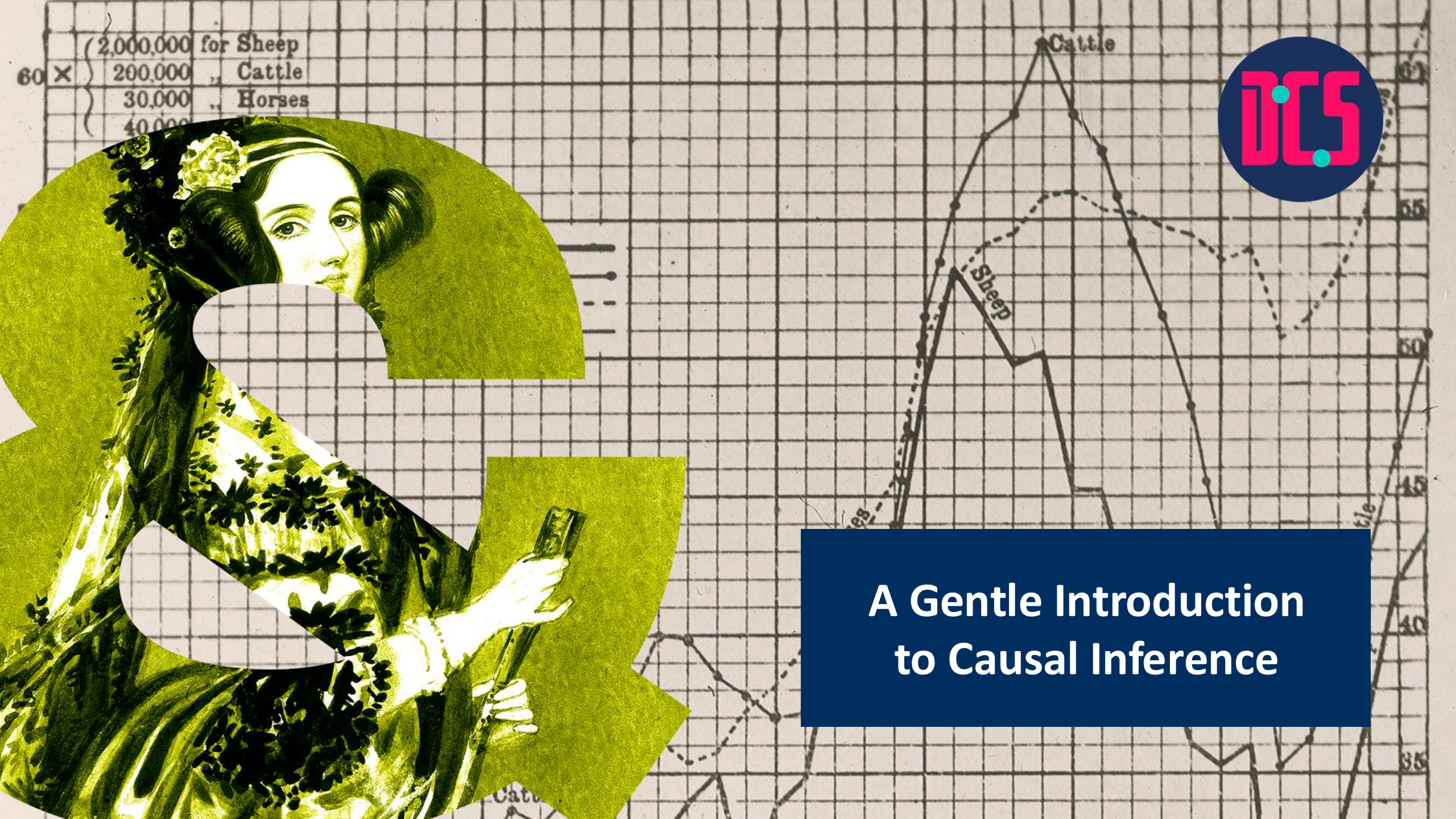


A Gentle Introduction to Causal Inference

The schedule for each session…

14:00 -- 14:10 Introduction and Motivations
14:10 -- 14:50 Presentation and Q&A
14:50 -- 15:00 10-minute Break
15:00 -- 15:45 Practical Session
15:45 -- 16:00 Final Wrap-Up

THE UNIVERSITY of EDINBURGH
Centre for Data, Culture & Society

DATA CULTURE SOCIETY

Welcome!

Chris Oldnall

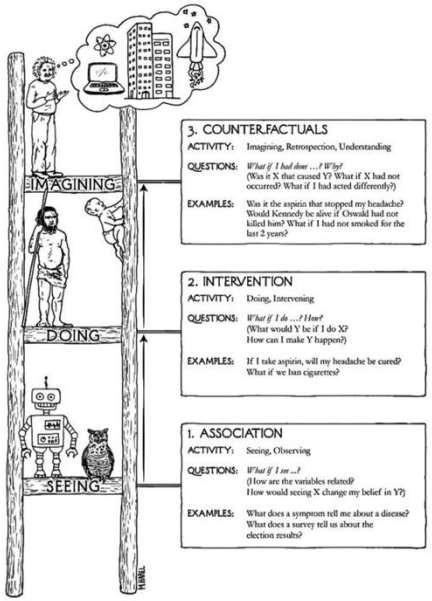
THE UNIVERSITY of EDINBURGH
Centre for Data, Culture & Society

DATA CULTURE SOCIETY

Week 1:
Foundations of Causality

www.cdcs.ed.ac.uk

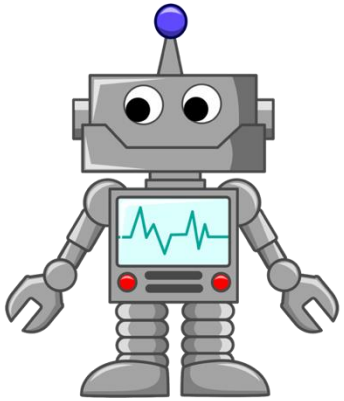
Pearl's Ladder of Causality



What does a symptom tell me about a disease?

$\mathbb{P}(y \mid x)$

Association



If I take a drug will the disease be cured?

$\mathbb{P}(y \mid \mathrm{do}(x), z)$

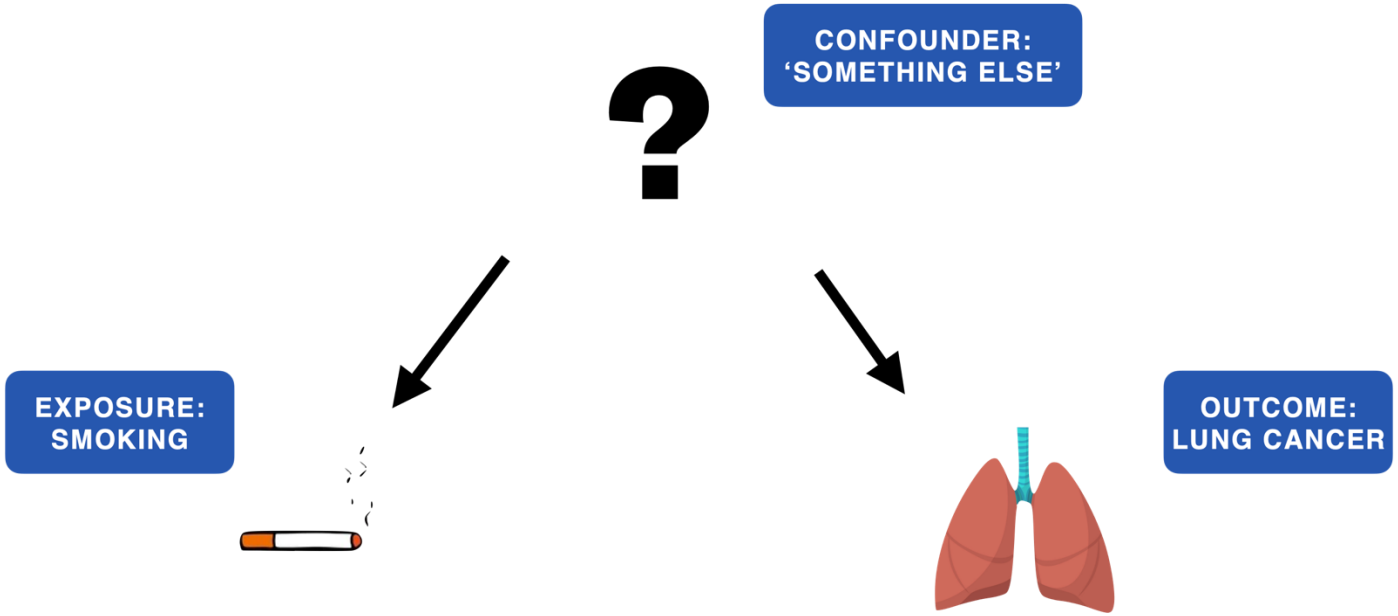
Intervention

Would the disease have continued had I not taken then drug?

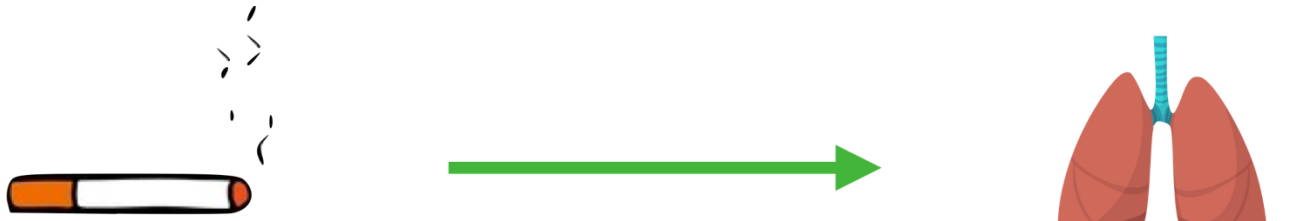
$\mathbb{P}(y_x \mid x', y')$

Counterfactuals

Smoking in the multiverse of madness



How do we calculate the average causal effect?

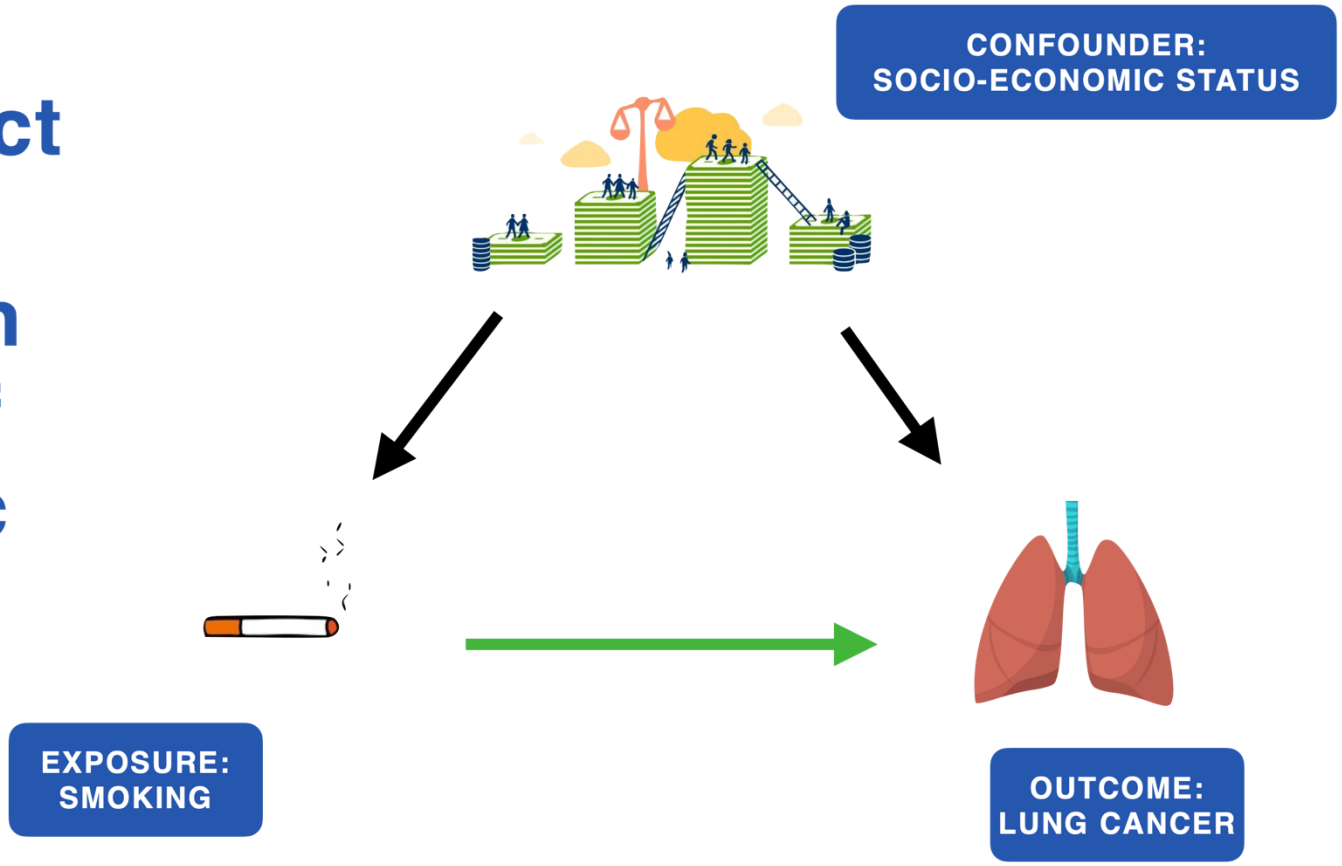


EXPOSURE: SMOKING

OUTCOME: LUNG CANCER

$$\psi = \mathbb{E}_X[Y \mid X]$$

How do we measure the effect of smoking on lung cancer with the influence of socio-economic status?



Well…how do we deal with confounding in general?

1. Randomisation / Study Design
2. Matching / Accounting
3. Instrumental Variables

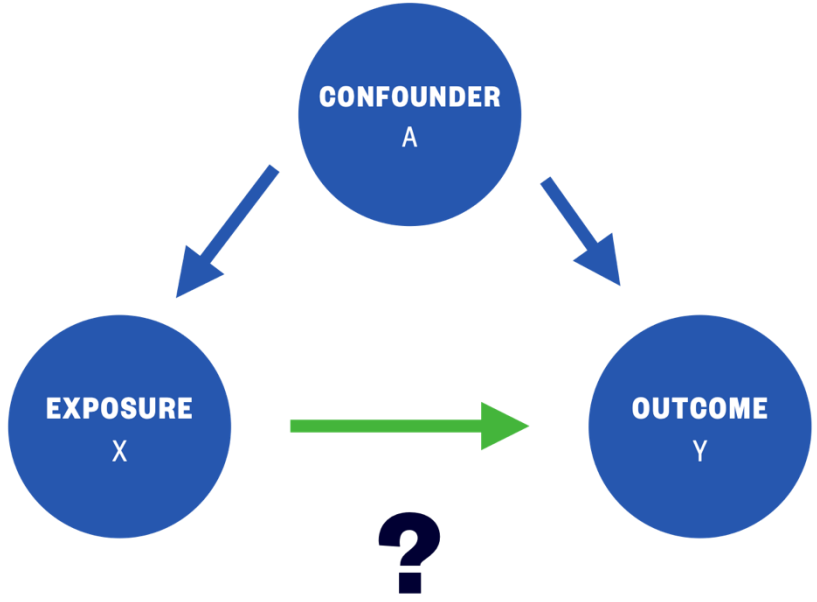
Average causal effect with confounding

$$\mathscr{M} = (X, A, Y)$$

X - Exposure

A - Confounder

Y - Outcome



$$\psi = \mathbb{E}_X[\mathbb{E}_A[Y \mid X, A]]$$

What about mediators? What do I do?

Workplace Policies as a Mediator for Employee Well-Being:

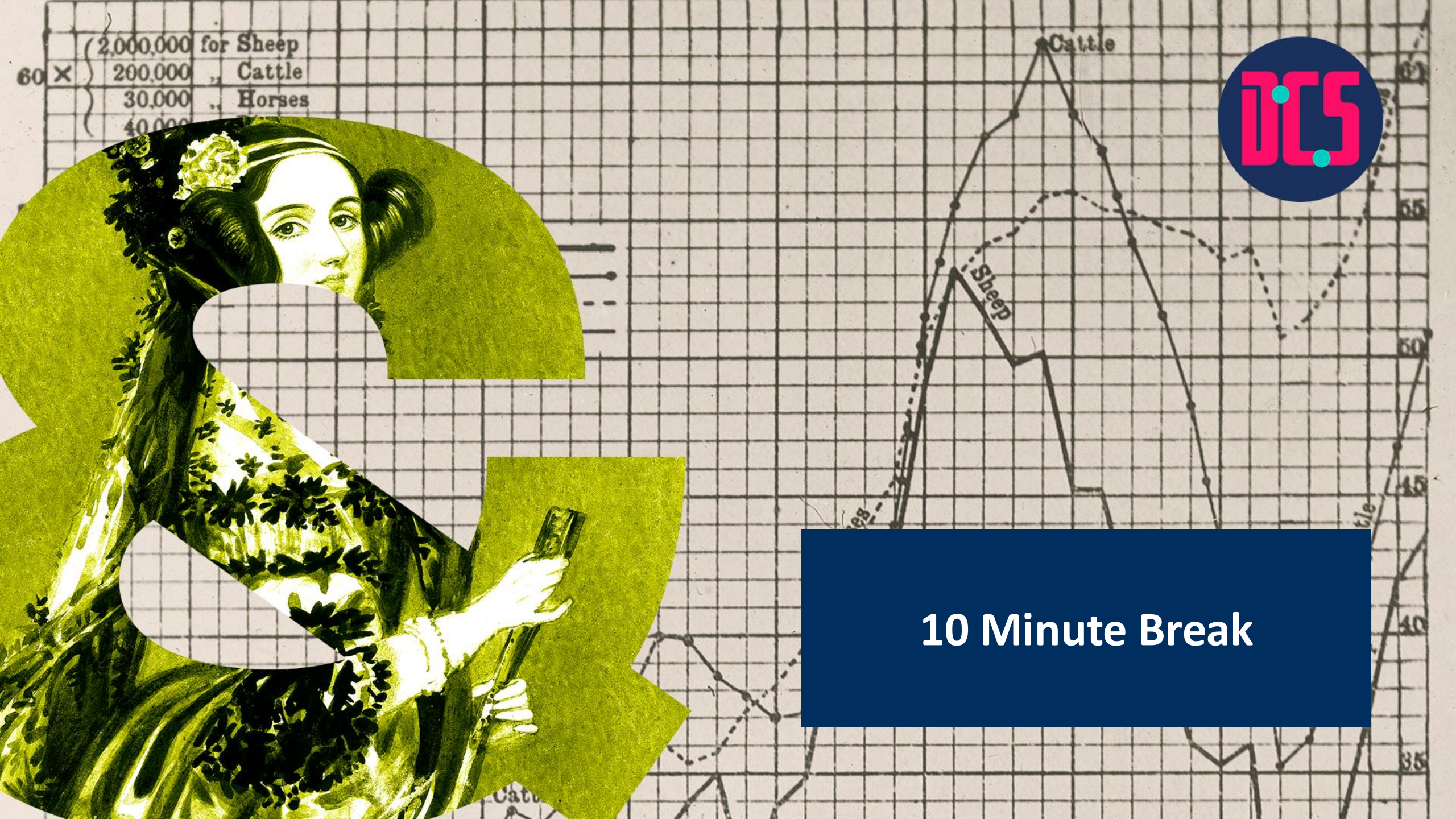
Independent Variable (X): Implementation of workplace policies to reduce stress.

Mediator (M): Employee satisfaction with work-life balance.

Dependent Variable (Y): Employee well-being and job performance.

The implementation of stress-reducing workplace policies (X) may affect employee well-being (Y) through the mediator of employee satisfaction with work-life balance (M). This mediator helps explain how the policies influence employee outcomes.

Ultimately, leave them alone!



10 Minute Break

THE UNIVERSITY of EDINBURGH
Centre for Data, Culture & Society

DATA CULTURE SOCIETY

Practical Session 1

www.cdcs.ed.ac.uk

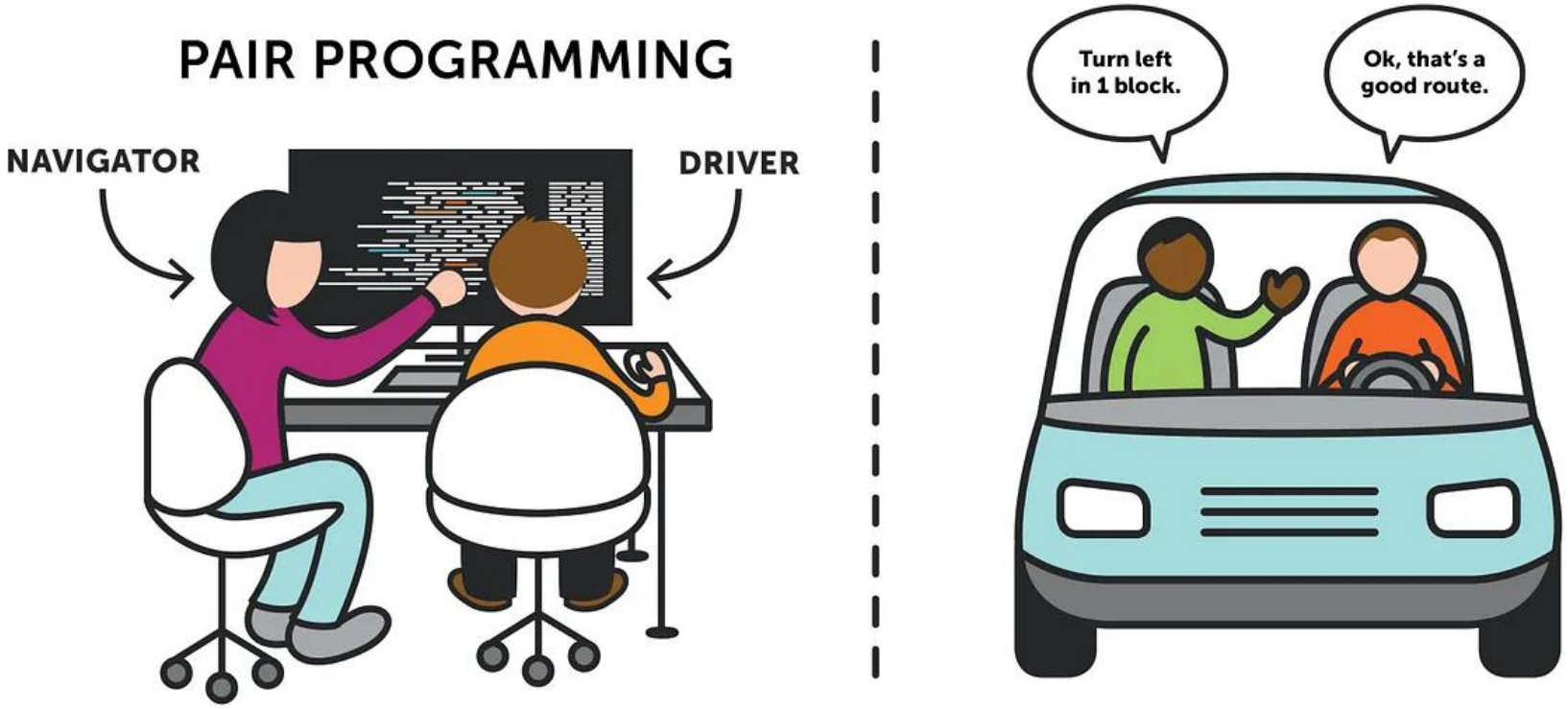


Image from:
https://medium.com/@tomspencer_uk/pair-programming-and-problem-solving-4531ef3bf171

Pair Programming

- find a partner
- switch driver & navigator roles regularly, e.g., after every task in the notebook
- you can work with the same partner throughout the course, or switch between sessions
- ask us for help! (yes, even for small things)

THE UNIVERSITY of EDINBURGH
Centre for Data, Culture & Society

DATA CULTURE SOCIETY

Let's get programming

For Python:

1.Go to https://noteable.edina.ac.uk/login
2.Login with your EASE credentials
3.Select 'Standard Notebook (Python3)' as a personal notebook server and press start
4.Click the '+GitRepo'
5.Copy and Paste this repository URL https://github.com/DCS-training/IntroCausalInference as the Repository URL - you do not need to add in any other fields.
6.Decide where to locate the folder. By default, it will locate it in your home directory
7.Press 'Clone' Congratulations you have now pulled the content of the repository on your Notable server space.

For R:

1. Go to https://noteable.edina.ac.uk/login
2. Login with your EASE credentials
3. Select RStudio as a personal notebook server and press start.
4. Go to File > New Project> Version Control > Git
5. Copy and Paste this repository URL https://github.com/DCS-training/IntroCausalInference as the Repository URL (The Project directory name will filled in automatically but you can change it if you want your folder in Notable to have a different name).
6. Decide where to locate the folder. By default, it will locate it in your home directory.
7. Press Create Project Congratulations you have now pulled the content of the repository on your Notable server space.