## Looking back(wards) at independent and dependent variables for Research Methods



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### Independent & dependent variables

- Fundamental concepts in undergraduate Research Methods
  - Causal relations
  - Experimental design
    - Hypotheses
    - Predictions
- Common difficulty: independent & dependent variables
  - Terms: independent ↔ dependent
  - Identifying
  - Defining

### Framework for retention + application

- 1. Lecture framing
- 2. Group activity
- 3. Homework assignment
- 4. Seminar/discussion activity
- → based on students' intuitions about cause & effect

### 2. Lecture activities (group)

#### In groups:

- 1. Think of 3 other cause-and-effect relations
- 2. Identify "changer" and "change-ee"
- 3. Using the relation template:("As \_\_\_\_ changes, \_\_\_\_ changes")
  - State the "forwards" direction
  - State the "backwards" direction

#### Lecture:

introduce "independent variable" for "changer" and "dependent variable" for "change-ee"

### In groups:

4. For 3 relations, identify IVs and DVs

### 3. Homework assignment (individual)

1. Find 3 recent news articles with cause-and-effect relations

#### For each article:

- 2. Identify "changer" and "change-ee"
- 3. Using the relation template:
  - ("As \_\_\_\_ changes, \_\_\_ changes")
    - State the "backwards" direction

State the "forwards" direction

- 4. Identify IV and DV
- > Relate concepts to personal/recent experiences
  - Reflect on intuitions
- > Topics 2017-2024:
  - climate change
  - COVID lockdowns
  - public health
  - personal relationships

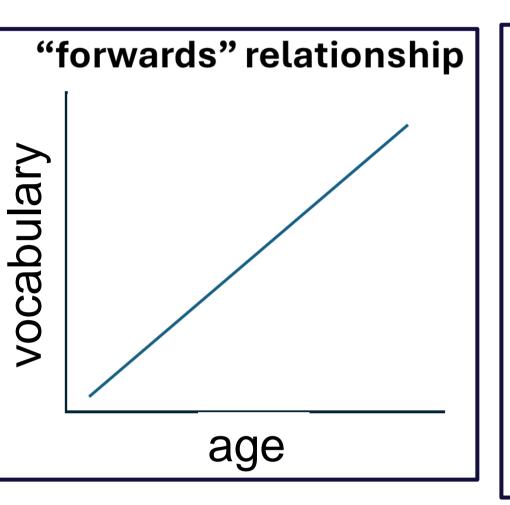
### 4. Seminar activity (group + individual)

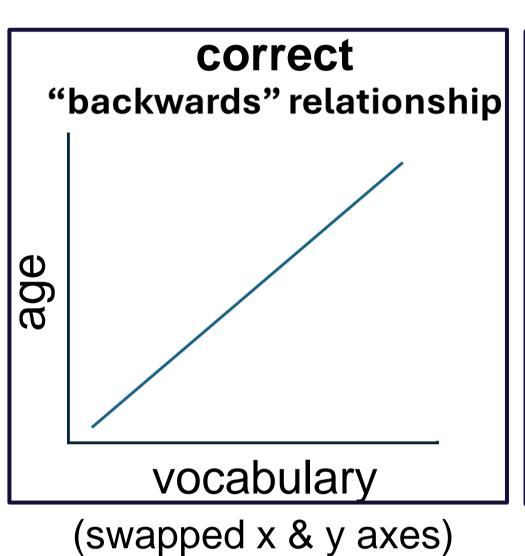
#### Aims:

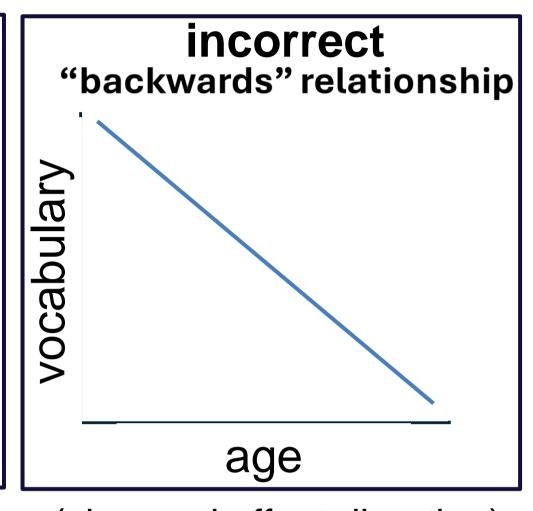
- reinforce IV/DV concepts
- link to data visualization

### **Individually:**

1. Plot "forwards" and "backwards" relations from assignment







(changed effect direction)

### <u>In groups:</u>

- 2. Compare plots guess effects from forwards and backwards plots
  - Identify/clarify misunderstandings
- 3. Share favorite backwards plot

### Future directions: Al considerations

### Homework assignment

- currently: easily Al-able
- aim: understand independent/dependent variables
- Option 1: re-develop to be un-Al-able
- ✓ Option 2: incorporate AI to achieve aim
  - Same assignment steps 1-3 (2 articles)
  - Additionally (1 article):
    - 5. in prompt to ChatGPT (or preferred):
      - a. **Explain** "changer"/"change-ee" and "forward"/"backwards"
      - b. Provide article, generate response to step 3
      - engagement with prompt, content
    - 5. Compare genAl output to own output
      - assessment of genAl output
    - → Submit: screenshot of prompt and output,
  - Assessment: prompt match with responses in 1-3

### Seminar activity

Similarly: plot relations, then generate & assess plots

# 1. Lecture framing

- 1. Define a variable
  - has measurable features
  - can have different possible values

Examples: Vocabulary size, Age

### 2. Causal relations between variables

- A variable can **cause** change: "**changer**" (Independent variable – term *not* yet introduced)
- A variable can **be** changed: "**change-ee**"

  (Dependent variable term *not* yet introduced)



### Relation is NOT reversible

Template:

✓As <u>changer</u> changes, <u>change-ee</u> changes = "forwards"

XAs <u>change-ee</u> changes, <u>changer</u> changes = "backwards"

e.g. As <u>age</u> changes, <u>vocabulary</u> changes (forwards, "ok")
As <u>vocabulary</u> changes, <u>age</u> changes (backwards, "weird")

3. Note on 3<sup>rd</sup> variables: correlation/causation