European Ph.D

on Social Representations and Communication

# 10th International Summer School of the European PhD on Social Representations & Communication

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# Social Influence and Communication in the New Scenarios of the Information Society

## Is it possible to change risk behaviour?

## SCIENTIFIC DIDACTIC MATERIAL

University of Rome "La Sapienza"

Colonna Castle, Genazzano – Rome (Italy)
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# META-ANALYSIS
# An overview

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**Give sense accumulated data**

**Intervention Evaluation**

**Reviews**

**- Point out findings**

**- Point out future research**

- **Reviews as part of scientific research.**

- **From narrative reviews to quantitative research synthesis**

- **1960-70. First attempts of integration**

- **1976, Glass: Meta-analysis (Conference *American Educational Research Association*)**

# What are the problems of narrative reviews?

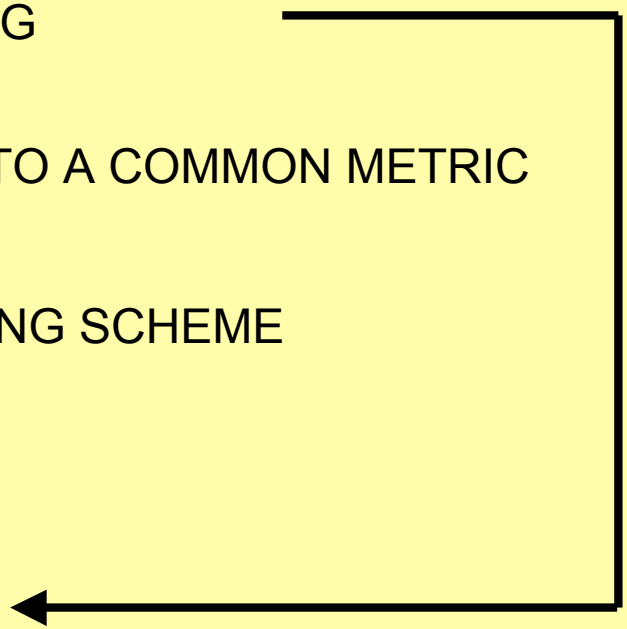
- **Inclusion of selective studies.**
- **Difficulty to analyse potential moderator variables**
- **Inadequate information about studies.**
- **Subjective weights on the studies.**

# Meta-analysis characteristics

- **Precision**
- **Objective**
- **Replicability**

# META-ANALYSIS PHASES

1. PROBLEM: HYPOTHESIS
2. RESEARCH SEARCHING
3. TRANSFORMATION INTO A COMMON METRIC
4. DEVELOPPING A CODING SCHEME
5. DATA ANALYSIS
6. CONCLUSIONS
7. REPORT



The problem of sampling bias

# RESEARCH SEARCHING AND SELECTION

- Rigour and transparency
- What look for
- How look for
- Selection criteria:

REPLICABILITY

# WHAT LOOK FOR

- **Search for every study in the defined population**

- **Quality selection? Methodological quality dilemma**

# HOW TO LOOK FOR

**No formal channels**
- **Personal contacts**
- **Invisible schools**
- **Internet**

**Primary formal channels**
- **Conference Programs and Proceedings**
- **Journals**
- **Ascendent searching**

**Secondary formal channels**
- **Bibliographic databases**
- **Bibliographic reference volumes**
- **Citation index**

# SELECTING RESEARCH
# Inclusion/exclusion criteria

**BEFORE research searching**

- **temporal limit**
- **Channels**

**DURING research searching**

- **Language**
- **Key-words**
- **Incomplete abstracts**

**AFTER research searching**

- **Not enough information**

# WHAT LOOK FOR

- **Search for every study in the defined population (include published and unpublished manuscripts)**

- **Quality selection? Methodological quality dilemma**
  - Methodological quality is a continuum
  - Being too restrictive may restric ability to generalize
  - Being too inclusive may weaken the confidence that can be placed on the finding
  - An appropriate balance to the research question

# WHAT IS THE INFORMATION WE HAVE IN EACH STUDY

**- Substantive characteristics (eg: type of treatment, duration, maintenance of program…)**

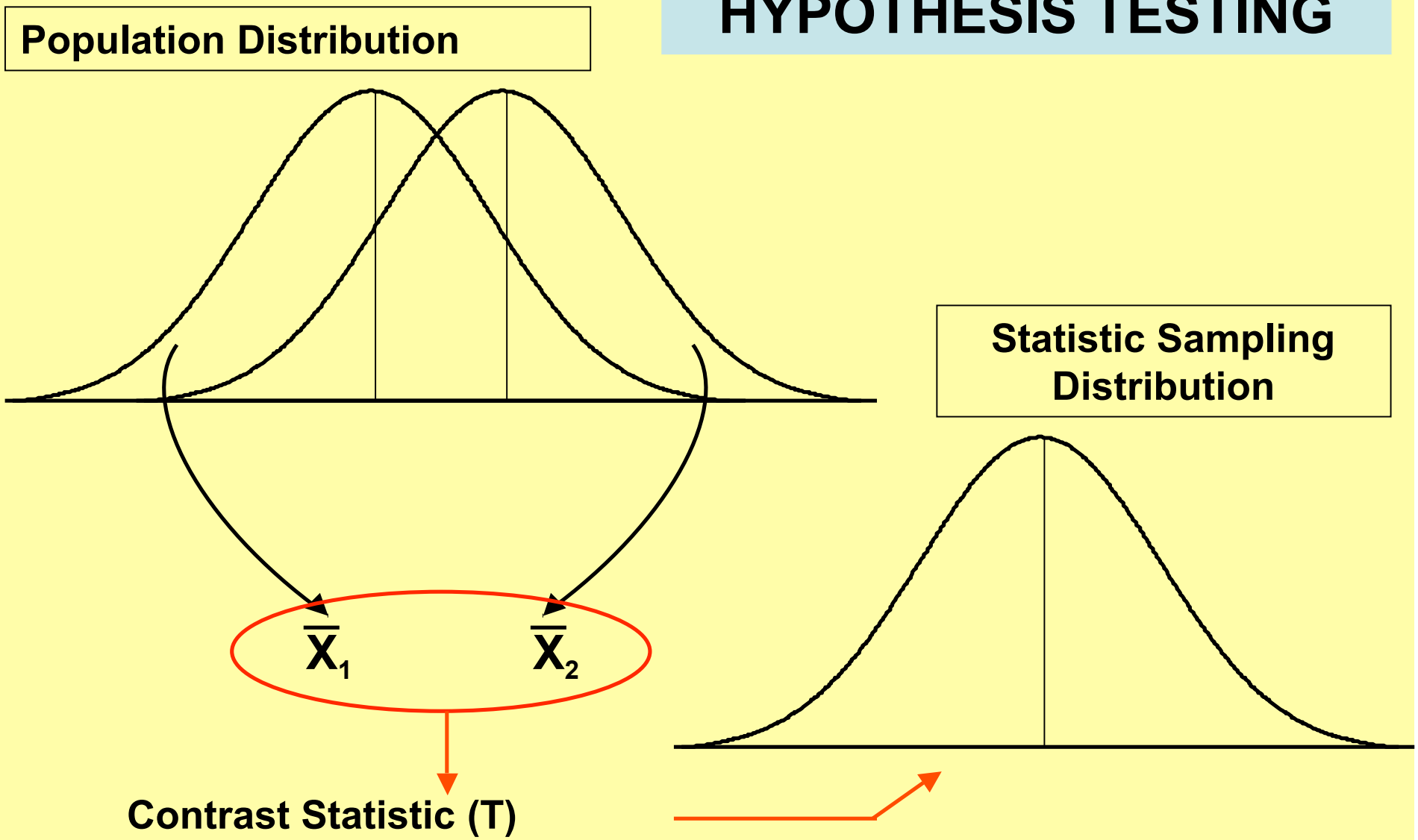
**- Subject characteristics (eg: mean age sample, educational level, mean number of years as a smoker…)**

**- Methodological characteristics (eg: attrition, quality of the study, subject source, design…)**

**- Extrinsic characteristics (eg: published vs unpublished, date of report, year,…)**

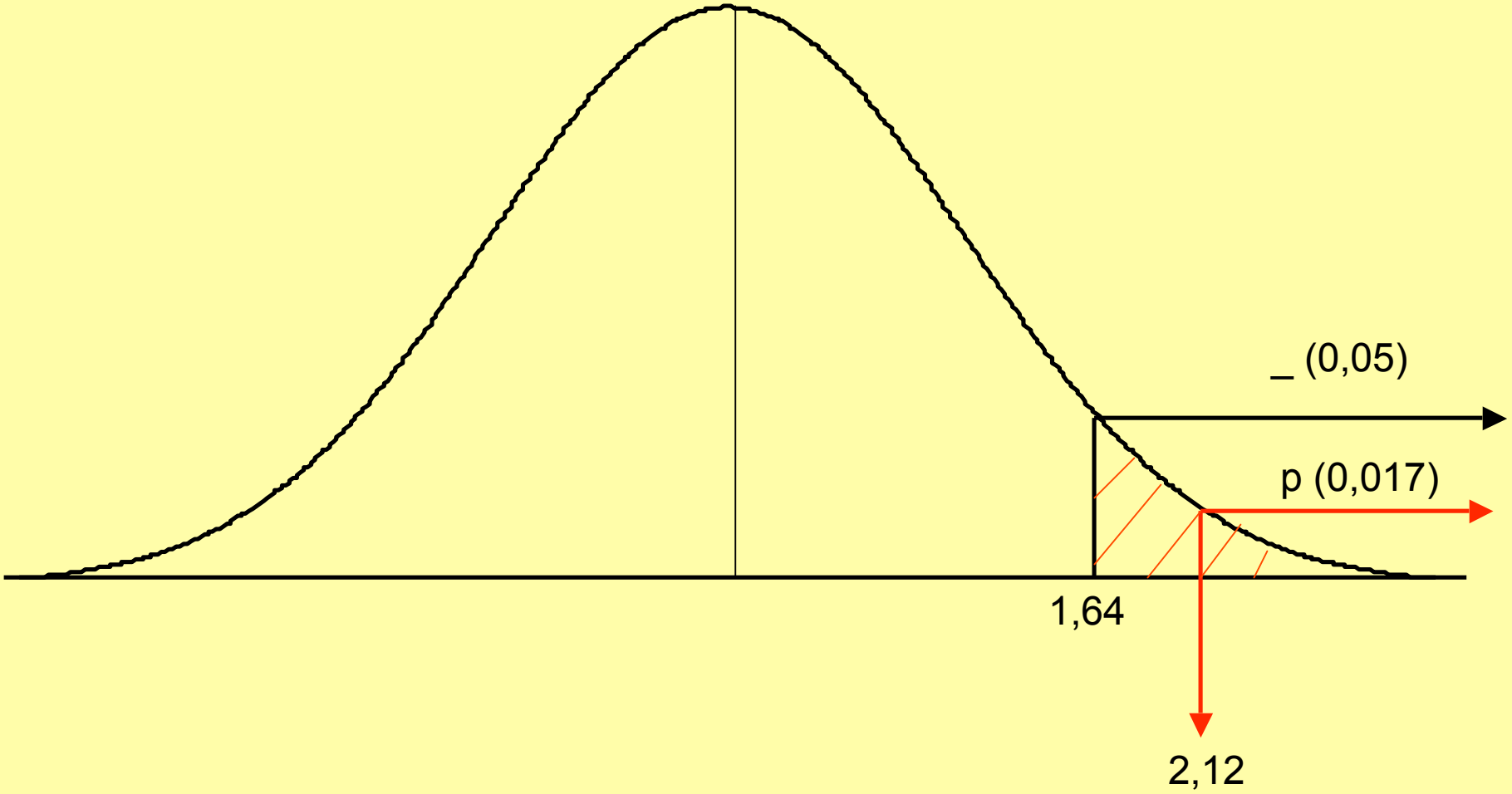
**- Statistical information**

# HYPOTHESIS TESTING



**Statistical sampling distribution**

# HYPOTHESIS TESTING



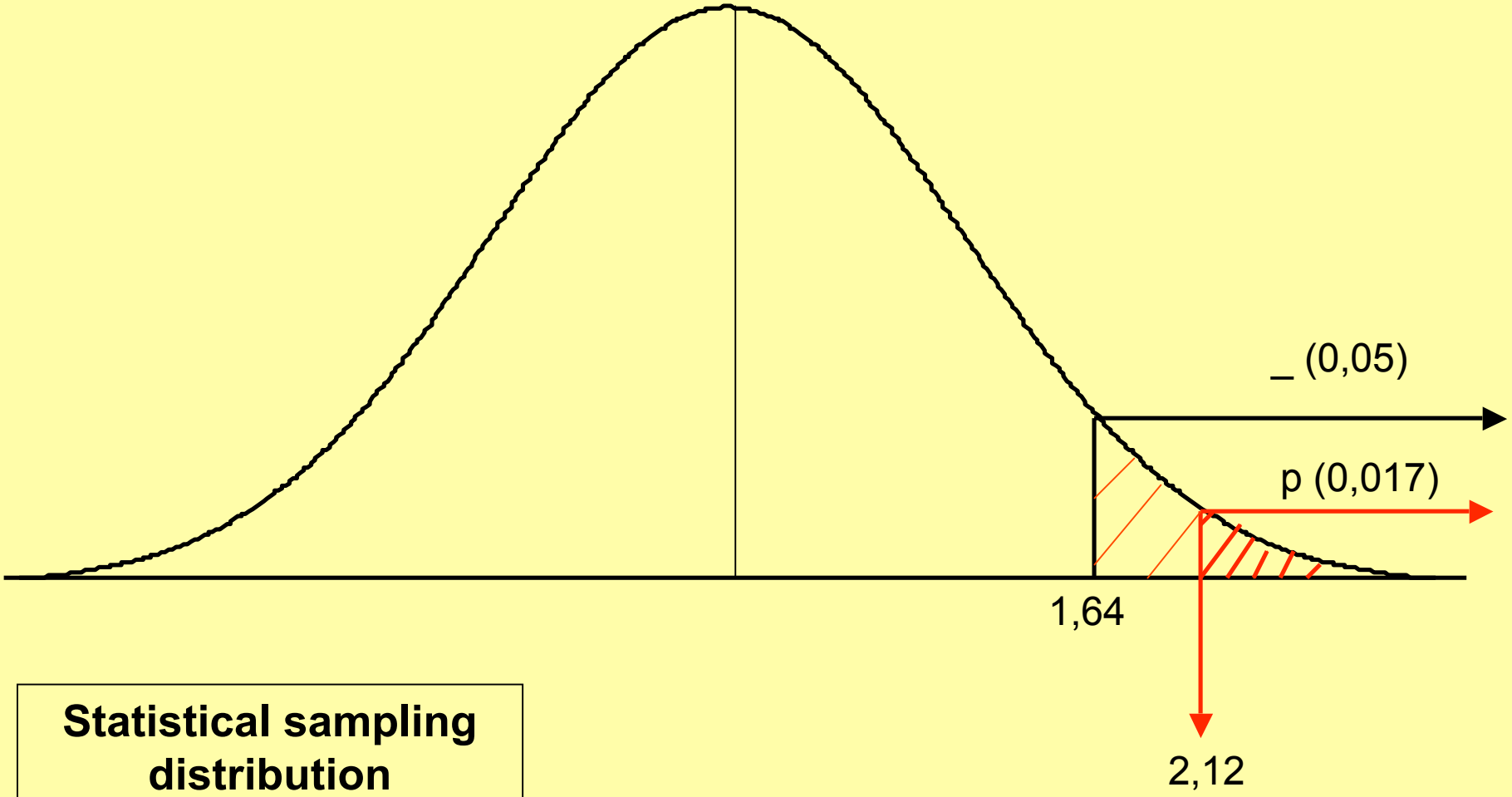
# TRANSFORMATION TO A COMMON METRIC

**Index types**

- **observed significance level**
- **Effect size**
  - **Standardized mean difference (_)**
  - **Pearson Correlation (r)**
  - **Odds ratio**

# OBSERVED SIGNIFICANCE LEVEL

**Being $H_0$ true, the probability to obtain a statistical value, at least as extreme as that one,**




**Statistical sampling distribution**

# OBSERVED SIGNIFICANCE LEVEL, ´p'

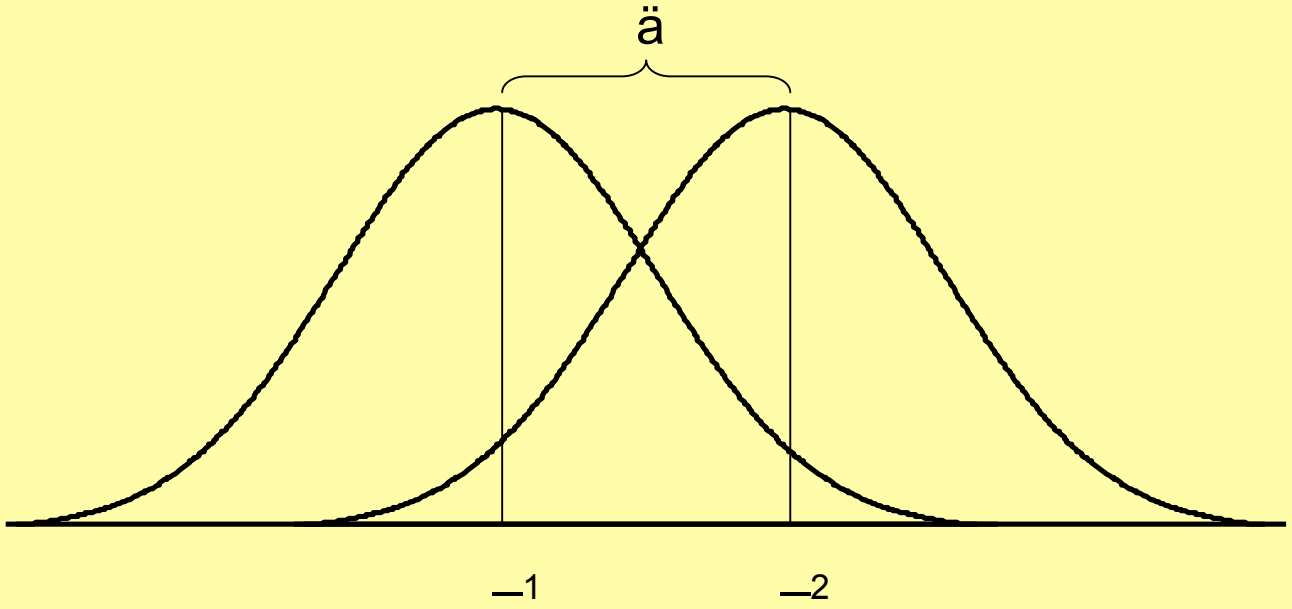
- **We can calculate a combined significance level of K studies**
- **Problem: `p´ is not always being informed (only > or > _ )**
- **It does not give information about the relevance of the association**

# Effect Size:

- The effect size makes meta-analysis possible
- Represents the magnitude and direction of the relationship of interest
- Is independent of sample size
- Different meta-analyses, different effect size indexes

# EFFECT SIZE

**Standardized mean difference (_)**

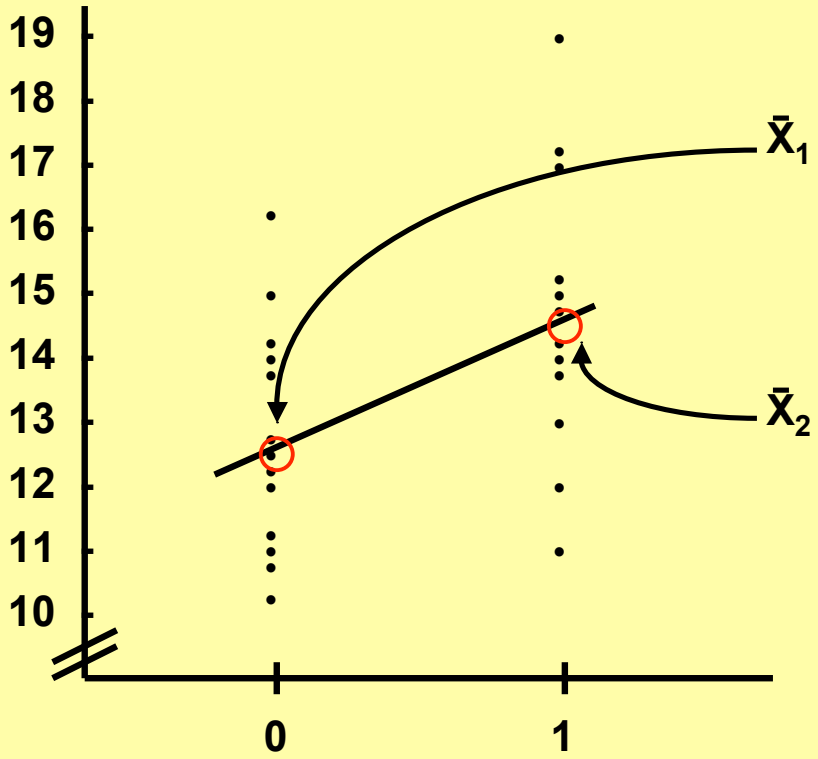



$$ä = \frac{ì_1 - ì_2}{ó}$$

$$d = \frac{\overline{X}_1 - \overline{X}_2}{S}$$

# EFFECT SIZE

## Pearson Correlation (r)




$$r = \sqrt{\frac{d^2}{d^2 + 4}} = \frac{d}{\sqrt{d^2 + 4}}$$

$$d = \frac{2 \cdot r}{\sqrt{1 - r^2}}$$

# DATABASE

| STUDIES | CHARACTERISTICS | | | | | | | | | RESULTS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SUBSTANTIVES | | | METHODOLOGIES | | | EXTRINSICS | | | | | | |
| SOURCE | Treat. indiv/group | Medication | ... | TYPE DESIGN | TYPE CONTROL GROUP | ... | PUBLICATION YEAR | TYPE PUBLICATION | ... | $N_E$ | $N_C$ | d r | p |
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| ... | | | | | | | | | | | | | |
| k | | | | | | | | | | | | | |

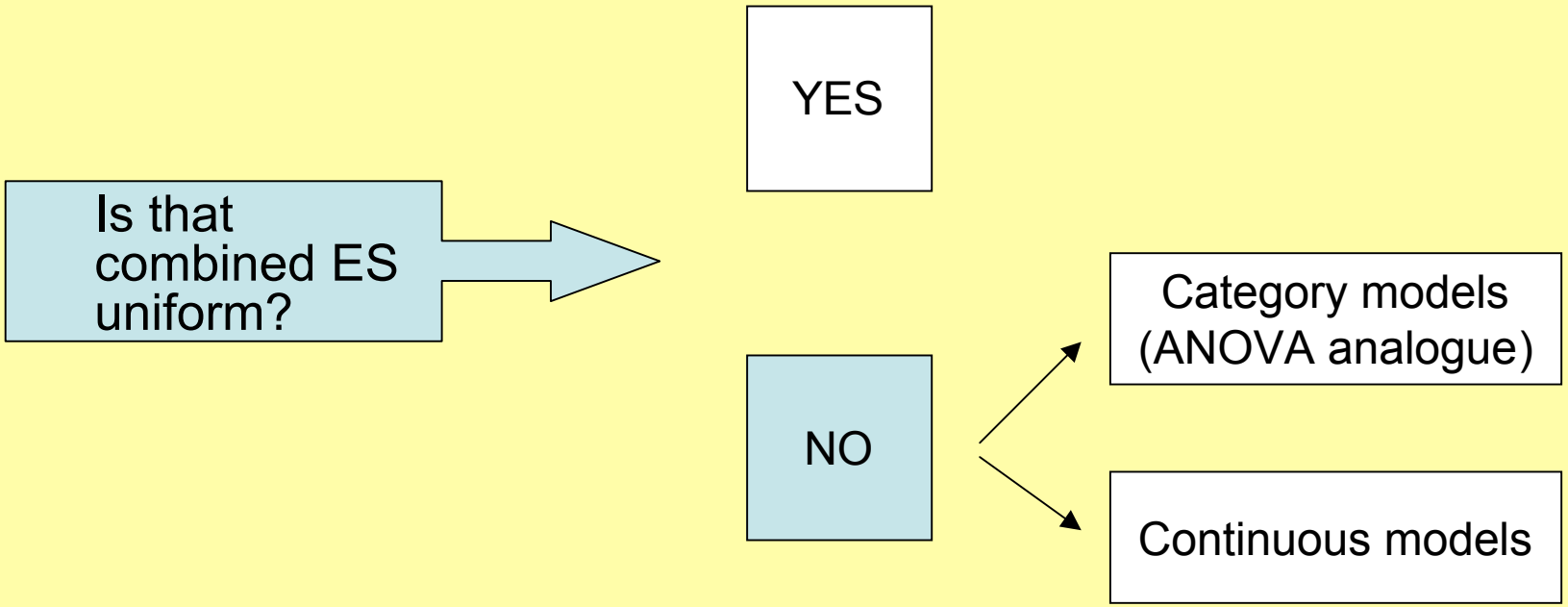
# DATA ANALYSIS

1.- What would be the result of a null contrast with the K studies retrieved? → Combined significance test

2.- What is the estimated effect size for the K studies? → Global estimated Effect Size

3.- Is the Effect size uniform? → homogeneity test

# Homogeneity test



# An example

| Studies | Number of Participants | $n^2$ | p | z | $n_i \cdot z$ |
|---|---|---|---|---|---|
| 1 | 48 | 2304 | .025 | 1.96 | 94.08 |
| 2 | 28 | 784 | .50 | 0 | 0 |
| 3 | 32 | 1024 | .33 | .44 | 14.08 |
| 4 | 24 | 576 | .90 | -1.28 | -30.72 |
| 5 | 64 | 4096 | .01 | 2.33 | 149.12 |
| 6 | 40 | 1600 | .39 | .28 | 11.20 |
| 7 | 20 | 400 | .50 | 0 | 0 |
| 8 | 30 | 900 | .15 | 1.04 | 31.20 |
| $\Sigma$ | 286 | 11684 | | 4.77 | 268.96 |

Simple procedure,

$$z = \frac{4.77}{\sqrt{8}} = 1.69,\ p < .0461$$

Weighted procedure,

$$z = \frac{268.96}{\sqrt{11684}} = 2.49,\ p < .0064$$

# 2.- What is the combined Effect Size?

- We have a set of Effect Sizes (an ES per study or an ES per subsample within study)

- Studies with bigger samples (N) are more precise, so they should have more weight.

- For this reason each ES is weighted by its inverse variance

An **Example** (taken from Lipsey and Wilson, 2001)

10 Effect size (ES) and their weights (w)

| Study | ES | w |
|---|---|---|
| 1 | -0.33 | 11.91 |
| 2 | 0.32 | 28.57 |
| 3 | 0.39 | 58.82 |
| 4 | 0.31 | 29.41 |
| 5 | 0.17 | 13.89 |
| 6 | 0.64 | 8.55 |
| 7 | -0.33 | 9.80 |
| 8 | 0.15 | 10.75 |
| 9 | -0.02 | 83.33 |
| 10 | 0.00 | 14.93 |

$$\overline{ES} = \frac{\sum (w \times ES)}{\sum w}$$

$$\overline{ES} = \frac{\sum (w \times ES)}{\sum w} = \frac{41.82}{269.96} = 0.15$$

# Interpreting Effect Size Results

Cohen's "Rules-of-Thumb"

standardized mean difference effect size

small = 0.20
medium = 0.50
Large = 0.80

But, take into account the context of the intervention

Correspond to the distribution of effects across meta-analyses found by Lipsey and Wilson (1993)

# The Analog to the ANOVA

Example taken from Lipsey and Wilson (2001)

| Study | Grp | ES | w | w*ES | w*ES^2 |
|---|---|---|---|---|---|
| 1 | 1 | -0.33 | 11.91 | -3.93 | 1.30 |
| 2 | 1 | 0.32 | 28.57 | 9.14 | 2.93 |
| 3 | 1 | 0.39 | 58.82 | 22.94 | 8.95 |
| 4 | 1 | 0.31 | 29.41 | 9.12 | 2.83 |
| 5 | 1 | 0.17 | 13.89 | 2.36 | 0.40 |
| 6 | 1 | 0.64 | 8.55 | 5.47 | 3.50 |
| | | | 151.15 | 45.10 | 19.90 |
| | | | | | |
| 7 | 2 | -0.33 | 9.80 | -3.24 | 1.07 |
| 8 | 2 | 0.15 | 10.75 | 1.61 | 0.24 |
| 9 | 2 | -0.02 | 83.33 | -1.67 | 0.03 |
| 10 | 2 | 0.00 | 14.93 | 0.00 | 0.00 |
| | | | 118.82 | -3.29 | 1.34 |

A grouping variable

# Homogeneity Analysis

- Homogeneity analysis tests whether all effect sizes are estimating the same population.

- If homogeneity is rejected, the distribution of effect sizes is assumed to be heterogeneous.

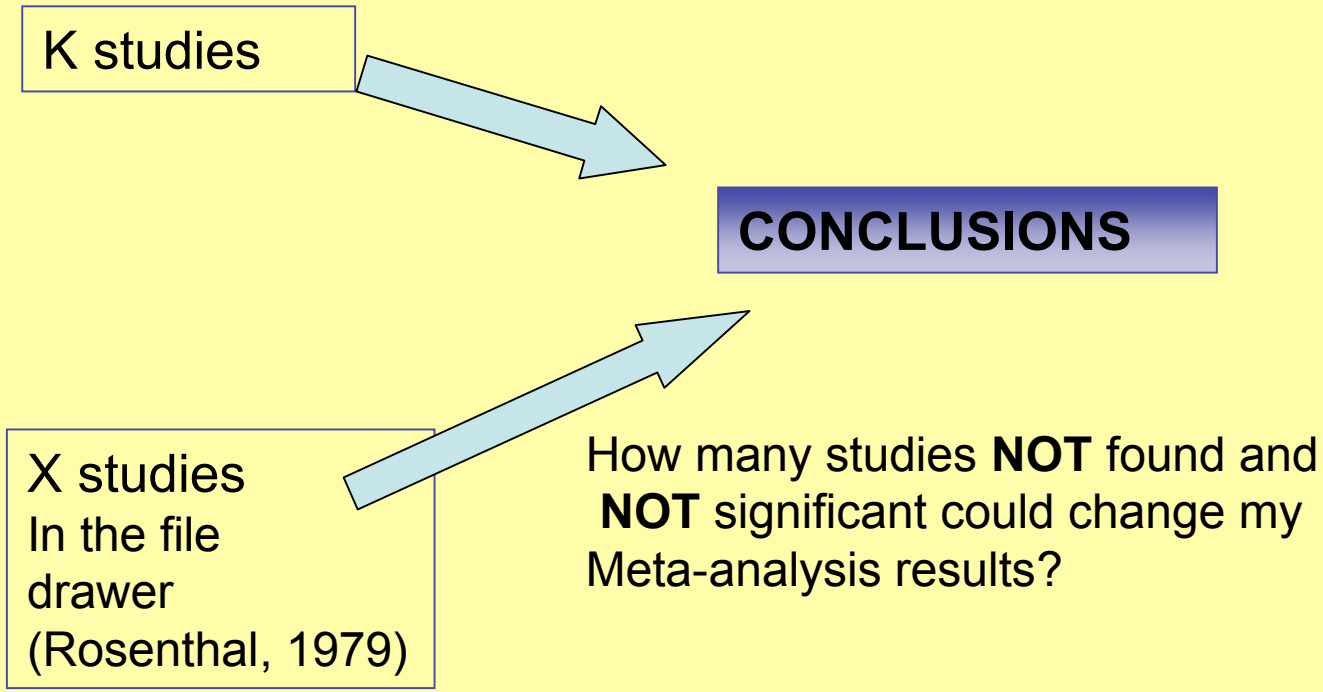
# The Analog to the ANOVA

Partition the overall Q into two pieces, a within groups Q and a between groups Q.

| | | | |
|---|---|---|---|
| $Q_B = 7.69$ | $df_B = 1$ | $Q_{CV\_.05}(1) = 3.84$ | $p_B < .05$ |
| $Q_W = 7.07$ | $df_W = 8$ | $Q_{CV\_.05}(8) = 15.51$ | $p_W > .05$ |
| $Q_T = 14.76$ | $df_T = 9$ | $Q_{CV\_.05}(9) = 16.92$ | $p_T > .05$ |

(taken from Lipsey and Wilson, 2001)

# The problem of the publication bias



# Fail-Safe number, Rosenthal (1979)

$$N_S = \left( \frac{\sum_{i=1}^{k} z_i}{1{,}64} \right)^2 - k$$

Criteria: **5•k + 10**

Example: if K=10 Ns=40

Ns =250

# THE REPORT

1. **INTRODUCTION**

2. **METHOD**
   - Research searching and inclusion criteria
   - Codification
   - Analysis procedure

3. **RESULTS**

   Descriptive analysis of the research searching

   Integration results for the K studies:
   - Descriptive analysis
   - Inferential analysis (category models, regression…)

4. **DISCUSSION**

5. **REFERENCES***

6. **APPENDIX**

# Weaknesses of Meta-analysis

- Requires a good deal of effort
- Mechanical aspects are not suitable to capture more qualitative distinctions between studies
- “Apples and oranges” criticism

# Strengths of Meta-analysis

- Imposes a discipline on the process of summing up research findings
- Represents findings in a more differentiated and precise manner than conventional reviews
- Capable of finding relationships across studies that are obscured in other approaches
- Can handle a large number of studies (this would overwhelm traditional approaches to review)

# Present and future of Meta-analysis: the "collaborations"

**Objectives**

- **Avoid duplicity**
- **Support MA**
- **Make scientific evidence closer to professional practice**

- **Cochrane Collaboration (www.cochrane.es)**
- **Campbell Collaboration (www.campbellcollaboration.org)**

# Basic References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