



Standard Practice for Estimating Thurstonian Discriminal Distances¹

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1. Scope

1.1 This practice describes procedures to estimate Thurstonian discriminational distances (that is, d' values) from data obtained on two samples. Procedures are presented for four forced-choice methods (that is, the triangle, the duo-trio, the 3-alternative-forced-choice (or 3-AFC) and the 2-AFC (also called the directional difference test)), the A/Not-A method, the Same-Different method and for data obtained from ordered category scales. Procedures for estimating the variance of d' are also presented. Thus, confidence intervals and statistical tests can be calculated for d' .

1.2 The procedures in this document pertain only to the unidimensional, equal-variance model. Other, more complicated Thurstonian models, involving multiple dimensions and unequal variances exist but are not addressed in this standard. The procedure for forced-choice methods is limited to dichotomous responses. The procedure for the A/Not-A method assumes equal sample sizes for the two samples. The procedure for the Same-Different method assumes equal sample sizes for the matched and unmatched pairs of samples. For all methods, only unreplicated tests are considered. (Tests in which each assessor performs multiple (that is, replicated) evaluations require different analyses.)

1.3 Thurstonian scaling is a method for measuring the perceptual difference between two samples based on a probabilistic model for categorical choice decision making. The magnitude of the perceived difference, δ , can be estimated from the assessors' categorical choices using the methods described in this practice (See [Appendix X3](#) for a more detailed description of Thurstonian scaling).

1.4 In theory, the Thurstonian δ does not depend on the method used to measure the difference between two samples. As such, δ provides a common scale of measure for comparing samples measured under a variety of test conditions. For example, Thurstonian scaling can be used to compare products measured under different test conditions, to compare panels

(trained, consumer or both) that have evaluated the same samples (using the same or different test methods) and to compare test methods on their ability to discriminate samples that exhibit a fixed sensory difference.

1.5 *This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- [E253 Terminology Relating to Sensory Evaluation of Materials and Products](#)
- [E456 Terminology Relating to Quality and Statistics](#)
- [E460 Practice for Determining Effect of Packaging on Food and Beverage Products During Storage](#)
- [E679 Practice for Determination of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits](#)
- [E1432 Practice for Defining and Calculating Individual and Group Sensory Thresholds from Forced-Choice Data Sets of Intermediate Size](#)
- [E1593 Guide for Assessing the Efficacy of Air Care Products in Reducing the Perception of Indoor Malodor](#)
- [E1627 Practice for Sensory Evaluation of Edible Oils and Fats](#)
- [E1697 Test Method for Unipolar Magnitude Estimation of Sensory Attributes](#)
- [E1810 Practice for Evaluating Effects of Contaminants on Odor and Taste of Exposed Fish](#)
- [E1879 Guide for Sensory Evaluation of Beverages Containing Alcohol](#)
- [E1885 Test Method for Sensory Analysis—Triangle Test](#)
- [E1958 Guide for Sensory Claim Substantiation](#)
- [E2049 Guide for Quantitative Attribute Evaluation of Fragrance/Odors for Shampoos and Hair Conditioners by Trained Assessors](#)

¹ This practice is under the jurisdiction of ASTM Committee E18 on Sensory Evaluation and is the direct responsibility of Subcommittee E18.03 on Sensory Theory and Statistics.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.