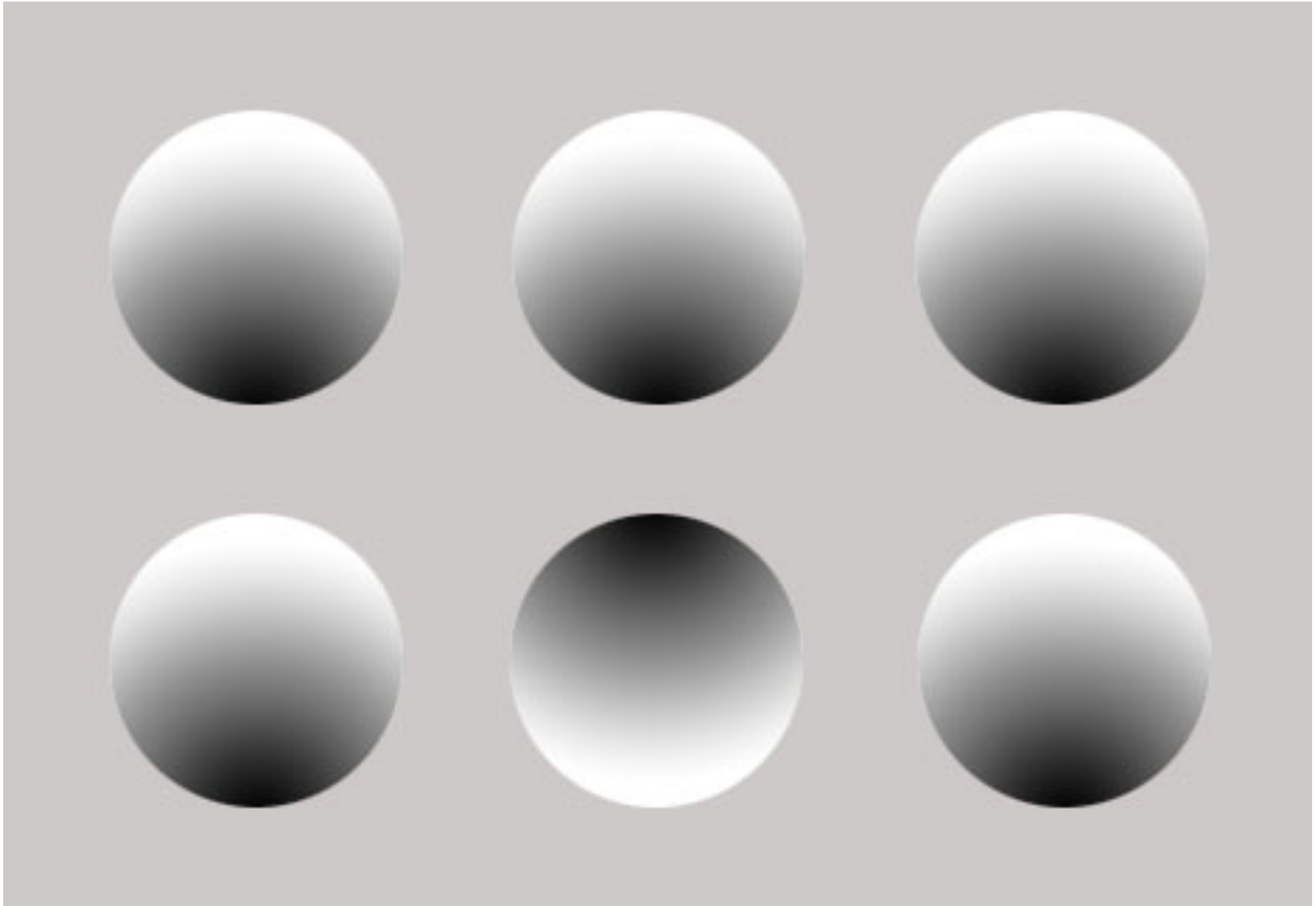


The psychology of risks and benefits

Paul Rozin

University of Pennsylvania

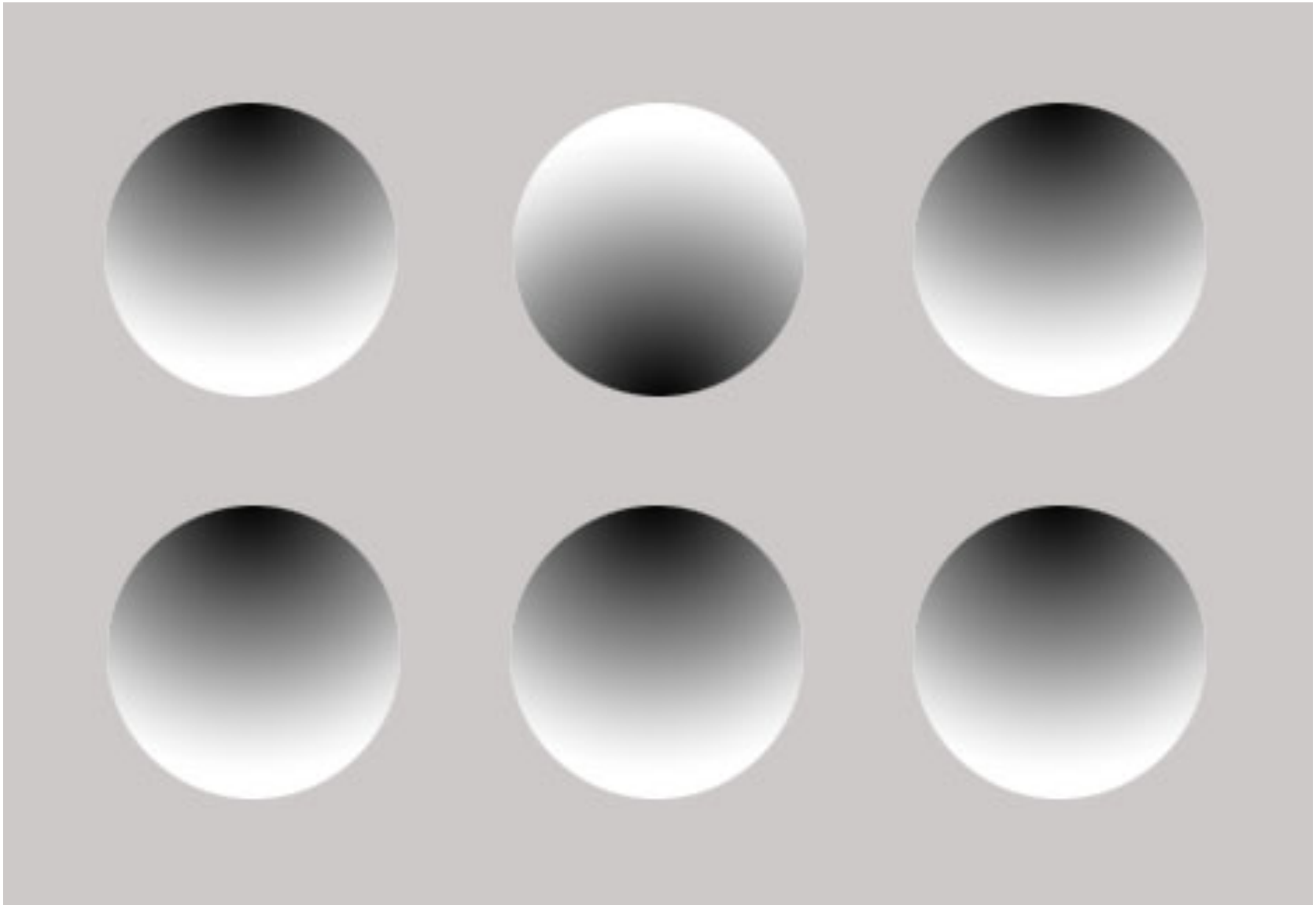
What do you see?



The 6-dot illusion

- The six dot illusion
 - Why?
- Rule: Construct as few light sources as possible

Now what do you see?



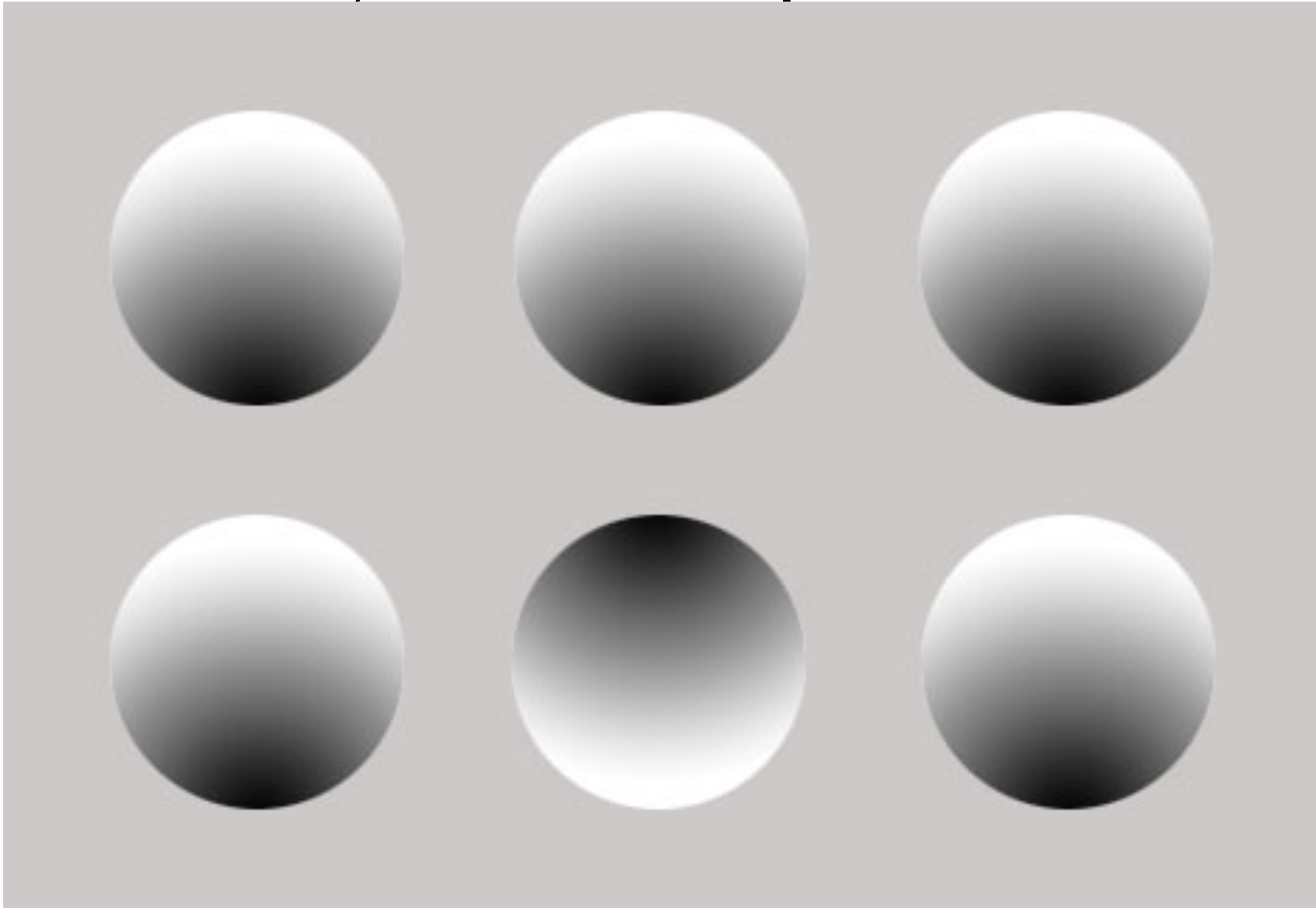
The 6-dot illusion

- The six dot illusion
 - Why?
- Rule: Construct as few light sources as possible
- The dot inversion demonstration
- Rule: Assume light source is overhead

The 6-dot illusion

- The six dot illusion
 - Why?
- Rule: Construct as few light sources as possible
- The dot inversion demonstration
- Rule: Assume light source is overhead
- Overhead literally or away from earth center?
- The head inversion demonstration

Turn your head upside down

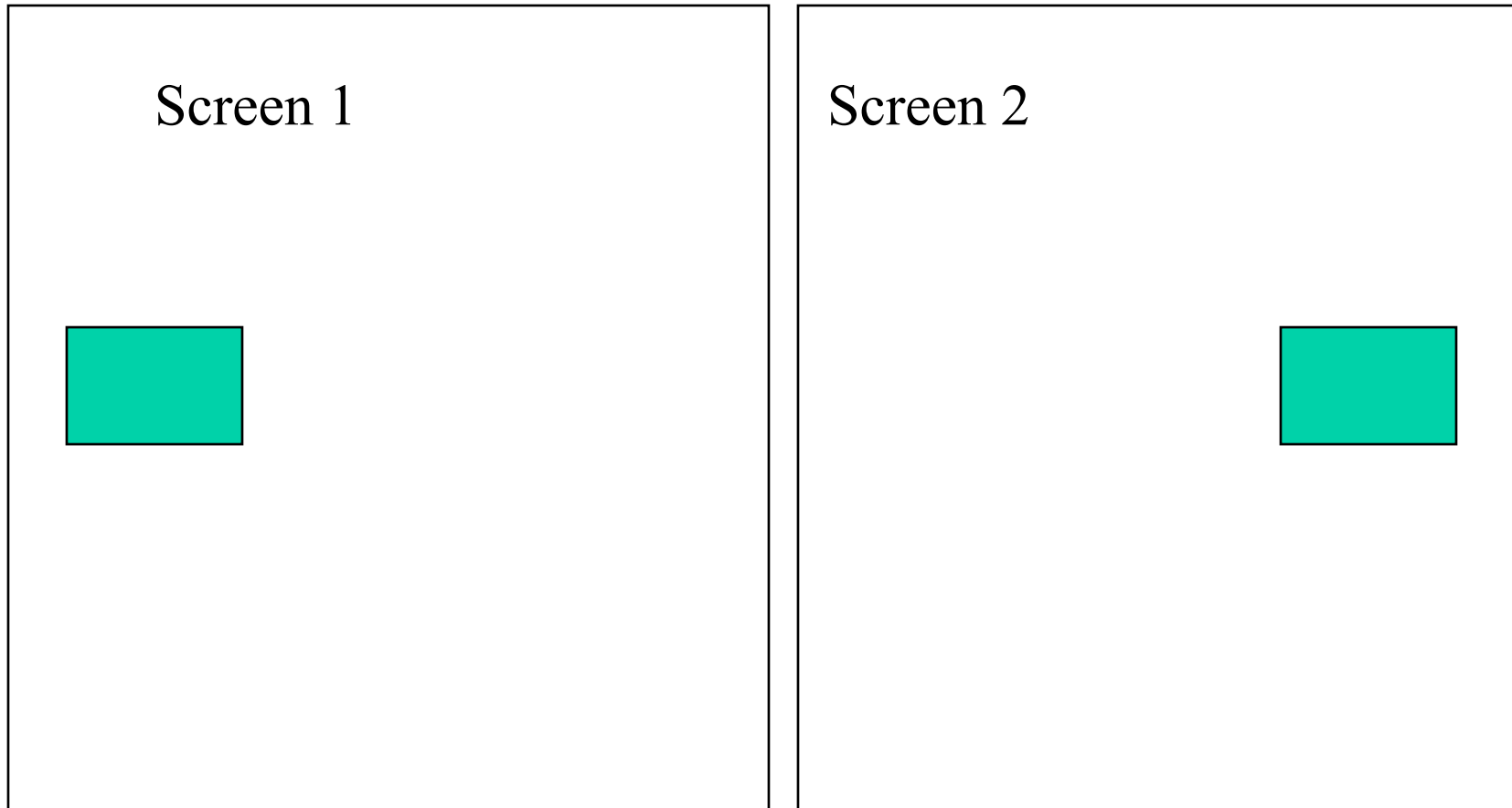


Movement perception 1

- Computer demonstrations of phi phenomenon
- PHI2
- F1 Lower, F2 Raise interval
- F10 return to menu
- Look in peripheral vision
- The basic phenomenon: DEMO D1

Motion demonstration D1

Alternation of screens 1 and 2: fraction of a second between screens: Apparent movement



Movement perception

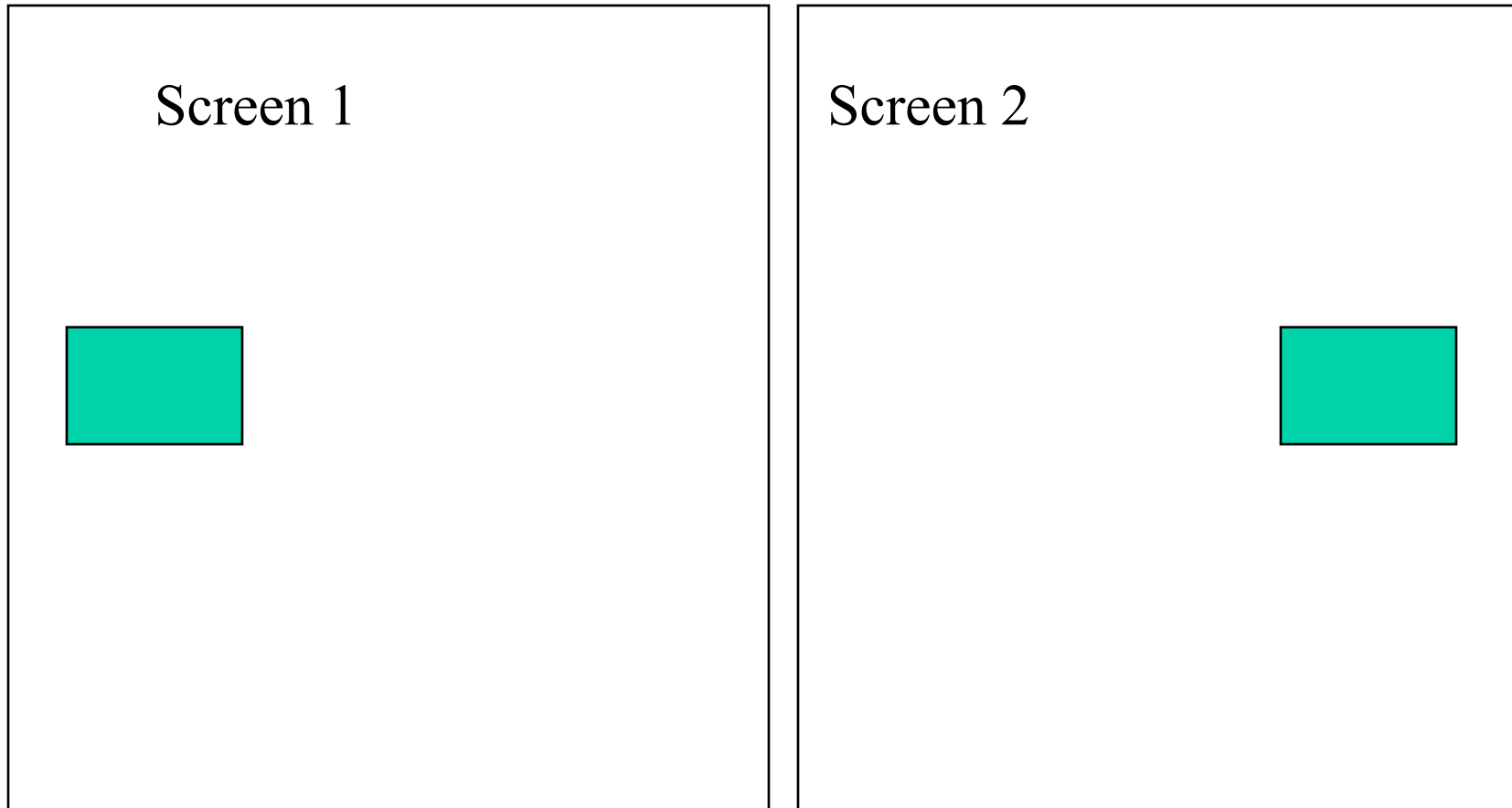
- Ignored for a long time, illusions not of interest
- Use of phi in movies, signs
- Using an illusion to study the system

Movement perception 1

- Rule: if X1 disappears and X2 reappears QUICKLY in another location, assume X moved

Motion demonstration D1

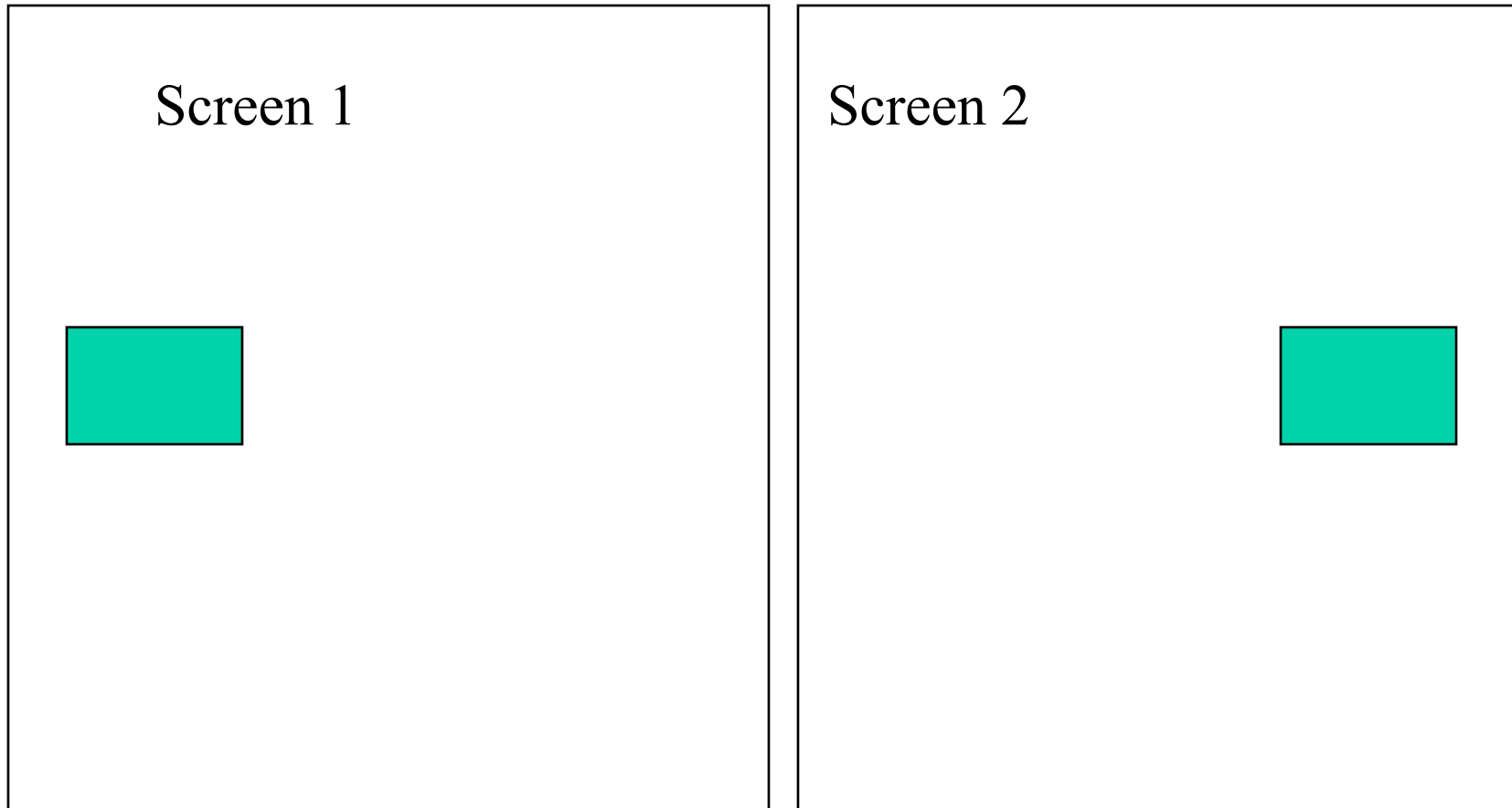
Alternation of screens 1 and 2: fraction of a second between screens: Apparent movement



Movement perception 1

- Rule: Disappearance interval must be short (fraction of a second).
- (Otherwise would have seen the movement)
- Demo D2 (overlap squares)
- Demo D3 (only one flashing)

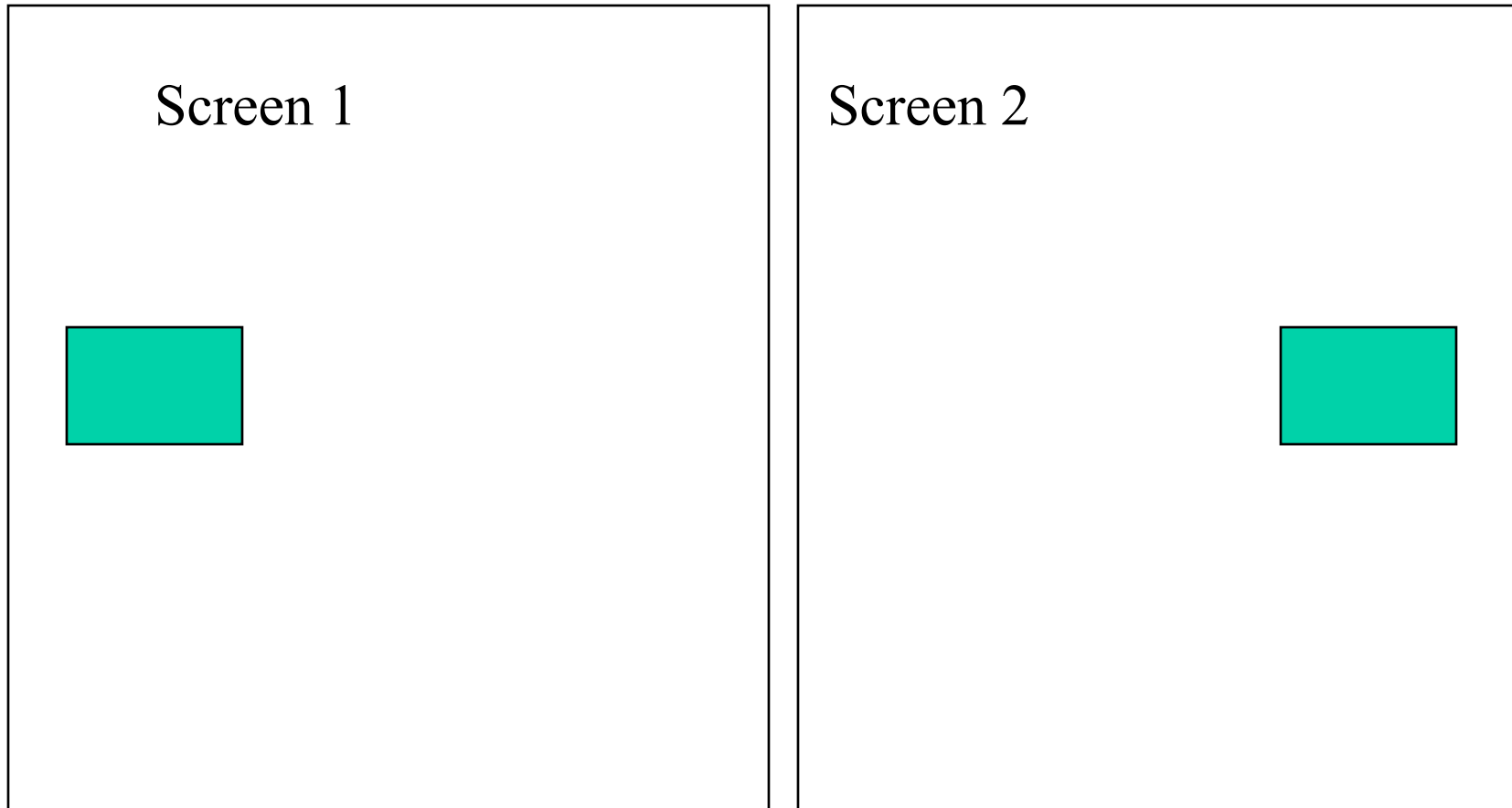
Motion demonstration D2: Alternation of screens
1 and 2 but 1 overlaps with 2.No movement
perceived



Motion demonstration D3

1 on constantly, 2 blinks on and off:

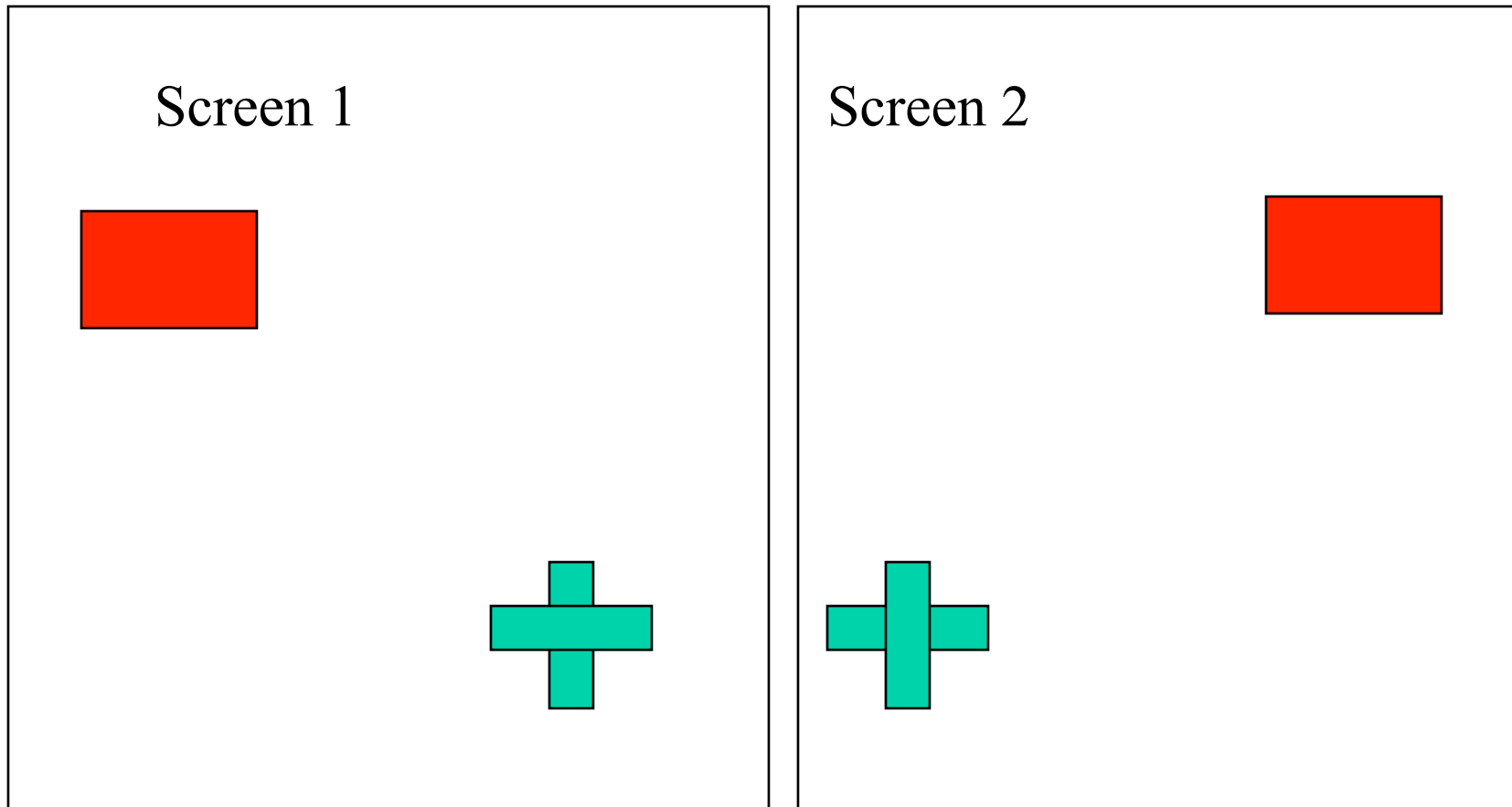
No movement perceived



Movement perception

- How does it work?
- The eye movement explanation
 - When you move eyes to follow object, get sense of movement
- No: Moving eyes while looking at unmoving object
- D9

Motion demonstration D9: Screens alternate: simultaneous motion in opposite directions



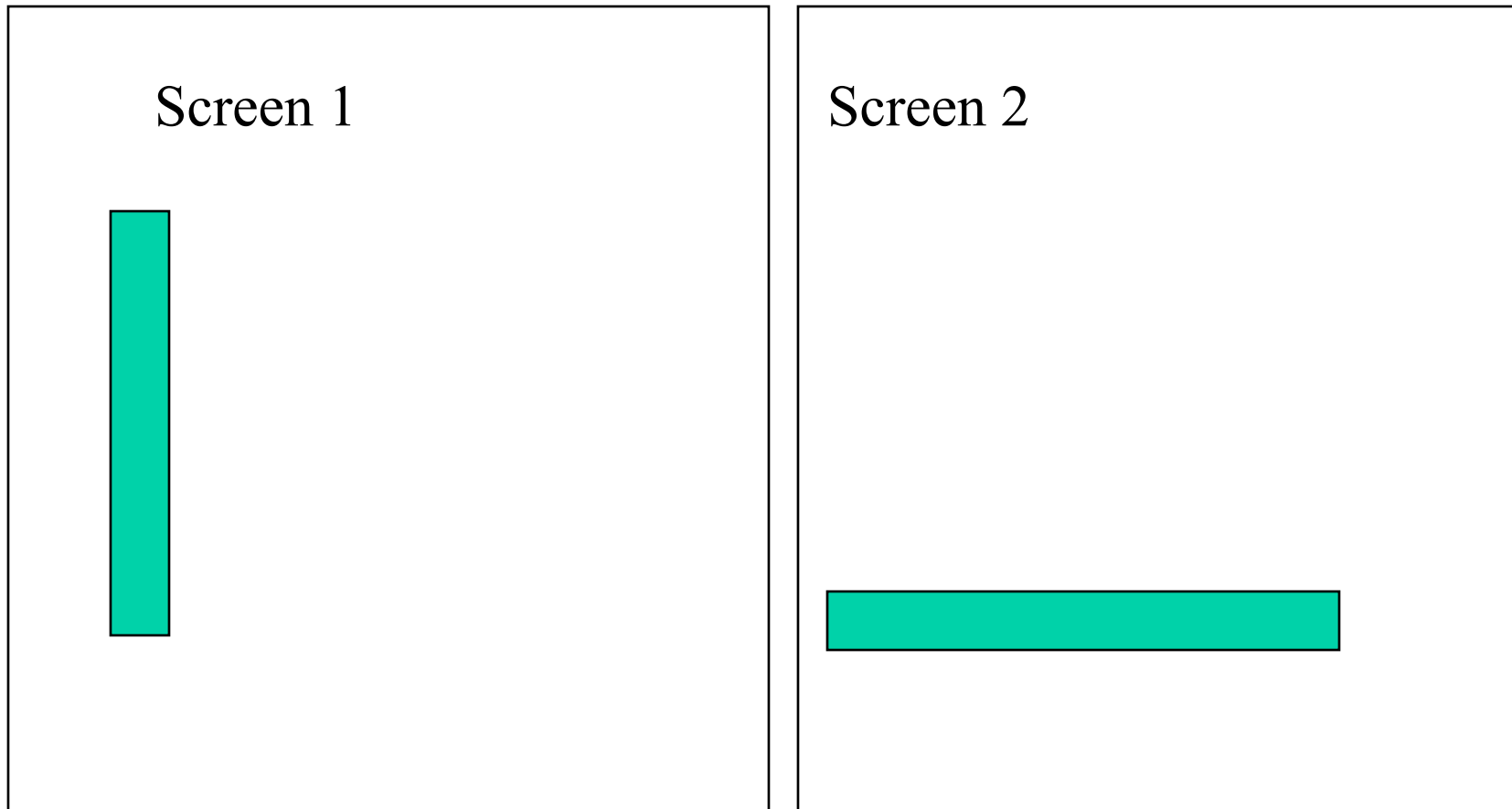
Movement perception

- The eye -movement explanation
 - Your eyes can't move in opposite directions at the same time!!

Movement Perception 3

- Rule: Create the simplest possible motion
- Rule: Construct as few objects as possible and conserve them as much as possible
- Rule: Construct motion to be as uniform as possible
- Demo D6 Bar

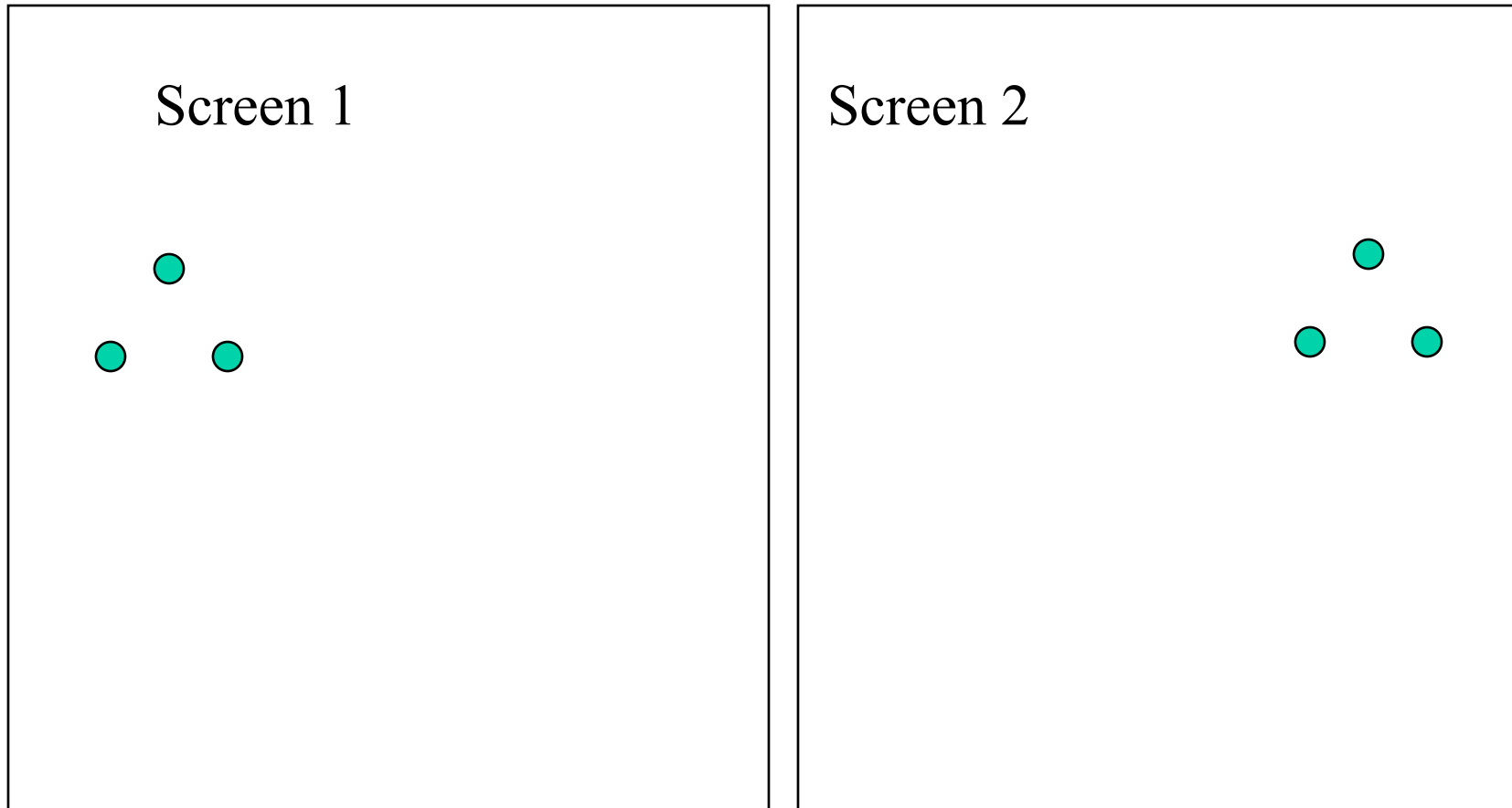
Motion demonstration D9: Screens alternate: Bar appears to fall and rise



Movement Perception 4

- Rule: Conserve object identity in movement, when possible
- Demo D7

Motion demonstration D7: Three dots moving together creates a triangle surface



Movement Perception 5

- Surface demonstrations
- Rule: Create surfaces to simplify movement: entities that move together are attached to the same surface
- Frame of reference and interpretation of motion

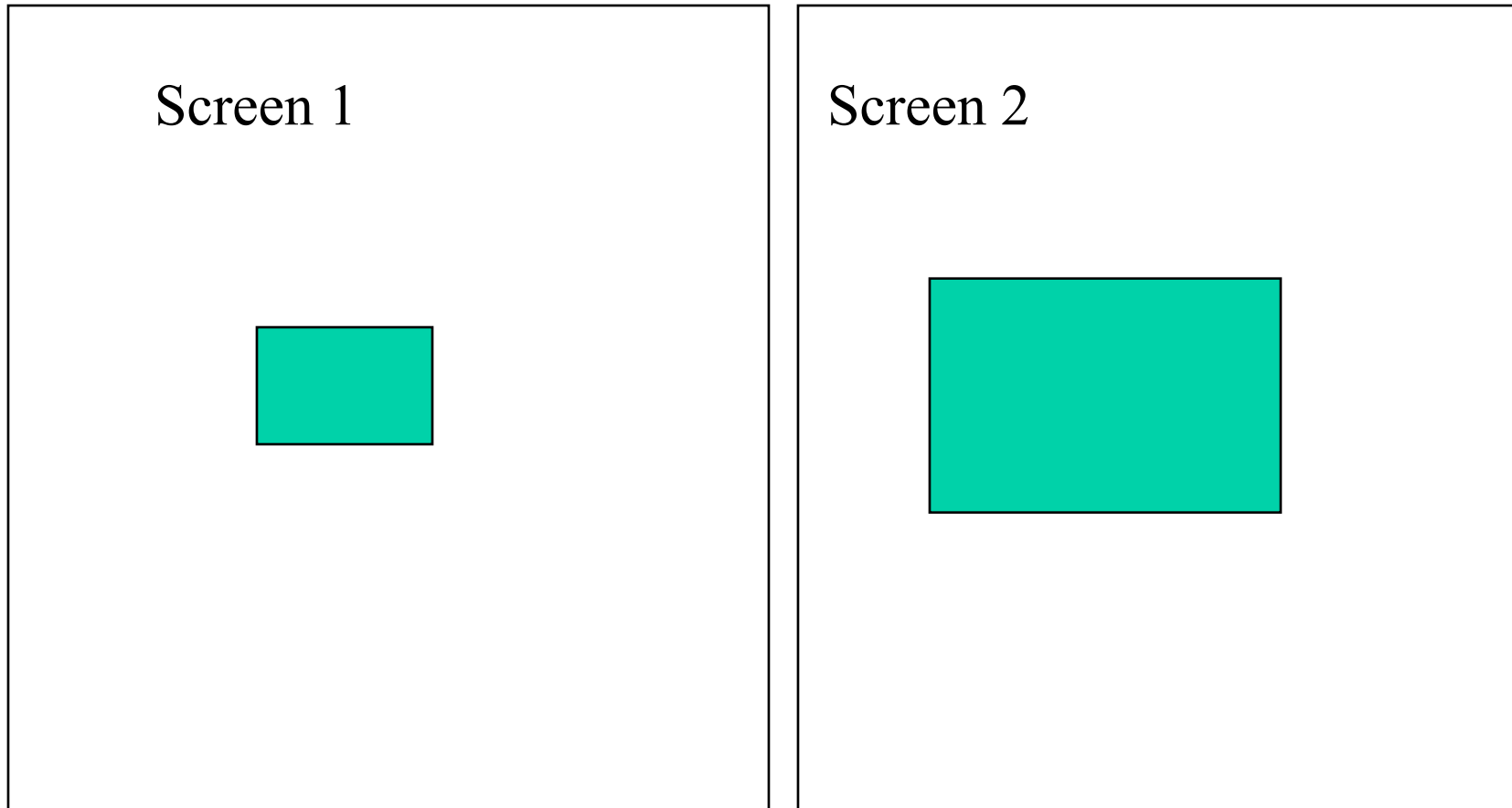
Movement Perception 6

- D5 sm/lg box

Motion demonstration D5

Alternation of screens. Create third dimension.

Box appears to be moving closer and further

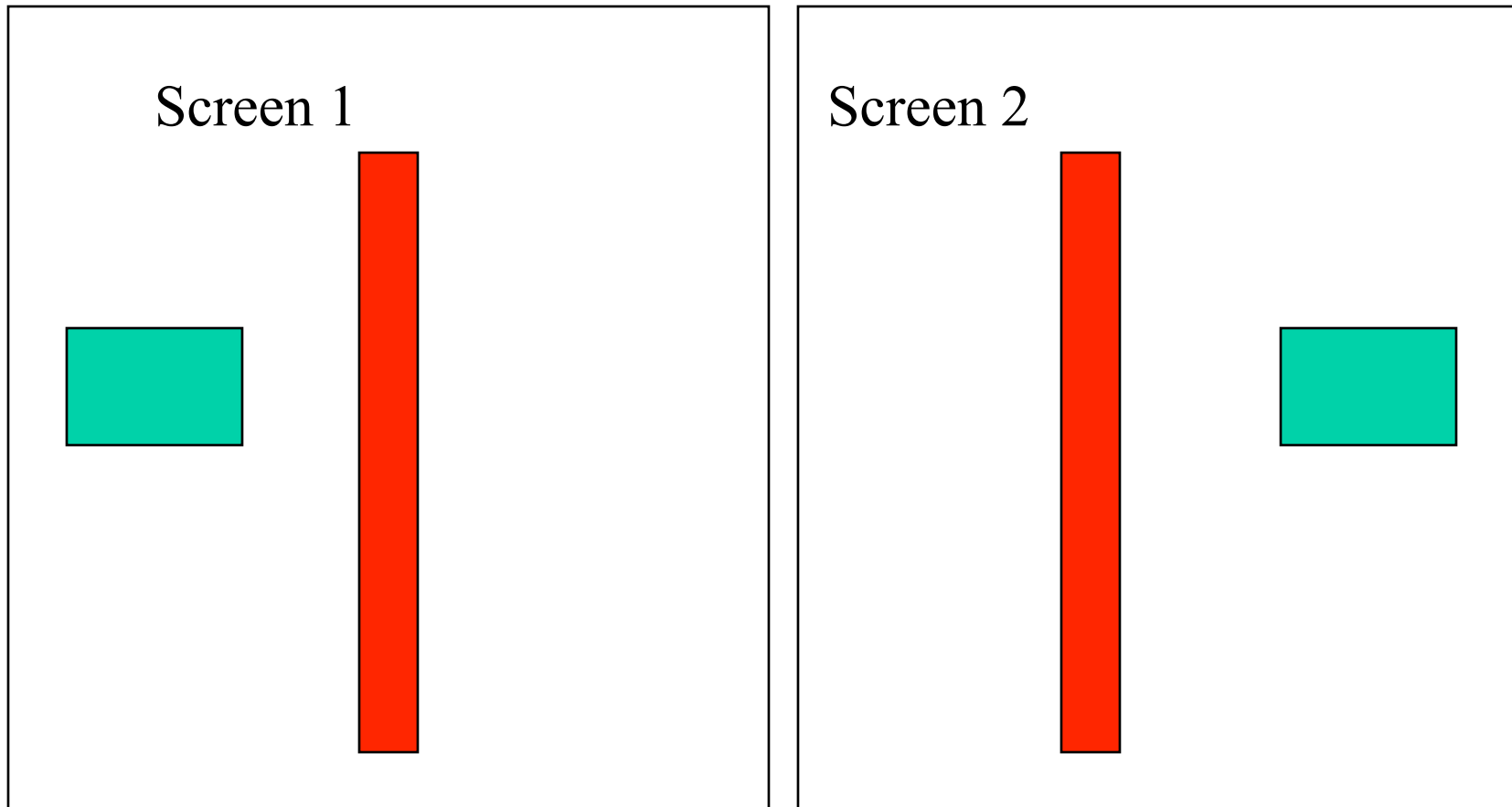


Movement Perception 7

- Rule: Create third dimension to account for rapid change in size
- D14 midbar

Motion demonstration D14

Create third dimension. Green square appears to move in front of or behind red bar

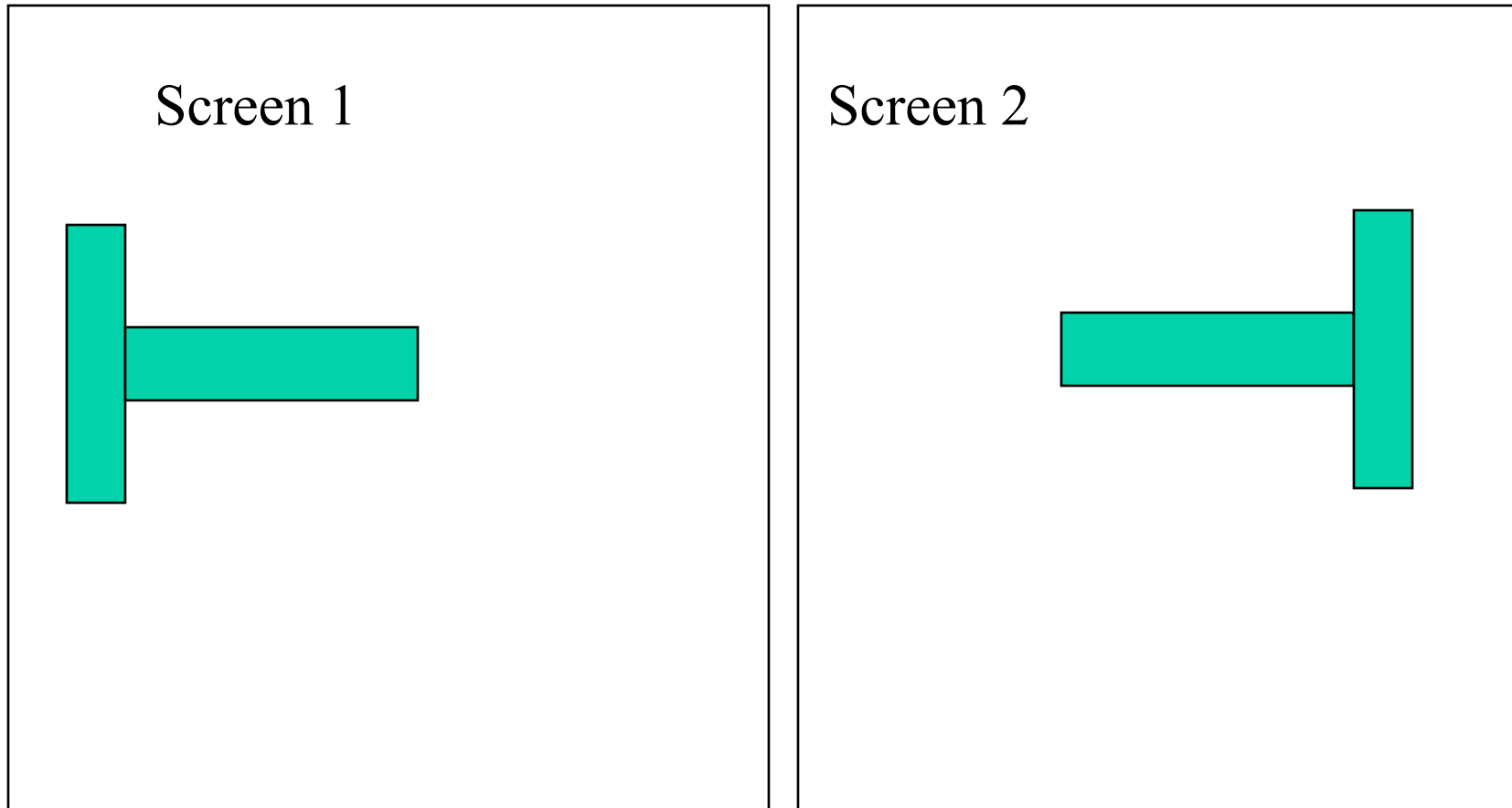


Movement Perception 8

- Rule: Create third dimension to avoid collision (when no sign of collision)
- D15 T

Motion demonstration D15

Shape seems to rotate through the third dimension

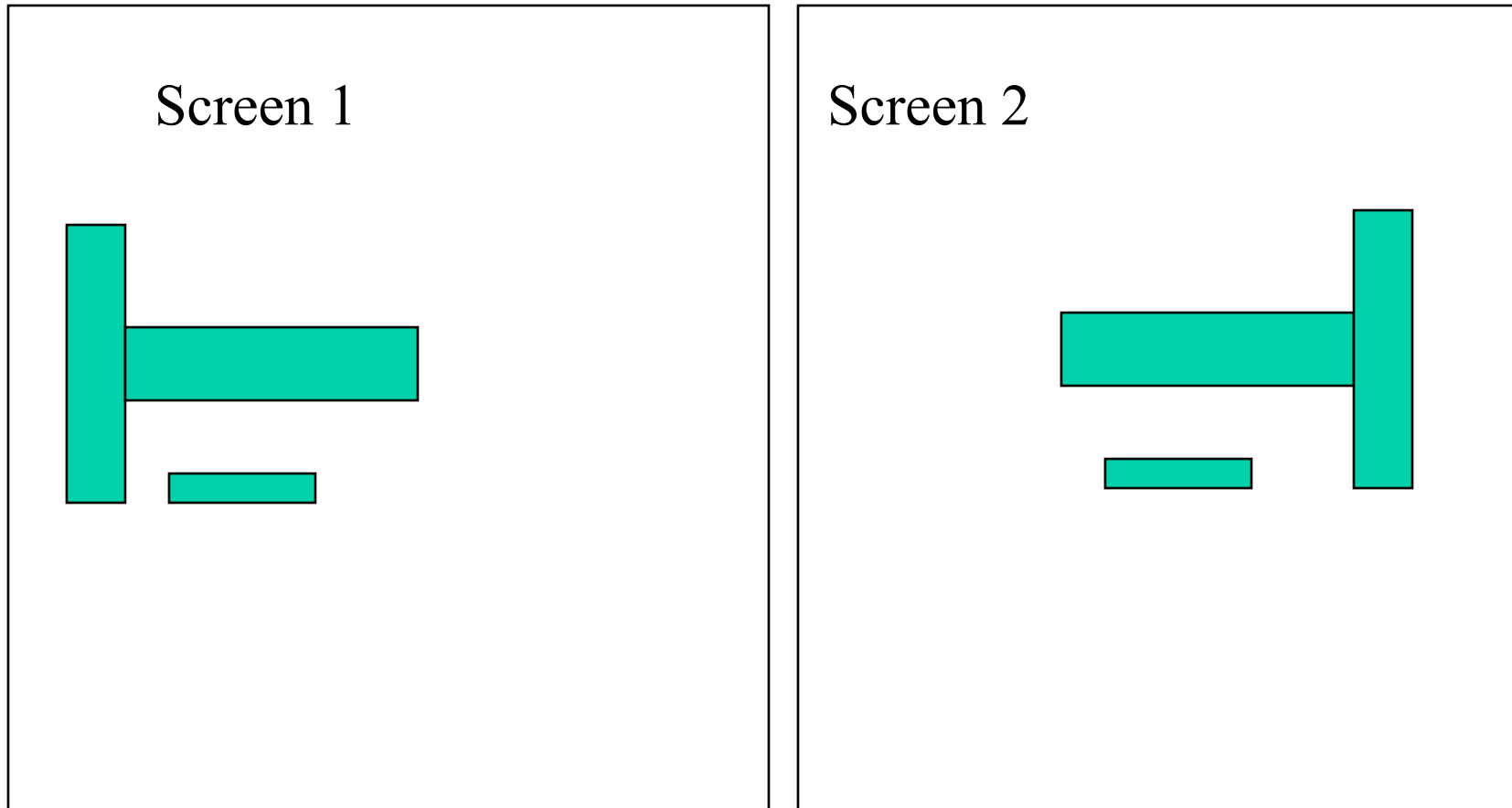


Movement Perception 9

- Rule: Create third dimension to avoid unlikely shape distortion
- Complex situations
- D 16 Tbar

Motion demonstration D15

Shape seems to rotate through the third dimension



- Rule: Create third dimension and surface to create simple interpretation. Surface causes bar to flip into third dimension
- Developing a full set of rules
- Computer vision approximates human vision

Final demo of motion

- Hans Wallach movement demonstration
- HANS
- F1 change frame
- F10 stop
- Speed = 3
- Illuminated dot on edge of a wheel rolling on a track:
Appears to be a bouncing ball with no back motion
- Illuminate the center of the wheel with a dot, and same original dot seen as rotating around it, with clear backwards motion

Demonstration

- Even birthday = E
- Odd birthday = O
- EVEN CLOSE EYES

O group



EVEN OPEN EYES
ODD CLOSE EYES

E group



BOTH GROUPS OPEN EYES

Estimate how
old this
Woman is



Results of Age study f09 1

- Group O ages:
- Average:

- Group E ages:
- Average:

F08 Old or Young Lady Prime

Group n	Mean age estimate	Standard deviation
Old Prime	58.7	23.2
Young Prime	33.7	16.7

We see what we expect to see

Surviving

- Constructing a mental map of the world
- A map that is useful
- The map was useful in our ancestral environment
- The physical environment has changed drastically
- The social environment has changed drastically
- New importance of very small and very large numbers
- The educational environment has changed more slowly
- Science is a process, but is taught as a set of “facts” or “theories”
- Adaptive survival in 21st Century: Understanding statistics, science etc.
- Not used to very small or very large numbers

- Rules or Heuristics
- Conditions where heuristics fail, sometimes described as **biases**
 - Daniel Kahneman
 - Amos Tversky
- Basic knowledge (e.g., gravity)
- Heuristics: Guiding principles
- Economics: Assumes full information available and rationality

Knowledge of probability

- Approximations
- Penn Freshmen: Ivy League
- About 90% know chance of getting three heads in three penny throws
- About 25% know chance of getting two heads in three penny throws

Risks and benefits

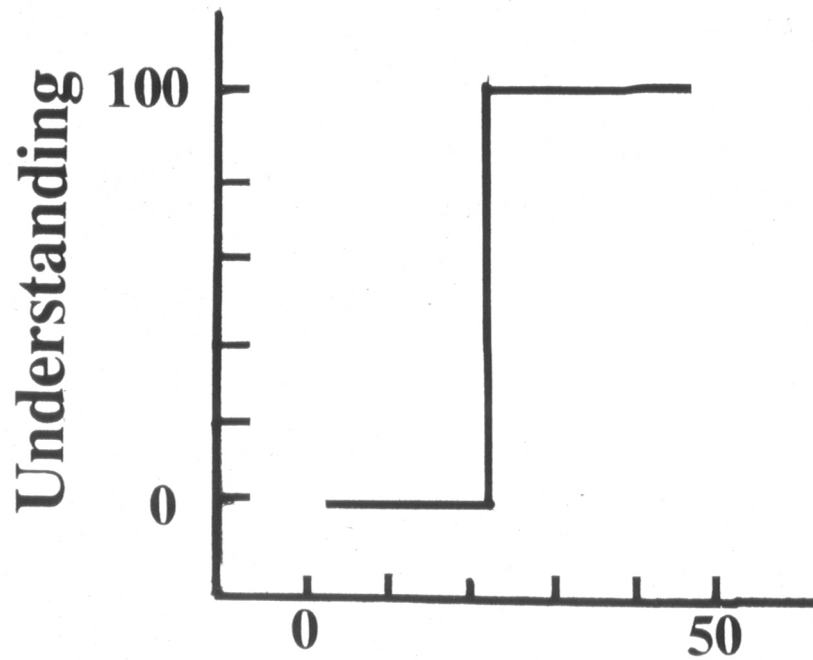
- Probabilities
- Paul Slovic
- Rate risks and benefits of modern technologies (e.g., nuclear power, genetic engineering, deep sea drilling)
- Lay people: risks negatively correlated with benefits
- Experts: risks positively correlated with benefits
- Must compare the two

Lack of understanding of science

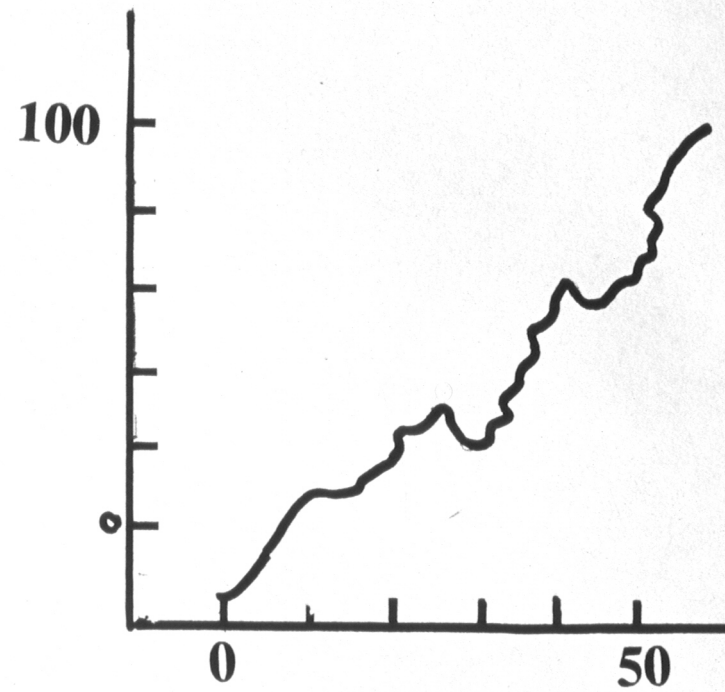
- **Penn freshmen. What does it mean that finding X is evidence for theory Y?**
- **>25% use the words: “proof, prove”**
- **Idea of texture of evidence, converging methods**
- **How do you know? Course**
- **X is evidence for Y if X increases the probability that Y is correct**

The Progress of Science

Lay Model

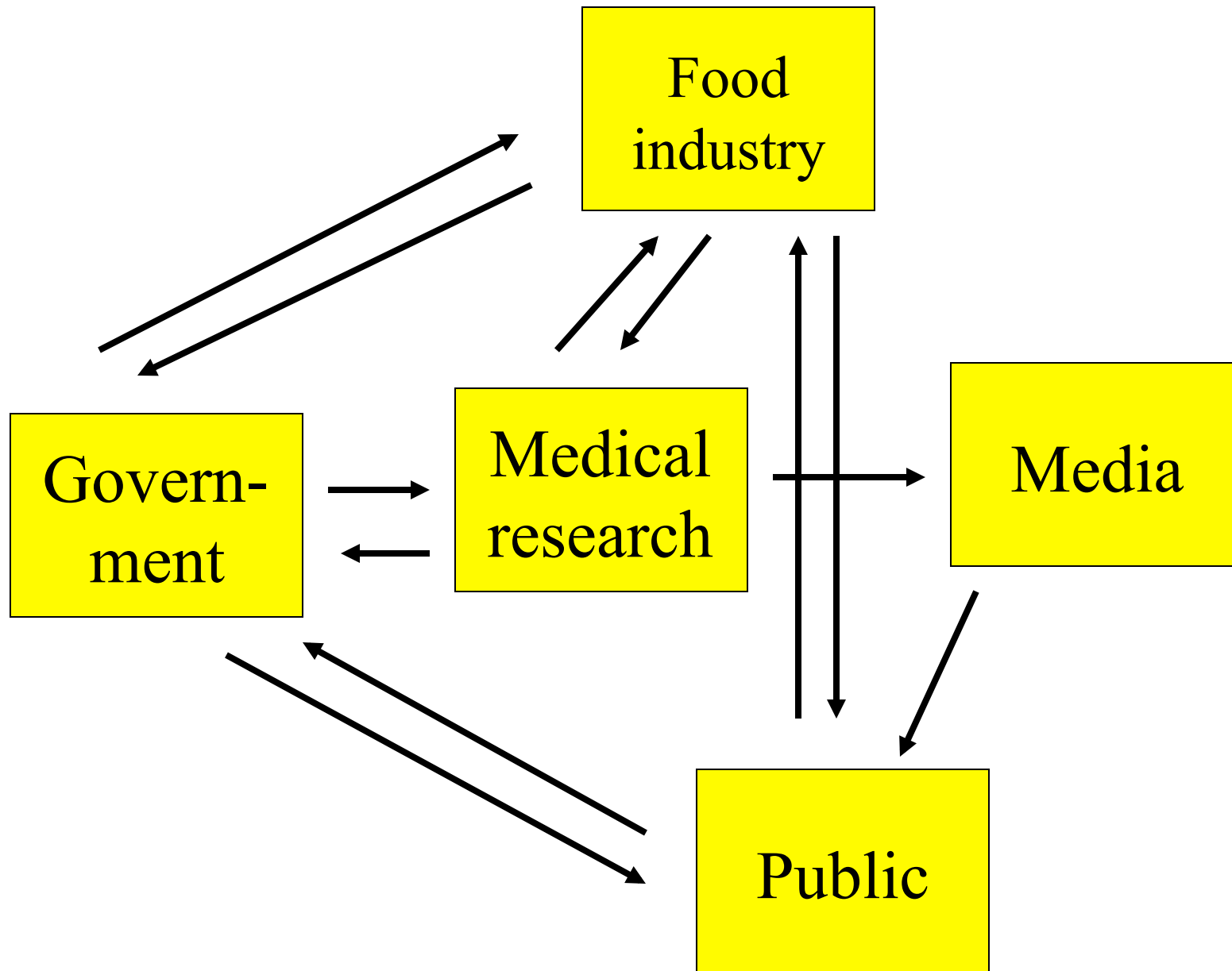


Actual Events



Time (years)

Generating “facts” or “claims”

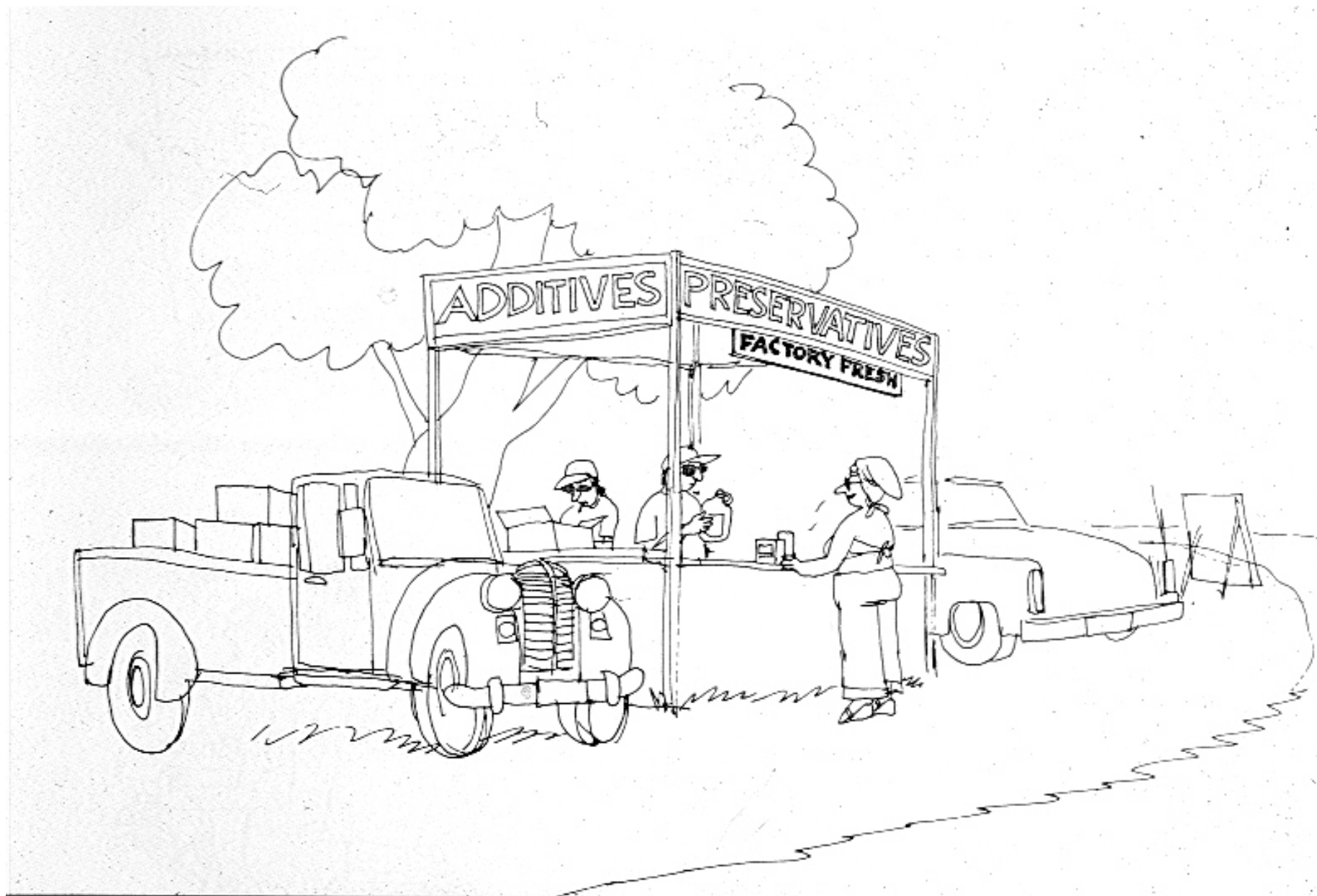


Misinformation
Natural preference

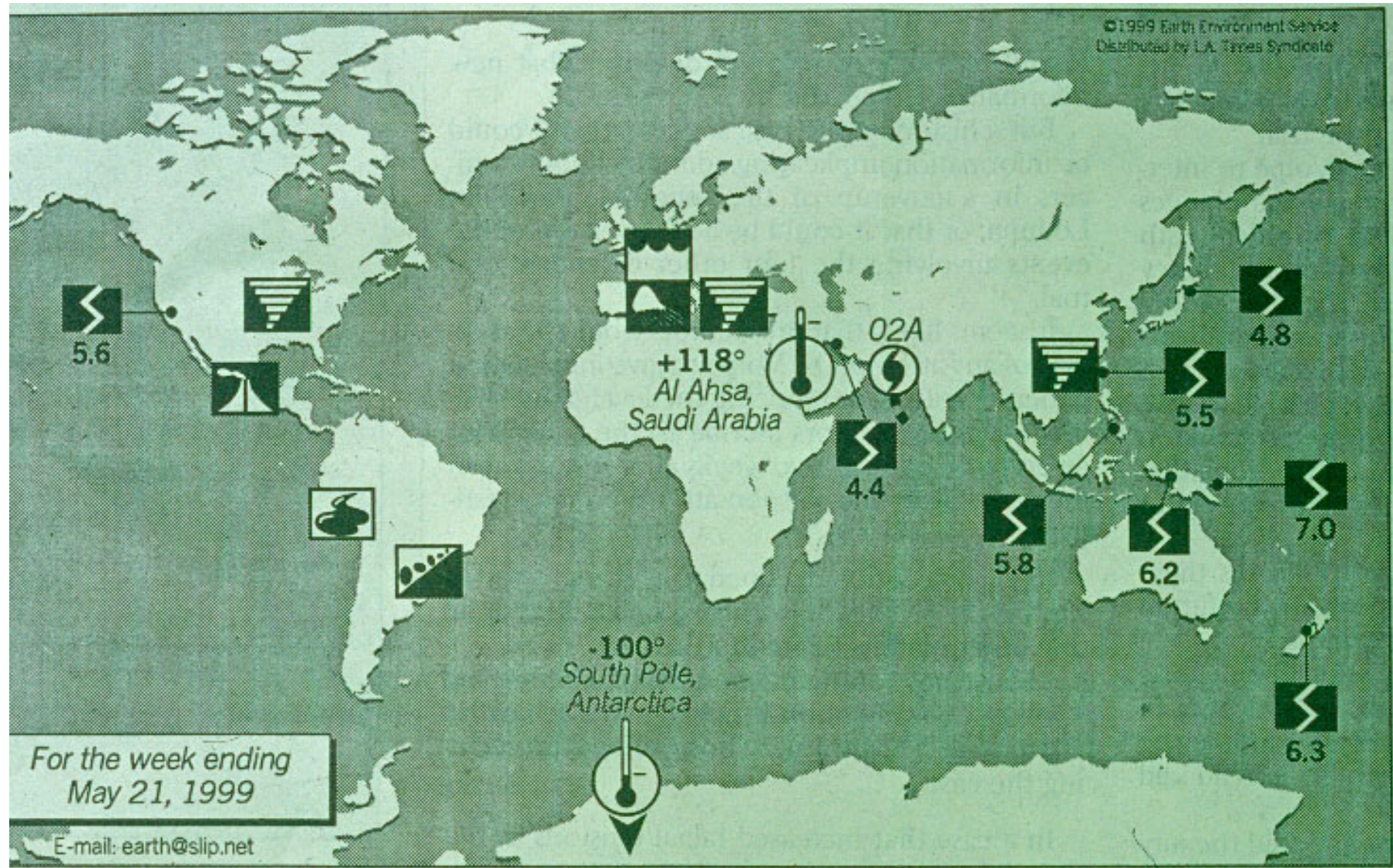








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For the week ending
May 21, 1999

E-mail: earth@slip.net

ers braced for cyclone 02A to hit
by 20 with winds of 120 mph. The

Euro Floods

Residents of the affected shantytown
were holding a protest march de

Bruce Ames on pesticides

Process vs Content: survey results from representative Americans (0-100 scale)

	% reduction in natural		
Wolf			
German shepherd	12%		
Cocker spaniel	15%		
Wild animal with one gene insert	54%		

Calphalon



KOHLERS

DO NOT LEAN

CHILD SEATING
NOT INTENDED



NO

DO NOT



OCHA-CIDIL Project

2001-2002

- Claude Fischler, Paul Rozin and others
- Random telephone sample interviews
- 150 (phase 2) or 1000 (phase 3) telephone interviews per country:
- France, Germany, Italy, Switzerland, U.K., U.S.A.

Additives vs Subtractives

(Random Euro-American sample)

Item	Naturalness (mean) (0-10 scale)
Milk with natural vitamin D supplement	5.35
Milk with all fat removed (skim)	5.88

**N = 6000: France, Germany, Italy,
Switzerland, UK, USA**

Natural definition: adding vs subtracting (% mentioning)

	US	France	UK	
Adding	45	32	38	
Subtracting	2	1	2	

Water: Process vs Content

- Logic
- Original Natural Form
- Add or remove something
- Remove what was added or replace what was removed (with same stuff)

natural spring water with no minerals

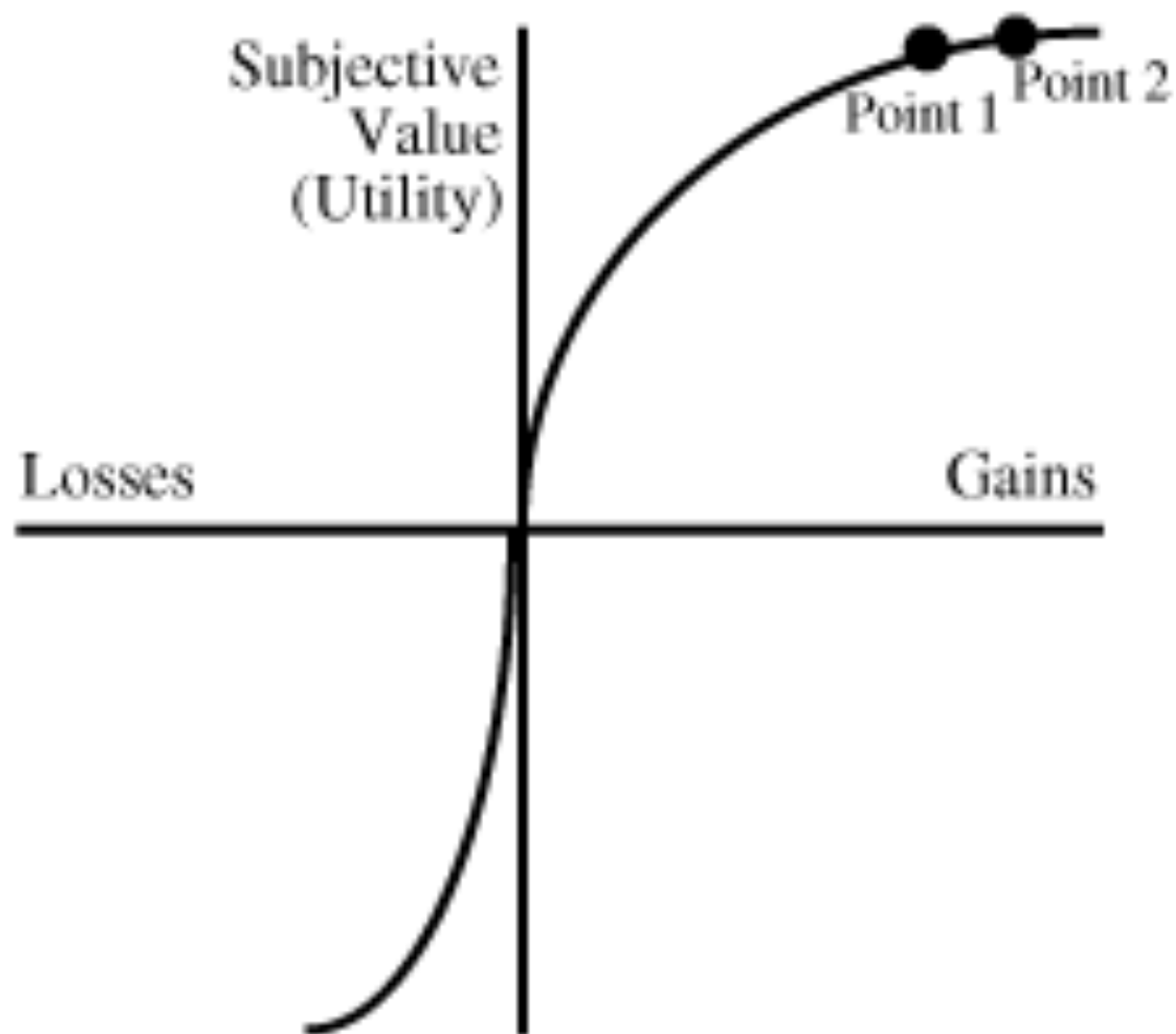
	Mean Natural (0-100)	Mean acceptable (0-100)
Spring water with no minerals	92 ^a	91 ^a
Add .1% minerals from other spring water	69 ^b	86 ^b
Remove same minerals	62 ^c	83 ^b

a, b and c are significantly different in each column

Some important heuristics

- 1. loss aversion (Kahneman and Tversky)

Kahneman & Tversky



Minute
APPLE JUICE
NEW!
100% PURE - READY TO DRINK



- **Imagine that you win a lovely Cross Pen in a lottery. What is the smallest amount of money that you would accept to sell this pen?**
- **Imagine a lovely Cross pen. What is the largest amount of money that you would pay to obtain such a pen?**

Endowment effect:

Cross pen given and to give up or to buy

	Lowest sell \$ for owned (median)	Highest buy \$
F07	25	10
F08	40	10
F09	20	10

New pill item

- FORM A
- You have to take pill to treat an acute serious disease that you have. You have a choice of two pills which are equally effective in treating your disease. Pill A has a risk of .00002 of inducing cancer and a risk of .00002 of inducing heart disease. Pill B has a risk of .00001 of inducing cancer and a risk of .00003 of inducing heart disease.
-
- FORM B
- You have to take pill to treat an acute serious disease that you have. You have a choice of two pills which are equally effective in treating your disease. Pill A has a risk of .00002 of inducing cancer and a risk of .00002 of inducing heart disease. Pill B has a risk of .00001 of inducing heart disease and a risk of .00003 of inducing cancer.

Pill results F08/F09: % Prefer = (.00002 risk for cancer and heart disease:) vs one risk up and one risk down

Pill % prefer	2008 % prefer equal (A)	2009 % prefer equal (A)
.00001 cancer .00003 heart disease	48%	42%
.00003 cancer .00001 heart disease	83%	82%

Negativity dominance (Rozin & Royzman, 2001)

- Combinations of negative and positive are more negative than they “should be”
- Negatives are more potent than “equivalent” positives (loss aversion)
- Negative events grow faster in strength as they are approached than do positive events

Negativity Dominance

- Contamination
- Stigma in politics
- Balancing Murders and Saved lives

Framing

- Context, interpretation
- Examples of importance of framing

The wallet question and framing

- You have \$60 in your wallet. You are going to a theatre and intend to buy a ticket for the admission price of \$20. As you enter the theatre, you discover that you have lost \$20; you have only \$40 in your wallet. Would you pay \$20 for a ticket?
- Alternate form: \$40 in wallet and a \$20 ticket. You find you lost the ticket.
- 1) YES 2) NO

Wallet-ticket framing

lose \$20 ticket or lose \$20: % buy ticket

	Lose ticket	Lose \$20
Literature	46	88
F09	64%	84%

Jacket-Calculator item

- Imagine that you are about to purchase a jacket for \$125 and a calculator for \$25. The salesman informs you that the jacket you wish to buy is on sale for \$115 at another branch of the store, located 20 minutes drive away (you have a car). Would you make the trip to the other store?
- Alternate: Calculator on sale for \$15.
- 1) YES 2) NO

Jacket \$125 or calculator \$25 at
\$10 discount at 20 min away
% who will drive

	\$125 to \$115	\$25 to \$15
Literature	32	71

Framing (Kahneman)

- Economics and Contingent Valuation
- Estimating the cost to society of Exxon Valdez Oil Spill
- How much would you give to clean up 1 mile of the Alaska Coast?
- Times number of people in country or other base
- Problem of framing

Framing

- Choosing a comparison condition
- How good is your marriage?
- Tegmark: \$100,000,000 for meteorite warning
- \$.33 per American
- Grant to every poor, deaf American say 100,000: \$1,000 each
- 10X federal expenditures on opera
- Framing a question

Framing a question

- Do you think the US should (allow/forbid) speech against democracy?
- (very large random sample Americans)
- forbid allow
- % yes 25% % no 44%

- Framing
 - 5% fat or 95% fat free
 - Death or estate tax
 - Patriot act or limitation of freedom act
 - Granola bars

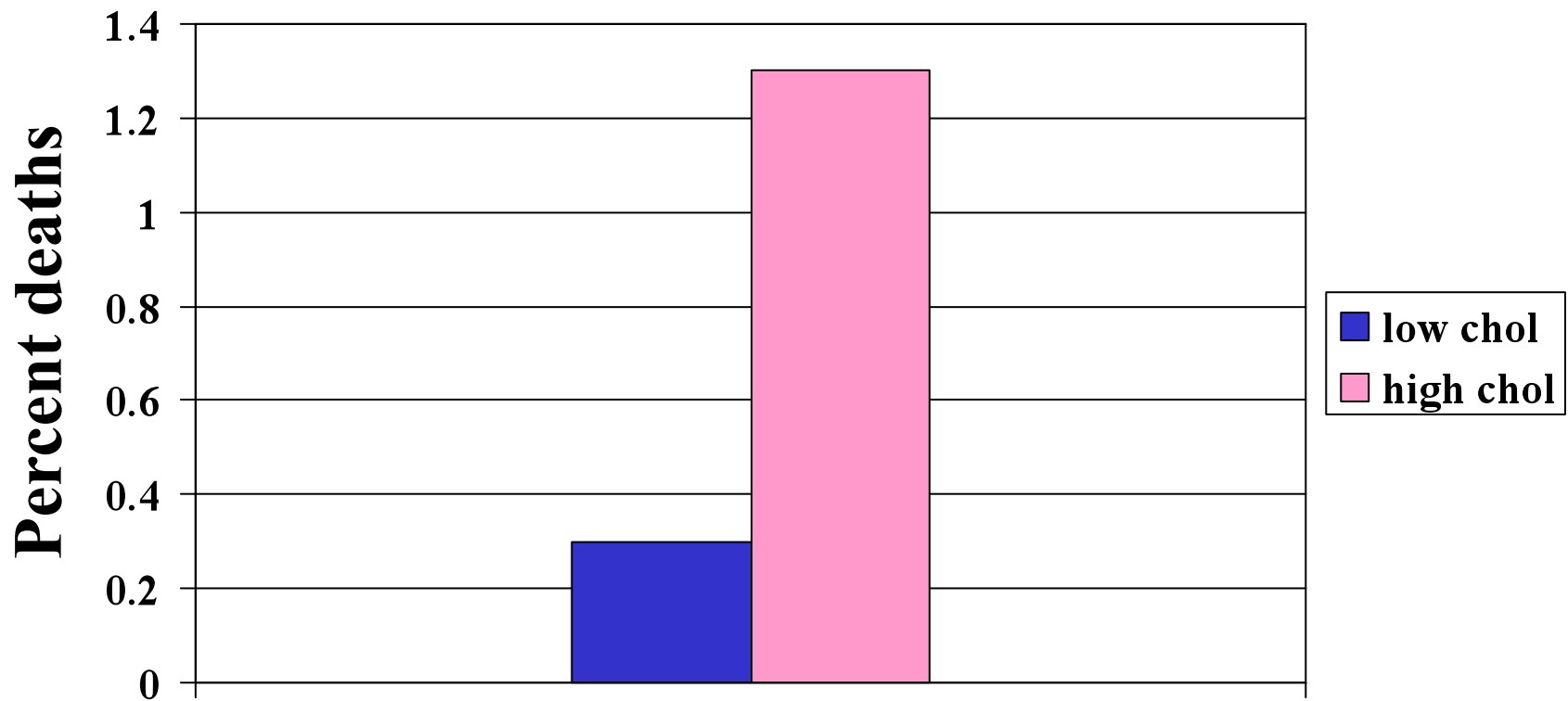
Framing: Presentation of results

MRFIT STUDY

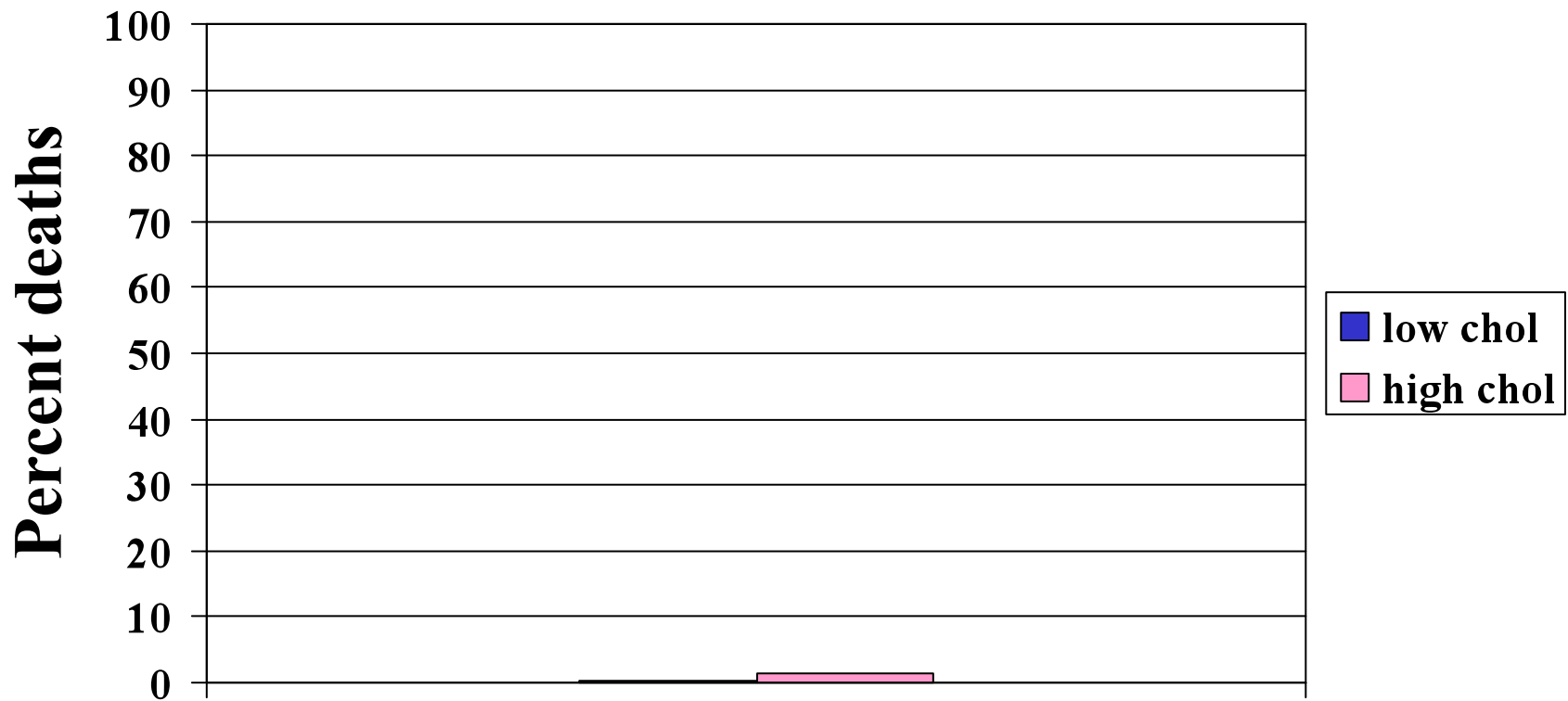
12,000 middle-aged US males
followed for seven years

Condition	Highest cholest decile >265	Lowest cholest decile <170
Fatal heart attacks (%)	1.3%	0.3%

Mr. Fit: % Fatal heart attacks by highest vs. lowest decile in blood cholesterol
4 times higher risk!!



Mr. Fit: % Fatal heart attacks by highest vs. lowest decile in blood cholesterol

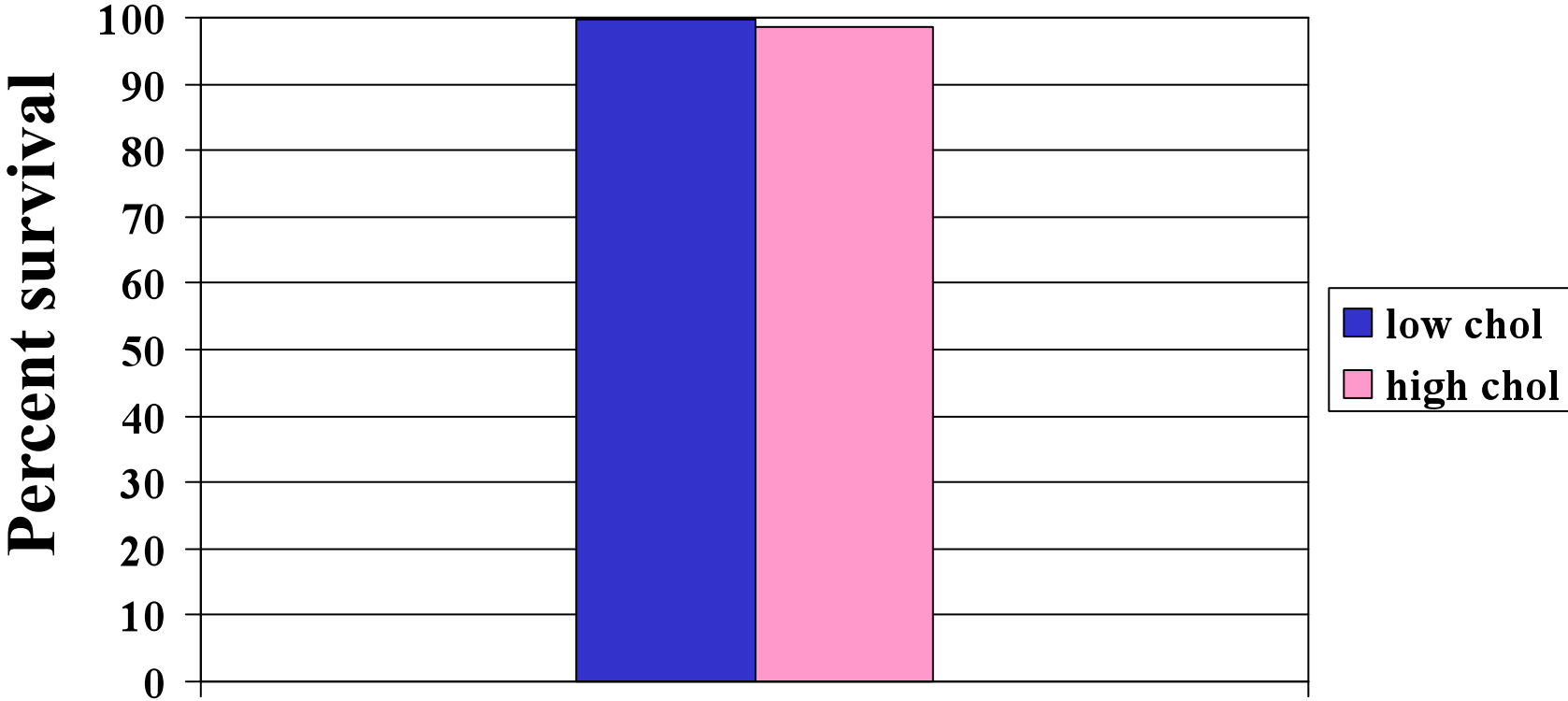


MRFIT STUDY

12,000 middle-aged US males

Condition	Highest cholest decile >265	Lowest cholest decile <170
Fatal heart attacks (%)	1.3%	0.3%
No fatal heart attack (%)	98.7%	99.7%

Mr. Fit: % NO Fatal heart attacks by highest vs. lowest decile in blood cholesterol



Framing and loss aversion

- Discounts and surcharges
- Risk seeking for losses
- Risk aversion for gains

Framing 1: Loss

- Imagine that the U.S. is preparing for the outbreak of an unusual infectious disease, which is expected to kill 600 people.
- Two alternative programs to combat the disease have been proposed. Assume that the consequences of the programs are as follows:
-
- If Program 1 is adopted, 400 people will die
- If Program 2 is adopted, there is a 1/3 probability that
- nobody will die, and a 2/3 probability that 600 people will
- die.
- Which of the programs do you favor? 1 or 2
- RISK TO REDUCE LOSS

Framing 2: Gain

- Imagine that the U.S. is preparing for the outbreak of an unusual infectious disease, which is expected to kill 600 people.
- Two alternative programs to combat the disease have been proposed. Assume that the consequences of the programs are as follows:
- If Program 1 is adopted,
 - 200 people will be saved
- If Program 2 is adopted,
 - there is a 1/3 probability that 600 will be saved, and a 2/3 probability that nobody will be saved
- Which of the programs do you favor? 1 or 2
- RISK TO REDUCE GAIN

Risk and loss aversion

200 save or 1/3 all save, 2/3 none

vs 400 die or 1/3 no die, 2/3 all die

% no risk	Save frame	Die frame
Literature	76	13
F09	72	33

Short-sightedness

- The ancestral environment
- Succumbing to temptation
- Dominance of the moment:
 - Smoking, chocolate, procrastination, going into the cold ocean

Short sightedness F08: \$100 vs \$105

	% choose \$105	Interest rate
A. \$100 now or \$105 in one week	64%	>250%
B. \$100 in one year \$105 in one year and one week	82%	small

A vs B $p < .001$

Short-sightedness

- Succumbing to temptation
- Procrastination
- Buying insurance
- Examples of short-sightedness
- Short sightedness in institutions: Singapore
- The problem with democracies and frequent elections
- Capitalism: The problem with stockholders and quarterly returns in public (vs private) corporations

Mole hill effect

- Putting on a seat belt
- Getting frequent flyer membership
- Filing for rebates

Enhancers of public concern re disasters (Paul Slovic)

- Low likelihood
- Unpredictable
- Sudden
- Catastrophic
- Human caused

The response to 9/11

- Low likelihood disaster
- Exaggerated by
- Unpredictable
- Sudden
- Human caused
- (vs. influenza epidemic)
- 1918 FLU killed 10-20 million
- Need for certainty rather than low risk
- Over-reaction re insecurity and security measures (e.g., anthrax scare)

The mortgage meltdown

- Short sightedness
- Framing as distributed risk (like jacket discount, looking at distributed risk rather than debt ratio)
- Social influence

Governments

- Made of people
- Problems with frequent elections
- Getting re-elected
- e.g. raising taxes, cutting entitlements
- All points relevant: endowment effect (loss aversion)
- Short sightedness most critical

Some principles for constructing the world

- Non-random
- Bias to causes
- Correlation to causation
- Monotonicity
- Categorizing continua
- Single variable causation

Ways to help

- Reframing
- Avoiding short sightedness with:
- Commitment devices
- Incentives
- Default options
- EDUCATION
- How do you know?

END