Match pairs: You want to maximize control of variables.

Best subject identical twins raised on your secret twin farm.

Second best subject: The same person.

Before or after

Left/right

Third best subject: People who match on all the variables that matter.

Make your pairs. One treated, one control

How might you use match pairs in these circumstance?

Testing the affectiveness of a red hair coloring kit.

Testing a new kind of sole for boots

Testing a new type of fly paper

Testing wrinkle cream

Testing the effectiveness of a memory trick for remembering names.

Which of these is a circumstance where you might do match pairs and which is one where you might use blocks?

Testing the a new weed control formula.

Testing a new computer operating system

Testing possible endings for a movie.

Testing new cover for a news magazine.

Testing the popularity of a new music group.

Testing a new insecticide.

Testing effect of a new vitamin on muscle development

Testing a new fertilizer.

Control
- Make treatment as similar as possible
- Where you can't and just in case, randomize all decisions
- Manage all variables:
    - o Subject knowledge
    - o Knowledge of the person applying treatment
    - o Knowledge of the person measuring the result

Knowledge:
1) Give placebos - same behaviors, same experience

2) Double blind experiment:
- Really should be triple blind.

Book: neither subject nor people applying treatment know which treatment you are getting.

Me: Subject, people applying treatment, person measuring result should all be blind.

Other:
Subjects are not necessarily perfect people:

Refusal: After selection do not participate.
May or may not cause bias
- With control probably not

Nonadherers: They don't follow instructions.
May or may not cause bias
- May or may not be controllable

Dropouts: They leave the experiment
May or may not cause bias,
- May be controllable
- May be an issue of response variables

Alice ran an experiment on the affect of yoga on people's level of happiness. Subjects in the treatment group were instructed to do 60 minutes of yoga everyday. When interviewing the subjects afterward some apologized for not having had enough time to do 60 minutes a day.

Bill tried to run an experiment. When he described the experiment he told the subjects that he would give them a pill. The day they showed up and he showed them the pill, the size of his thumb, 8 refused to participate.

Susan ran an experiment on weight loss techniques in which the subjects had to spend 2 minutes describing their food into a tape recorder before they could eat it. 4 subjects stopped because it was too much of a pain in the neck.

Last: Do you have predictive validity? Does the experiment predict the real world?

Too much control/entering an artificial world

- The treatment creates a world so unlike the real world, the answers can not be generalized.
  - o The explanatory variable is too novel (third brake light, day care)
  - o Hawthorne Effect attention of the experiment makes it not like the real world.
  - o The subjects are different from the population (mice).

Name:
In quesons 1-3 consider the two scenarios and decide which suggests a blocking design and which a matching design.

1) Exp. 1: The average value of the response variable for the control group was compared to the average result for the treatment group.
Exp. 2: The average difference in the response variable was calculated and compared.

1: Block or Match (circle one) 2: Block or Match (circle one)

2) Exp. 1: Each subject used a new tool to mow a lawn and each subject used the old tool.
Exp 2: A group of subjects used the new tool and a group of subjects used the old tool.

1: Block or Match (circle one) 2: Block or Match (circle one)

3) Exp. 1: The designer's concern is that people from different religions will respond differently.
Exp 2: The designer is concerned that many lurking variables might affect each of subjects' responses.

1: Block or Match (circle one) 2: Block or Match (circle one)

4) In tesng new 3D glasses, for each subject an experimenter used a true random process to decide if they got new glass or old glasses. The experimenter then fied the glasses to each subject so they were on properly and then escorted the subject as they found a seat. What basic rule is violated in this scenario?

I am testing how frequent brushing effects the whiteness of your teeth. The subjects were put in three group whose brushing was controlled for two weeks. Treatment group 1 was told to brush once a day. Treatment group 2 was told to brush 6 times a day. Treatment group 3 was told not to brush their teeth. Three different dental students then rated each su bject's teeth and the average score rating for each group was calculated. Problems? Solutions?

The Olympic ski teams wants to test the effectiveness a special additive to ski wax. Group 1 had no additive in their wax. For group 2 the wax mixture was 5% additive. For group 3 the wax mixture was 20% additive. The experimenters then had the skiers ski on an indoor artifical ski surface and compared total run times for the three groups.

A study wanted to test the effectiveness of warning signs in the forest in preventing problems with people disturbing animals. Four different national parks were divided up into 8 section. 4 sections had signs telling people to leave dangerous animals alone. 4 sections had signs listing the different animals in the forest and showing pictures. Rangers then tracked the average number of animal incidents. They did not find a significant difference. Any issue?

Skills:

Identify lurking and confounded variables.

Interpret statistical significance

Diagram 2 kinds of studies

Regular Controlled Random Experiment

Block

Identify 3 kinds from diagram

Decide when blocking or matching would be good

Decide how to block or match

Design 3 kinds of studies

How many groups?

Clear statement of explanatory and response variables

Criticize a study for:

-Controlling variables badly (control groups, placebo, other)

-Double blind (3 ways)

- Creating unrealistic circumstance (no predictive validity)

Identify refusal, drop-out, non-adherers.

Suggest ways to fix those problems/make a design that avoids them

Control of variables (block, control groups, placebo, subjects, large N)

Not being blind, be blind

Creating unrealistic circumstance - don't

You want to study the effect of positive reinforcement on students, but you believe it might work better with stronger students than with weaker students. Design an experiment.

Explain what these statements mean:

The difference in math SAT scores between Central and Staples was 10 points. This was significantly different. What does that mean?

The difference in math SAT scores between Central and Staples was 10 points. This was not significantly different. What does that mean?

The difference in number of colds between Airborne users and non-Airborne users was not statistically significant.

The difference is so {small/large} that statistical calculations tell us a difference that {small/large} is {quite likely/quite unlikely} if the the parameters are really same.

An experiment tests cause and effect

Does **this** cause **that**?

The treatment, measured by the explanatory variable

The result measured by the response variable.

We are confusing two things.
1) Explaining the causation the experimenter is trying to test.

The experimenter is trying to prove X causes Y.

2) Identifying variables.

Statistical significance:
A big result, a big difference

Experiment 1:
Control group: 400
Treatment group: 401

A difference this small might happen even if the treatment had no real effect, just by dumb luck.
NOT SIGNIFICANT

Experiment 2:
Control group: 400
Treatment group: 450

A difference this big would probably only happen if the treatment had a real effect.
It is not just dumb luck.
A SIGNIFICANT RESULT

Explanatory variable has an effect: → The difference between control and treatment group is big.

Explanatory variable has a NO effect: → The difference between control and treatment group is NOT big.

HOW BIG IS BIG enough?

Statistical significance: A big result, a big difference

Experiment 1:
Control group: 400
Treatment group: 401

Experiment 2:
Control group: 400
Treatment group: 450

Explanatory variable has an effect: → The difference between control and treatment group is big.

Explanatory variable has a NO effect: → The difference between control and treatment group is NOT big.

HOW BIG IS BIG ENOUGH?

Big enough it is UNLIKELY to have happened by dumb luck.

Statistical calculations tell us.

E

Your words have to say:	Significant	NOT
Was the difference	Big	Small
Mention statistical calculations	Yes	Yes
The difference is	Unlikely	Likely
Discuss treatments	Effective	Notffectiveness

The difference in subject ratings of TV show enjoyment between the treatment group and the control group was large. Statistical calculations show that the difference was so large that difference would be very unlikely to have happened if the number of commercials made no difference.

The difference in subjects' enjoyment ratings for the treatment and control groups was so small that a difference this small could be due just to chance. Statistical calculations show that a difference this small is very likely to happen even if the number commercials have no effect.

Interpret statistical significance each context:

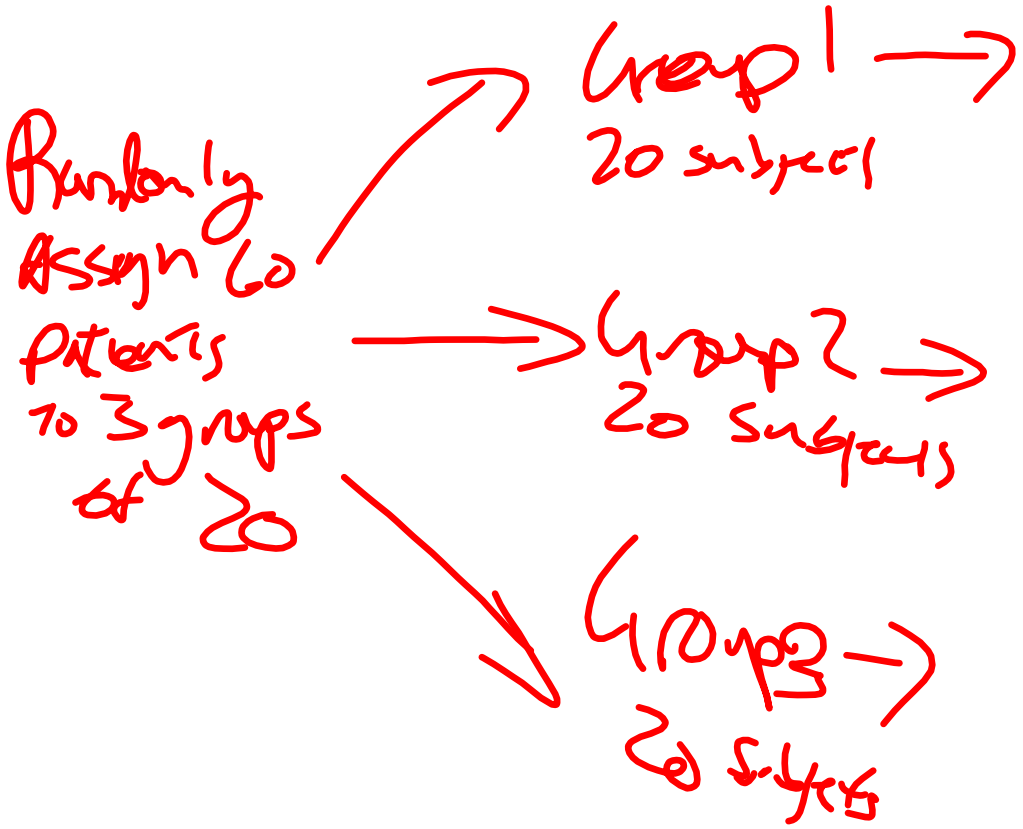
The study showed that using toothpaste three times a day gave significantly whiter teeth than not brushing your teeth.

The showed that using .25 oz of toothpaste three times a day did not make teeth significantly whiter than using .1 oz of toothpaste.

The study showed that the wax additive made a significant difference in the total run times for the ski teams.

The ranger interviews showed no significant support for the idea that signs made a difference in camper behavior.

Critique studies:


Randomly
assign 60
patients
to 3 groups
of 20
Group 1 →
20 subjects
Group 2 →
20 subjects
Group 3 →
20 subjects