Taste Thresholds

When our brain recognizes and interprets a sensation, we become consciously aware of that sensation. Sensation and perception occur only when the stimulant is above a certain minimum concentration. The minimum amount of stimulant, which elicits a response in our senses, is the detection or absolute threshold…the threshold of sensation. Stimuli at concentrations below the detection threshold are not noticed consciously. Some of our senses may respond to them, but they're not perceived. The detection threshold is the smallest amount of stimulus that can produce a general but unidentifiable sensation. "Something's there, but I don't know what". At a higher concentration there is a threshold of perception. This is the smallest amount that can be accurately described by name. "Yes! This is sweet".

People are most sensitive to bitterness and least to sweetness. Our threshold for the bitterness of quinine sulfate ranges from 1,000 to 10,000 times lower than our threshold for table sugar. Our sensitivities to salty and sour are in between. The average threshold for people to perceive sweetness in wine is 1 gram per 100 ml (1 g/100 ml). When a group of people is asked if they perceive sweetness in a series of wine samples, 50% of the group will say yes at 1 g/100 ml. For sweetness in wine, individual taster perception can range from 0.5 to 2.5 g/100 ml. Differences occur because of a host of reasons.

Two people, with the same wine knowledge and tasting experience, with major threshold differences, act as if they taste different wines. A wine with a sugar concentration of 0.8 g/100 ml may seen dry to one and sweet to the other. Both are correct. The person that felt the wine was dry probably did feel it was smoother and more full-bodied.

By repeating a series of sweetness, tartness and bitterness tests each taster should learn their threshold for the basic tastes.

Threshold Test

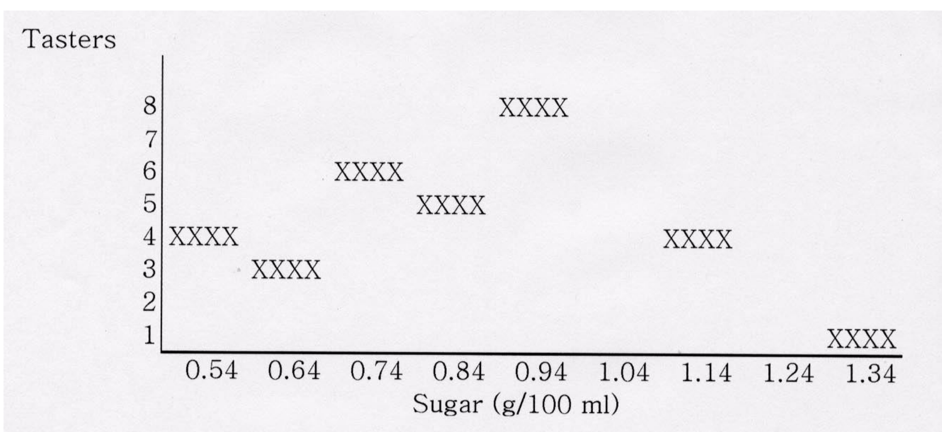
Members of the American Wine Society did a sweetness threshold test at their annual Conference in November of 1993. They started with a wine with a residual sugar (RS) of 0.54 g/100 ml. To this wine they added cane sugar to raise the RS to five different levels. 31 AWS members tasted. The form below was used. Each of the wines B through F could only be tasted once. The reference wine A could be tasted over and over.

Wine	A	B	C	D	E	F
Not Sweet						
Sweet						

They were to put an X or ? in the appropriate box.

The results were:

Wine	A	B	C	D	E	F
Not Sweet	27	23	17	11	4	0
Sweet	4	7	13	18	26	30
Not Sure	0	1	1	2	1	1
sugar g/100 ml	0.54	0.64	0.74	0.94	1.14	1.34



Perception Threshold

1 Read all the steps before you begin.
2 Work quietly to facilitate concentration.
3 If you like, re-familiarize yourself with the sweet taste of sugar.
Rinse your palate with water before tasting wine.
4 Taste each wine only once. Take small sips and hold the wine in your mouth 15 to 60 seconds before spitting.
5 Taste the base wine (A) to become familiar with it. It will not taste sweet to most of you.* Record your perception of it.
6 Taste remaining wines, concentrating on the presence or absense of sugar
7 Do not retaste the previous wines.
8 Retaste the base wine (A) as often as you so wish.
9 Record your perception of each wine: NOT SWEET-SWEET-NOT SURE

* If the residual sugar of the base wine (A) is 0.1-0.3 g/100 ml, most tasters will perceive it is not sweet.

Date: ______________ Taster: ______________

WHITE WINE	A	B	C	D	E	F
NOT SWEET						
SWEET						
NOT SURE						
residual sugar (g/100 ml)	0.25					

RED WINE	A	B	C	D	E	F
NOT SWEET						
SWEET						
NOT SURE						
residual sugar (g/100 ml)	0.25					

Difference Tests

Difference tests are used to compare two wines and objectively evaluate their difference, to test judge's abilities, to decide if chemical or sensory differences are significant and finally to establish quality differences

Panels with 5 to 10 judges generally are best for most difference tests. For preference tests...the more the merrier. It is not quite as simple as it seems to just find good judges. The judges must represent the same cross section of "tasters" as the population of consumers being studied.

The sensory organs on the tongue that allow us to experience tastes are called **taste buds**. Each of us has a different number and distribution of taste buds. Additionally, we each produce varying amounts flow rates of saliva. People are born with a genetically determined number of taste buds: 25% are super-tasters, 50% are medium-tasters and 25% are non-tasters. To the super-taster, espresso, olives, arugula, dark chocolate and dry wines can taste too bitter and are therefore not palatable. Super-tasters experience intense tastes and oral burns. To them, chili peppers, black pepper and cayenne have chemical irritants. They also react negatively to salt, acids, sweetness and fats in foods. Non-tasters like over-spiced and strong pungent foods like blue cheeses, strong coffee, anchovies and loads of garlic. Medium-tasters are in between

Keep in mind that a panel with a disproportionate share of super-tasters, medium-tasters or non-tasters will probably not be able to judge consumer preference.

Any results of any sensory evaluation are of little value until the panel of judges can show they can detect differences. These are generally very subtle and difficult to detect. When no difference can be established, the question of preference cannot be asked.

Paired-Sample Test. Two samples are given to a judge. They differ in one well-defined characteristic; e.g., sweetness, tartness, different barrels, etc. The judge is asked to identify the one with most intensity or to express a preference. This may be carried out with only one or a panel of judges. The **null hypothesis** assumes samples do not differ from one another. Based on the null hypothesis of no difference, half the responses should be correct by chance alone, i.e., H_o: p=1/2. Even if you didn't taste the wines, the probability of guessing right, is 50%.

Example of a Paired-Sample Test:

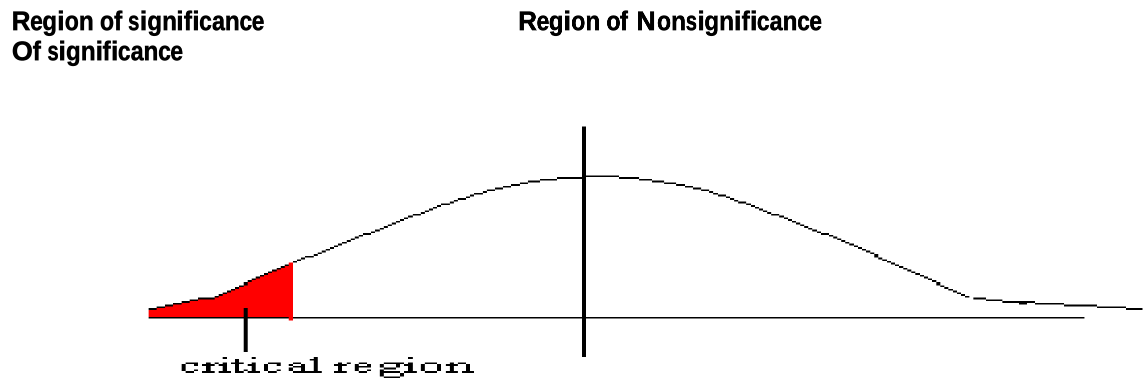
Test for Wine Sweetness

Taste both samples. Circle the sweeter of the two.

Test	Samples	
1	___	___
2	___	___
3	___	___

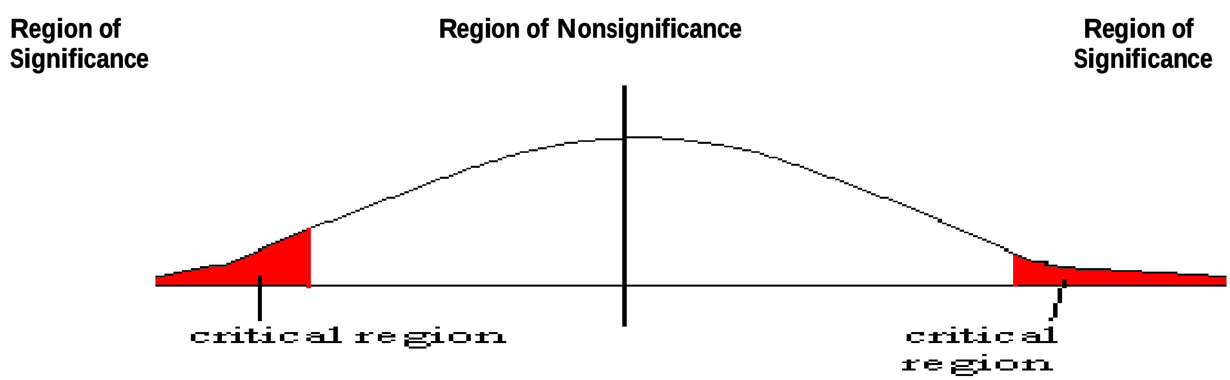
Name ____________________ Date ____________

These tests can be used in quality control, preference evaluation and judge selection. If a judge makes the differentiation correctly over several trials, it can be concluded the judge makes the differentiation correctly significantly more often than expected by chance (p=1/2), for that particular defined constituent (e.g. sweetness). In this case a one-tailed hypothesis is applicable and the alternative hypothesis is H_1: $p>1/2$. This judge chooses correctly more often than guessing. The one-tailed region of significance or critical region in the normal distribution is the 5% level. See below.



One-tailed test, 5% level. H_o: $p=1/2$. H_i: $p>1/2$

Preference testing asks for a judge's subjective opinion. If enough judges arrive at the same choice, a significant choice can be declared. It must be shown the judges have conventional tastes. Since either wine may be preferred, the alternate hypothesis here is H_1: $p\neq \frac{1}{2}$ and the two-tailed test is applicable. See below.



Two-tailed test, 5% level. H_o: $p=1/2$. H_i: $p\neq 1/2$

Duo-Trio Tests. This is a modified paired-sample test. A reference sample is presented and then two coded samples follow. One of the coded samples is identical to the reference. The judge is asked to identify the identical sample. As in the paired-sample test, the null hypothesis is H_o: $p=1/2$ because, the judge will pick the correct sample about one-half the time.

Since this is a difference test, it is one-tailed. This is a widely used quality control (QC) test. Should the reference sample, i.e., the existing blend, be changed?

Example of a Duo-Trio Test:

Test for Wine Tartness

Taste the reference sample and the two coded samples. Decide which of the coded samples is the same as the reference sample.

Test	Coded Samples		Sample same as reference sample
1	___	___	______
2	___	___	______
3	___	___	______

Name ____________________________ Date ________________

Triangle Test. In this test, the judge is given three coded samples. Two are identical samples. The judge is asked to find the odd sample. The probability of a correct choice by chance alone is one-third; i.e., the null hypothesis is H_o: p=1/3. This is a useful QC test.

The Duo-Trio and Triangle test should only be used for difference (one-tailed) testing. The two against one sampling causes bias in preference judgments.

Example of a Triangle Test:

Test for Wine Blend Change

Taste all three samples. Decide which of the three is unlike the other two.

Test	Samples			Sample unlike the other two .
1	___	___	___	_______
2	___	___	___	_______
3	___	___	___	_______

Name ___________________________ Date _______________

For various numbers of trials in the Paired-Sample and Duo-Trio tests, Table 1 shows the minimum numbers of correct judgments required to establish a significant difference (one-tailed test) at 5%, 1% and 0.1% levels. For Paired-Sample tests, the minimum numbers of agreeing judgments required to establish a significant preference (two-tailed test) are also given. Table 2 gives similar information for establishing a significant difference in the Triangle test.

2/22/2008

Significance in Paired-Sample and Duo-Trio Tests. H_0: p=1/2 Table 1

The number n is the number of trials, i.e., the number of judges or judgements in the test

	Minimum Correct Judgements to Establish Significant Difference (ONE-SIDED TEST)			Minimum Agreeing Judgements Necessary to Establish Significant Preference (TWO-SIDED TEST)		
n	p=0.05	p=.01	p=.001	p=0.05	p=.01	p=.001
7	7	7	-	7	-	-
8	7	8	-	8	8	-
9	8	9	-	8	9	-
10	9	10	10	9	10	-
11	9	10	11	10	11	11
12	10	11	12	10	11	12
13	10	12	13	11	12	13
14	11	12	13	12	13	14
15	12	13	14	12	13	14
16	12	14	15	13	14	15
17	13	14	16	13	15	16
18	13	15	16	14	15	17
19	14	15	17	15	16	17
20	15	16	18	15	17	18
21	15	17	18	16	17	19
22	16	17	19	17	18	19
23	16	18	20	17	19	20
24	17	19	20	18	19	21
25	18	19	21	18	20	21
30	20	22	24	21	23	25
35	23	25	27	24	26	28
40	26	28	31	27	29	31
45	29	31	34	30	32	34
50	32	34	37	33	35	37
60	37	40	43	39	41	44
70	43	46	49	44	47	50
80	48	51	55	50	52	56
90	54	57	61	55	58	61
100	59	63	66	61	64	67

Significance in Triangle Tests. H_0: p=1/3 Table 2

The number n is the number of trials, i.e., the number of judges or judgements in the test

	Minimum Correct Judgements to Establish Significant Difference				to Establish Significant Difference		
n	p=0.05	p=.01	p=.001		p=0.05	p=.01	p=.001
5	4	5	5	41	20	22	24
6	5	6	6	42	21	22	25
7	5	6	7	43	21	23	25
8	6	7	8	44	21	23	25
9	6	7	8	45	22	24	26
10	7	8	9	46	22	24	26
11	7	8	9	47	23	25	27
12	8	9	10	48	23	25	27
13	8	9	10	49	23	25	28
14	9	10	11	50	24	26	28
15	9	10	12	51	24	26	29
16	10	11	12	52	25	27	29
17	10	11	13	53	25	27	29
18	10	12	13	54	25	27	30
19	11	12	14	55	26	28	30
20	11	13	14	56	26	28	31
21	12	13	15	57	27	29	31
22	12	14	15	58	27	29	32
23	13	14	16	59	27	30	32
24	13	14	16	60	28	30	33
25	13	15	17	61	28	30	33
26	14	15	17	62	28	31	33
27	14	16	18	63	29	31	34
28	15	16	18	64	29	32	34
29	15	17	19	65	30	32	35
30	16	17	19	70	32	34	37
31	16	18	19	75	34	36	39
32	16	18	20	80	35	38	41
33	17	19	20	85	37	40	43
34	17	19	21	90	39	42	45
35	18	19	21	95	41	44	47
36	18	20	22	100	43	46	49
37	18	20	22	200	80	84	89
38	19	21	23	300	117	122	127
39	19	21	23	400	152	158	165
40	20	22	24	500	188	194	202

Source: Amerine & Roessler, Wines Their Sensory Evaluation, 1976

SignificanceTables

One and Two Tailed Tests

The **probability** of an event can be defined as the relative frequency of that event in a large number of trials. Probability ranges from 0 to 1; a p=0 cannot occur, while a p=1 is certain to occur. The probability of heads or tails on a well-balanced coin has a p=1/2 of either side occurring on average. Imagine a judge being presented with three glasses of wine, two of which are the same wine and the third different but very similar. By chance alone, the judge will pick the odd sample one on three times, p=1/3. By chance, the judge will fail p=2/3. Conventionally, in a sequence of events, one occurrence will be called a *success* and the nonoccurrence a *failure*. The sum of the successes and failures for a given result will always equal one. Hence, if the probability for success is p, the probability for failure is 1 - p.

Suppose we have a null hypothesis H_0 and an alternative hypothesis H_1. We consider the distribution given by the null hypothesis and perform a test to determine whether or not the null hypothesis should be rejected in favor of the alternative hypothesis.

There are two different types of tests that can be performed. A **one-tailed** test looks for an increase or decrease in the parameter whereas a **two-tailed** test looks for any change in the parameter (which can be any change- increase or decrease).

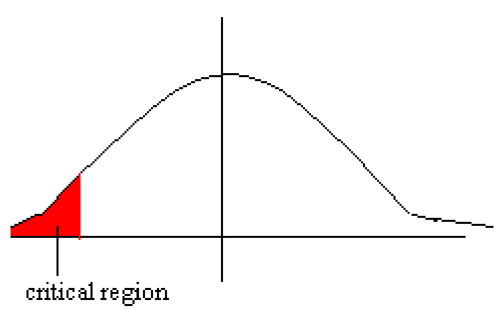
We can perform the test at any level (usually 1%, 5% or 10%). For example, performing the test at a 5% level means that there is a 5% chance of wrongly rejecting H_0.

If we perform the test at the 5% level and decide to reject the null hypothesis, we say, "There is significant evidence at the 5% level to suggest the hypothesis is false".

One-Tailed Test

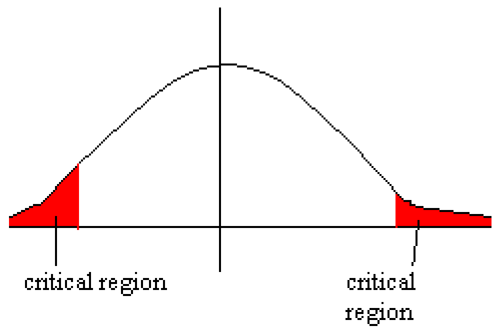
We choose a critical region. In a one-tailed test, the critical region will have just one part (the red area below). If our sample value lies in this region, we reject the null hypothesis in favor of the alternative.

Suppose we are looking for a definite decrease. Then the critical region will be to the left. Note, however, that in the one-tailed test the value of the parameter can be as high as you like. These are used for difference tests.



Two-Tailed Test

In a two-tailed test, we are looking for either an increase or a decrease. These are used for preference tests.



George Vierra
gjvnapa@sbcglobal.net