Thurstones d’ = 1.0 as Just (Un-)Noticeable Difference for ingredient reduction strategies

(Weber’s intensity dependence of JND prevents a salami attack on quality)

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Objective

Current salt- or sugar reduction strategies need a consistent long-term oriented approach in order to maintain consumer sensory experience.

Changing a recipe by a *Just (Un-) Noticeable Difference* can serve that requirement.

Background

The concept of a Just Noticeable Difference (JND) was very popular in the historical psychophysics of E. H. Weber (1795-1878). He found the JND to be linearly dependent on stimulus intensity: the higher the intensity level, the lower the sensory sensitivity. Taking that result inversely, the more steps of ingredient reduction already were made, the more sensitive the consumers will be at the next reduction step.

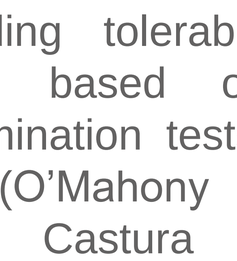
Currently, decisions regarding tolerable ingredient reductions are based on outcomes of sensory discrimination tests. In agreement with others (O’Mahony & Rousseau 2002, p. 159; Castura & Franczak 2017, p. 58f), we propose using Thurstones d’ = 1.0 as the discrimination threshold (just un-noticeable vs. just noticeable difference; common equivalence limit) and as action standard for an ingredient reduction that does not need to be communicated to consumers.

Method

For a peach nectar sugar reduction project 6 triangle tests were conducted by a descriptive expert panel (N = 10 x 2).

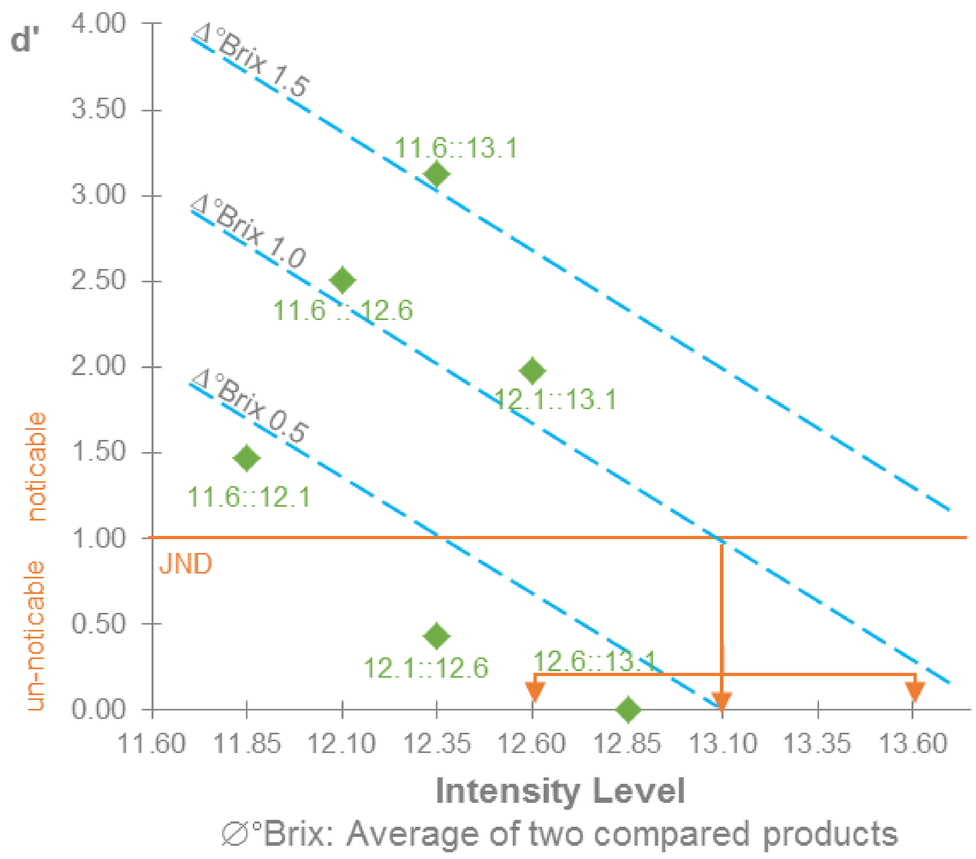
Included were 4 peach nectar samples varying from 11.6 to 13.1 °Brix in 0.5 °Brix intervals (Δ°Brix).

11.6				
12.1	11.6::12.1			
12.6	11.6::12.6	12.1::12.6		
13.1	11.6::13.1	12.1::13.1	12.6::13.1	
°Brix	11.6	12.1	12.6	13.1

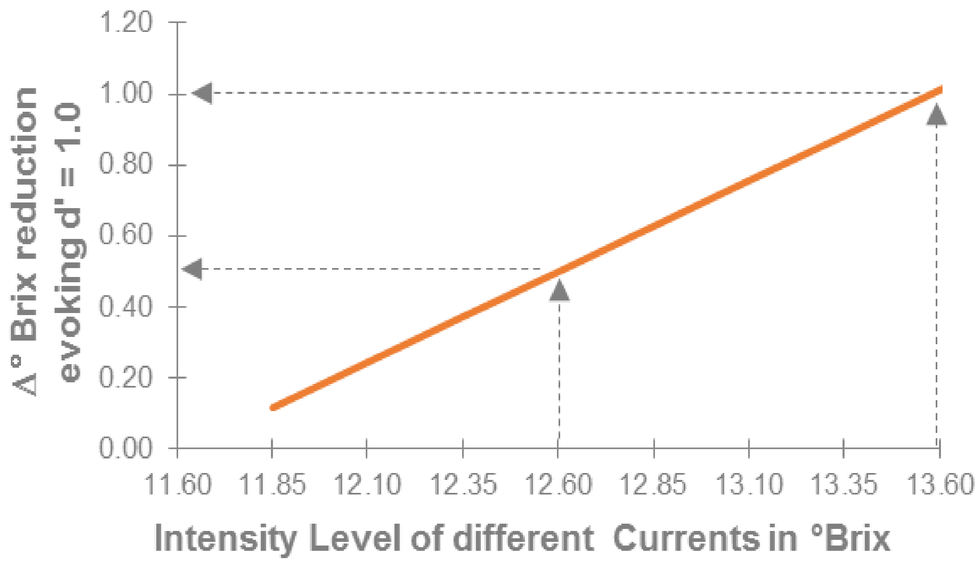


The 6 product pairs vary in Δ°Brix from 0.5 to 1.5 and in the intensity level from 11.85 to 12.85 ∅°Brix.

$d' = + 2.02\ \Delta°Brix - 1.384\ \varnothing°Brix_{centred}$ $(R^2\ .95)$



The 6 calculated d’ scores [♦] were regressed on the °Brix difference (Δ°Brix) and the intensity level (∅°Brix: x axis) of each product pair. The resulting equation (dotted lines) proved the Weber hypothesis (negative slope for the intensity level $\varnothing°Brix_{centred}$ b = **-1.384**, p_{1t} = .01).
After the equation is established, a reduction strategy could be recommended for different current Nectars, e.g. from different regions by solving the equation for d‘ = 1.0.
E.g. a Current (= ∅°Brix + 0.5 Δ°Brix) with 13.6 could be reduced by 1.0 °Brix, a Current with 12.6 could be reduced only by 0.5 °Brix (dotted arrows in following graph).



Conclusion

- The approach allows identifying the thresholds for an unnoticeable ingredient reduction.
- The more product pairs compared in discrimination tests, the more reliable the equation is estimated.
- Weber’s intensity dependence of JND prevents a salami attack on quality usually encountered in ingredient reduction processes: the lower the intensity (e.g. after several reduction steps) the more sensible are the tasters, and the smaller the JND.

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