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Parity Claims

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Background: The recently reissued ASTM Claims Guide[1] provides a useful classification of types of claims and recommendations concerning appropriate product testing. Figure 1 is a schematic summary of the claims discussed in that document. There are comparative and non-comparative claims. The comparative group includes superiority and parity claims. The guide separates parity claims into two types – equality and unsurpassed. An equality claim is justified when two products are essentially equivalent within some reasonably defined bounds on an attribute of interest. A product is unsurpassed when it exceeds the lower bound for equality. According to this definition, an unsurpassed claim can be made when a product meets the equality requirement or is superior. The guide provides the statistical tools to support an unsurpassed claim, but not an equality claim. In this report we will discuss both of these types of parity claims.

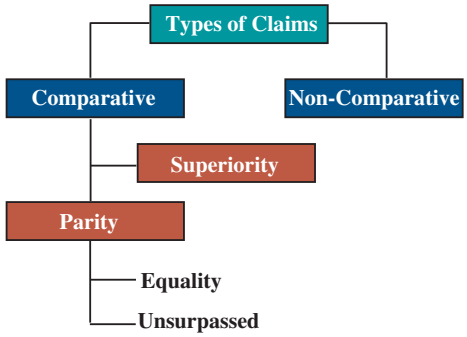

Figure 1. Schematic depiction of the ASTM Claims Guide classification.

Scenario: Glucose and fructose produce synergistic sweetness effects when mixed[2,3]. Due to this synergy, a new process for producing corn syrups leads to an economically more attractive sweetener than your competitor's sweetener, high fructose corn syrup. You would like to claim that your soft drink is as sweet as your competitor's product, but due to its lower cost, your margin will be higher. In a 2-alternative forced choice test (2-AFC) you use the standard that if the choice probability for two products falls between 0.45 and 0.55, they are considered to be essentially equivalent, and meet the ASTM definition of equality. The 2-AFC test is conducted by instructing test participants to indicate which of two alternative products is sweeter. In an experiment of this type with 800 consumers, 390 chose your product as sweeter. You would like to know if this results substantiates an equality claim under the definition given earlier.

Equality Claims: An equality claim is specified in terms of an acceptable range of possible difference within which the products can be considered to be essentially equivalent. For paired preference and difference testing in which the instruction is to choose the product which is most preferred or has the most of some specified attribute (for example, sweetness or moistness), one may choose a 45%:55% split for the population as a limit on the meaning of equality. If either product equals or exceeds 55% of the choices, then the products are not considered to be essentially equivalent or "equal". The null hypothesis is that the choice probability is ≤ 0.45 or ≥ 0.55. A test which rejects this hypothesis provides support for an equality claim. In contrast, a test that rejects the hypothesis that the choice probability is equal to 0.5 provides support for a difference claim.

Table 1 provides the minimum counts to claim equality (reject the null hypothesis that the products are different) at the 95% confidence level for sample sizes of 400 to 1900. Table 2 is the corresponding table for the 99% confidence level.

n	*Counts*
400	196
500	244
600	290
700	337
800	384
900	430
1000	476
1100	523

n	*Counts*
1200	569
1300	615
1400	661
1500	707
1600	753
1700	799
1800	845
1900	891

n	*Counts*
700	346
800	393
900	440
1000	487
1100	534
1200	581
1300	627
1400	674

n	*Counts*
1500	720
1600	767
1700	813
1800	860
1900	906
2000	952
2100	999
2200	1045

Tables 1 (upper) and 2 (lower). In a paired test the observed lower count must fall between the table value and 0.5*n* inclusive to declare support for an equality hypothesis at the 95% (Table 1) and the 99% (Table 2) levels.

For example, a paired test with 1000 consumers is conducted in which 470 chose one product and 530 chose the other product. Since the required lower count must fall between 476 and 500 inclusive and the experiment resulted in a value of 470, we cannot reject the null hypothesis at the 95% level and make an equality claim. Figure 2a shows power curves for true choice probabilities between 0.45 and 0.55 at an α of 0.05. It is apparent from this figure that sample sizes in excess of 800 are usually required to have high confidence (> 80%) of rejecting the null hypothesis as defined earlier.

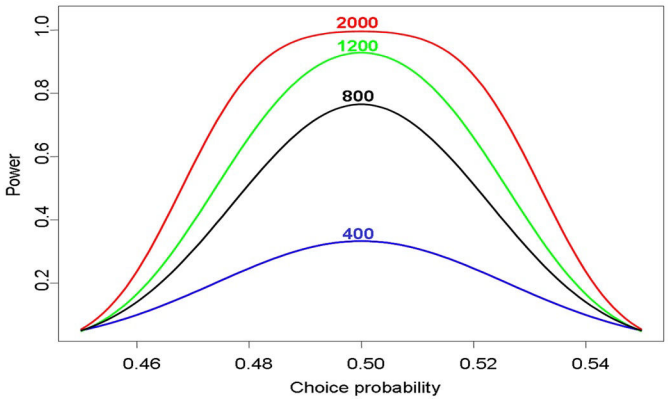

Figure 2a. Power curves under the null hypothesis of a 45:55 difference (or more different) and $\alpha = 0.05$ with $n = 400$, 800, 1200 and 2000.

Figure 2b shows power curves for true choice probabilities between 0.45 and 0.55 at an α of 0.01. Sample sizes in excess of 1200 are usually required to have high confidence (> 80%) of rejecting the null hypothesis at an α of 0.01.

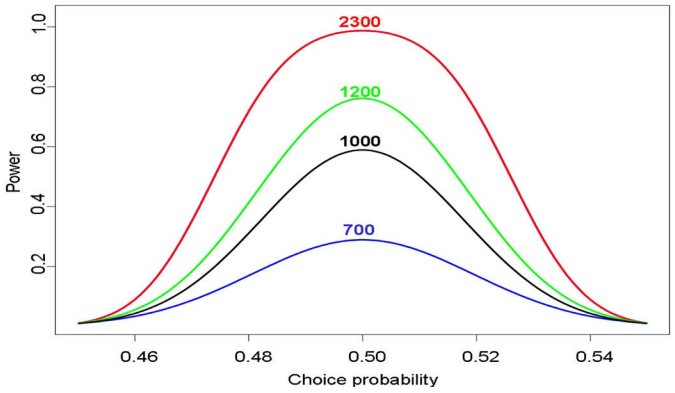

Figure 2b. Power curves under the null hypothesis of a 45:55 difference (or more different) and α = 0.01 with *n* = 700, 1000, 1200 and 2300.

Unsurpassed Claims: The difference between an unsurpassed claim and an equality claim is that in an unsurpassed claim an advertiser may include superiority (preferred or greater or less on some attribute) to establish the claim. This leads to the fact that an unsurpassed claim uses only one of the two limits that were used to define an equality hypothesis. For instance, in an equality preference claim, the preference probabilities must fall between 45% and 55%. In an unsurpassed preference claim the preference probabilities may fall above 45% in favor of the advertiser's product. Sample size requirements for an unsurpassed claim are generally much lower than for an equality claim.

n	*Counts*
100	54
150	78
200	102
250	126
300	150
350	173
400	197
450	220

n	*Counts*
500	244
550	267
600	291
650	314
700	337
750	360
800	384
850	407

n	*Counts*
100	57
150	82
200	107
250	131
300	156
350	180
400	204
450	228

n	*Counts*
500	251
550	275
600	299
650	323
700	346
750	370
800	393
850	417

Tables 3 (upper) and 4 (lower). In a paired test to declare the advertisers product unsurpassed at the 95% (Table 3) and the 99% (Table 4) levels relative to a competitor, the counts for the advertiser's product must equal or exceed the table counts at the sample sizes indicated.

Table 3 provides the minimum choice proportion for the advertiser's product to make an unsurpassed claim at the 95% confidence level for sample sizes of 100 to 850. Table 4 is the corresponding table for the 99% confidence level. Notice that in Table 3 when sample sizes approach and exceed 300, experimental results in which the advertiser's product receives less than 50% of the choices can support an unsurpassed claim because at this sample size it is still possible to reject the hypothesis that the advertiser's product is inferior to the competitor (i.e. the population choice probability is 45%). In fact, at a sample size of 800, the advertiser could obtain results such as 48%(advertiser):52% (competitor) and still claim to be unsurpassed by the competitor.

"No Difference" counts: When a "no difference" option is available, it is necessary to account for the choice of this category before using Tables 1-4. The recommendation in this report is to redistribute these counts proportional to the choice proportions. Another option, which is less powerful, is to report the results for those who expressed a difference (preference.)

Do my results support a parity claim?: Three hundred and ninety (390) respondents out of 800 chose my product as sweeter. This value exceeds the value in Table 1 (384), leading to the conclusion that the parity hypothesis is supported at the 95% level because the null hypothesis that the products are different is rejected.

Application to other discrimination methods: The tables cannot be used for discrimination tests such as the duo-trio and triangular methods. Although the duo-trio method has the same guessing probability as the paired comparison test (which of two alternatives is greater or less on some attribute) the two methods differ with respect to the relationship between sensory difference and choice probability. For instance, a 55% choice in favor of one product in a paired comparison does not correspond to a 55% choice in the duo-trio, but corresponds to a 50.3% choice[4]. This means that the tables presented in this report will not apply to the duo-trio. In view of this correspondence, it may not be practical to use the duo-trio method to establish a parity position based on the standard given for the 2-AFC.

Conclusion: Provided that an agreed-upon definition of "equality" exists, it has been shown how paired tests (2-AFC or preference) can be used to establish either of two types of parity claims - equality and unsurpassed. More extensive tables for deciding whether support for these claims exists from experimental tests are available upon request from The Institute for Perception at www.IFPress.com.

References

1. ASTM E 1958, "Standard Guide for Sensory Claim Substantiation". ASTM International.
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4. Ennis, D.M. (1993). The power of sensory discrimination methods. *Journal of Sensory Studies,* **8**, 353-370.