

Correlation & causation

Critical thinking 2

Today

- ① Instructions on Writing contest 2
- ② Review: assumptions
- ③ Mini lecture: correlation/causation
- ④ Exercises



Writing contest 2: instructions

(omitted)

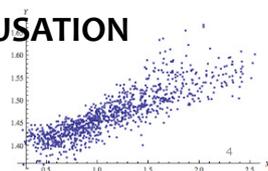
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Review: assumptions

(omitted)

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CORRELATION & CAUSATION



Correlation doesn't imply causation

- Crucial for our interpretation of research findings



Exercise 1

Be creative!

- List possible **causal** relations underlying the following possible positive correlations:
 - a) Kids' success in the marshmallow test × their success in life
 - b) Kids' weight × parents' income
 - c) Early completion of Gyutto-E × TOEFL score
 - d) Distance from campus × attendance rate
 - e) Number of FB friends × number of friends
 - f) Intensity of emotion × voice

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Exercise 2

- a) Explain the **2 correlations** reported in this Wellcome article with a **diagram**.
- b) List **all possible causal relations** involved in the correlations.



Number of Facebook friends linked to size of brain regions, study suggests

wellcome, 19 October 2011

<https://wellcome.ac.uk/press-release/number-facebook-friends-linked-size-brain-regions-study-suggests>

- Scientists funded by the Wellcome Trust have found a direct link between the number of 'Facebook friends' a person has and the size of particular brain regions. In a study published today, researchers at University College London (UCL) also showed that the more Facebook friends a person has, the more 'real-world' friends they are likely to have.
- The researchers are keen to stress that they have found a correlation and not a cause, however: in other words, it is not possible from the data to say whether having more Facebook friends makes the regions of the brain larger or whether some people are 'hardwired' to have more friends.
- The social networking site Facebook has more than 800 million active users worldwide. Nearly 30 million of these are believed to be in the UK.
- The site allows people to keep in touch online with a network of friends. The sizes of individual networks vary considerably, and some users have only a handful of online friends while others have over a thousand; however, whether this **variability** is reflected in the size of real-world social networks has not been clear.

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- Professor Geraint Rees, a Wellcome Trust Senior Clinical Research Fellow at UCL, said: "Online social networks are massively influential, yet we understand very little about the impact they have on our brains. This has led to a lot of unsupported **speculation** that the internet is somehow bad for us."
- "Our study will help us begin to understand how our interactions with the world are mediated through social networks. This should allow us to start asking intelligent questions about the relationship between the internet and the brain—scientific questions, not political ones."
- Professor Rees and colleagues at the UCL Institute of Cognitive Neuroscience and the Wellcome Trust Centre for Neuroimaging studied brain scans of 125 university students—all active Facebook users—and compared them against the size of the students' network of friends, both online and in the real world. Their findings, which they **replicated** in a further group of 40 students, are published today in the journal *Proceedings of the Royal Society B*.
- Professor Rees and colleagues found a strong connection between the number of Facebook friends an individual had and the amount of grey matter (the brain tissue where the processing is done) in several regions of the brain. One of these regions was the amygdala, a region associated with processing memory and emotional responses. A study published recently showed that the volume of grey matter in this area is larger in people with a larger network of real-world friends—today's study shows that **the same is true** for people with a larger network of online friends.

- The size of three other regions—the right superior temporal sulcus, the left middle temporal gyrus and the right entorhinal cortex—also **correlated** with online social networks but did not appear to correlate with real-world networks.
- The superior temporal sulcus has a role in our ability to perceive a moving object as biological, and structural defects in this region have been identified in some children with autism. The entorhinal cortex, meanwhile, has **been linked to** memory and navigation—including navigating through online social networks. Finally, the middle temporal gyrus has been shown to activate in response to the gaze of others and so **is implicated** in perception of social cues.
- Dr Ryota Kanai, first author of the study, added: "We have found some interesting brain regions that seem to link to the number of friends we have - both 'real' and 'virtual'. The exciting question now is whether these structures change **over time**—this will help us answer the question of whether the internet is changing our brains."
- As well as examining brain structure, the researchers also examined whether there was a link between the size of a person's online network of friends and their real-world network. Previous studies have looked at this, but only in relatively small sample sizes.

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- The UCL researchers asked their volunteers questions such as 'How many people would send a text message to you marking a celebratory event (e.g. birthday, new job, etc.)?', 'What is the total number of friends in your phonebook?' and 'How many friends have you kept from school and university that you could have a friendly conversation with now?' The responses suggest that the size of their online networks also related to the size of their real world networks.
- "Our findings support the idea that most Facebook users use the site to support their existing social relationships, maintaining or reinforcing these friendships, rather than just creating networks of entirely new, virtual friends," adds Professor Rees.
- Commenting on the study, Dr John Williams, Head of Neuroscience and Mental Health at the Wellcome Trust, said: "We cannot escape the **ubiquity** of the internet and its impact on our lives, yet we understand little of its impact on the brain, which we know is **plastic** and can change over time. This new study illustrates how well-designed investigations can help us begin to understand whether or not our brains are evolving as they adapt to the challenges posed by social media."

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Coded

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 - Background
- "Our study will help us begin to understand how our interactions with the world are mediated through social networks. This should allow us to start asking intelligent questions about the relationship between the internet and the brain—scientific questions, not political ones."
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 - Exp 1: methods
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- The size of three other regions—the right superior temporal sulcus, the left middle temporal gyrus and the right entorhinal cortex—also correlated with online social networks. Exp 1: result (b) did not appear to correlate with real-world networks.
- The superior temporal sulcus has a role in our ability to perceive a moving object as biological, and structural defects in this region have been identified in some children with autism. The entorhinal cortex, meanwhile, has been linked to memory and navigation—including navigating through online social networks. Finally, the middle temporal gyrus has been shown to activate in response to the gaze of others and so is implicated in perception of social cues.
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 - Exp 1: discussion
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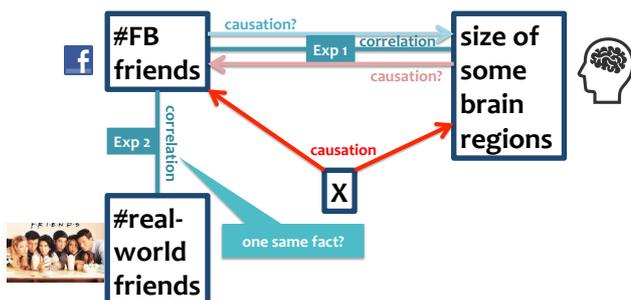
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 - Conclusion of Exp 2
- Commenting on the study, Dr John Williams, Head of Neuroscience and Mental Health at the Wellcome Trust, said: "We cannot escape the ubiquity of the internet and its impact on our lives, yet we understand little of its impact on the brain, which we know is plastic and can change over time. This new study illustrates how well-designed investigations can help us begin to understand whether or not our brains are evolving as they adapt to the challenges posed by social media."
 - Conclusions/ implications

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Model answer

Possible causal relations



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