

# Counterbalancing

In a repeated measures design, you must control for order effects by *counterbalancing*.

- With *complete counterbalancing*, every possible order is included in the experiment. The number of orders of X groups is  $X!$  - if you have three groups there are  $3!$  possible orders.  $3! = 3 \times 2 \times 1 = 6$ .
- When there are more than two or three groups, it is difficult to include all possible orders. In this case, you can assign each subject to a random order of conditions, or you can construct a *Latin Square*.
- With a Latin Square, the number of orders is equal to the number of conditions. Each condition appears only once in each order *and* each condition precedes and follows each other condition one time.
- With four groups, complete counterbalancing requires  $4 \times 3 \times 2 \times 1 = 24$  orders. With a Latin Square, only four orders are needed.
- Follow the rules in Appendix D to determine the orders for a Latin Square. With four groups – termed A, B, C, D – the four orders are:

Order 1: A B D C

Order 2: B C A D

**Order 3: C D B A**

**Order 4: D A C B**