Week 9 lecture notes - PSYC 3435

Mar 20-24, 2017

This week, we'll talk about factorial designs

Motivation

So far, all of our experiments have had exactly **one** independent variable. What happens when you have two or more?

Example

Suppose you are interested in the effects of modality (visual versus auditory) on memory. Consider the following experiment:

- procedure: give participants a list of words to remember
- IV1: presentation mode (visual, auditory)
- IV2: test mode (visual, auditory)
- DV: score on a recognition test ("was this word in the list?")

One way to approach this is to run two t-tests on memory scores:

- Test 1: compare means for visual study and auditory study
- Test 2: compare means for visual test and auditory test

Here's some data (use JASP dataset?):

- Study mode:
  - visual study: M = 65
  - auditory study: M = 65

- Test mode:
  - visual test: M = 65
  - auditory test: M = 65
- what would we say about the results of our manipulations??
  - no effect of study mode AND no effect of test mode!

However, we might be missing something:

- what happens when we consider various combinations of our IVs?

Data:

	visual pres	auditory pres
visual test	80	50
auditory test	50	80

- what happens when we plot these?
- what story does this data tell?
- this is a textbook example of an *interaction*, and is the result of a **factorial design**

Definitions - Factorial Designs

- *factors* - another name for independent variable
  - ex: test mode
- *levels* - the values each factor can take
  - ex: test mode has two levels: visual, auditory
- an N x M factorial design has *two* factors; the first with N levels and the second with M levels
- Example: in our previous study, we had a 2 x 2 design.
- Example: consider a 2 x 4 design:

	B1	B2	B3	B4
A1				
A2				

The number of *conditions* is calculated by multiplying the numbers of levels, so a 2x4 design has 8 conditions.

Anatomy of a 2x2 design

	A1	A2	
B1	condition mean A1B1	condition mean A2B1	marginal mean B1
B2	condition mean A1B2	condition mean A2B2	marginal mean B2
	marginal mean A1	marginal mean A2	

- if marginal means differ, this is called a *main effect*
- if pattern in one variable changes across the levels of the other, this is called an *interaction*

Advantage of factorial design

If you have only one independent variable, there are only two possible outcomes: there is an effect, or there is not

If you have TWO independent variables, things are much more interesting!

Let

- A = main effect of factor A
- B = main effect of factor B
- AB = interaction of A and B

Then there are EIGHT possible outcomes:

- No effects at all
- A only
- B only
- AB only
- A and B, but not AB
- A and AB, but not B
- B and AB, but not A
- A, B, and AB

Examples of 2x2 designs

For each of the following:

- compute the marginal means
- plot the means
- decide whether the main effects and/or interactions are significant

	A1	A2
B1	30	60
B2	30	60

	A1	A2
B1	60	60
B2	30	30

	A1	A2
B1	60	30
B2	30	60

	A1	A2
B1	30	60
B2	30	30