

Decision-Making I

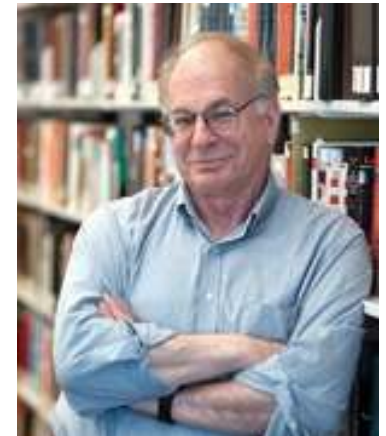
Heuristics

Heuristics and Biases

(启发式与偏差)

- **Tversky (-1996) & Kahneman (2002, Nobel)** propose that people often do not follow rules of probability
- Instead, decision making may be based on **heuristics**
- Lower cognitive load but may lead to **systematic errors** and **biases**
- Example heuristics
 - **Representativeness** (代表性启发)
 - **Availability** (可获得性启发, 可利用性法则)

Daniel Kahneman ([Hebrew](#): דניאל כהנמן) (born March 5, 1934) is an [Israeli American psychologist](#) and winner of the 2002 [Nobel Memorial Prize in Economic Sciences](#). He is notable for his work on the [psychology](#) of [judgment](#) and [decision-making](#), [behavioral economics](#) and [hedonic psychology](#). With [Amos Tversky](#) and others, Kahneman established a [cognitive](#) basis for common human errors using [heuristics](#) and [biases](#) (Kahneman & Tversky, 1973; Kahneman, Slovic & Tversky, 1982; Tversky & Kahneman, 1974), and developed [prospect theory](#) (Kahneman & Tversky, 1979). He was awarded the 2002 [Nobel Memorial Prize in Economics](#) for his work in **prospect theory**.



Daniel Kahneman

Prospect Theory

在《赌客信条》一书中，作者孙惟微将前景理论归纳为5句话：

1、“二鸟在林，不如一鸟在手”，在确定的收益和“赌一把”之间，多数人会选择确定的好处。所谓“见好就收，落袋为安。称之为“确定效应”。

2、在确定的损失和“赌一把”之间，做一个抉择，多数人会选择“赌一把”。称之为“反射效应”。

3、白捡的100元所带来的快乐，难以抵消丢失100元所带来的痛苦。称之为“损失规避”。

4、很多人都买过彩票，虽然赢钱可能微乎其微，你的钱99.99%的可能支持福利事业和体育事业了，可还是有人心存侥幸搏小概率事件。称之为“迷恋小概率事件”。

5、多数人对得失的判断往往根据参照点决定，举例来说，在“其他人一年挣6万元你年收入7万元”和“其他人年收入为9万元你一年收入8万”的选择题中，大部分人会选择前者。称之为“参照依赖”。

确定效应

Availability Heuristic

- A person is said to employ the availability heuristic whenever he estimates frequency or probability by the ease with which instances or associations could be brought to mind

可利用性法则指在很多时候，人们只是简单根据他们对事件已有的信息，包括记忆的难易程度或记忆中的多寡，来确定该事件发生的可能性，而不是寻找去其他相关的信息，容易被知觉到或回想起的被认为更容易出现。事件刺激的频率、新异性、生动性、情绪性也会影响到其可获得程度，从而影响到其在个体心目中的主观概率。**Kahnemann** 和 **Tversky** 研究了根据想起一个例子的速度来评价某个事件发生的可能性问题，发现这种方法存在严重的回忆偏向和搜索偏向，因为人们在记忆中搜寻相关信息时，并不是所有的相关信息都能被无偏差地搜索到。

Availability Heuristic

- Are there more words in the English language that begin with the letter R or that have R as their third letter?

有一个例子能很好地说明搜索方式有效性对决策的影响：你认为以r(如：**ride**)开头的单词，还是第三个字母是r(如：**circle**)的单词多？人们因为很容易地从记忆中提取一些单词，如**red**，**roof**等一系列以r开头的单词，却很难短时间内提取第三个字母是r的单词。于是往往立刻做出判断：以r开头的单词多。但实际上仅仅是因为我们对第二种情况不够熟悉，认为第三个字母这一提取索是无效的。真正的情況恰好与我们的选择相反

- Which causes more deaths in developed countries?
 - (a) Traffic accidents
 - (b) Stomach cancer

 - (a) Homicide
 - (b) Suicide

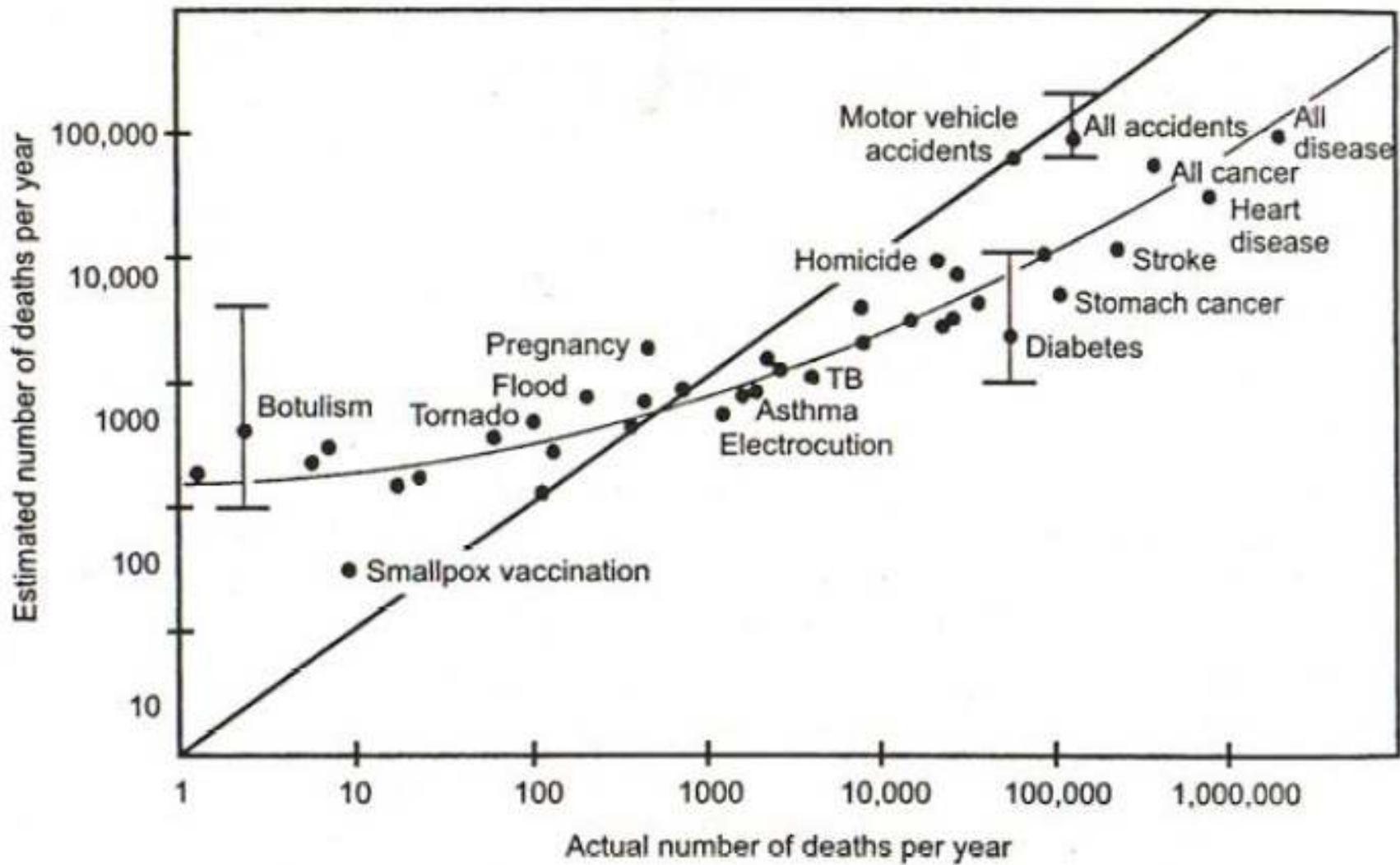
Results

- Typical Guess
 - traffic accident = 4X stomach cancer
- Actual
 - 45,000 traffic, 95,000 stomach cancer deaths in US
- Ratio of newspaper reports on each subject
 - 137 (traffic fatality) to 1 (stomach cancer death)

In 2003:

Suicide rate = 9.37 person per 100,000 population

Homicide rate = 5.49 person per 100,000 population



Why use the availability heuristic?

- Availability is based on fundamental aspect of memory search
- Works well under many circumstances
 - Availability correlates with likelihood of events

可获得性启发法常用于判断某事件发生的频率或者概率，这时人们往往会利用记忆中最容易提取的信息进行主观估计，因此，频率或者概率的估计极大地受事件熟悉程度与突出性等可回溯性因素及搜索方式的有效性和事件可想象的难易程度的影响而造成认知偏差。多数人都有过类似经验，当被问到某种疾病的发生概率时，人们往往根据身边熟悉的人得此病的情况进行推断。

可利用性法则的应用

要恰当利用可获得性启发法,投资者应:

- 1、学会忘记。人的记忆力强是好事,但有时也不妨学会忘记。在总结经验教训的基础上,不妨将过去在股市中经历的风风雨雨全部忘掉;只有忘记旧的,才能更好地接受新的信息。
- 2、一旦经过分析作出投资决策,不宜仓促改变决定。要时刻谨防一些生动、新异的新闻、消息和故事,影响自己的投资决策,更不要成为情绪的俘虏。
- 3、保持良好的心境。心境会影响到个人对未来的预期调整系数;不良的心境会使调整系数过高或过低,不利于形成正确的投资预期。
- 4、不宜在心中对自己的“希望”进行过多的预演。对某一场景预演越多,越以为它会出现,最终则成为自己臆想的奴隶。

Example 1

- All the families having exactly six children in a particular city were surveyed. In 72 of the families, the exact order of the births of boys and girls was:
 - G B G B B G
- What is your estimate of the number of families surveyed in which the exact order of births was:
 - B G B B B B
- Answer:
 - a) < 72 b) 72 c) > 72

Example 2

- A coin is flipped. What is a more likely sequence?
 - A) H T H T T H
 - B) H H H H H H



Representativeness Heuristic

- The sequence “H T H T T H” is seen as more **representative** of or **similar** to a prototypical coin sequence

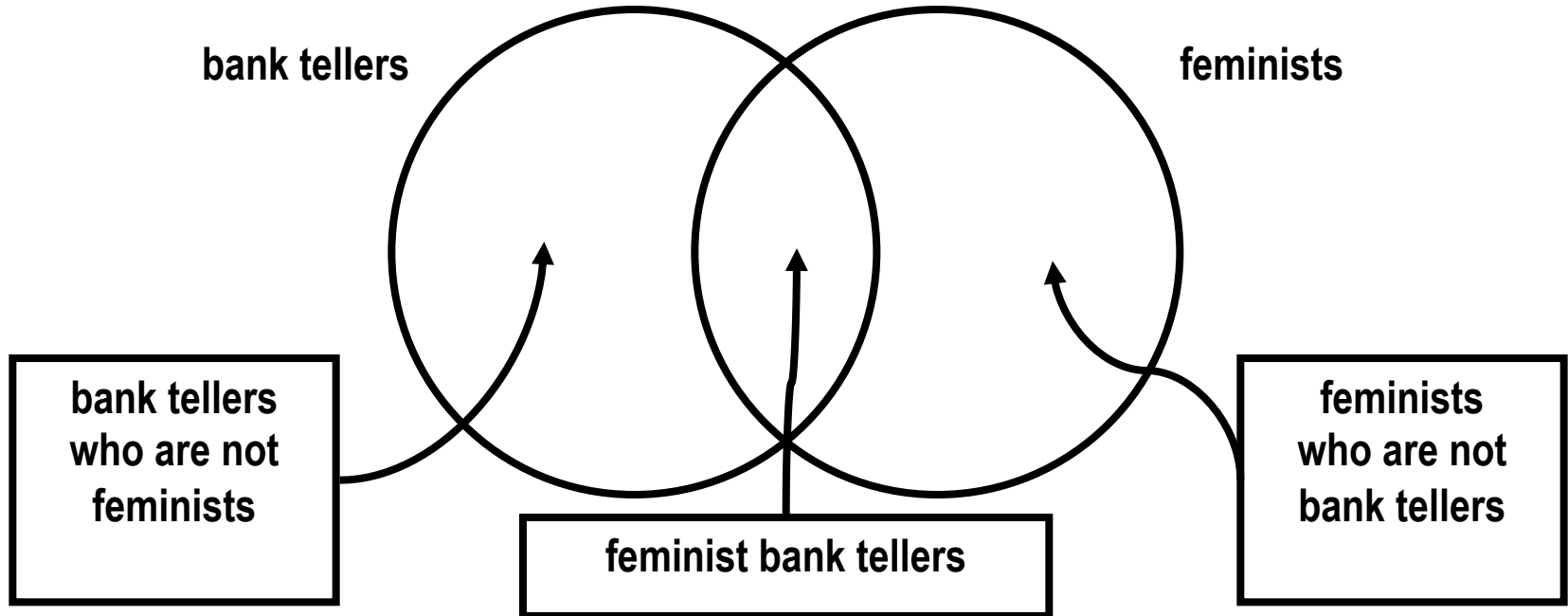


Example 3

- Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.
- Please choose the most likely alternative:
 - (a) Linda is a bank teller
 - (b) Linda is a bank teller and is active in the feminist movement

Conjunction Fallacy

- Nearly 90% choose the second alternative (bank teller and active in the feminist movement), even though it is logically incorrect (**conjunction fallacy**)



合取谬误（**conjunction fallacy**），是一种机率谬误，是一种认为多重条件“甲且乙”比单一条件“甲”更可能发生的认知错误

- 另一实验：约翰，男，45岁，已婚，有子女；他比较保守，谨慎并且富有进取心；他对社会和政治问题不敢兴趣，闲暇时间多用于业余爱好，比如做木匠活和猜数字谜语。
- 假设他来自于一个工程师和律师组成的样本群。然后分别告诉被测试者不同的先验概率。一组被测试者被告知工程师人数为样本的30%，律师为70%。另一组被测试者被告知工程师人数为样本的70%，律师为30%。询问两组被测试者约翰更有可能从事哪种职业？
- 结果表明，两组被测试者大都认为约翰是工程师，即使在主试有意提醒他们注意叙述条件的情况下，这种现象仍未改变。这说明，人们只根据描述性语言的代表性进行判断却全然不考虑先验概率的影响。

Representativeness heuristic

- Kahneman and Tversky (1982) explained these results using the **representativeness** heuristic
 - tendency of people to judge probabilities or likelihoods according to how much one thing resembles another
- Linda is more representative of a feminist bank teller than just a bank teller alone, so people give the second answer

代表性法则指人们在不确定性的情形下，会抓住问题的某个特征直接推断结果，而不考虑这种特征出现的真实概率以及与特征有关的其他原因。在很多情况下，代表性法则是一种非常有效的方法，能帮助人们迅速地抓住问题的本质推断出结果，但有时也会造成严重的偏差，特别是会忽视事件的基率，即无条件概率和样本大小。**Rabin**称这种用小样本特征反映母体特征的信念为“小数定理”。

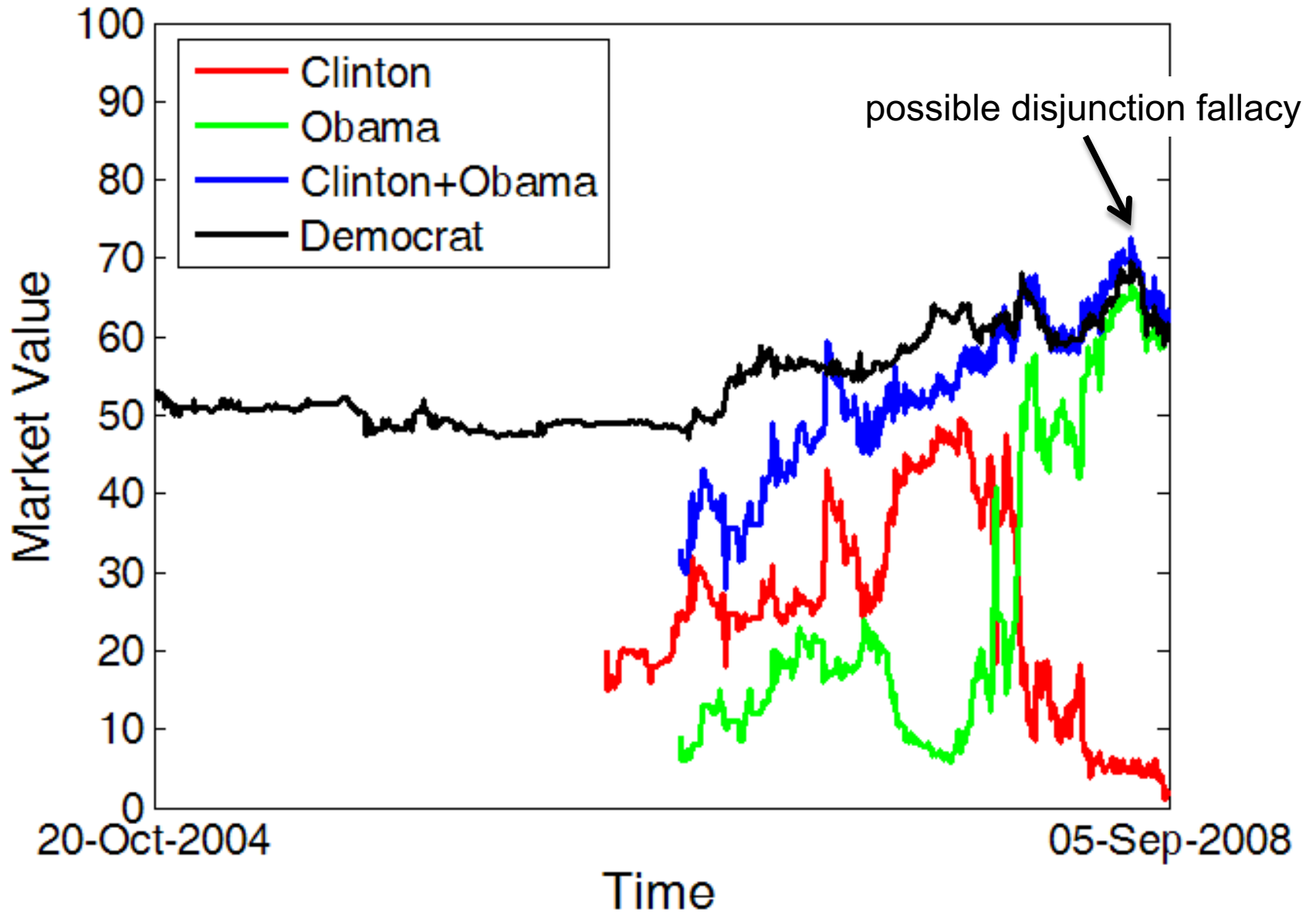
Disjunction Fallacy

- Suppose it is the year 2008*. What is the likelihood that:
 - (A) **Obama** wins the general election
 - (B) **Clinton** wins the general election
 - (C) **A Democrat** wins the general election
- According to laws of probability, when A and B are mutually exclusive events and C combines all these events:
 - $P(A) + P(B) = P(C)$
- But sometimes the sum of the judged probabilities of individual events exceeds the judged probability of the general event
 - $P(A) + P(B) > P(C)$
- This is an example of a **disjunction fallacy**

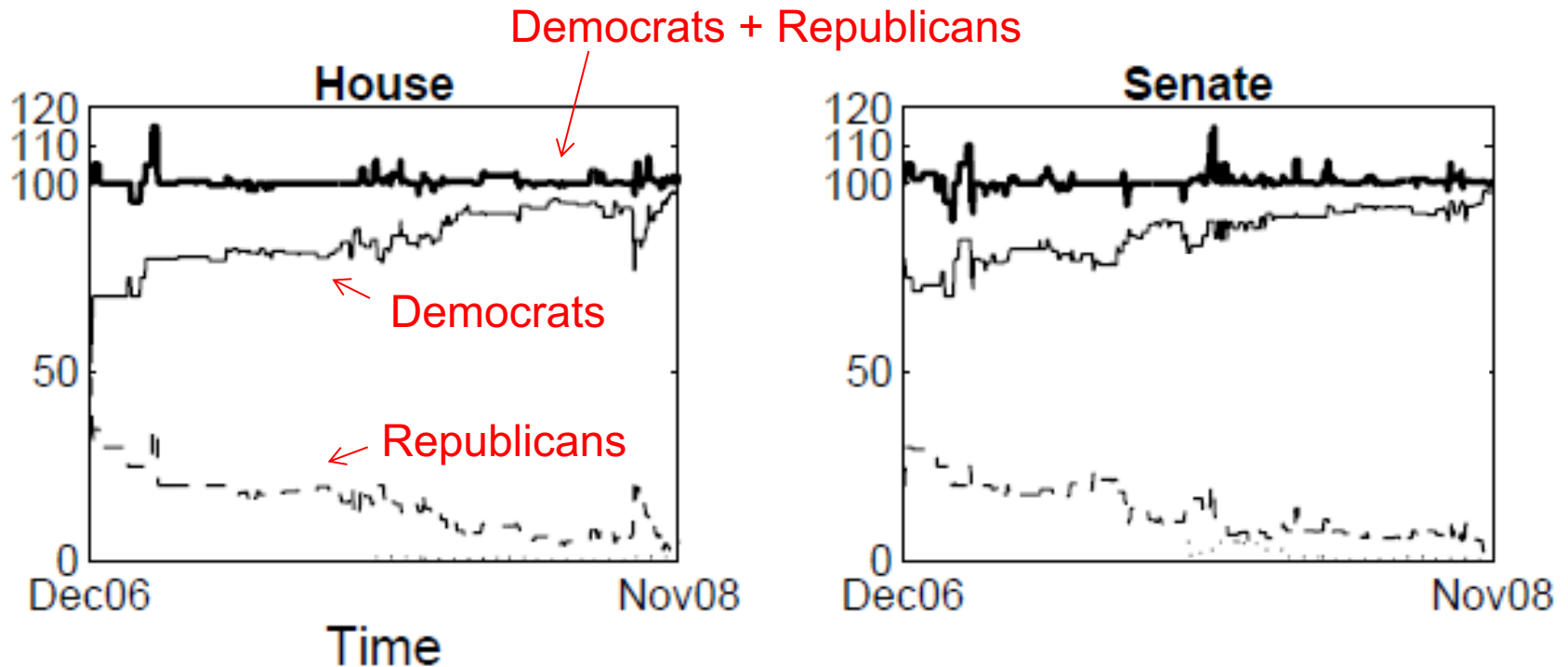
It is easier to imagine a particular democrat winning the election.....

* assume that Edwards already dropped out of the race

“Obama”, “Clinton” and “Democrat”



Prediction markets for “Democrats” or “Republicans” winning the house/senate



Occasionally, prediction markets show a disjunction fallacy

- In some cases, people might be relying on heuristics to estimate the likelihood of events
 - e.g. representativeness heuristic
 - can lead to conjunction and disjunction fallacies
- These heuristics can influence prediction markets
 - could potentially be exploited by people aware of these fallacies operating

Hot Hand Belief in Basketball

- Question:
 - Does a player have a better chance of making a shot after having just made his last two shots than he does after having just missed his last two shots?
- Answers by Cornell and Stanford University Basketball fans
 - Yes = 91%
 - No = 9%



Does the “hot hand” phenomenon exist?

- Most basketball coaches/players/fans refer to players having a “Hot hand” or being in a “Hot zone” and show “Streaky shooting”
 - However, making a shot after just making two shots is as likely as after just missing two shots
- Not much statistical evidence that basketball players switch between a state of “hot hand” and “cold hand”

What to make of these results?

- One interpretation of Tversky & Kahneman's findings:
 - people do not use proper probabilistic reasoning
 - people use arbitrary mechanisms/ heuristics with no apparent rationale
- However, Gigerenzer and Todd show in their "**Fast and Frugal Heuristics**" research program that heuristics can often be very effective

Which city has a larger population?

- A) San Diego
- B) San Antonio (TX)

- 66% accuracy with University of Chicago undergraduates. However, 100% accuracy with German students.
 - San Diego was recognized as American cities by 78% of German students. San Antonio: 4%
- With lack of information, use **recognition heuristic**

Which German city has a larger population?

A) Leipzig (莱比锡)

B) Dresden (德累斯顿)

How to pick a stock

- Problem: what stocks to invest in?
- Solution 1--“optimizing”:
 - Gather lots of info about many companies
 - Process with sophisticated tools and choose
- Solution 2--the recognition heuristic:
 - Purchase stocks from recognized companies

“Paying for the name.....”

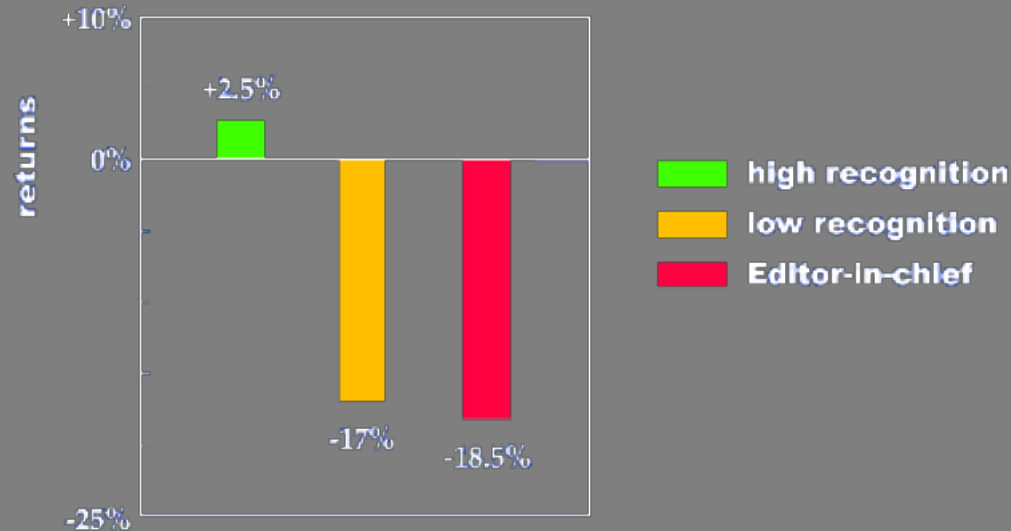


(slide from Peter Todd)

Picking Stocks with Recognition Heuristic

Capital

Online stock picking competition (2000)



Note: this result has not replicated in other studies (e.g., Boyd, 2001; Rakow, 2002)

-- don't rush to use this heuristic on your own money!

See also Borges et al, 1999