

# Intro to Conjoint Experiments

## Session 2

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# Session 1: Recap

- ① In broader terms, causality is a connection of phenomena that connects one element (the cause) with another elements (effect/outcome/response)
  - it is a **process**. The 1st element of this process is responsible for 2nd and the 2nd dependent on the 1st.
  - causality is temporally bound. The cause(s) must precede the effect and **all lie in its past**.
- ② The “fundamental problem of causal inference”
  - We only ever observe one of the two outcomes.
  - We need to rely on assumptions to estimate the causal effect
- ③ **No causation without manipulation.**
  - Avoid to elevate to the status of ‘cause’ attributes that cannot be, in principle, manipulated

# Materials

- Lecture's PDF
- Lab
- Exercise

Where to find the material:

- On my [GitHub/conjoint\\_class](#)

# What is a conjoint experiment

- ① **Substantively:** An instrument to understand peoples' choices
- ② **Technically:** A (factorial) survey experiment designed to measure (underlying) preferences
  - ① Whether showing one attribute as opposed to another would change the respondent's choice
  - ② E.g., why do voters choose one party, candidate, or policy over another?
- ③ It deals with options that simultaneously vary across two or more attributes (**multi-dimensionality**)
- ④ As such, involves trade-offs (e.g., Male Republican VS Female Democrat)
  - ① The possibility that option A (Donald Trump) is better than option B (Hilary Clinton) on attribute Gender (Male) while B is better than A on attribute PID (Democrat).

# How a CJ looks like?

Suppose there is a primary in your party for an open seat for the U.S. House of Representatives and the two individuals below are considering running. We'd like you to consider the following two potential candidates for this office.

Please review the following two resumes:

	Candidate 1	Candidate 2
Number of Children	3	3
Gender	Female	Male
Number of Years in Politics	3 years	8 years
Current Occupation	Mayor	Corporate Lawyer
Age	65	65
Spouse's Occupation	Farmer	Farmer

Based on the limited information above, which of the two candidates would you be more likely to support in the congressional primary?

Candidate 1Candidate 2



- 1 Q: What the causal process involves?
- 2 Q: What are we manipulating in this example? (**No Causation without manipulation.**)

# Limitations of traditional observational studies

- ① Respondent's preferences are measured without putting them in a broader context
  - ① Answers to survey questions can fluctuate considerably depending on how the questions are asked ([Kahneman, Slovic, and Tversky 1982](#)).
  - ② E.g. a voter may evaluate a particular policy position differently depending on the other policies bundled in a given party platform.
- ② Separation of priority ranking and preference intensity. In actual decisions, these two steps are inseparably connected in respondents' minds.
  - ① E.g., voting is both preference towards a party/candidate and intensity of such preference
- ③ Causal identification and causal ordering is difficult (or almost impossible)
  - ① Q: Does ideological proximity cause vote choice or is the other way around?

# Why CJ are relevant for causal analysis?

They go beyond the simple cause-and-effect relationship between a single binary treatment and an outcome variable.

- ➊ Evaluate the relative explanatory power of different theories, moving beyond tests of a single hypothesis
  - ➊ Analysis of more complex causal questions
  - ➋ E.g., is ideology or party identification that drive vote choice ?
  - ➌ Relatively cheap and fast to implement
- ➋ Display high(er) levels of validity
  - ➊ External validity: CJs effectively approximate real-world outcomes ([Hainmueller, Hangartner, and Yamamoto 2015](#); [Auerbach and Thachil 2018](#))
  - ➋ Internal Validity: CJs enhance realism relative to the direct elicitation of preferences on a single dimension
  - ➌ Measurement quality: respondents are found to be consistent even for quite complex tasks (e.g., [Bansak et al. 2019](#))
- ➌ Reduce social desirability biases such as vote for female (vs male) political candidates (e.g., [Teele, Kalla, and Rosenbluth 2018](#)) or opposition to social housing in respondent's neighbourhood (e.g., [Hankinson 2018](#)).
- ➍ Good prediction device that can provide insights into practical problems such as policy design and implementation.

## Section 1

# Different CJ designs

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# Rating (scales) (1)

- ① It usually involves only one profile at the time
- ② As such, no trade-off between attributes
- ③ Similar to vignette studies

## Product 1

Directions: Please rate the likelihood of buying this product on a scale from 0 to 100.

Brand:	Modern
Price:	R 480
Type:	Scrub
SPF:	30
Made in:	Switzerland
Moisturiser:	None

Rating:	75
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## Rating (scales) (2)

- ① PRO: easy to execute, implement, and model
- ② CON: no trade-offs as it often occurs in real choice settings
- ③ CON: often no clear differentiation between profiles
- ④ CON: interpretation might be difficult in certain situation
  - ① what liking a candidate actually means?
  - ② does liking a candidate would imply that people would actually vote for that candidate?

# Ranking (1)

- ① It involves more than one profile at the time
- ② As such, trade-offs are easier to see
- ③ Clear differentiation between most-preferred and least-preferred profiles if low number of choices

1. Please look at the following three wetland restoration programs. PLEASE ASSUME THAT THESE ARE THE ONLY THREE CHOICES AVAILABLE TO YOU AND DO NOT ALSO CONSIDER PROGRAMS LISTED ON OTHER PAGES. Although you may not be interested in any program, if these programs were the ONLY choices available to you, which one would you prefer?

Program Options	Program #1	Program #2	Program #3
<b>Contract Length</b>	10 years	30 years	15 years
<b>Contract Type</b>	Conservation easement	Restoration contract	Restoration contract
<b>Program Administration</b>	Non-governmental agency	Combination of state and federal agencies	Federal agency
<b>Recreational Use of Enrolled Land</b>	May be used by landowner only	May be used by landowner only	May be leased or used by landowner
<b>Timber Harvesting Options</b>	Selective thinning allowed	No harvesting allowed	Harvesting allowed
<b>Program Payment</b>	\$75 per acre per year for 10 years (\$750 in total)	\$225 per acre per year for 30 years (\$6,750 in total)	\$75 per acre per year for 15 years (\$1,125 in total)

Please rank the different programs

3

1

2

## Ranking (2)

- ➊ PRO: easy to execute, implement, and model
- ➋ CON: causal interpretation might be difficult due to mid ranks
  - ➊ What is the difference between the 6th and the 5th candidate in a 15 candidates rank conjoint
  - ➋ Does the ranking a candidate first would imply that people would actually vote for that candidate?
- ➌ CON: often increase measurement error since ranking is not an easy task  
(Boyle et al. 2001)

# Choice Based (1)

- ② “The most widely used flavour of conjoint analysis” ([Software 2008](#))
- ③ Revealed Preference (RP): real life choices
  - Clear validity advantages ([Diamond and Hausman 1994](#))
  - E.g., which insurance plan people have chosen after having compared several different offers
- ④ **Stated Preference (SP)**: experimental setting where we ask respondents **what would they do** instead of observing what they have done
  - E.g., what type of insurance plan people **would choose** after having compared several different offers
  - Can be used to assess the choice decision in an hypothetical or future scenario (relevant for policy implementation)
  - However, what people say in surveys can diverge from what they would do in actual decisions

## Choice (2)

Suppose there is a primary in your party for an open seat for the U.S. House of Representatives and the two individuals below are considering running. We'd like you to consider the following two potential candidates for this office.

Please review the following two resumes:

	Candidate 1	Candidate 2
<b>Number of Children</b>	3	3
<b>Gender</b>	Female	Male
<b>Number of Years in Politics</b>	3 years	8 years
<b>Current Occupation</b>	Mayor	Corporate Lawyer
<b>Age</b>	65	65
<b>Spouse's Occupation</b>	Farmer	Farmer

Based on the limited information above, which of the two candidates would you be more likely to support in the congressional primary?

Candidate 1Candidate 2



## Choice Based (3)

- ➊ PRO: High(er) external validity
  - ➊ Trade-off between 2 or 3 profiles is more natural and close to real-life choice scenarios
- ➋ PRO: Quite easy modelling approaches
- ➌ PRO: Context manipulations are easy to implement
  - ➊ E.g., priming respondents with certain informations
- ➍ CON: Careful experimental design
- ➎ CON: Can be difficult to set up

# Other designs

- ❶ Point allocation
- ❷ Adaptive Conjoint
  - ❶ Adaptive choice-sets based on respondent's characteristics, preferences or attitudes
  - ❷ E.g., in the choice of transport mode, the choice set of an individual without driving license and/or car should not include the alternative "car"
  - ❸ More complex adaptive designs that involve algorithms to cluster individuals based on their underlying preferences
- ❸ Combination of previous design
- ❹ E.g., rating with choice based
- ❺ E.g., ranking conjoint with an adaptive design



# Terminology Choice-based CJ (1)

## 1 Alternatives

- 1 The two (or more) profiles that a respondent will have to choose from (e.g., Candidate A VS Candidate B)

## 2 Attributes

- 1 Independent variables, explanatory variables, treatments, features
- 2 Characteristics of the different alternatives (e.g. age, gender of the proposed candidates)

## 3 Levels (of the attributes)

- 1 The discrete values that an attribute can take (e.g., Age: 20, 30, 40, 50)

## 4 Choice-sets: a combination of two or more alternatives (e.g., only progressive candidates VS only conservative candidates)

- 1 Relevant if we want to analyse a subset of the profiles (e.g., only female candidates)

# Terminology in Choice-based CJ (2)

Suppose there is a primary in your party for an open seat for the U.S. House of Representatives and the two individuals below are considering running. We'd like you to consider the following two potential candidates for this office.

Please review the following two resumes:

## Alternatives

Attributes	Candidate 1	Candidate 2
Number of Children	3	3
Gender	Female	Male
Number of Years in Politics	3 years	8 years
Current Occupation	Mayor	Corporate Lawyer
Age	65	65
Spouse's Occupation	Farmer	Farmer

Levels

Based on the limited information above, which of the two candidates would you be more likely to support in the congressional primary?

Candidate 1   Candidate 2



Choice-Set

Q: What the research is controlling (and manipulating) and what not?

## Section 2

# The challenge of experimental design

# Why a challenge?

- Why is it called design?
  - ① Manipulation of the treatment conditions occurs **by design**
  - ② That is, the researcher controls the specific treatment conditions
- Design is the most relevant elements of any experiment approach and the greater barrier in answering your research question
- It allow us to understand the decision rules used to select a profile instead of another

# Design characteristics in a CJ

## ① Feature Design

- ① Attributes
- ② Levels

## ② Choice-Set Design

- ① Conjoint profiles

## ③ Information/Context Design

- ① Priming, framing . . . .
- ② E.g. information acceleration processes, elaboration tasks, information sources

# Feature Design: attributes

- ❶ Identify and define the **attributes**
  - ❶ Which attributes should be included in order to answer my RQ?
  - ❷ Define a universal but finite list of attributes that are theoretically relevant
    - ❶ Usually 10-15 attributes
  - ❸ Reduce the attributes
    - ❶ Less than 10 attributes is considered acceptable
  - ❹ Avoid double-barrel attributes
    - ❶ E.g., “Expertise” of a candidate
    - ❷ Q: can you think of another example?

# Feature Design: levels

- ➊ Identify and define the **levels**
  - ➊ Which levels are suitable for the decision task?
  - ➋ Are the levels ordinal, nominal or continuous?
  - ➌ Select theoretically relevant start- and end-points for each attributes
    - ➊ Q: What is a sensible range for the age of a candidate?
  - ➍ Define a finite list of levels that have discriminant power.
    - ➊ From 2 to maximum 8
    - ➋ Q: What age levels should we include for a candidate?
    - ➌ Q: Does a year difference make any difference in accuracy?
  - ➎ If the design is too big and you assume linearity, use only start- and end-point designs
    - ➊ e.g., Instead of ordinal age use “Young” and “Old”
  - ➏ Avoid attributes ambiguity
    - ➊ E.g., “High level of integrity” of a candidate VS “Never committed for corruption”

# Attributes Design: Garbage in Garbage out I

## 1 Internal Validity: **garbage in, garbage out**

### 1 **Masking** or inter-attributes correlation ([Verlegh, Schifferstein, and Wittink 2002](#))

- 1 Perceived association between an attribute included in the design and an omitted one
- 2 E.g. Including policy positions but excluding PID

### 2 **Satisficing** ([Bansak et al. 2019](#))

- 1 Disregard substantive informations due to high cognitive complexity.
- 2 E.g., inferring from PID policy positions and attributes

### 3 Unrealistic trade-off(s) between attributes

- 1 A doctor (Attribute: Profession) without an academic degree (Attribute: Education)

### 4 **“Range effect”** ([Verlegh, Schifferstein, and Wittink 2002](#))

- 1 Using specific level combinations could lead to implicit associations
- 2 E.g., a white Democratic candidate of age 78 from Vermont

## 2 External Validity: **“Number-of-levels effect”** 1. Too many levels could make the interpretation difficult 2. Statistical power might be insufficient



# Choice-Set Design: Profiles, Tasks, Outcome

- ➊ Number of Alternative **Profiles**
  - ➊ Single Profiles (1)
  - ➋ Paired Profiles (2)
  - ➌ Multi Profiles (up to 4)
- ➋ Number of conjoint choice **Tasks** per respondent
  - ➊ From 2 to no more than 20
- ➌ **Outcome** measures
  - ➊ Discreet Choice (better for trade-offs)
  - ➋ Individual rating (better for detecting extreme response style)
- ➍ **Randomization**
  - ➊ Position of the attributes in our CJ

# Choice-Set Design: Sample size and complexity

- ❶ Sample size = Number of choices per individual (tasks) X Number of participant in the study (N) X Number of profiles
  - Trade off between statistical power and fatigue
- ❷ Design Complexity = Number of Attributes X Number of Attributes' Levels X Number of Profiles
  - It is a trade-off between cognitive burden and experimental conditions
- ❸ Data quality = Power (Sample size) - Design Complexity - Cognitive Burden

# Conjoint Design: Summary

- ① Conjoint experiments are experimental design to measure (underlying) preferences
  - Whether a respondents prefer one attribute as opposed to another when choosing a profile
- ② Advantages
  - Analysis of more complex causal questions
  - Good external and internal validity
- ③ Different designs
  - Rating
  - Ranking
  - Choice (most used)
- ④ Terminology
  - Attributes: characteristics of the profile
  - Levels: characteristics of the different attributes
- ⑤ Garbage in Garbage out
  - Clarity in the attributes/levels
  - Design Complexity
  - Fatigue
  - Cognitive Burden

# References I

- Auerbach, Adam Michael, and Tariq Thachil. 2018. "How Clients Select Brokers: Competition and Choice in India's Slums." *American Political Science Review* 112 (4): 775–91. <https://doi.org/gdvp54>.
- Bansak, Kirk, Jens Hainmueller, Daniel J. Hopkins, and Teppei Yamamoto. 2019. "Beyond the Breaking Point? Survey Satisficing in Conjoint Experiments." *Political Science Research and Methods*, 1–19. <https://doi.org/gf8qqg>.
- Boyle, Kevin J., Thomas P. Holmes, Mario F. Teisl, and Brian Roe. 2001. "A Comparison of Conjoint Analysis Response Formats." *American Journal of Agricultural Economics* 83 (2): 441–54. <https://doi.org/cz2mjj>.
- Diamond, Peter A., and Jerry A. Hausman. 1994. "Contingent Valuation: Is Some Number Better Than No Number?" *Journal of Economic Perspectives* 8 (4): 45–64. <https://doi.org/chjk56>.
- Hainmueller, Jens, Dominik Hangartner, and Teppei Yamamoto. 2015. "Validating Vignette and Conjoint Survey Experiments Against Real-World Behavior." *Proceedings of the National Academy of Sciences* 112 (8): 2395–2400. <https://doi.org/f63mkr>.

## References II

- Hankinson, Michael. 2018. "When Do Renters Behave Like Homeowners? High Rent, Price Anxiety, and NIMBYism." *American Political Science Review* 112 (3): 473–93. <https://doi.org/gd56v2>.
- Kahneman, Daniel, Paul Slovic, and Amos Tversky. 1982. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge University Press.
- Software, Sawtooth. 2008. "Sawtooth Software Choice-Based Conjoint Analysis." 2008. <https://sawtoothsoftware.com/download/techpap/cbctech.pdf>.
- Teele, Dawn Langan, Joshua Kalla, and Frances Rosenbluth. 2018. "The Ties That Double Bind: Social Roles and Women's Underrepresentation in Politics." *American Political Science Review* 112 (3): 525–41. <https://doi.org/gdwd55>.
- Verlegh, Peeter W. J., Hendrik N. J. Schifferstein, and Dick R. Wittink. 2002. "Range and Number-of-Levels Effects in Derived and Stated Measures of Attribute Importance." *Marketing Letters* 13 (1): 41–52. <https://doi.org/b8c7mq>.