**How to interpret Interaction effects**

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Interaction is the extra effect that you get when two variables when used together provide a greater effect than the sum of the two individual effects.

S = 10 + 3\*X1 + 5\*X2 + 2X1\*X2

Assume all coefficients are significant.

If x1 is increased by one unit, S would increase by 3 units, all else remaining same.

If x2 is increased by one unit, S would increase by 5 units, all else remaining same.

If both X1 and X2 are increased by one unit, and there is interaction effect, then the total effect of S will be 3 + 5 + 2 = 10. In other words you get 10 instead of 8 that you would have got if there were no interaction between the two variables.

Any extra effect due to the joint effect of two variables is also called synergy or positive interaction effect.

One can also get a negative interaction effect (or cancellation effect) that is, two variables when used together may reduce the total effect instead of increasing the effect. This happens with medicines. One medicine might help with one health problem and another may help with another health problem. But when both medicines are taken, one medicine could counter the effect of the other medicine.

H = 10 + 3\*X1 + 5 \*X2 – 2 X1\*X2

In the above equation, there is negative interaction and the joint effect of X1 and X2 is 6 (3+5-2) and not 3+5.

Another example:

H = 10 - 3\*X1 - 5 \*X2 – 2 X1\*X2

Increase in one unit of X1 (say more sugar in blood) reduces H (health) by 2 units.

Increase in one unit of X2 (say more cholesterol) reduces H (health) by 5 units.

If a person has both high sugar and high cholesterol, then H would reduce by more than the sum of the above two effects i.e. H would reduce by 10 units and not 8 units that one would expect if there were no interaction.

Here, this is a case of synergy, since the joint effect due to interaction is magnified and not reduced.

Third example

S = 10 - 3\*P + 5\* A + 2 P\*A

If Price (P) decreases by one unit, sales would increase by 3 units.

If Ad (A) increases by one unit, sales would increase by 5 units.

If both price were reduced and Ad increased by 1 unit, you would expect sales of 8 if there were no interaction.

With interaction the effect will be 3+5+2 or 10.

This may be confusing. Think like this.

Lowering Price is good for sales.

Increasing Ad is good for sales.

If advertising makes the price effect stronger (as more people will know about the lower price), then the -3 effect of price should become larger i.e. should become -5. This can only happen if the interaction coefficient is -2.

Bottom line:

Be careful when you interpret interaction effects.

All marketing mix variables do have interactions and so one should always test for interactions.