

1. How to think about choices

- If I will pass the exam,
then studying is wasted effort.
- If I will not pass the exam,
then studying is wasted effort.



Since, whatever will happen, studying is wasted effort,
it is better for me **not** to study.

possible states

Pass

Not pass

possible
choices

Study

Not study

possible states

Exam is long
and difficult

Exam short
and easy

possible
choices or
acts

Study

Not study

2. What does 'Rationality' mean?

Harold Egbert Camping, president of Family Radio 1958-2011, predicted that the Rapture (the taking up into heaven of God's elect people) would take place on May 21, 2011 at 6pm.

Some followers of Camping gave up their jobs, sold their homes and spent large sums promoting Camping's claims.

Did these people act irrationally?

Bob smokes two packets of cigarettes a day. When asked if he would still smoke if he knew that he was going to get lung cancer from smoking, he says “No”. When asked if he is worried about getting lung cancer, he says that he is not and explains that his grandfather was a heavy smoker all his life and died at the age of 98. He also explains that he read an article stating that smoking causes lung cancer only if one has a genetic predisposition to it.

state →	s_1 : genetically	s_2 : no genetic
act ↓	predisposed	predisposition
<hr style="border-top: 1px dashed black;"/>		
<i>smoke</i>	get cancer	no cancer
	enjoy smoking	enjoy smoking
<hr style="border-top: 1px dashed black;"/>		
<i>not smoke</i>	no cancer	no cancer
	no enjoyment	no enjoyment
<hr style="border-top: 1px dashed black;"/>		

3. Framing

I will give you \$200:



and then you will have to choose one of:

OPTION A : I give you an additional \$100:



HEADS: I give you an additional \$200



OPTION B : I toss a coin



TAILS: I give you no additional money

I will give you \$400:



and then you will have to choose one of:

OPTION 1 : You give me back \$100:













OPTION 2 : I toss a coin



HEADS: You keep the \$400

TAILS: You give me back \$200

Put the first and third problems side by side:

<p style="color: red;">I will give you \$200:</p>  <p>and then you will have to choose one of:</p> <p>OPTION 1 : I give you an additional \$100:</p>  <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; height: 100px; vertical-align: top;"> <p>OPTION 2 : I toss a coin</p>  </td> <td style="width: 50%; height: 100px; vertical-align: top;"> <p>HEADS: I give you an additional \$200</p>  <p>TAILS: I give you no additional money</p> </td> </tr> </table>	<p>OPTION 2 : I toss a coin</p> 	<p>HEADS: I give you an additional \$200</p>  <p>TAILS: I give you no additional money</p>	<p style="color: red;">I will give you \$400:</p>  <p>and then you will have to choose one of:</p> <p>OPTION 1 : You give me back \$100:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; height: 100px; vertical-align: top;"> <p>OPTION 2 : I toss a coin</p>  </td> <td style="width: 50%; height: 100px; vertical-align: top;"> <p>HEADS: You keep the \$400</p> <p>TAILS: You give me back \$200</p> </td> </tr> </table>	<p>OPTION 2 : I toss a coin</p> 	<p>HEADS: You keep the \$400</p> <p>TAILS: You give me back \$200</p>
<p>OPTION 2 : I toss a coin</p> 	<p>HEADS: I give you an additional \$200</p>  <p>TAILS: I give you no additional money</p>				
<p>OPTION 2 : I toss a coin</p> 	<p>HEADS: You keep the \$400</p> <p>TAILS: You give me back \$200</p>				

In both cases:

Option 1 = you end up with \$300

Option 2 = you face the uncertain prospect (lottery)

$$\left(\begin{array}{c|c} \text{You end up with \$400} & \text{You end up with \$200} \\ \hline \text{Probability } \frac{1}{2} & \text{Probability } \frac{1}{2} \end{array} \right)$$

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed.

- If **Program A** is adopted, 20,000 people will be saved.
- If **Program B** is adopted, there is a $\frac{1}{3}$ probability that **all** 60,000 people will be **saved** and a $\frac{2}{3}$ probability that **none** of the 60,000 will be **saved**.

Which of the two programs would you favor?

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed.

- If **Program C** is adopted, 40,000 people will **die**.
- If **Program D** is adopted, there is a $\frac{1}{3}$ probability that **none** of the 60,000 will **die**
and a $\frac{2}{3}$ probability that **all** of the 60,000 people will **die**.

Put the second and fourth problems side by side:

<p>Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed.</p> <ul style="list-style-type: none"> • If Program A is adopted, 20,000 people will be saved. • If Program B is adopted, there is a $\frac{1}{3}$ probability that all 60,000 people will be saved and a $\frac{2}{3}$ probability that none of the 60,000 will be saved. 	<p>Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed.</p> <ul style="list-style-type: none"> • If Program C is adopted, 40,000 people will die. • If Program D is adopted, there is a $\frac{1}{3}$ probability that none of the 60,000 will die and a $\frac{2}{3}$ probability that all of the 60,000 people will die.
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The two problems are the same. In both cases,

if Program A/C is adopted, 20,000 people are saved and 40,000 die;

Program B/D corresponds to the following lottery

$\left(\begin{array}{l} \text{all 60,000 are saved} \\ = \text{nobody dies} \\ \text{Probability } \frac{1}{3} \end{array} \right.$	$\left. \begin{array}{l} \text{nobody is saved} \\ = \text{all 60,000 die} \\ \text{Probability } \frac{2}{3} \end{array} \right)$
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4. How to process information

- In the US, **1% of women of age 40 have breast cancer.**
- If a woman **has** breast cancer, the probability that she tests **positive** on a screening mammogram is **90%**.
- If she **does not have** breast cancer, the probability that she tests **negative** on a screening mammogram is **90%**.

That is, mammograms have a **90% accuracy**.

*Susan is a 40-year old woman who tested **positive** on a mammogram.*

What are the chances that she actually has breast cancer?

You are at the CVS store in West Covell Blvd about to buy a watch that costs \$14. You bump into a friend who says that the same watch costs only \$7 at Target. Are you willing to drive 15 minutes across town to get the better deal?

You are about to buy a washing machine that costs \$420. A friend tells you that a different store, which is a 15-minute drive from here, sells the same washing machine for \$413. Are you willing to drive 15 minutes across town to get the better deal?

Recommended viewing:

1. Dan Ariely, Are we in control of our own decisions?, on Ted.com:

<http://www.ted.com/talks/view/lang/en//id/548>

2. Dan Gilbert, Why we make bad decisions, on Ted.com:

http://www.ted.com/talks/lang/en/dan_gilbert_researches_happiness.html