I. How we believe
II. Pattern recognition
III. Polygraphs/memory
IV. Astrology
“Good” Places for Life

• Question: How many “Earth-like” planets:

• Requirements:
  – Single star system (not binary)
  – Star should be sunlike (similar to our sun)
  – Must have planets
  – Must have Earth-like planet

• Estimates (arguable, but you can change them!)
  – ~50% are single star systems (not binary)
  – ~10% are sunlike (similar to our sun)
  – ~10% have planets
  – ~10% have an Earth-like planet

\[ 4 \times 10^{11} \times 0.5 \times 0.1 \times 0.1 \times 0.1 = 2 \times 10^8 = 200,000,000 \]

Earthlike planets in the Milky Way galaxy alone!!!

[low estimate]

From 2 weeks ago...
Goldilocks planets

- Earthlike planets (1-2x size of Earth)
- Habitable zone → liquid water

- NASA Kepler, based upon observations now estimates:
  - Fraction of stars with Earthlike planets: 22% +/- 8%
  - Total number of Earthlike planets in the Milky Way: 8.8 billion!
  - Nearest Earthlike planet may be as close as 12 light years!
How we believe
Medical researchers have developed a new cream for treating skin rashes. New treatments often work but sometimes make rashes worse. Even when treatments don’t work, skin rashes sometimes get better and sometimes get worse on their own. As a result, it is necessary to test any new treatment in an experiment to see whether it makes the skin condition of those who use it better or worse than if they had not used it.

Researchers have conducted an experiment on patients with skin rashes. In the experiment, one group of patients used the new cream for two weeks, and a second group did not use the new cream.

In each group, the number of people whose skin condition got better and the number whose condition got worse are recorded in the table below. Because patients do not always complete studies, the total number of patients in each two groups is not exactly the same, but this does not prevent assessment of the results.

Please indicate whether the experiment shows that using the new cream is likely to make the skin condition better or worse.

<table>
<thead>
<tr>
<th></th>
<th>Rash Got Better</th>
<th>Rash Got Worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who did use the new skin cream</td>
<td>223</td>
<td>75</td>
</tr>
<tr>
<td>Patients who did not use the new skin cream</td>
<td>107</td>
<td>21</td>
</tr>
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</table>

What result does the study support?

- People who used the skin cream were more likely to get better than those who didn't.
- People who used the skin cream were more likely to get worse than those who didn't.
Of those who **DID** use skin cream
223/298 = 75% got better
75/298 = 25% got worse

Of those who **DID NOT** use skin cream
107/128 = 84% got better
21/128 = 16% got worse

**Conclusion:** people who used the skin cream were more likely to get worse than those who did not!
Study protocol

- Give people a test to measure their “numeracy” (how good they are with numbers.)

- Give them the skin cream question.
  - Switch the numbers around to avoid bias.

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  (A) Rash Decreases

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  (B) Rash Increases

- Finding: people with higher numeracy more likely to get the correct answer.
Higher numeracy more likely to correctly interpret the data

Solid: rash increases
Dash: rash decreases

Correct interpretation of data
Numeracy score

Worse with numbers Better with numbers

Correct
Incorrect
This study is NOT about skin creams!!
2\textsuperscript{nd} part of study

- Use exactly the same numbers, same setup, but switch the question.
- Ask questions about their political position.
- Ask now about whether a ban on handguns increase or decrease crime.
Higher numeracy more likely to correctly interpret the data.

Solid: rash increases
Dash: rash decreases

Correct interpretation of data (1 - )

Numeracy score

Worse with numbers Better with numbers
Hypothesis

• Info:
  – Numeracy (how good are you at math?)
  – Political position (conservative/liberal)
  – Different versions of the skin cream study.
    • Political position does not affect skin cream conclusions.

• Ask about gun bans and crime.
• What do you expect to see?
Political position affects interpretation, even for the highest numeracy participants!!

**Red:** Conservative republican  
**Blue:** Liberal democrat

Worse with numbers  
Better with numbers
“Liberal Democrats” (< 0 on Conserv_Repub)  “Conservative Republicans” (> 0 on Conserv_Repub)

CR rash decreases
LD rash decreases
LD rash increases
CR rash increases

CR crime decreases
LD crime decreases
CR crime increases
LD crime increases
Beliefs lead rationale

• **Backfire effect**
  - If you hold a belief, exposure to contrary evidence is likely to strengthen your belief.

• **Comments affect understanding**
  - Studies show that uncivil comments to an online article actually affect interpretation
Face of Satan?

- Photographer Mark D. Phillips (unmodified)
Et = 37.17 GeV
September 11

- **Numerology**
  - September 11 is the 254th day of the year: $2+5+4=11$
  - The first plane to hit the tower was flight 11
  - New York City, Afghanistan, and The Pentagon each contain 11 letters
  - The adjacent Twin Tower buildings looked like the number 11
  - New York was the 11th state added to the Union
Nostradamus?

- "In the City of God there will be a great thunder, Two brothers torn apart by Chaos, while the fortress endures, the great leader will succumb, The third big war will begin when the big city is burning" - Nostradamus 1654

- Not really Nostradamus (he did his work in the 1500’s) but it was written prior to September 11th, 2001.
Pattern recognition

• The human brain is the greatest pattern recognition system ever known.
• What is the consequence of this?
Lie Detectors and National Security

- "The Polygraph and Lie Detection" (NAS Press, 2003)
  - Conclusion: found polygraph tests to be unacceptable for DOE employee security screening because of the high rate of false positives and susceptibility to countermeasures.
  - DOE carefully reevaluated its policies and reissued them without change, arguing that a high rate of false positives must mean the threshold for detecting lies is very low.

- Comments:
  - "There is almost universal agreement that polygraph screening is completely invalid," FBI polygraph expert Dr. Drew Richardson asserts.
  - In 1997 Senate testimony, Richardson warned, "To the extent that we place any confidence in the results of polygraph screening, and as a consequence shortchange traditional security vetting techniques, I think our national security is severely jeopardized."
  - Mark Mallah, a former FBI agent deemed deceptive by a polygraph exam and cleared after a 2-year investigation, says, "In all its history, the polygraph has not detected one single spy. Ever."
  - Many spies (Aldrich Ames, Robert Hanssen, Larry Wu-Tai Chin) passed repeated lie detector tests.
“The most beautiful thing we can experience is the mysterious. It is the source of all true art and all science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead: his eyes are closed.”

Albert Einstein
Astrology
Wikipedia I

• Astrology is a group of *systems*, *traditions*, and *beliefs* which hold that the relative positions of *celestial bodies* and related details can provide information about *personality*, human affairs, and other terrestrial matters. A practitioner of astrology is called an *astrologer*. Astrologers believe that the movements and positions of celestial bodies either directly influence life on *Earth* or correspond to events experienced on a human scale. Modern astrologers define astrology as a *symbolic* language, an *art* form, or a form of *divination*. Despite differences in definitions, a common assumption of astrologers is that celestial placements can aid in the interpretation of past and present events, and in the *prediction* of the future.
Astrology is generally considered a pseudoscience or superstition by the scientific community, which cites a lack of statistically significant astrological predictions, while psychology explains much of the continued faith in astrology as a matter of cognitive biases. In 2006 the U.S. National Science Board published a statement which said it considers belief in ten survey items, astrology among them, to be "pseudoscientific".
Can planet position matter?

- The force on you from mars is at most: 0.000000005 pounds (usually it’s less)

- This is the same force exerted by the gravitational field of a person standing near you.

- How can this affect your personality?
"The most incomprehensible thing about the world is that it is comprehensible."