

Three-Way Interaction Plots: When the Halves “Look Different”

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A common heuristic for interpreting three-way interaction plots is to look at the “simple” two-way interaction in the left half of the plot and the “simple” two-way interaction in the right half of the plot separately. If these two-way interactions “look different,” then we say that there is a three-way interaction. This heuristic does not always work.

The next three pages contain six plots (two per page) of the same three-way design, with factors A , B , and C predicting the dependent variable DV . Each factor, A , B , and C , has two levels, 0 and 1. The dependent variable is related to the factors as follows.

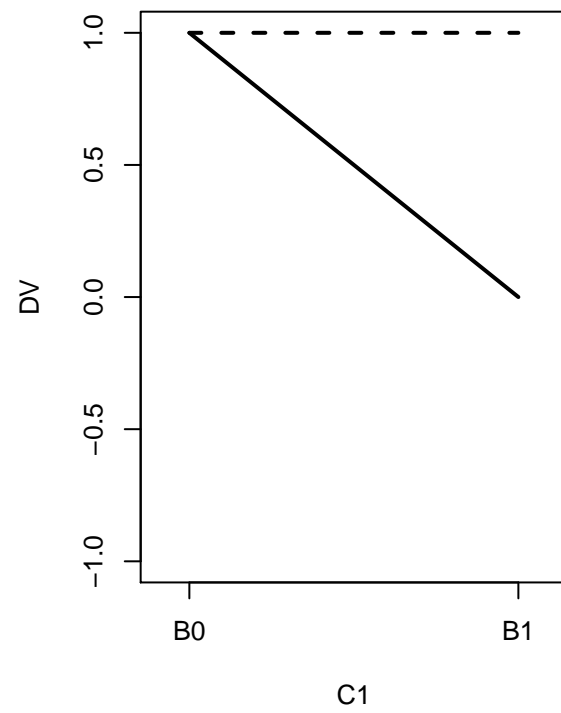
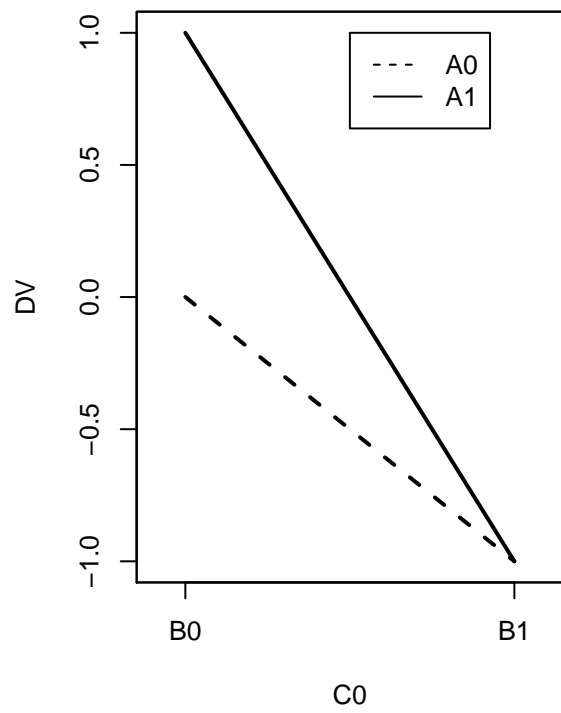
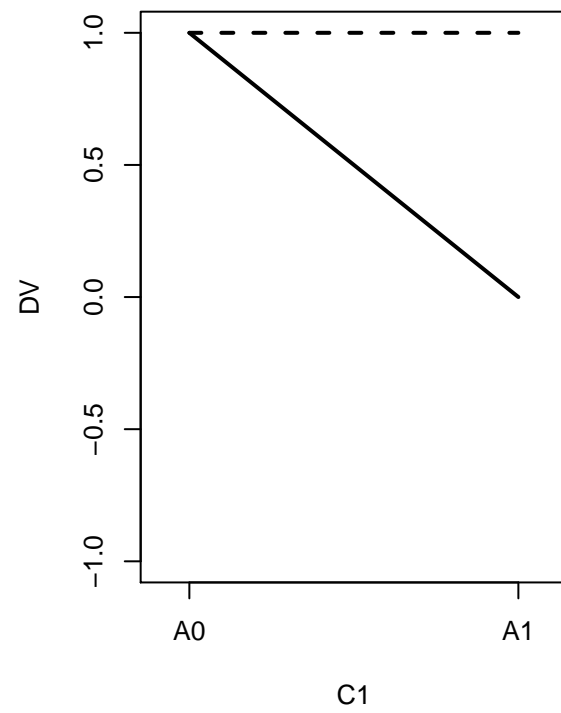
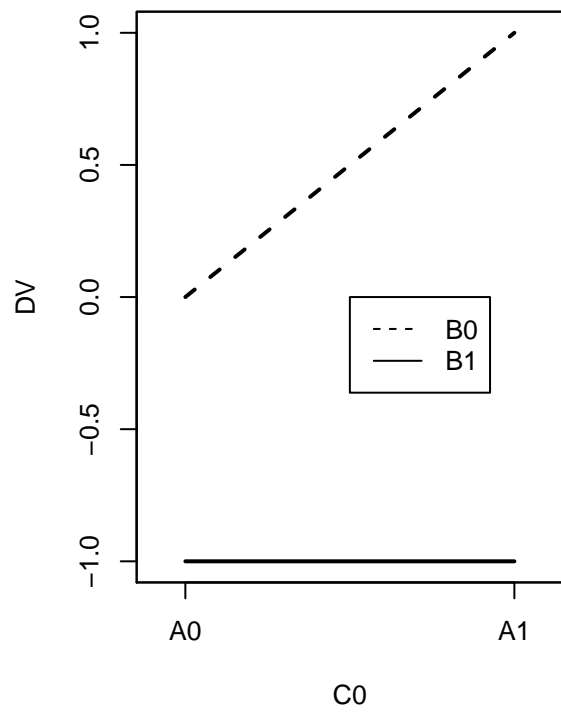
$$DV = A - B + C - AB - AC + BC$$

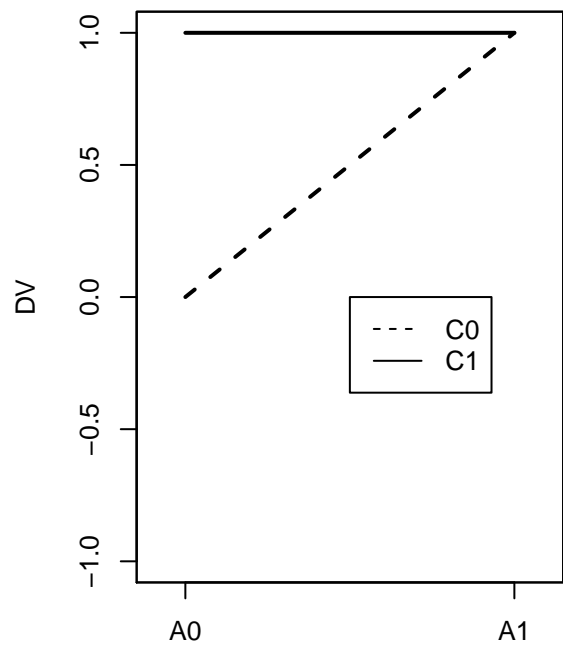
The three-way interaction is exactly zero, but all three two-way interactions are present.

We can choose among six different ways of generating a three-way interaction plot of these relationships, and all six are shown in the following pages.

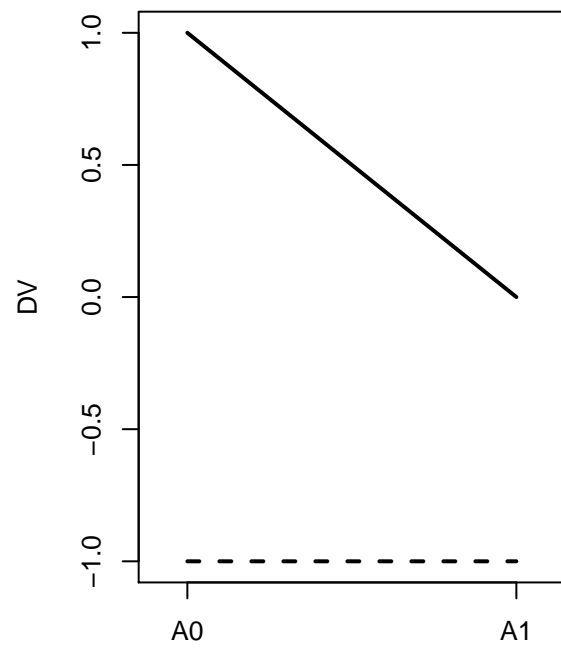
In all the plots, it “looks like” there is a three-way interaction based on our heuristic of the side-by-side two-way interactions “looking different.” Nonetheless, there is no three-way interaction.

Note that a two-way interaction is just a difference between two slopes. (For example, if the lines are parallel, the slopes are the same and the difference between them is zero, so there is no two-way interaction.) Using this information, if you look closely at any of the plots below, you can tell that there is not a three-way interaction. Take the first plot as an example. On the left, for $C0$, the line for $B0$ has a positive slope (its slope is 1) and the line for $B1$ is flat (its slope is 0). The difference is $1 - 0 = 1$. On the right, for $C1$, the line for $B0$ is flat and the line for $B1$ has a slope of -1 , so the difference is $0 - -1 = 1$. Even though the pattern looks different, the difference between the two slopes on the left is the same as the difference between the two slopes on the right. Thus, the two-way interaction at $C0$ has the same magnitude as the two-way interaction at $C1$, so there is no three-way interaction.

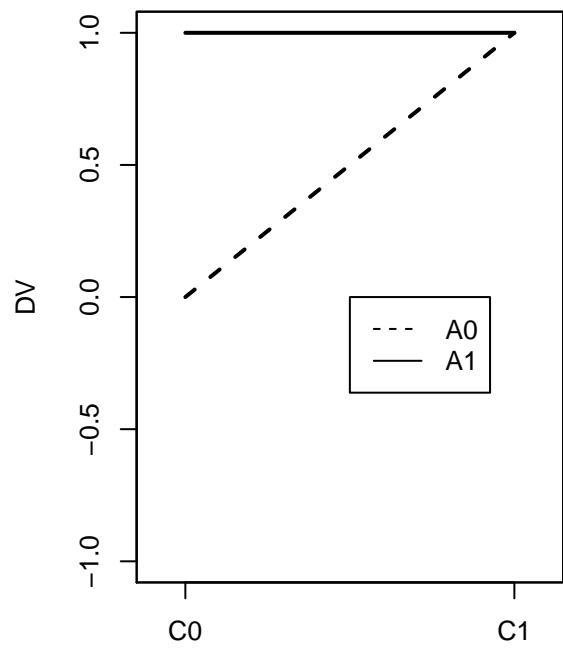




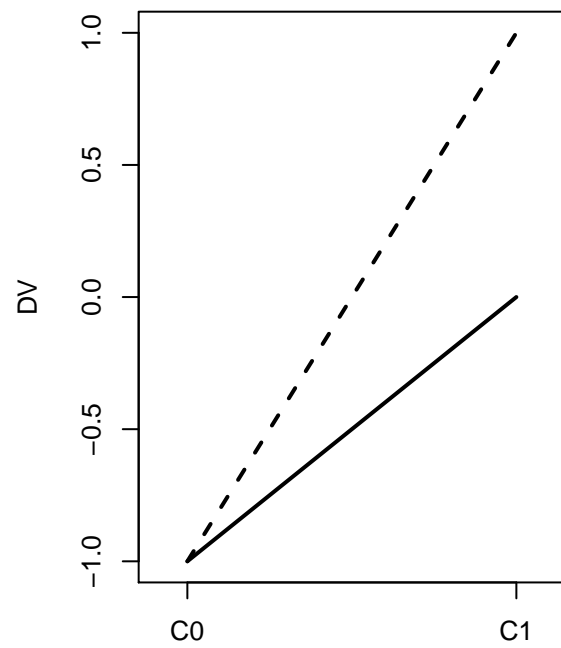
B0



B1



B0



B1

