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Comparison of Tetrad and Triangle Testing as an Applicable Discrimination Test

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INTRODUCTION

Panelist availability is a primary struggle for many Sensory programs. This creates challenges in obtaining statistically powerful results and can lead to improper conclusions. A triangle test is the most widely used difference test. However, it requires a large number of panelists to obtain results with confidence. The tetrad test is a new alternative method and is known to be an easier psychological task as well as being more statistically sensitive. In this study, we will compare not only the theory of tetrad versus triangle but the practical application as well.

MATERIALS AND METHODS

Material

An amber lager was used with varying levels of diacetyl flavor added.

Beer profile: a balance of piney, citrusy, and floral hop aromas, and a balance of caramel and toffee malt notes as well as a hints of pine and citrus hop flavors.

Preparation of samples

1 pill containing 300 µg of 2, 3-butanedione was dissolved in 10 ml of water and added to beer at varying levels to obtain desired VDK levels. Spike pills were purchased from AROXA™.

Samples

Diacetyl levels of each sample (ppm)

Triangle			Tetrad		
Control	Trial	Difference	Control	Trial	Difference
0.048	0.055	0.007	0.051	0.057	0.006
0.043	0.069	0.026	0.045	0.064	0.019
0.049	0.077	0.028	0.052	0.073	0.021
0.056	0.099	0.043	0.049	0.097	0.048
0.051	0.107	0.056	0.051	0.149	0.098

SENSORY METHOD

Triangle Instructions:

In front of you are three samples. Two of the three samples are the same, one of the samples is different. Taste the samples in the order indicated below and identify the sample that is most different.

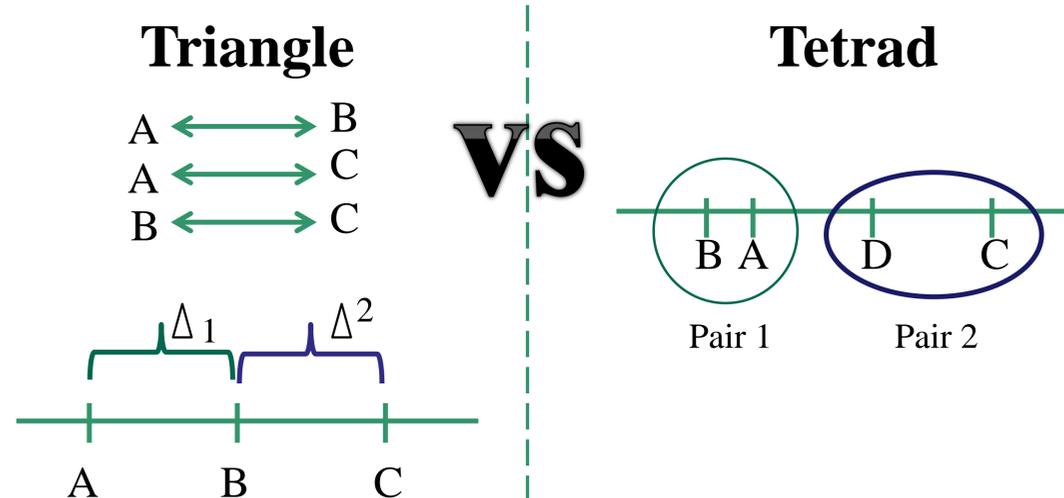
Tetrad Instructions:

In front of you are four samples, Two are similar and belong to one group the other two are also similar to each other and belong to another group. Taste the samples in the order indicated below separate them accordingly into 2 groups of two.

Statistical Analysis

Determined p-values,
Estimated effect size (d')
Computed test power

The triangle relies on a comparison, whereas the tetrad uses a linear approach.



Carr, B.T. Tetrad Testing: Why and How. 2015

RESULTS AND DISCUSSIONS

Discussion

- More significant differences were found when using tetrad testing
 - 2 out of five triangle tests found significant differences
 - 4 out of 5 tetrad test were significant
- The power of tetrad was higher for the tetrad method
 - Effect size (d') did not decrease by more than 1/3 for the tetrad testing
 - On average the Power was higher for the tetrad method than the triangle

Results

Triangle tests						
Product	N	Proportion Correct	P-value	d'	Var d'	Power
0.007	18	0.39	0.390	0.800	0.740	0.101
0.026	26	0.50	0.060	1.470	0.260	0.531
0.028	20	0.40	0.340	0.900	0.593	0.131
0.043	22	0.72	0.001	2.600	0.309	0.911
0.056	24	0.79	0.001	3.060	0.330	0.965

Tetrad Tests						
Product	N	Proportion Correct	P-value	d'	Var d'	Power
0.006	18	0.44	0.220	0.796	0.227	0.219
0.019	24	0.58	0.010	1.300	0.114	0.777
0.021	20	0.65	0.001	1.530	0.094	0.942
0.048	30	0.60	0.001	1.360	0.089	0.897
0.090	28	0.79	0.001	2.050	0.110	0.992

CONCLUSION

The tetrad test is an acceptable replacement for the triangle test. The known statistical power advantage is beneficial and can allow for discriminating test with smaller sample size.