

PSEUDOREPLICATION

TYPES OF EXPERIMENTS

- MENSURATIVE—COLLECTING MEASUREMENTS AT ONE OR MORE POINTS IN SPACE OR TIME; SPACE OR TIME IS THE ONLY EXPERIMENTAL VARIABLE OR TREATMENT
- MANIPULATIVE EXPERIMENTS
 - - ALWAYS INVOLVES TWO OR MORE TREATMENTS AND HAS AS ITS GOAL THE MAKING OF ONE OR MORE COMPARISONS
 - - DEFINING FEATURE: DIFFERENT EXPERIMENTAL UNITS RECEIVE DIFFERENT TREATMENTS AND THAT THE ASSIGNMENT OF TREATMENTS TO EXPERIMENTAL UNITS IS OR CAN BE RANDOMIZED

PSEUDOREPLICATION IN MENSURATIVE EXPERIMENTS

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- DEFINED AS THE TESTING FOR TREATMENT EFFECTS WITH AN ERROR TERM INAPPROPRIATE TO THE HYPOTHESIS BEING CONSIDERED.
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PSEUDOREPLICATION

- OCCURS IN MENSURATIVE EXPERIMENTS FROM USE OF INFERENTIAL STATISTICS TO TEST FOR TREATMENT EFFECTS WITH DATA FROM EXPERIMENTS WHERE:
 - 1. TREATMENTS WERE NOT REPLICATED (THOUGH SAMPLES MAY BE) OR
 - 2. REPLICATES ARE NOT STATISTICALLY INDEPENDENT.
- PSEUDOREPLICATION REFERS NOT TO A PROBLEM IN EXPERIMENTAL DESIGN (OR SAMPLING) BUT RATHER TO A PARTICULAR COMBINATION OF EXPERIMENTAL DESIGN (OR SAMPLING) AND STATISTICAL ANALYSIS THAT IS INAPPROPRIATE FOR THE HYPOTHESIS IN QUESTION

CRITICAL FEATURES OF A CONTROLLED EXPERIMENT

- CONTROLLED EXPERIMENT--IT IS THE TASK OF EXPERIMENTAL DESIGN TO REDUCE OR ELIMINATE THE INFLUENCES OF THOSE SOURCES OF CONFUSION.
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- CONFUSION IS ELIMINATED THROUGH USE OF CONTROLS, REPLICATION, RANDOMIZATION, AND INTERSPERSION OF TREATMENTS.

CONTROLS

- ANY TREATMENT AGAINST WHICH ONE OR MORE OTHER TREATMENTS IS TO BE COMPARED
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- ALLOW SEPARATION OF THE EFFECTS OF DIFFERENT ASPECTS OF THE EXPERIMENTAL PROCEDURE
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- REGULATION OF THE CONDITIONS UNDER WHICH THE EXPERIMENT IS CONDUCTED

REPLICATION, RANDOMIZATION, INDEPENDENCE

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- REPLICATION AND RANDOMIZATION--IMPROVE ESTIMATION AND PERMIT TESTING
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- REPLICATION REDUCES EFFECT OF NOISE
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- RANDOMIZATION ELIMINATES POSSIBLE BIAS
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- RANDOMIZATION PERMITS INDEPENDENCE OF ERRORS THAT IF NOT KNOWN PROHIBIT US FROM KNOWING ALPHA
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DEMONIC AND NONDEMONIC INTRUSION

- WHEN SOMETHING HAPPENS THAT CREATES A TREATMENT EFFECT BASED ON THE WAY STUDY IS SET UP (DEMONIC)
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- NONDEMONIC--CHANCE EVENTS RELATED TO WEATHER --DOES NOT HAPPEN TO ALL PLOTS/TREATMENTS

INTERSPERSION OF TREATMENTS

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- MENSURATIVE EXPERIMENTS--ISOLATED
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- MANIPULATIVE--INTERSPERSED--MIXED AT EVERY LOCATION
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- BUT MUST BE RANDOMIZED AT EACH LOCATION TO ENSURE INTERSPERSION OF TREATMENTS
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SEGREGATION

- COMPLETELY RANDOMIZED DESIGN -MAY PRODUCE SEGREGATION
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- RANDOMIZED BLOCK-COMMONLY USED DESIGN
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- SYSTEMATIC--REGULAR INTERSPERSION
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- SIMPLE SEGREGATION--SPURIOUS TREATMENT EFFECTS
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- CLUMPED SEGREGATION--SPURIOUS TREATMENT EFFECTS
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- ISOLATIVE SEGREGATION--SPURIOUS TREATMENT EFFECTS, LACK OF REPLICATION
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- RANDOMIZED BUT WITH INTERDEPENDENT REPLICATES-NO BETTER THAN ISOLATIVE SEGREGATION
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- NO REPLICATION--A COMPARISON OF TWO AREAS (FOR EXAMPLE)
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PRELAYOUT AND LAYOUT-SPECIFIC ALPHA LEVELS

- PRELAYOUT--SUM OF ALPHAS OF ALL POSSIBLE LAYOUTS/NUMBER OF POSSIBLE LAYOUTS
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- THIS GIVES PRELAYOUT ALPHA
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- THEN IF YOU PICK A LAYOUT WITH HIGH INTERSPERSION, HAVE HIGH LAYOUT SPECIFIC ALPHA

Bonferroni Correction

- Method of maintaining alpha when conducting multiple experiments
 - Two or more t-tests, Anovas, etc.
 - Divide alpha by number of tests

PSEUDOREPLICATION

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- SIMPLE PSEUDOREPLICATION--SINGLE REPLICATE PER TREATMENT
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- THEN COULD COLLECT NUMBER OF OBSERVATIONS WITHIN EACH TREATMENT
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- TEMPORAL PSEUDOREPLICATION--TIME REPRESENTS REPLICATES OF TREATMENTS
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- SACRIFICIAL PSEUDOREPLICATION--HIDING SOME OF THE VARIATION AMONG REPLICATES --POOLING OF REPLICATES
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- IMPLICIT PSEUDOREPLICATION--HOW AWARE AUTHORS ARE OF THEIR DESIGN PROBLEMS
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INFERENCE

- Comment based on Tacha et al. –beware of making inferences from limited sampling to a population

Role of Hypothesis Testing?

- Johnson vs. Robinson and Wainer
- Use of P values in field research studies
 - descriptive studies
 - Not really confirmatory experiments
 - P values make it appear to be confirmatory experiment