Fallacies
formal, informal, rhetorical & statistical
Formal fallacies

• A logical *argument* that is not *valid*
  – Valid: The premises fit & prove the conclusion
  – For example:
    
    *All S is M.*
    *All P is M.*

    **Therefore, all S is P.**
Formal fallacies

• A logical argument that is not valid

– For example:

All rabbits run fast.
Homare Sawa runs fast.

Therefore, Homare Sawa is a rabbit.
Formal fallacies

• A logical *argument* that is not *valid*

Compare a valid example:

*All rabbits run fast.*
*Homare Sawa is a rabbit.*
*Therefore, Homare Sawa runs fast.*
Rhetorical (informal) fallacies

• (Some) Attempts to convince without logic
  – People instead of premises, data

  *Everybody says it, so it must be true.*
  *Stupid people say it, so it must be false.*

  – Ignorance/knowledge instead of logic

  *We don’t know it’s not true…*

  *This is a good idea, so it must be true.*
Statistical fallacies

• Misunderstanding / misrepresenting statistics

It’s significant \((p < 0.01)\), so it’s important.

The temperature has been going down since September. By June we’ll be freezing.

• Calculating incorrectly, improperly

All my friends agree with me.

Therefore, everyone agrees with me.
Chocolate & Nobel Prizes

Figure 1. Correlation between Countries’ Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

Messrli
2012
Chocolate & Nobel Prizes

Maurage et al. 2013
Chocolate & Nobel Prizes

Maurage et al. 2013
Chocolate & Nobel Prizes
Sunlight correlates with vacations

Sunlight in Florida correlates with Visitors to Universal Orlando Islands of Adventure

<table>
<thead>
<tr>
<th>Year</th>
<th>Sunlight in Florida (KJ/sq.m) (CDC)</th>
<th>Visitors to Universal Orlando Islands of Adventure (TEA)</th>
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</thead>
<tbody>
<tr>
<td>2007</td>
<td>18945.54</td>
<td>5.43</td>
</tr>
<tr>
<td>2008</td>
<td>19289.68</td>
<td>5.297</td>
</tr>
<tr>
<td>2009</td>
<td>18870.38</td>
<td>4.627</td>
</tr>
<tr>
<td>2010</td>
<td>19418.7</td>
<td>5.949</td>
</tr>
<tr>
<td>2011</td>
<td>19700.78</td>
<td>7.674</td>
</tr>
</tbody>
</table>

Correlation: 0.89205

Courtesy of tylervigen.com
Japanese cars & US suicides

Japanese passenger cars sold in the US correlates with Suicides by crashing of motor vehicle

Suicides by crashing: 140 suicides (2006), 120 suicides (2008), 100 suicides (2009)


Courtesy of tylervigen.com
Government

Can you spot the fallacy?
British politicians’ bargain

• 2011: British politicians say government wastes £10bn (¥2兆) per year

• Ben Goldacre read the report to check their calculation.
  http://www.badscience.net/2012/04/is-this-the-worst-government-statistic-ever-created/
British politicians’ bargain

Government workers get mobile phones from an expensive company. If their mobile phones were from a different company, they would be 20% cheaper.

City government spends £50bn per year on all programs. If they can save 20%, that is £10bn.
Both charts based on the same numbers
But this one is only the top 0.0004% of the range
Language, Psychology

Can you spot the fallacy?
Many English speakers say they hate the word *moist*. They say they dislike its sound, but maybe they actually dislike its meaning. Thibodeau et al. (2015) asked people to rate whether they like or dislike several words. Although 21% dislike *moist*, those same people did not dislike *hoist* or *rejoiced*. Therefore, people who dislike the word *moist* dislike its meaning, not its sound.
Word aversion

Many English speakers say they hate the word "moist." They say they dislike its sound, but maybe they actually dislike its meaning.

Thibodeau et al. (2015) asked people to rate whether they like or dislike several words. Although 21% dislike "moist," those same people did not dislike "hoist" or "rejoiced." Therefore, people who dislike the word "moist" dislike its meaning, not its sound.

“A is False” does not necessarily mean “B is True.”

(Sometimes called the False Dilemma)
Economics

Can you spot the fallacy?
Growth vs. debt

Reinhart & Rogoff (2010) compared economic growth and government debt. They found little connection. But when debt is more than 90% of GDP, growth drops dramatically.

Herndon et al. (2013) couldn’t duplicate Reinhart & Rogoff’s findings. Eventually they found that Reinhart & Rogoff had made a computer error that caused their statistics to be calculated incorrectly.
Growth vs. debt

Reinhart & Rogoff, who oppose big debt for political reasons, found that big debt is bad.

Herndon et al. found that big debt does not have much effect. (Small debt has a good effect, but politicians don’t argue about that.)

1. Garbage in, garbage out

2. Beware of finding what you are looking for.
Sociology and Communication

Can you spot the fallacy?
People rarely change their political positions. Lacour & Green (2014) found that when an interviewer says that he or she is gay, the people being interviewed are more likely to change their opinions about gay marriage.
Canvassing

This was not a fallacy – it was a lie. Lacour made up fake data to “prove” the effectiveness of his canvassing techniques.

The respected journal Science published the paper, and peer reviewers accepted it, in part because Green is a very well-known and respected scholar in this field. One reviewer said, “I trust anything Don Green says.”

Green asked Science to retract the paper.
The fallacy fallacy

• (This video and others are available on YouTube from PBS Idea Channel.)
  https://youtu.be/oGBO-WMrIIIQ?list=PLtHP6qx8VF7dPql3l1To4i6vElPt0kV5