

# EXPERIMENTS

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From the classics to new technologies (A focus on Qualtrics)

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**X**



**Y**

# When does a causal relationship exist?

According to **John Stuart Mill**, three conditions must be met simultaneously:



1

## Temporal precedence

The cause must precede the effect in effect in time.



2

## Covariation

The cause must be correlated with with the effect: as one varies, so does does the other.



3

## Exclusion of alternatives

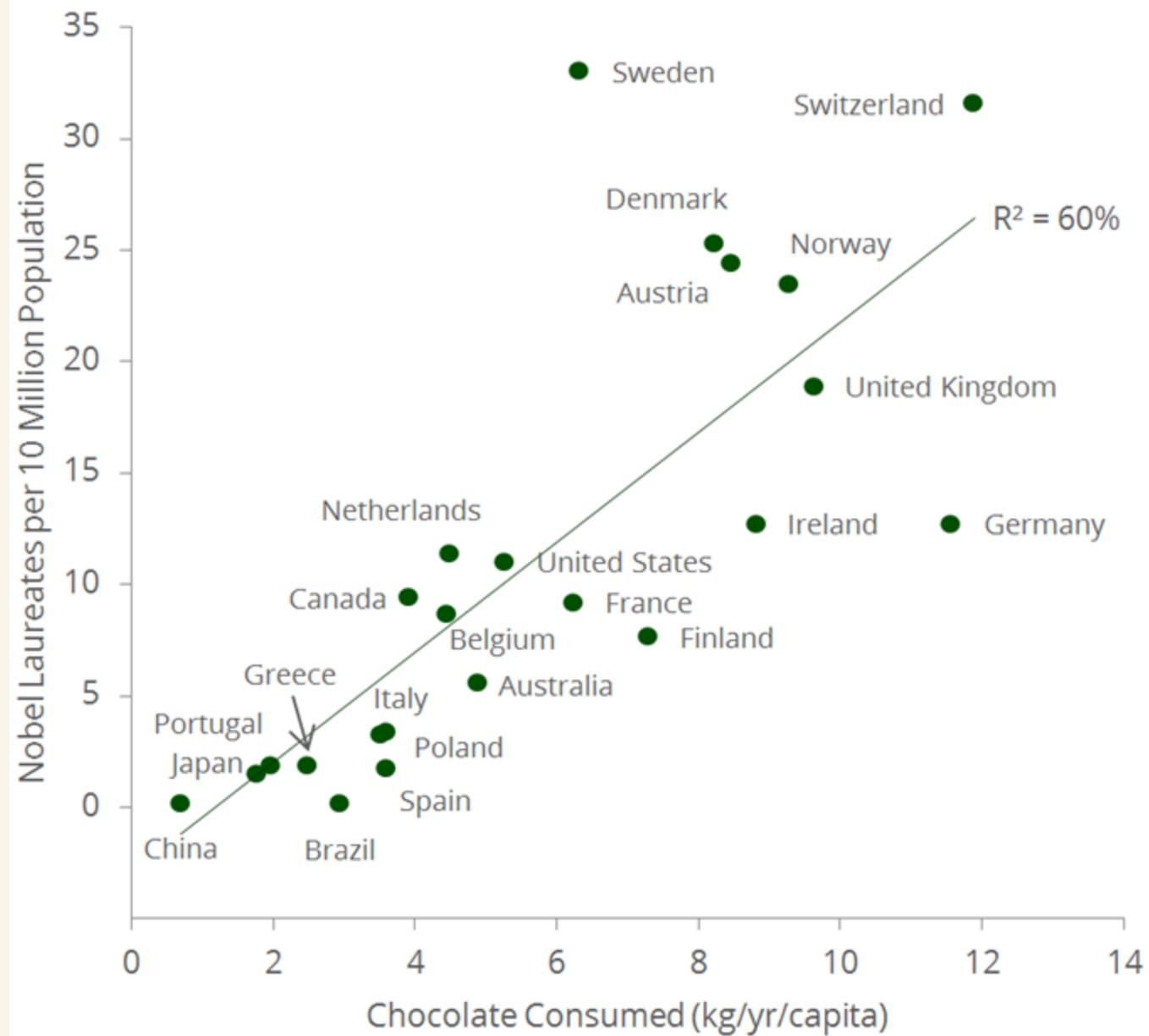
There should be no plausible alternative explanations for the observed effect.

# Classic example

- ✓ Chocolate consumption explains Nobel laureates (???)

## Endogeneity

where the effect of an independent variable on a dependent variable cannot be casually interpreted because it includes omitted causes leading to biased (i.e., inconsistent) estimates (Antonakis et al., 2010).



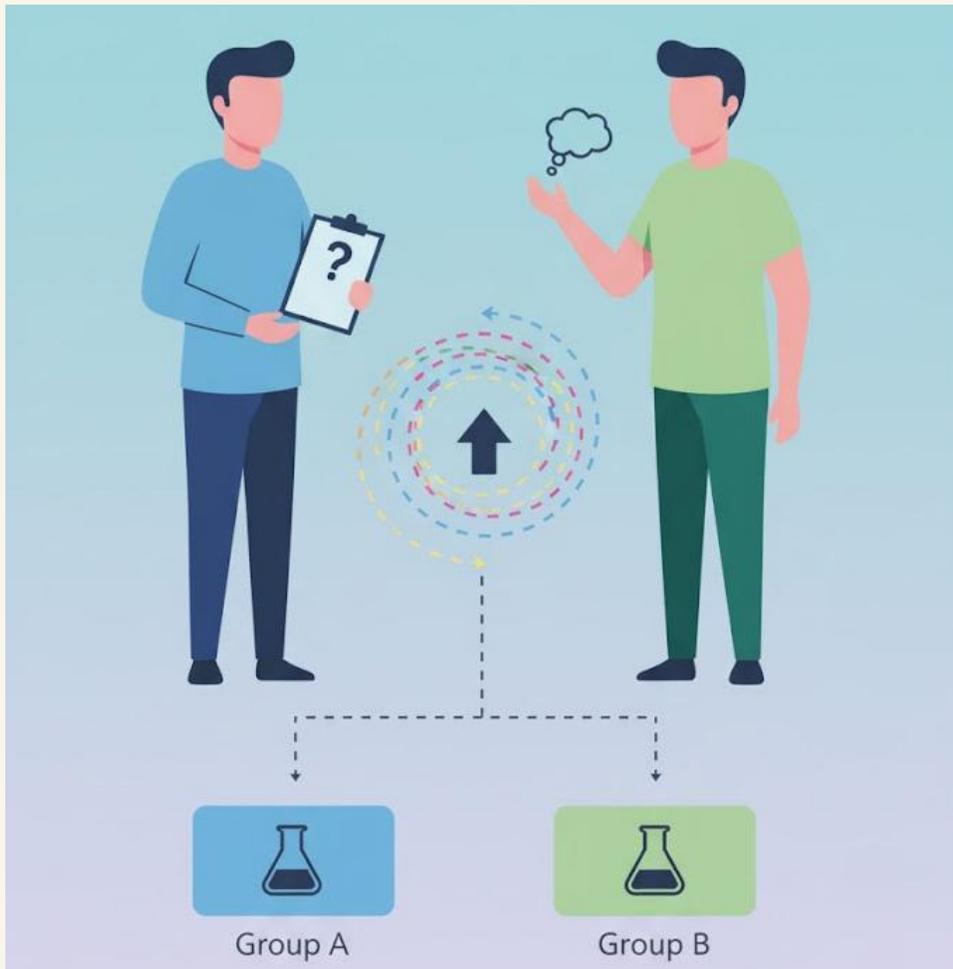
# The Counterfactual Problem



In an experiment, we observe what happened to those who received a treatment. The **effect** is the difference between what *did happen* and what *would have happened* to the same people if they had *simultaneously* not received the treatment.

📄 **Fundamental Problem:** we cannot observe a counterfactual! A central goal of experimental research is to create the best possible approximation to this physically impossible condition.

# Key Feature: RANDOMIZATION



By randomly selecting and assigning participants to conditions, conditions, the groups become **probabilistically equivalent** with **equivalent** with respect to nuisance variables.

- If outcome differences are observed between groups, groups, it can be confidently concluded that they are they are due to the treatment — and **not** to pre-existing differences.

# Key Feature: at least 2 CONDITIONS

We compare groups or individuals exposed to **different manipulations** or the absence thereof. It is the *difference* between the between the conditions that determines the effect.

→ Experimental Condition  
Participants receive the treatment under study.

→ Control Condition  
Participants do not receive the treatment (or receive a neutral neutral one).

→ Design is crucial  
Having a manipulation is not enough: without an adequate design, the results risk being meaningless.



## Key Feature: CONTROL

### Manipulation

Treatment variables are **deliberately varied** by the experimenter to produce the desired effect.



### Constancy

All other variables and the environment are **kept constant** to eliminate alternative explanations.



# What is an Experiment?



Definition:

- a series of observations conducted under controlled conditions to study a relationship with the purpose of drawing causal inferences about that relationship.
- An experiment involves the manipulation of an independent variable, the measurement of a dependent variable, and the exposure of various participants to one or more of the conditions being studied.
- Random selection of participants and their random assignment to conditions also are necessary in experiments.



# Why Experiments?

Experiments allow us to **deliberately vary** one variable to find out what what happens to another variable — that is, to discover the **effects of of presumed causes**. They overcome the limitations of correlational analysis, analysis, where third variables (confounds) can explain any observed relationship.

- Example: High education and high income can both be caused by caused by intelligence — not one by the other.

Golden Standard to Test Causality

# Benefits of experiments

## Test Causality

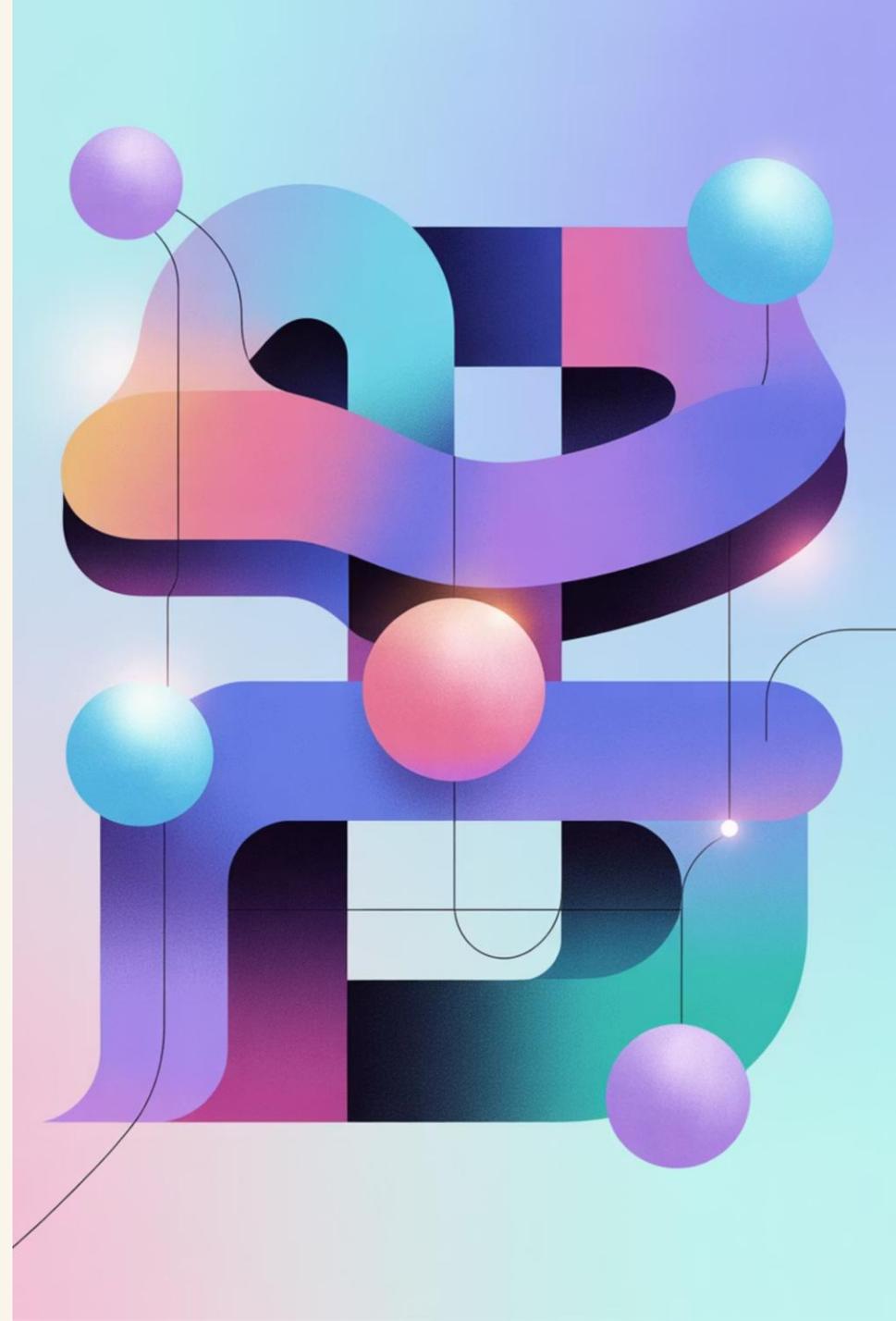
The ability to definitively conclude that one variable (the cause) is responsible for a change in another (the effect)

## Estimate the Effect Size

We identify the effect of a variable on another.

## Rule out alternative explanation

We cannot claim that the effect is explained by anything else.



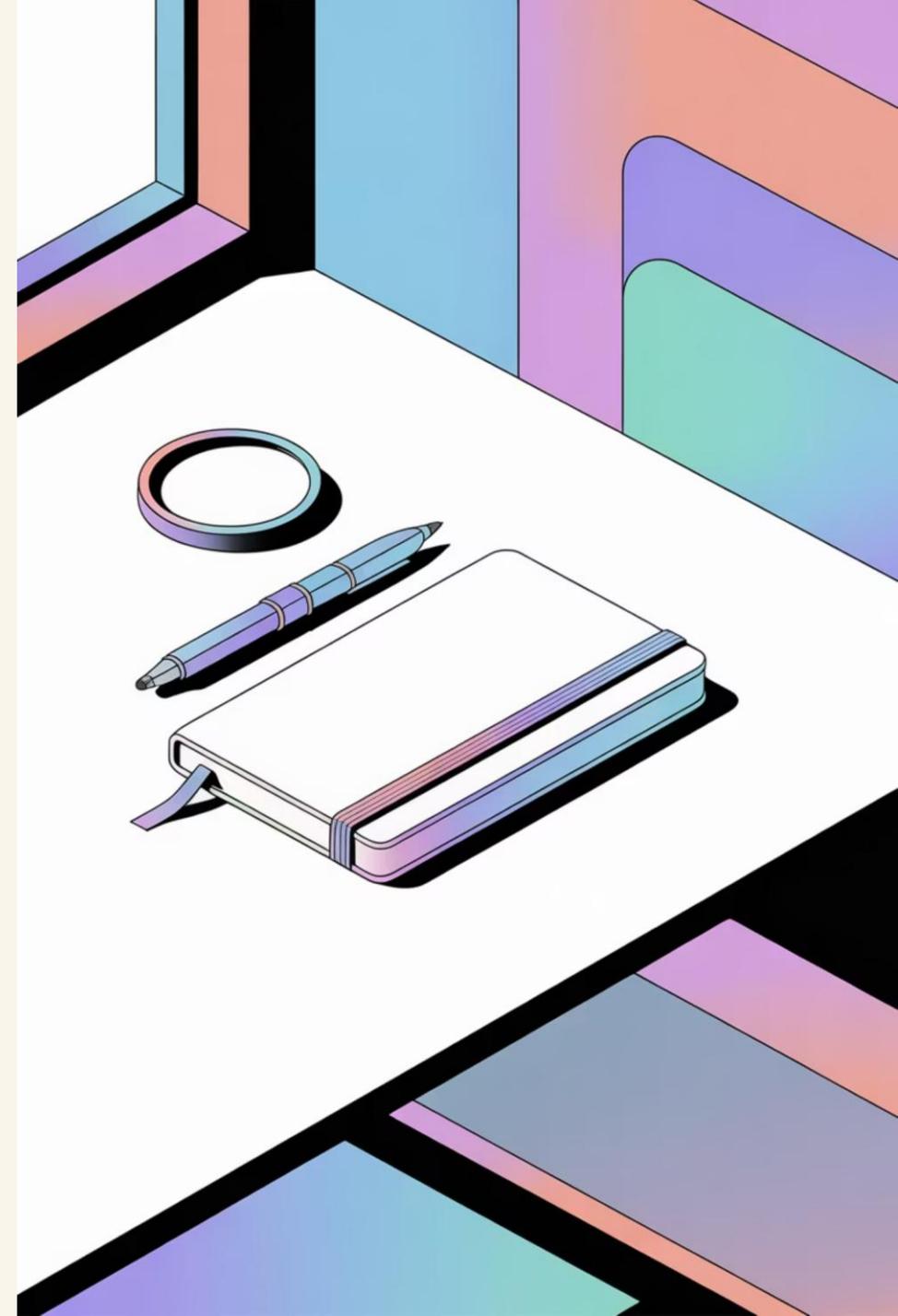
# General Advice: Keep the Experiment Simple

## ✗ Complex Design

The more elaborate an experimental design, the more methodological methodological and practical problems will arise.

## ✓ Simpler Experiments

It is often preferable to conduct **several simple experiments** rather than rather than one very complicated one.



# The Four Types of Validity

To generalize causal inferences, we must consider four fundamental dimensions of validity:



## Statistical Validity

Are conclusions about co-variations statistically reliable?



## Internal Validity

Did the treatment *truly* cause the observed change?



## Construct Validity

Do the operationalizations accurately reflect the theoretical constructs?



## External Validity

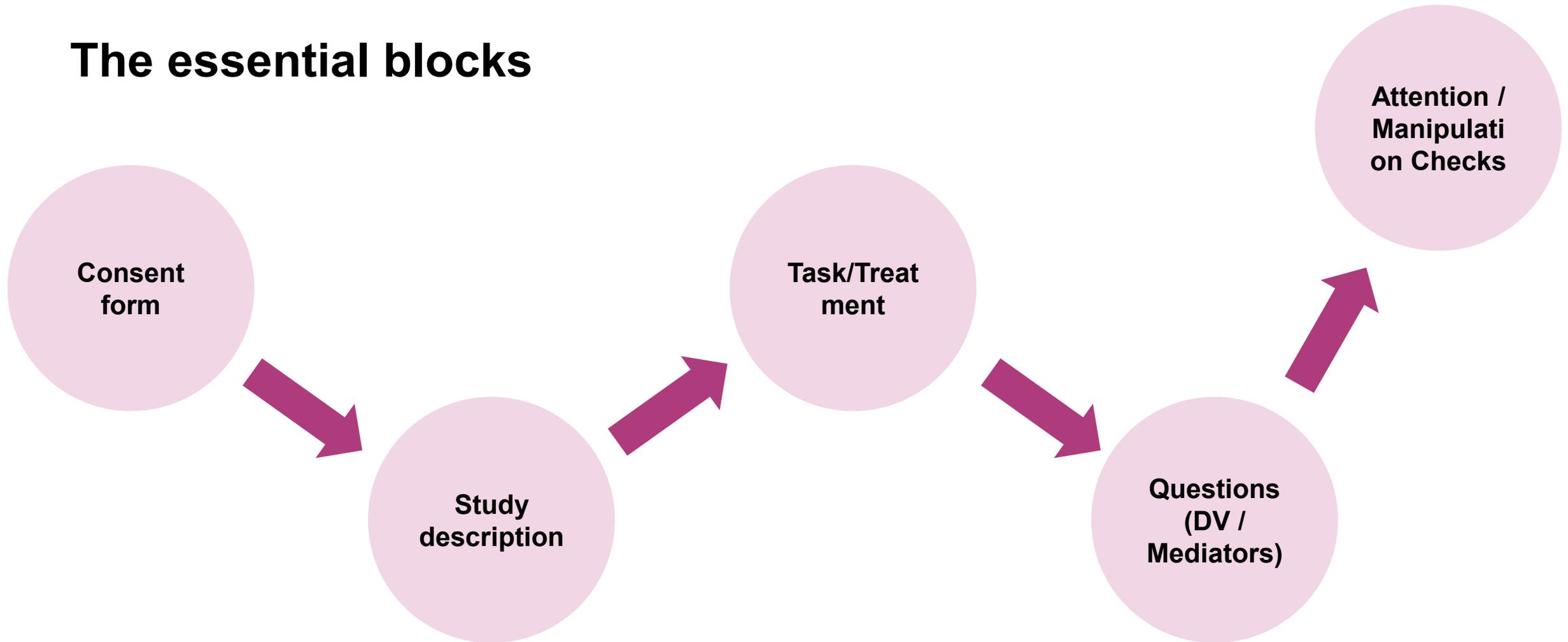
Do the results generalize to other contexts, people, and times?

qualtrics<sup>®</sup> XM

qualtrics<sup>®</sup> XM

**It is an online platform to design studies and/or experiments and collect responses**

# The essential blocks





Edit block

Tools ▾ Saved at 11:05 AM Draft

🔍 Preview Publish



Block behavior



Workshop

💡 ExpertReview score Great



Question randomization

▶ intro | 1 Question

Add Block



Loop & merge

▶ description | 2 Questions

Add Block



Format

▶ control | 2 Questions

Add Block



Next/Previous button text

▶ treatment | 2 Questions

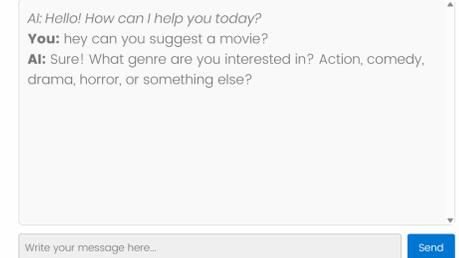
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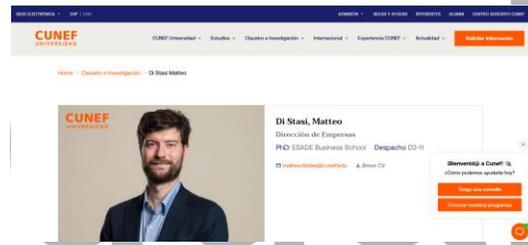
## Classic Vignette



## Embedding LLM Chat - GPT



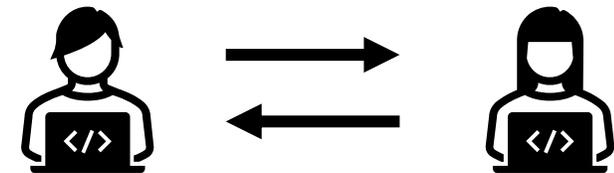
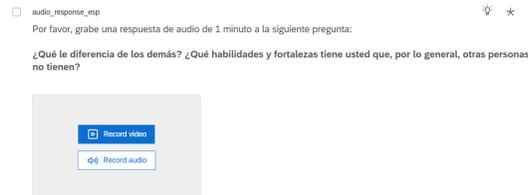
## Embedding Websites



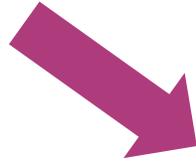
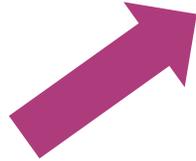
# trics<sup>XM</sup>

## Live Interactions

## Record Audio/Video

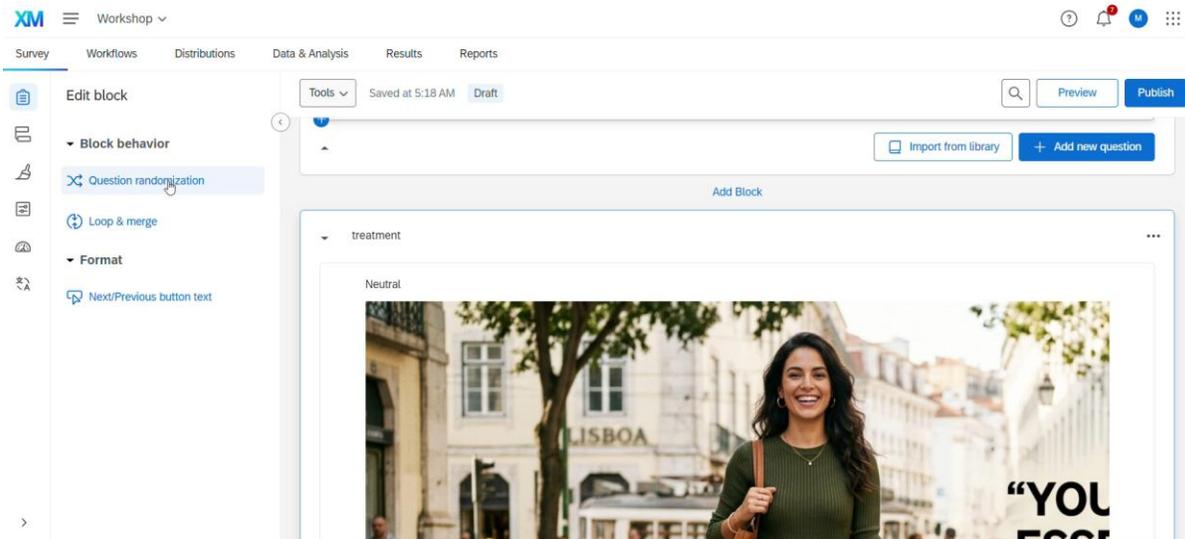


# Vignette

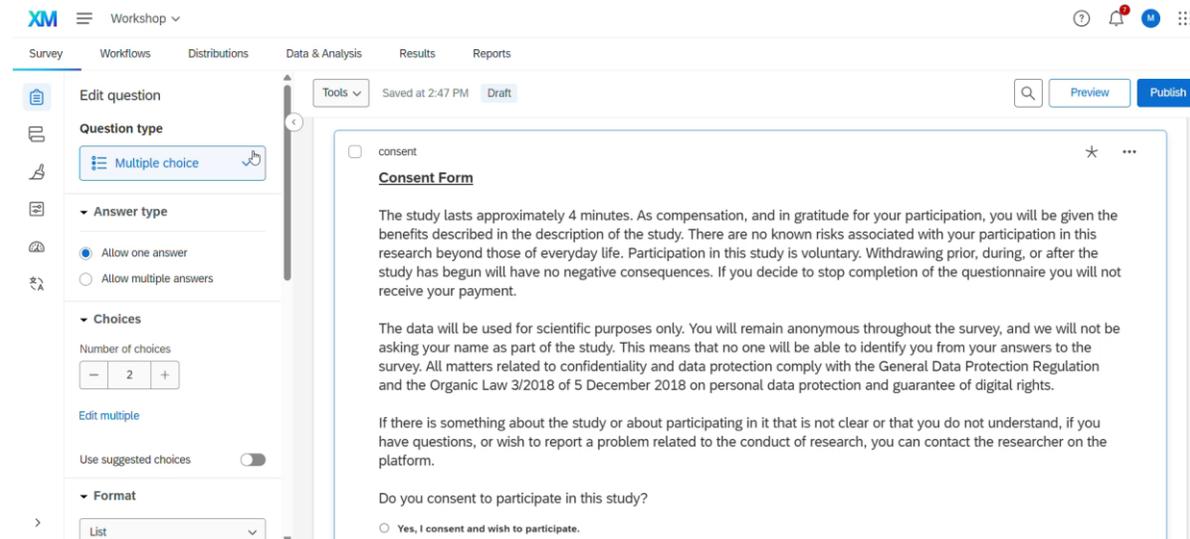


# Random assignment in Qualtrics

## From Block



## From Logic



# Embeddings

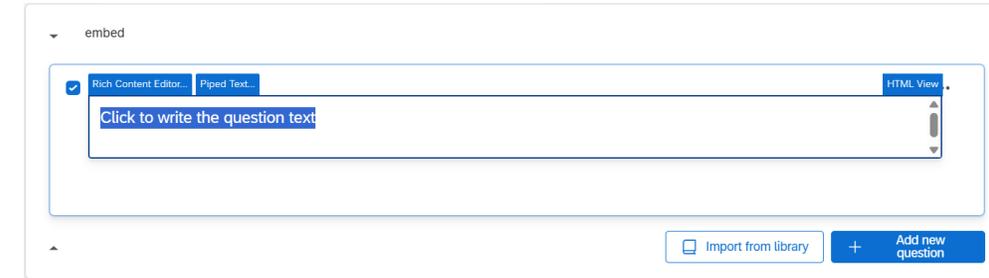
Embedding a webpage or other apps in Qualtrics is the act of integrating an external interactive application into the survey flow using an `<iframe>` (inline frame) element, which creates a virtual container that renders the external game directly within the survey's user interface.



# Embedding

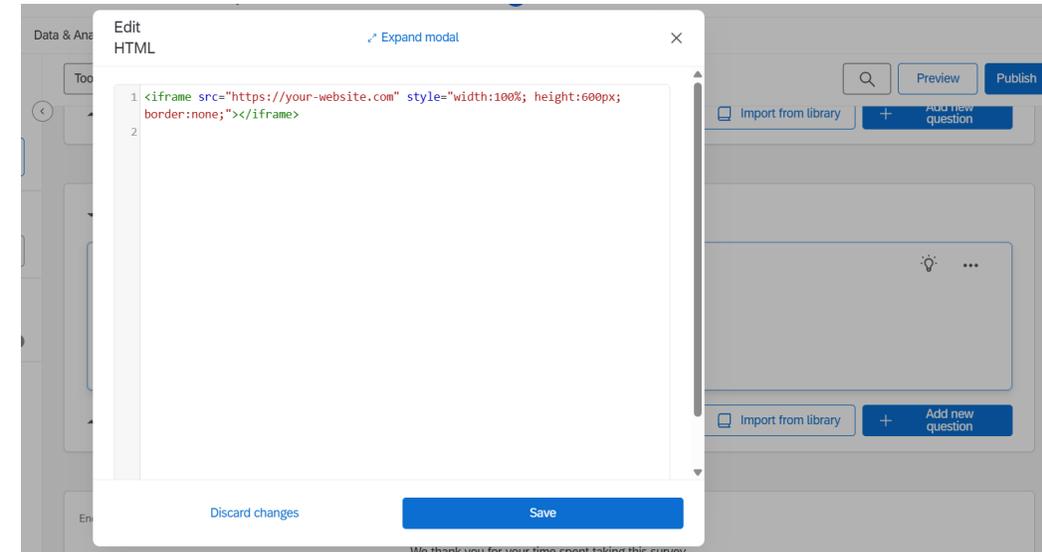
Create a text graphic question

Click on HTML



Embed a website

Add this code:  
`<iframe src="https://your-website.com" style="width:100%; height:600px; border:none;"></iframe>`



# Embedding

## Chat GPT

*AI: Hello! How can I help you today?*

**You:** hey can you suggest a movie?

**AI:** Sure! What genre are you interested in? Action, comedy, drama, horror, or something else?

Write your message here...

Send

## Embedding

## Chat GPT

1. You need a Chat GPT API
2. Create a text question
3. Copy and paste HTML code:

```
1 <div id="chat-box" style="height: 400px; border: 1px solid #ccc; overflow-y:
  scroll; padding: 15px; background: #f9f9f9; border-radius: 8px;">
2   <p><i>AI: Hello! How can I help you today?</i></p>
3 </div>
4
5 <div style="margin-top: 15px; display: flex; gap: 10px;">
6   <input type="text" id="user-msg" style="flex-grow: 1; padding: 10px;
  border-radius: 4px; border: 1px solid #aaa;" placeholder="Write your message
  here...">
7   <button id="send-btn" type="button" style="padding: 10px 20px;
  background: #0076d1; color: white; border: none; border-radius: 4px; cursor:
  pointer;">Send</button>
8 </div>
```

# Embedding

# Chat GPT

## 4. Copy and paste Java code:

```
Qualtrics.SurveyEngine.addOnReady(function() {
  var display = document.getElementById('chat-box');
  var input = document.getElementById('user-msg');
  var btn = document.getElementById('send-btn');
  var log = ""; // This stores the transcript

  btn.onclick = function() {
    var text = input.value.trim();
    if (text === "") return;

    // Display User Text
    display.innerHTML += "<p><b>You:</b> " + text + "</p>";
    input.value = ""; // Clear box

    // Call AI (Replace YOUR_API_KEY with your actual key)
    fetch('https://api.openai.com/v1/chat/completions', {
      method: 'POST',
      headers: {
        'Content-Type': 'application/json',
        'Authorization': 'Bearer YOUR_API_KEY'
      },
      body: JSON.stringify({
        model: "gpt-3.5-turbo",
        messages: [{role: "user", content: text}]
      })
    })
    .then(response => response.json())
    .then(data => {
      var reply = data.choices[0].message.content;
      display.innerHTML += "<p><b>AI:</b> " + reply + "</p>";
      display.scrollTop = display.scrollHeight; // Auto-scroll to bottom

      // Save to Qualtrics Embedded Data
      log += "User: " + text + "\nAI: " + reply + "\n\n";
      Qualtrics.SurveyEngine.setEmbeddedData('chat_history', log);
    });
  };
});
```

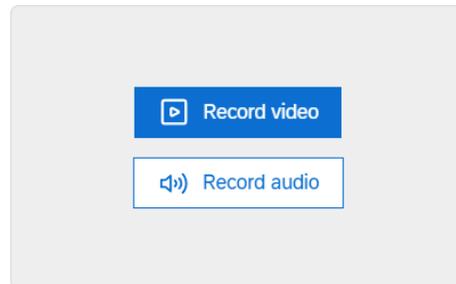
# Record Audio/Video

audio\_response\_esp



Por favor, grabe una respuesta de audio de 1 minuto a la siguiente pregunta:

**¿Qué le diferencia de los demás? ¿Qué habilidades y fortalezas tiene usted que, por lo general, otras personas no tienen?**



# Advanced Qualtrics



**Make participants  
live interact**



## See demo experiments

See SMARTRIQS in action. You can choose from a variety of sample experiments and games. You can also test the chat feature.



## Design and run experiments

Start designing interactive experiments in Qualtrics! You can either import the ready-made survey templates or build your own from scratch.



## Set up your own server

If you want to use sensitive participant data in your interactive experiments, you will have to set up SMARTRIQS on your own custom server.



To start an experiment, **please open the survey links multiple times** (feel free to use different tabs, different browsers, or different devices, including phones).

You can download the Qualtrics templates for these experiments from the **OSF repository**.

**Suggested citation:**

Molnar, A. (2019). SMARTRIQS: A Simple Method Allowing Real-Time Respondent Interaction in Qualtrics Surveys. *Journal of Behavioral and Experimental Finance*, 22, 161-169. doi: 10.1016/j.jbef.2019.03.005

Classic Games	Group Interaction	Communication
<a href="#">Dictator Game</a>	<a href="#">One-shot Public Goods Game</a>	<a href="#">Send Message (choice)</a>
<a href="#">Dictator Game 3 conditions (3 stake sizes)</a>	<a href="#">One-shot Public Goods Game with Punishment</a>	<a href="#">Send Message (open)</a>
<a href="#">Trust Game</a>	<a href="#">Repeated Public Goods Game</a>	<a href="#">Single-Stage Chat</a>
<a href="#">Ultimatum Game</a>	<a href="#">Effort Competition</a>	<a href="#">Single-Stage Chat with Waiting Room</a>
<a href="#">One-shot Prisoner's Dilemma</a>	<a href="#">Effort Competition with Waiting Room</a>	<a href="#">Group Discussion / Persuasion</a>
<a href="#">Third-Party Punishment</a>	<a href="#">Vickrey Auction</a>	<a href="#">Multimedia "sender"</a>
	<a href="#">p-Beauty Contest</a>	<a href="#">Multi-Stage Group Chat</a>

# Live Chat

Hit 'Enter' or the 'Send message' button to send a message.

EXIT CHAT

\*\*\* B has joined the chat \*\*\*  
\*\*\* A has joined the chat \*\*\*  
A: Hi!

Ho I

SEND MESSAGE

Hit 'Enter' or the 'Send message' button to send a message.

EXIT CHAT

\*\*\* B has joined the chat \*\*\*  
\*\*\* A has joined the chat \*\*\*  
A: Hi!

Type message...

SEND MESSAGE

# About live interactions

Likely only 70% of conversations will be concluded properly. Many dropouts.

Recruit in batches of 50 during peak participation time.

Inform participants clearly that they are going to interact.

# Where to collect data?

	<b>Network (e.g. social media)</b>	<b>Platform</b>	<b>Laboratory</b>	<b>Collaboration (company)</b>
<b>Cost</b>	Cheap	Medium	Expensive	?
<b>Speed in collecting data</b>	?	Fast	Slow	Slow
<b>Quality of data</b>	Poor - What's the incentive to take the study seriously?	Medium / Poor – Getting worse with chatbots	Medium / Good (High control and motivation)	Good and more externally valid
<b>Example</b>	Publish in X	Publish in Prolific or ResearchCloud	University lab (I know Pompeu Fabra, ESADE and IESE have ones)	TBD

**THANK YOU!**

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