

Deep Thoughts:

Facilitating Critical Thinking at All Ages

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VEGAS 2011

DEEP THOUGHTS

- **High School and College**
 - Reasoning Errors & Cognitive Biases
 - Logical Inconsistencies & Cognitive Dissonance
- **Elementary and Middle School**
 - Pondering, Questioning, Discussing
 - Inquiry & Flexible Thinking
 - Encouraging Depth in All Areas

HIGH SCHOOL, COLLEGE, & BEYOND

Adolescents and adults have fully developed processes for learning about the world.

Critical thinking is not possible until the individual is open to considering that the way they currently perceive and think about the world is flawed.

At TAM8 I demonstrated perceptual illusions. Those can be found at:

<http://www.criticalteaching.org/TAM8Workshop.html>

HIGH SCHOOL AND COLLEGE

Goals

- Demonstrate common flaws in the human cognitive system.
- Demonstrate that most of us hold attitudes which are inconsistent with one another.
- Lead students to question their thought processes and consider the sources of their beliefs and attitudes
- Lead students to increase flexibility of thought (open-mindedness).

Intelligence is not enough to think critically

REASONING ERRORS

Probability & Randomness

You have been offered a free ticket for a lottery in which a \$10 million jackpot will be awarded to those with all 6 numbers chosen randomly from 1 through 40. Which of these would you choose?

A.

1 2 3 4 5 6

C.

10 15 20 25 30 35

B.

7 11 23 27 33 38

D.

20 21 24 26 27 28

REASONING ERRORS

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> 90% choose B

Reasons commonly given for the choice:

"Because they are random & there is no pattern."

"The probability of a lot of picks having a pattern to it is very unlikely."

"It is more random, so I have a better chance of winning."

"Gives more chance of being chosen because is covering the spectrum. One on every line."

"Because the numbers are spread out."

"It has a wider distribution."

REASONING ERRORS

Probability & Randomness

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A.

1 2 3 4 5 6

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> 90% choose B

BUT...

All choices are equiprobable.

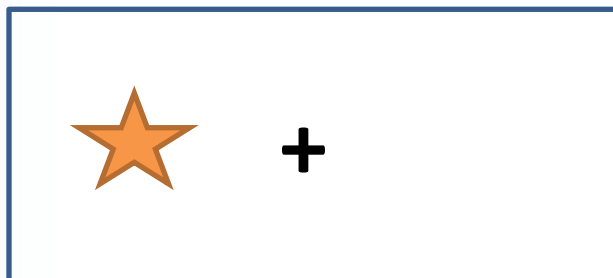
Random does not mean “no pattern”. It means “without purpose or criteria.”

Lottery numbers represent ping pong balls. Each is unique, but no order is meaningful.

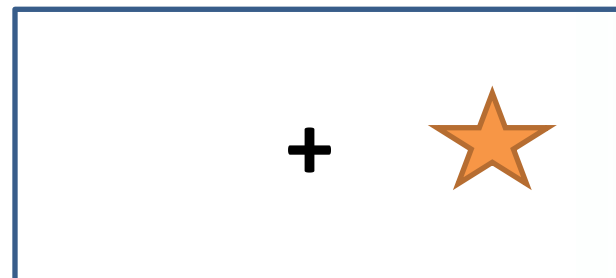
Numbers could be replaced by any symbols.

REASONING ERRORS

Instructions: The target will appear at random, with the constraint that 70% of the time it will appear on the left and 30% of the time it will appear on the right.



70%



30%

Task: Predict which side the target will appear in each of many (usually 100) trials.

REASONING ERRORS

The typical pattern of behavior: Choose the left location on approximately 70% of trials and the right 30%.



70%



30%

This pattern also occurs when participants are allowed to learn the probabilities implicitly through practice blocks instead of being told outright. The behavior was dubbed “probability matching”.

Then...

Some researchers hypothesized that the failure to use optimal strategies (choose the side with the higher probability at each trial) was not a failure to understand that each trial was independent, but rather a failure to recognize or believe that the target appears at random.

REASONING ERRORS

Truly random sequences contain “runs” (try flipping a coin 25 times and recording the outcome of each in order to see this). The following is a sequence of 1s and 0s chosen by a random number generator:

1 0 1 0 0 1 1 1 1 0 1 0 1 0 0 0 1 1 1 1

Notice two runs of 4 1s in only 20 trials.

Again, but with the restriction of 70% probability of a 1:

0 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 0 0 1 1

Our brains tell us that the distribution should be more spread out and less “patterned”.

REASONING ERRORS

Because our brains tell us that the distribution should be more spread out, researchers generated a block of trials, then broke up the runs so that the pattern's appearance matched human conceptions of "random".

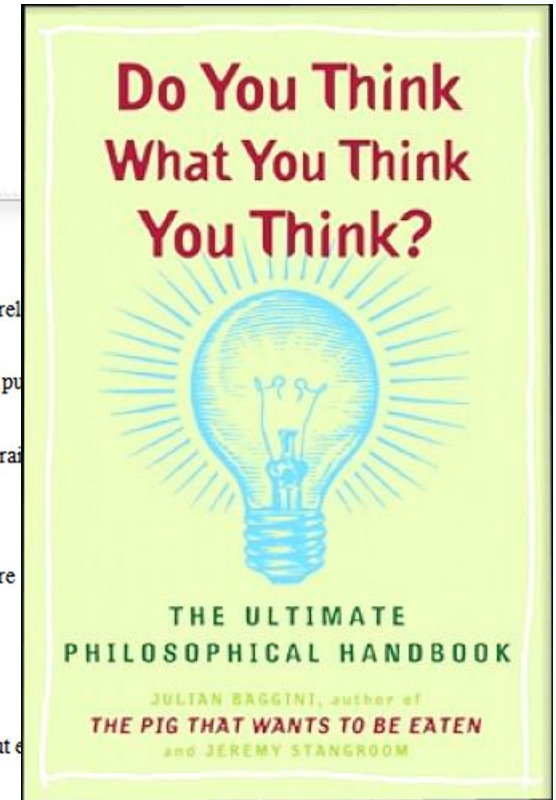
Original (random): 0 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 0 0 1 1

New (pseudo-random): 0 1 1 0 1 1 1 0 1 0 1 1 1 0 1 1 1 0 1 1

The typical pattern of behavior changed from matching probabilities to optimal strategy (choosing the most likely location in most, if not all, trials).

Do You Think What You Think You Think?

☐ ☐ 10. There exists an all powerful, loving and good God.

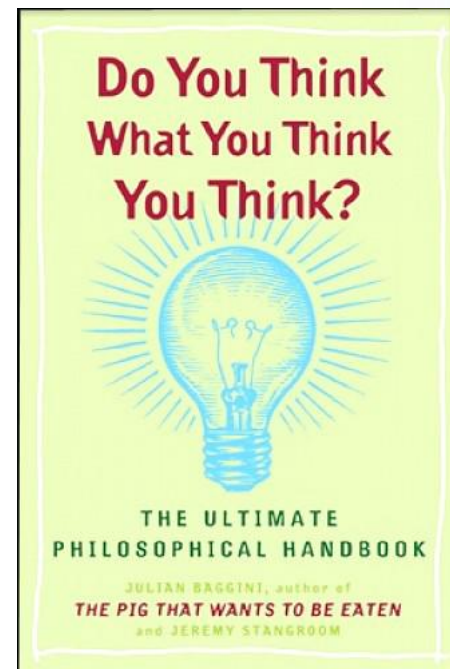


CONSISTENCY

Do You Think What You Think You Think?

By Julian Baggini & Jeremy Stangroom

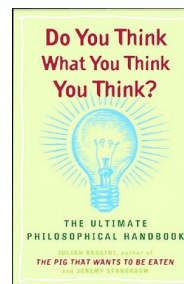
- I give students a set of inventories and excersizes at the beginning of the semester, including selections from this book.
- Once these have been 'graded', students cannot change their answers, so there is no hindsight bias to allow them to justify their reasoning errors.
- The first inventory is the most valuable in demonstrating inconsistencies of thought and attitude.



CONSISTENCY

Do You Think What You Think You Think?

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There are no objective moral standards; moral judgments are merely an expression of the values of particular cultures.

+ Acts of genocide stand as a testament to man's ability to do great evil.

The right to life is so fundamental that financial considerations are irrelevant in any effort to save lives.

+ Governments should be allowed to increase taxes sharply to save lives in the developing world.

There are no objective truths about matters of fact; "truth" is always relative to particular cultures and individuals.

+ The Holocaust is a historical reality that took place more or less as the history books report.

COGNITIVE BIASES

Framing

- *An unusual disease is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.*
 - A. If Program A is adopted, 200 people will be saved.
 - B. If Program B is adopted, there is a $\frac{1}{3}$ chance that all 600 people will be saved and a $\frac{2}{3}$ chance that nobody will be saved.
- *What would you do?*

COGNITIVE BIASES

Framing

- *An unusual disease is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.*
 - C. If Program C is adopted, 400 people will die.
 - D. If Program D is adopted, there is a $\frac{1}{3}$ chance that nobody will die and a $\frac{2}{3}$ chance that all 600 people will die.
- *What would you do?*

COGNITIVE BIASES

Framing

- All four choices have the same expected outcome:

Expected number of people alive = 200; dead = 400

- If Program A is adopted, 200 people will be saved.
- If Program B is adopted, there is a $\frac{1}{3}$ chance that all 600 people will be saved and a $\frac{2}{3}$ chance that nobody will be saved.
- If Program C is adopted, 400 people will die.
- If Program D is adopted, there is a $\frac{1}{3}$ chance that nobody will die and a $\frac{2}{3}$ chance that all 600 people will die.

COGNITIVE BIASES

Framing

- If Program A is adopted, 200 people will be saved.
- If Program B is adopted, there is a $\frac{1}{3}$ chance that all 600 people will be saved and a $\frac{2}{3}$ chance that nobody will be saved.

Framed in terms of gains, 72% choose A (risk-aversion)

Certain gain preferred over possible gain.

- If Program C is adopted, 400 people will die.
- If Program D is adopted, there is a $\frac{1}{3}$ chance that nobody will die and a $\frac{2}{3}$ chance that all 600 people will die.

Framed in terms of losses, 78% choose D (risk-taking)

Possible loss preferred over certain loss.

REASONING ERRORS

Why learn about these?

- Errors lead to inconsistencies
- Inconsistencies lead to cognitive dissonance
- Cognitive dissonance leads justification, rationalization, and poor decision-making.

JUSTIFICATION

Imagine:

You have just taken a tough qualifying examination (that you must retake if you do not pass). It is the end of the semester, you feel tired and run down, and the results of the exam will not be out for 2 days. You now have the opportunity to purchase a very attractive 5-day Christmas vacation package to Hawaii at an exceptionally low price. The special offer expires tomorrow. What would you do?

- A. Buy the vacation package.
- B. Not buy the vacation package.
- C. Pay a \$5 nonrefundable fee to extend the offer 2 days

JUSTIFICATION

Imagine:

*You have just taken a tough qualifying examination (that you must retake if you did not pass). It is the end of the semester, you feel tired and run down, and **you have found out that you passed the exam.** You now have the opportunity to purchase a very attractive 5-day Christmas vacation package to Hawaii at an exceptionally low price. The special offer expires tomorrow. What would you do?*

- A. Buy the vacation package.
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JUSTIFICATION

Imagine:

*You have just taken a tough qualifying examination (that you must retake if you did not pass). It is the end of the semester, you feel tired and run down, and **you have found out that you failed the exam and must retake it after the holidays.** You now have the opportunity to purchase a very attractive 5-day Christmas vacation package to Hawaii at an exceptionally low price. The special offer expires tomorrow. What would you do?*

- A. Buy the vacation package.
- B. Not buy the vacation package.
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JUSTIFICATION

Choices in experimental trials:

	Experimental Condition		
Option	Passed	Failed	No Result
Buy the vacation	54%	57%	32%
Don't buy	16%	12%	7%
Pay \$5 to extend	30%	32%	61%

The majority of participants chose to put off the choice if they did not know the outcome, but the majority of those who knew the outcome chose to purchase, regardless of what that outcome was.

Pass: "I deserve to celebrate!"

Fail: "I need to rest and recharge."

ELEMENTARY AND MIDDLE SCHOOL

- Children have not always developed the thinking that leads to those types of mistakes, but doesn't lead to rational behavior, either.
- Educational approaches tend to encourage students to memorize facts and procedures rather than think deeply and make associations that can be transferred to novel situations.
- Assessments discourage deep thought and encourage algorithmic problem-solving approaches.



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ELEMENTARY AND MIDDLE SCHOOL

Goals: Develop critical thinking skills

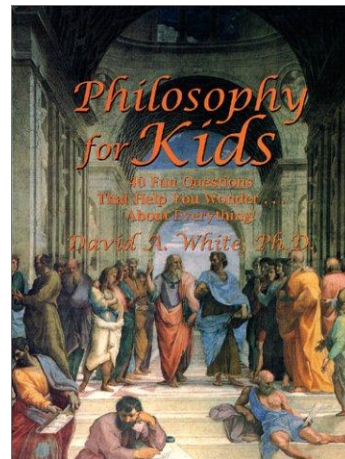
- Encourage critical thinking
- Provide practice in critical thinking
- Provide practice in listening and considering other views
- Encourage social risk-taking/communication
- Lead students to consider limits and conditional relationships

PHILOSOPHY SESSIONS

Philosophy for Kids

by David White

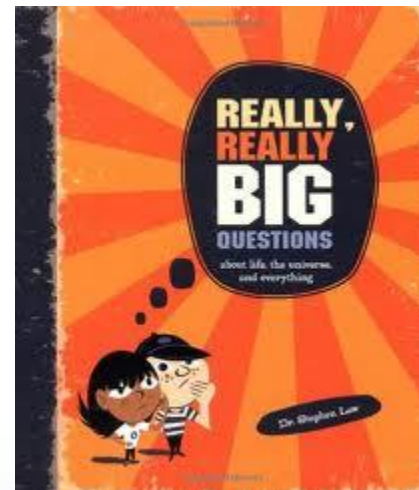
- Divided by domain: values, knowledge, reality, and critical thinking.



Really, Really Big Questions

by Stephen Law

- Divided by topic: the universe, the mind, morality, and knowledge.





PHILOSOPHY SESSIONS

1. Lay down the rules
 - Judgment-free zone
 - While in the circle, no person is judged for what they say. What they say may be judged. (no ad hominem attacks)
 - In my experience, kids understand this much better and find it much easier to follow than adults do.
2. Choose one philosopher and one question each session
3. Provide context: where and when the philosopher lived
4. Guide the discussion, provide scenarios and conditions
5. Allow discussion for 45-60 minutes



PHILOSOPHY SESSIONS

What I saw:

- Civil discussion
- Nobody hijacked the conversation
- Some children parroted what others said, but others had novel responses.
- Children with different perspectives may approach some questions differently (e.g., tree in the forest could be about “how do we know” or about “what is ‘sound’”).

PHILOSOPHY SESSIONS

Example:

- German philosopher Kant, 1724-1804

Should you ever tell a lie?

- *If your mother asked you if you ate a cookie before dinner (and you had), would you lie and say you didn't?*
- *If your best friend was wearing an extremely unattractive outfit, would you tell her she looks great even though you think she looks like a walking disaster?*
- *If you knew that you could get someone you really don't like into trouble by lying, would you?*
- *If you knew that you could get into the college of your dreams by lying on the application, would do it?*
- *If you could save a person's life by telling a lie, would you?*

PHILOSOPHY SESSIONS

Example:

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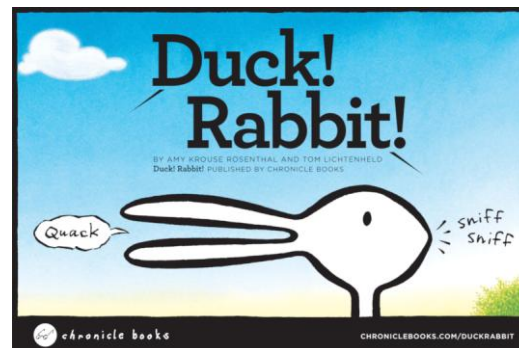
What if you found out that your dream school was looking for students from South Dakota who want to major in anthropology, so you lie to increase your chances of getting in? You get in, but another applicant who lives on a reservation in South Dakota and wants to major in anthropology is rejected.

What if that applicant is so distraught – because college was his only hope (in his mind) of getting off the reservation and out of poverty – that he kills himself?

INQUIRY & FLEXIBLE THINKING

Duck! Rabbit!

By Amy Krouse Rosenthal
and Tom Lichtenheld



- The duck/rabbit an ambiguous figure: how do we decide whether it is a duck or a rabbit?
- Publisher site includes a teacher's guide with activities and tips.
- <http://www.chroniclebooks.com/duckrabbit/pdfs/DRTeachersGuide.pdf>

HYPOTHESIZING

Duck! Rabbit!

By Amy Krouse Rosenthal
and Tom Lichtenheld

- Divide students into three groups and provide each group with one of the images.
- Tell students the story is about what's in the image.
- Ask students to:
 - Draw the full image
 - Describe the subject of the story

This would be excellent for pre-readers.

Image 1



Image 2

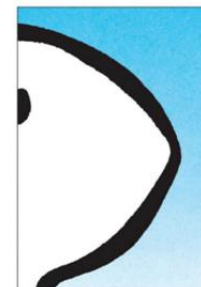
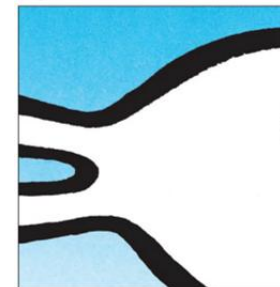


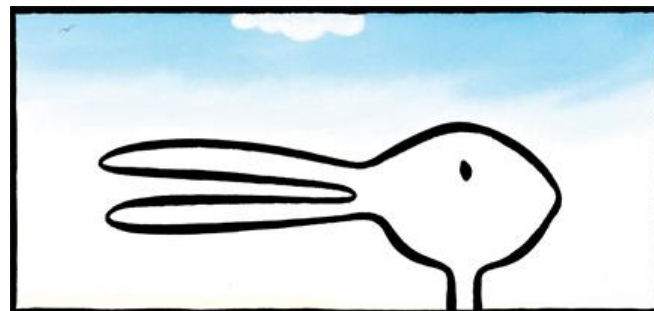
Image 3



FLEXIBLE THINKING

Duck! Rabbit!

By Amy Krouse Rosenthal
and Tom Lichtenheld



1. Divide the room in half and designate one side for “duck” and the other for “rabbit”.
2. Ask students to decide if what they see is a duck or a rabbit and stand on the appropriate side of the room.
3. After each page, students may change sides, but they may not stand in the middle.

FLEXIBLE THINKING

Other Possibilities



Rat Man



The Gypsy and the Narcissist

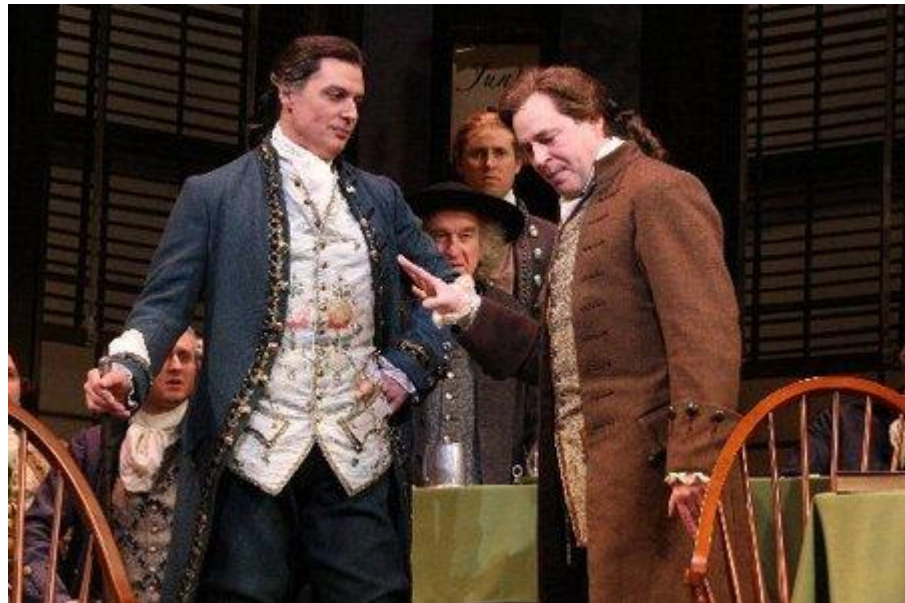
THINKING ABOUT EVERYTHING

The task itself (or assessment) determines depth

- Create tasks that require all levels of study to excel, but all levels teach (differentiated):
 - *Information gathering*
 - *Memorization*
 - *Elaboration*
 - *Association*
 - *Inference*

THINKING ABOUT EVERYTHING

- **Example:** Signers of the Declaration of Independence
 - **Task:** Write, rehearse, and perform a skit in which the characters debate whether or not they should sign the Declaration.





THINKING ABOUT EVERYTHING

- **Example:** Signers of the Declaration of Independence
 - Assign each child to portray one of the signers.
 - Form groups of 3-4.
 - Provide a list of required information to be conveyed, such as the state the signer represents and the number of children signer supports.

Some students will provide the information they need to and not much more. Others will consider how those facts might be relevant to the question of whether to sign.

ACKNOWLEDGEMENTS

- **Sybil Sperber:** an extraordinary teacher who developed and/or modified most of the elementary & middle school exercises presented here.
- **Kylie Sturgess:** an amazing educator who introduced me to the idea that children can and should be taught to be philosophers as a foundation for future education and development.
- **Brennis Lucero-Wagoner:** an extraordinary mentor who encouraged me to dig deep with students and accept no less than *understanding*.
- **The JREF:** for trusting me with an hour of your time to work toward our common goals.