p_a - (1 - p_a)|$	p_a	p_0	α	u_α	β	Power	u_β
0,1	0,45	0,5	0,05	1,645	0,1	0,90	1,282

Formula (F.2) leads to $n = 853$ consumers.

Annex G, G.1

Replace the subclause with the following:

G.1 General

This annex uses the examples of Annex E. The first two examples concern a difference test where the null hypothesis, H_0, may be defined as:

— the two products, A and B, are extracted from two populations that have the same mean.

The last two examples concern a non-inferiority test where the null hypothesis, H_0, may be defined as:

— the product A is inferior to the product B by a quantity at least equal to Δ.

For the difference tests, the examples are considered in the bilateral hypothesis. In cases of a unilateral hypothesis, a statistician shall be consulted. Non-inferiority tests are always unilateral.

Annex G, G.2, Formula (G.2)

Replace Formula (G.2) and subsequent formulae with the following:

$$s^2_{\text{within products}} = \frac{s_A^2 \times (n_A - 1) + s_B^2 \times (n_B - 1)}{n_A + n_B - 2} \quad \text{(G.2)}$$

Hence in this example:

$$s^2_{\text{within products}} = \frac{1{,}85^2 \times (110 - 1) + 1{,}65^2 \times (120 - 1)}{110 + 120 - 2}$$

and

$$\sqrt{s^2_{\text{within products}}} = \sqrt{3{,}057} = 1{,}748$$

The t_{cal} value is:

$$t_{cal} = \frac{7{,}23 - 6{,}87}{1{,}748 \times \sqrt{\left(\frac{1}{110} + \frac{1}{120}\right)}} = \frac{0{,}36}{0{,}231} = 1{,}558$$

Annex G, G.2, second bullet point

After the penultimate paragraph of the second bullet point, add the following note with a footnote:

NOTE 1 This t_{the} value can be calculated using the Excel[1)] function T.INV.2T(α;df) = T.INV.2T(0.05;110+120-2) for the α-risk = 5 %; in this example, it is equal to 1,970.

1) Excel is a product supplied by Microsoft. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Annex G, G.2, third bullet point

After the last paragraph of the third bullet point, add the following notes and renumber the pre-existing note as NOTE 3:

NOTE 2 The value of β can be calculated using the Excel[1)] function: T.DIST(x;deg_freedom;TRUE), that is T.DIST(-0.195;228;TRUE) = 0,423.

NOTE 3 When $t_\beta > 0$, the value of the power is directly given by the distribution function of the t-distribution at (−1) × t_β. For example, for δ = 0,30, t_β = 1,970 − (0,30/0,231) = +0,671; the calculation of the t-distribution function leads to P = T.DIST(-0.671;228;TRUE) = 0,251 ≈ 0,25.

NOTE 4 The t_{the} value for the chosen α-risk (1,980) can be calculated using the Excel[1)] function: T.INV.2T(0.05;119), where df = (120 − 1) = 119.

Annex G, G.3, last paragraph

After the last paragraph of the subclause, add the following note:

NOTE The value of β can be calculated using the Excel[1)] function: T.DIST(-0.873;119;TRUE) = 0,192, P = 1 − 0,192 = 0,81.

Annex G, G.4

Replace the clause title with the following:

G.4 Example 3 (case 3 of Annex E): To prove that the product A is not inferior to the product B by a quantity at least equal to Δ; each consumer only rates one product

Annex G, G.4, Formula (G.7)

Replace Formula (G.7) and the subsequent formula with the following:

$$t_{\text{cal}} = \frac{m_{\text{A}} - m_{\text{B}} + \Delta}{s^2_{\text{within products}} \times \sqrt{\left(\frac{1}{n_{\text{A}}} + \frac{1}{n_{\text{B}}}\right)}} \tag{G.7}$$

where

$$s^2_{\text{within products}} = \frac{s_{\text{A}}{}^2 \times (n_{\text{A}} - 1) + s_{\text{B}}{}^2 (n_{\text{B}} - 1)}{n_{\text{A}} + n_{\text{B}} - 2}$$

In the example,

$$s^2_{\text{within products}} = \frac{1{,}95^2 \times (300 - 1) + 1{,}80^2 \times (316 - 1)}{300 + 316 - 2}$$

and

$$s_d = \sqrt{s^2_{\text{within products}}} = \sqrt{3{,}514} = 1{,}875$$

Annex G, G.4, second bullet point, second paragraph

After the second paragraph, add the following note:

NOTE The t_{the} value for the chosen α-risk (1,647) can be calculated using the Excel[1)] function: T.INV(1-α;n_1+n_2-2) = T.INV(0.05;614) where 614 = df = (300 + 316 − 2).

Annex G, G.4, Formula (G.8)

Replace the formula subsequent to Formula (G.8) with the following:

$$t_{cal} = \frac{6{,}87 - 7{,}01 + 0{,}30}{1{,}875 \times \sqrt{\frac{1}{300} + \frac{1}{316}}} = \frac{0{,}16}{0{,}151} = 1{,}060$$

Annex G, G.5, Formula (G.9) and example

Replace Formula (G.9) and the subsequent formulae with the following, and add the following note:

$$t_{cal} = \frac{m_A - m_B + \Delta}{s_d \times \sqrt{\frac{1}{n}}} \quad \text{(G.9)}$$

In the example, this is:

$$t_{cal} = \frac{7{,}26 - 7{,}31 + 0{,}30}{2{,}08 \times \sqrt{\frac{1}{200}}} = \frac{0{,}25}{0{,}208} = 1{,}202$$

NOTE 1 In Formula (G.9), the t_{the} value for the chosen α-*risk* can be calculated using the Excel[1)] function: T.INV(0.95;199) = 1,653.

Annex G, G.5, Formula (G.10)

Replace the formula with the following:

$$t_\beta = t_{the} - \left(\frac{\Delta}{t_{calden}}\right) \quad \text{(G.10)}$$

where

t_{the} is the value leading to reject H_0;

Δ is the difference unacceptable to consider that two products are similar (i.e interchangeable);

t_{calden} is the denominator of t_{cal}, see Formula (G.9).

Annex G, G.5, last paragraph

Replace the last paragraph with the following and add the following note:

The rules concerning the β calculation are the same for Formulae (G.4), (G.6), (G.8) and (G.10). Since t_β is > 0, the power is directly given by the distribution function of the t-distribution with 200-1 degrees of freedom at $-1 \times t_\beta = -0,211$. Hence, it equals 0,417 ≈ 0,42. This value is very unsatisfactory.

NOTE 2 The value of *P*, then, can be calculated using the Excel[1)] function: T.DIST(-0.211;199;1) = 0,417.

Annex H, H.1, first paragraph

Replace the first paragraph with the following:

This annex uses the examples of Annex F; it therefore only deals with the tests comprising two products recalling that in the field of hedonic measurements, the ranking test on two products is called a preference test (see ISO 5495).

Annex H, H.2, second bullet point

Replace the last sentence with the following:

The preference proportions are therefore equal to $p_A = 0,41$ for A and $p_B = 0,59$ for B.

Annex H, H.2, Formula (H.1)

Replace the formula and subsequent formulae and text with the following:

Hypotheses:

a) $H_0: p = p_0$; $H_a: p \neq p_0$ – Bilateral

b) $H_0: p \leq p_0$; $H_a: p > p_0$ – Unilateral

c) $H_0: p \geq p_0$; $H_a: p < p_0$ – Unilateral

The t_{cal} value is given by Formula (H.1):

$$t_{cal} = \frac{X - np_0}{\sqrt{np_0 (1 - p_0)}} \quad (H.1)$$

where

X is the higher number of responses;

n is the total number of responses;

p_0 is the probability of preference for both products when there is no difference in preference between them; it is equal to 0,50.

$$t_{cal} = \frac{X - 0,5 \times n}{\sqrt{n \times 0,5 \times (1 - 0,5)}}$$