Experimental Research in Jamovi

# Welcome to Experimental Research!

Congratulations, you've reached the chapter on experiments—the **gold standard** for establishing cause-and-effect in scientific research! In Chapters 5-6, you learned that correlation doesn't equal causation and how researchers can get closer to making a causal case when an experiment is not possible. Now you'll learn how **experiments** actually CAN establish causation through manipulation and random assignment.

**🔄 Building on What You Know:** You'll use chi-square tests and t-tests from Chapter 5, plus ANOVA techniques. The difference? Now the groups being compared are created by YOU through random assignment!

## What You'll Learn

* **Between-Subjects Designs** — Different people in each condition (Module 7.2)
* **Within-Subjects Designs** — Same people experience all conditions (Module 7.3)
* **Factorial Designs** — Multiple variables, main effects & interactions (Module 7.4)

## Chapter 7 Data Files (from OSF)

Download from: https://osf.io/a8kev/ → "Ch. 7 – Experimental Research" folder

* **RITC\_DATA\_CH07\_HeinzBtwnSubjects** — Perspective-taking experiment (Module 7.2)
* **RITC\_DATA\_CH07\_WithinSubjects** — Drug consequences experiment (Module 7.3)
* **RITC\_DATA\_CH07\_HeinzFactorial** — Perspective × Wealth factorial (Module 7.4)

# Module 7.2: Between-Subjects Experiment

In a **between-subjects design**, different participants are randomly assigned to different conditions. Each person experiences only ONE condition.

## The Study: Perspective-Taking & the Heinz Dilemma

Does taking Heinz's perspective make people more sympathetic to his decision to steal? Participants were randomly assigned to one of two conditions:

| **Condition** | **Instructions Given** |
| --- | --- |
| **Perspective-Taking** | *"Try to visualize what Heinz is thinking, feeling, and experiencing. Look at the world through his eyes."* |
| **Objective (Control)** | *"Try to remain objective and emotionally detached. Don't get caught up in what Heinz might be feeling."* |

**Dependent Variables:**

* "Should Heinz steal the drug?" (Yes/No) → **Chi-Square test**
* "How morally acceptable was stealing?" (1-7 scale) → **T-Test**

## Analysis 1: Chi-Square Test (Yes/No Decision)

Use chi-square when your dependent variable is **categorical** (Yes vs. No).

### Step-by-Step in Jamovi

1. **Open** the RITC\_DATA\_CH07\_HeinzBtwnSubjects file
2. **Go to Analyses → Frequencies → Independent Samples**
3. **Move "Steal"** (the Yes/No variable) to Rows
4. **Move "Condition"** (Perspective-Taking vs. Objective) to Columns.

*\*Note: If the condition variable is marked as continuous, you will have to change it to nominal before conducting the analysis.*

1. **Under "Statistics", check:** χ² test
2. **Under "Cells", check:** "Column" percentages (to see % of Yes in each condition). \**Note: 1 = Yes, 2 = No*

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**💡 What to Look For:** Check the χ² value and p-value. If p < .05, there's a significant difference in the proportion saying "Yes" between conditions.

## Analysis 2: Independent Samples T-Test (Acceptability Ratings)

Use a t-test when your dependent variable is **continuous** (the 1-7 moral acceptability scale).

### Step-by-Step in Jamovi

1. **Go to Analyses → T-Tests → Independent Samples T-Test**
2. **Move "Acceptability"** to the Dependent Variables box
3. **Move "Condition"** to the Grouping Variable box
4. **Under "Additional Statistics", check:**

• "Mean difference"

• "Effect size" (Cohen's d)

• "Descriptives"

The result should look like the image below.

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**💡 What to Look For:** If p < .05, perspective-taking significantly changed moral acceptability ratings. Look at the means to see which direction — did perspective-taking INCREASE or DECREASE acceptability?

# Module 7.3: Within-Subjects (Repeated Measures) Experiment

In a **within-subjects design**, the SAME participants experience ALL conditions. Each person serves as their own control.

## The Study: How Drug Consequences Affect Moral Judgments

Each participant read THREE versions of the Heinz dilemma with different outcomes:

| **Condition** | **What Participants Were Told** |
| --- | --- |
| **Saves Life** | *"His wife is cured and lives a long life."* |
| **Eases Pain** | *"His wife spends her last few weeks free of pain but the drug does not save her life."* |
| **Experimental** | *"His wife will be able to take the experimental drug but its benefits are uncertain."* |

**⚠️ Why Counterbalancing Matters:** Order effects can bias results (e.g., fatigue, practice). The study randomizes which version each person sees first, second, and third.

## Analysis: Repeated Measures ANOVA

This analysis compares means across conditions **within the same people**.

### Step-by-Step in Jamovi

1. **Open** the RITC\_DATA\_CH07\_WithinSubjects file
2. **Go to Analyses → ANOVA → Repeated Measures ANOVA**
3. **In the "Repeated Measures Factors" box:**

• Click the factor name and rename it "Consequences"

• Set "Levels" to 3

• Rename the levels: "SavesLife", "EasesPain", "Experimental." The result should look like the image below.

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1. **Move the three acceptability variables** to the "Repeated Measures Cells":

• Acceptable\_SL (Saves Life) → Level 1

• Acceptable\_EP (Eases Pain) → Level 2

• Acceptable\_EX (Experimental) → Level 3

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1. **Under "Estimated Marginal Means":**

• Move “Consequences” into the Term 1 box

• Check Marginal means tables

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1. **Under "Post Hoc Tests":**

• Move "Consequences" to the box

• Check "Bonferroni" correction. The table should look like this:

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### Understanding the Output

**1. Within Subjects Effects Table:** Look at the "Consequences" row. If p < .05, there's a significant overall effect — at least one condition differs from the others.

**2. Descriptives Statistics:** The estimated marginal means table displays the condition means for each level of the dependent variable. However, to see the condition standard deviations you will have to conduct an exploratory analysis.

**Analyses → Exploration → Descriptives**

• Move the three levels of the DV into the Variables box

• Under Statistics make sure Mean and Std. deviation are selected.

**3. Post Hoc Comparisons:** Shows which specific pairs of conditions differ significantly (p < .05).

**💡 Expected Results:** F(2, 104) ≈ 7.65, p < .05. Life-saving (M ≈ 4.57) > Eases pain (M ≈ 3.98) > Experimental (M ≈ 4.19). People find stealing more acceptable when the drug definitively saves a life.

### Creating a Bar Chart for Within-Subjects Results

To create a bar chart for these variables you will want to add the means and standard deviations to a program like Excel. Jamovi does not have the ability to create a bar chart showing the mean for all three variables at once.

# Module 7.4: Factorial Design (2 × 2)

Factorial designs examine **multiple independent variables simultaneously**. A 2 × 2 design has two IVs with two levels each = 4 conditions.

## The Study: Perspective-Taking × Wealth

Does the effect of perspective-taking depend on Heinz's wealth? Maybe perspective-taking helps when Heinz is wealthy (people judge him harshly otherwise) but doesn't matter when he's poor (people are already sympathetic).

|  |  |  |
| --- | --- | --- |
|  | **Poor Heinz** | **Wealthy Heinz** |
| **Perspective-Taking** | Cell 1 | Cell 2 |
| **Objective** | Cell 3 | Cell 4 |

### What Factorial Designs Tell Us

* **Main Effect of Perspective:** Does perspective-taking affect judgments overall (ignoring wealth)?
* **Main Effect of Wealth:** Are people more sympathetic to poor vs. wealthy Heinz (ignoring perspective)?
* **Interaction:** Does the effect of perspective-taking DEPEND on wealth? This is often the most interesting finding!

## Analysis: Two-Way ANOVA

1. **Open** the RITC\_DATA\_CH07\_HeinzFactorial file
2. **Prepare the file for analysis.**

• Check that the Acceptablevariable is listed as Continuous

• Check that both the Perspective and Wealth variables are listed as nominal or ordinal.

• Within the Data View for both perspective and wealth name the levels of the variables. This will make interpreting your analyses easier later. For perspective 1 = objective, 2 = perspective taking. For wealth 1 = rich, 2 = poor.

1. **Go to Analyses → ANOVA → ANOVA**
2. **Move "Acceptability"** to the Dependent Variable box (make sure this is listed as a continuous variable).
3. **Move BOTH to Fixed Factors:**

• Perspective (Perspective-Taking vs. Objective)

• Wealth (Poor vs. Wealthy)

• Check the box for Effect Size

1. **Under "Model":** Ensure both factors AND their interaction are included
2. **Under "Estimated Marginal Means":**

• Add the interaction term (Perspective\*Wealth) to get cell means

• Check "Marginal means tables" — this creates a table with means!

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1. **Under “Post Hoc Tests”:** Under Post Hoc, move each factor over. Check the box for Bonferroni and the Effect Size ‘Cohen’s d.’ The result should look like the image below.

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### Understanding the Factorial Output

The ANOVA table shows F-values and p-values for:

* **Perspective:** Main effect of perspective-taking
* **Wealth:** Main effect of Heinz's wealth
* **Perspective\*Wealth:** The interaction — does perspective-taking work differently for poor vs. wealthy Heinz?

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**💡 Expected Results:** Main effect of Wealth: F(1, 196) = 9.80, p = .002. Interaction: F(1, 196) = 6.63, p = .011. People judge wealthy Heinz harshly UNLESS they take his perspective — then wealth doesn't matter as much!

### Reading an Interaction Graph

**Parallel lines** = No interaction (effect of one variable is the same at all levels of the other)

**Non-parallel lines** = Interaction! The effect depends on the other variable.

**Crossing lines** = Strong interaction (the effect reverses)

A graph with lines and numbers

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### Examining Post Hoc Tests

To tell if any single post hoc comparison is significant, examine the row being compared and evaluate the p value. P values below .05 indicate a significant simple effect.

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# Summary: The Power of Experiments

You've now mastered the gold standard for establishing causation:

* **Between-Subjects:** Different people, different conditions. Analyze with t-tests or chi-square.
* **Within-Subjects:** Same people, all conditions. Analyze with Repeated Measures ANOVA.
* **Factorial:** Multiple IVs, examine interactions. Analyze with two-way ANOVA.

**🔑 Why Experiments Establish Causation:** Random assignment distributes ALL potential third variables equally across conditions. The ONLY systematic difference between groups is the manipulation — so any difference in the DV must be CAUSED by the IV!

**📚 Looking Ahead:** In future chapters, you'll learn about more complex designs, including experiments with more than two conditions, mixed designs (combining between and within), and ways to ensure your experimental manipulations are valid and reliable.