What can choice modelling learn from behavioural economics and does it matter?

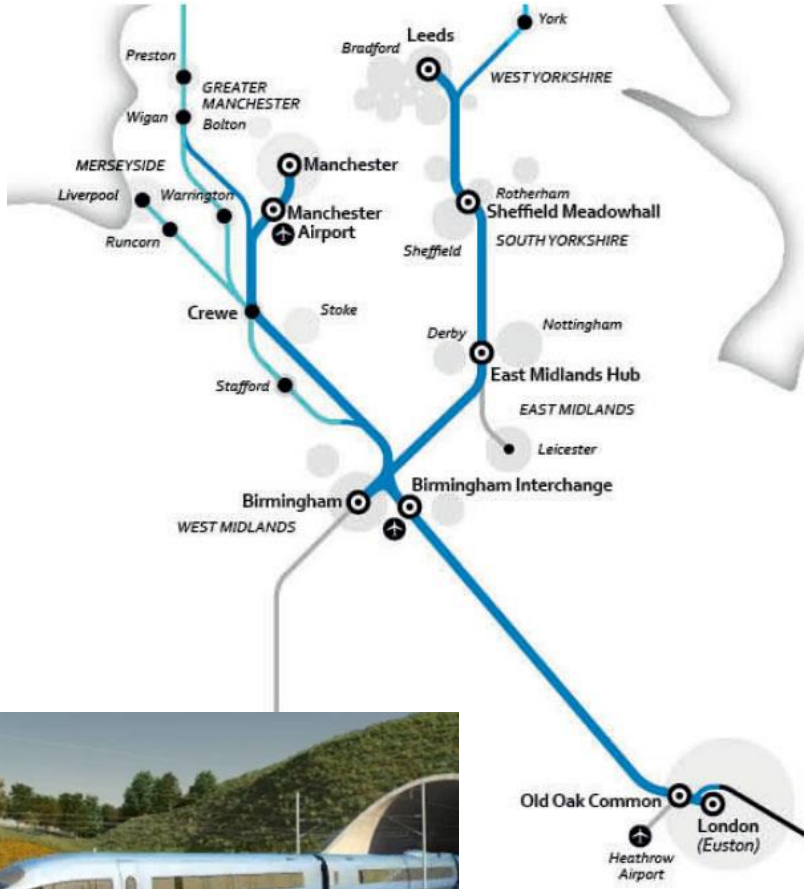
Questions I'll try to answer

- Why do we want to understand and predict choices?
  - Why is this especially important and challenging now?
- How do we do it?
  - Who is doing this, and are we the right people?
  - Do we do it the right way?
- What can we learn from behavioural economics?
- What are the challenges and opportunities?

Why do we want to understand and predict choices?

Why is this especially important and challenging now?

Need understanding and prediction of demand



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Some big decisions are needed

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Making choices in a difficult climate

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Life is more and more digital

Connect Amazon and Facebook

Improve your Amazon shopping experience by tapping into your Facebook network.

- Discover Amazon recommendations for movies, music, and more based on your Facebook profile.
- See upcoming birthdays and find your Facebook friends' Amazon Wish Lists more easily.
- Get gift suggestions for your friends based on their Facebook profiles.
- Explore your friends' profiles and see who has similar interests.

Connect with Facebook

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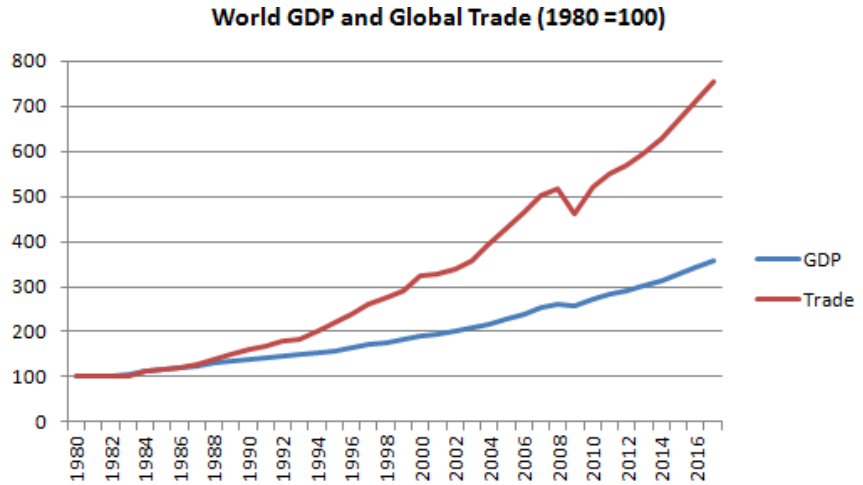
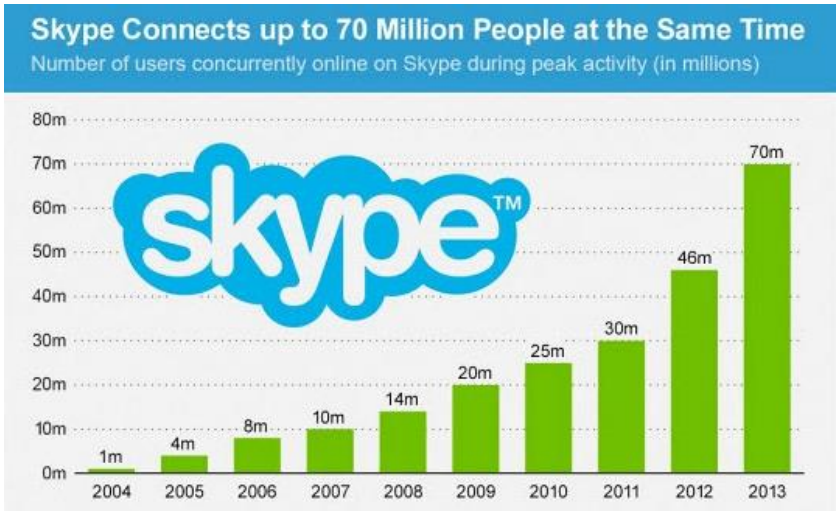
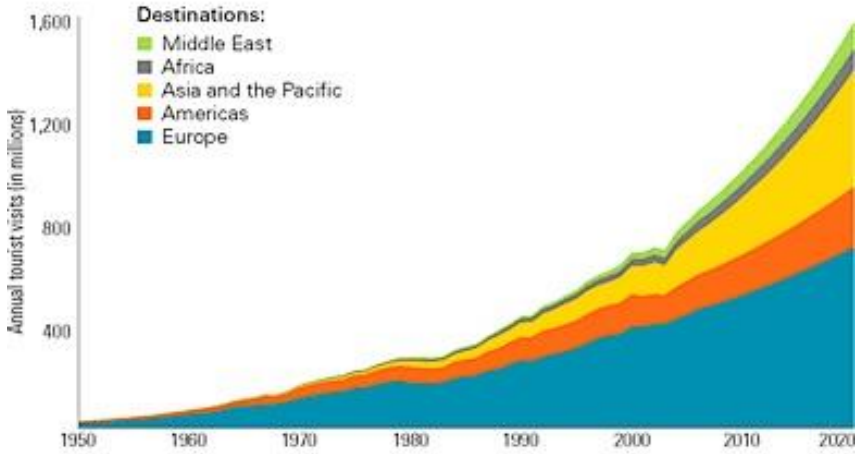
… and more international





Travel Explosion

The United Nations predicts that the annual number of international tourist visits will roughly double to 1.6 billion by 2020.



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How do we do it?

Understanding and prediction

$$P_{ni} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}} \right) f(\beta)\, d\beta \qquad R_i = \delta_i + \sum_{j \neq i} \sum_m \ln\left(1 + \exp\left[\beta_m \cdot \left(x_{jm} - x_{im}\right)\right]\right)$$

$$L_n = \int_{\eta_n} \left[\sum_{s=1}^{S} \pi_{n,s}(\alpha_n) \sum_{k=1}^{K_s} \varpi_{n,s,k} LC_{n,s}(\beta_{s,k}) \right] \left[\prod_{m=1}^{M} LI_{n,m}(\alpha_n) \right] \phi(\eta_n)\, \mathrm{d}\eta_n$$

$$P_{ni} = \frac{e^{V_{ni}/\lambda_k} \left(\sum_{j \in B_k} e^{V_{nj}/\lambda_k} \right)^{\lambda_k - 1}}{\sum_{\ell=1}^{K} \left(\sum_{j \in B_\ell} e^{V_{nj}/\lambda_\ell} \right)^{\lambda_\ell}}$$

$$P_{ni} = \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}}$$

Valuation of individual components and overall valuation

Forecasting of choices/demand in specific scenarios

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Used across disciplines

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Who is doing this?

Are we the right people?

Do we do it the right way?

(A selection of the) leading modellers

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We often treat choices in isolation …

Short term

vs medium term

vs long term

Transport

vs energy

vs health

….

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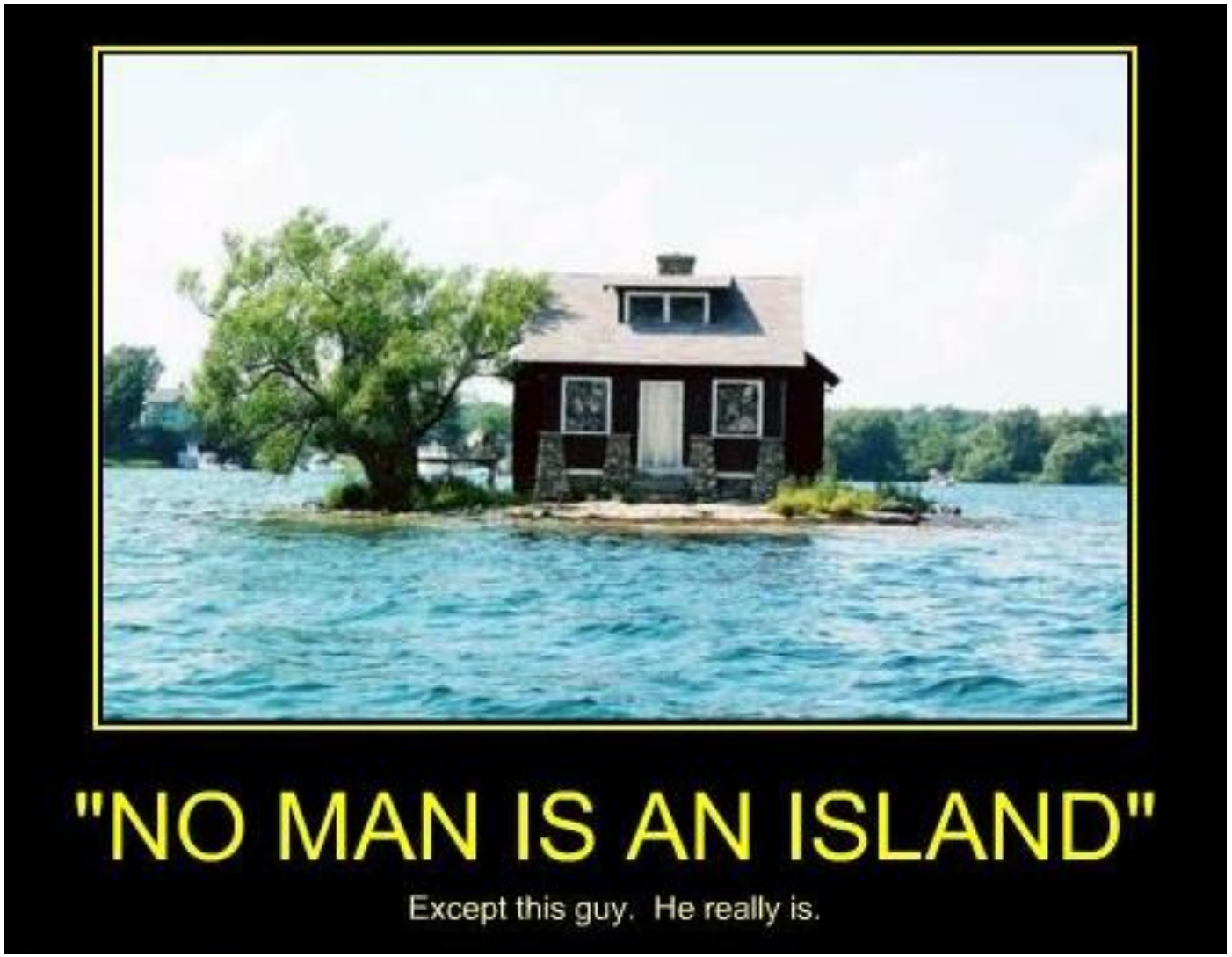
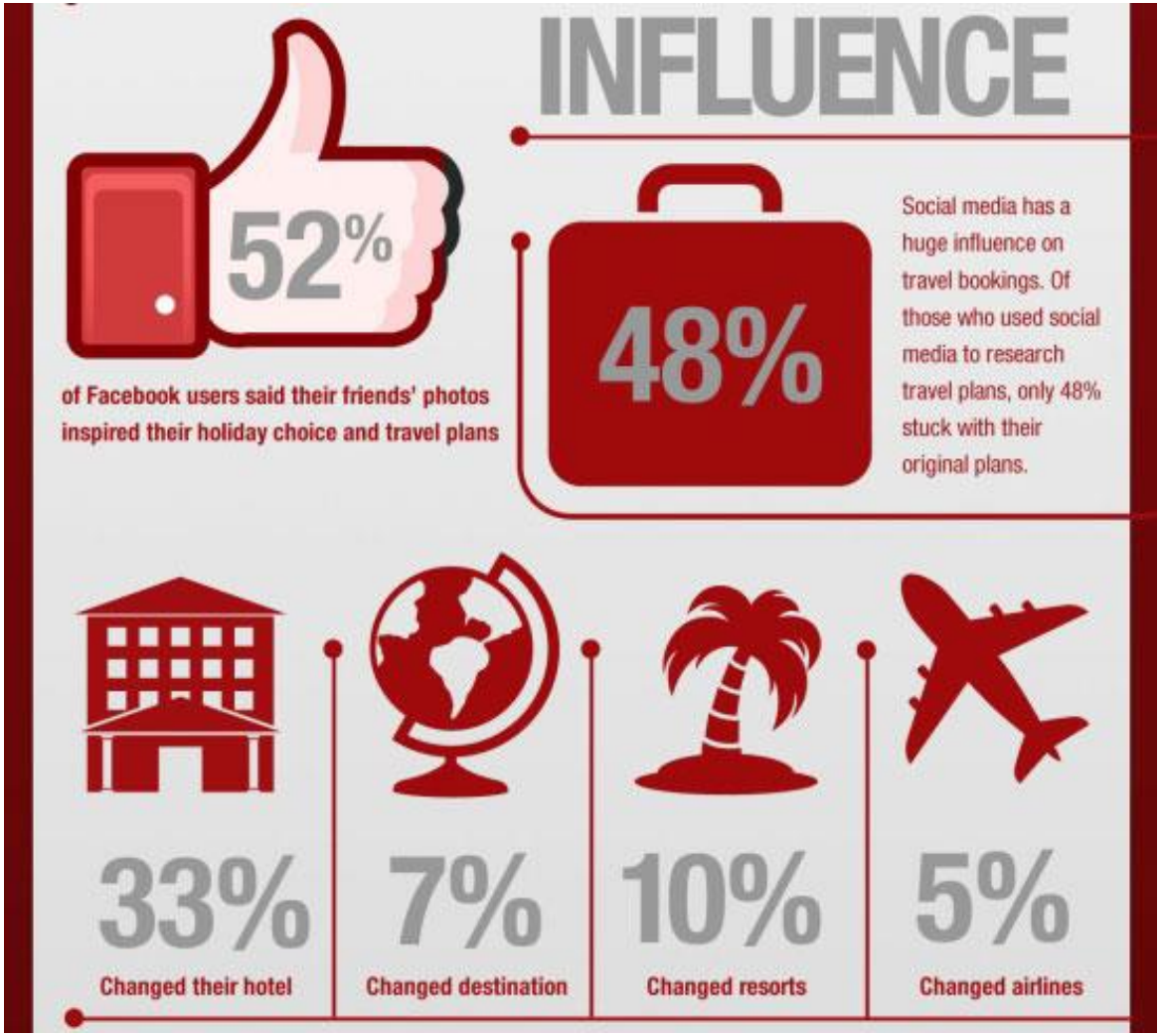
… and generally look at individual people



Reality is more complicated



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Are we modelling the right things?

Transport dominates, but main emphasis on short term choices

Other fields are catching up

Long term choices under-researched

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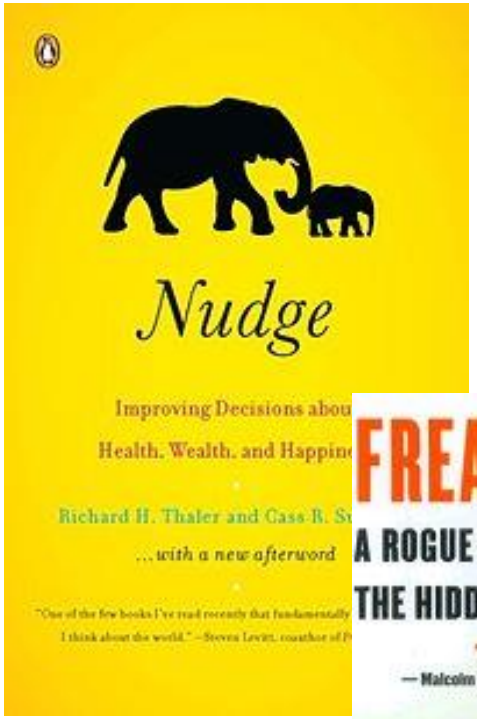
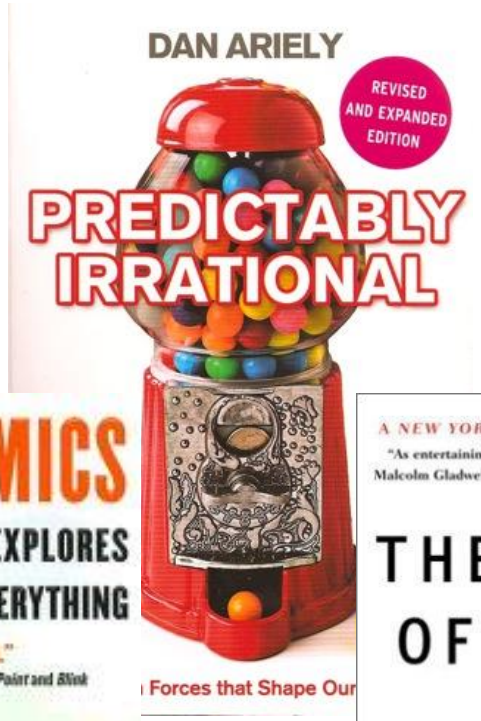
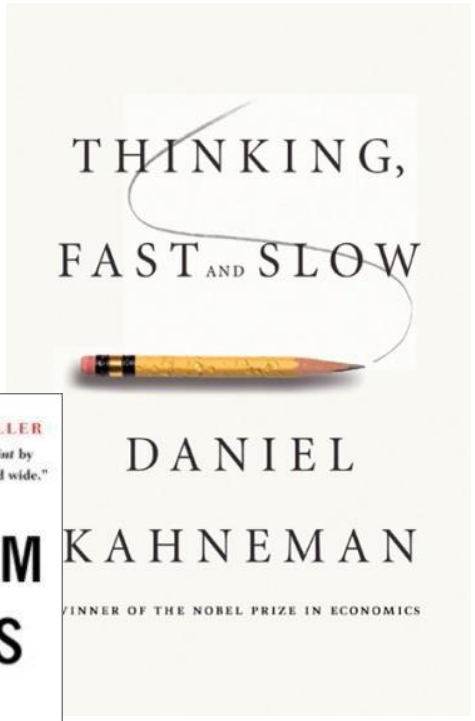
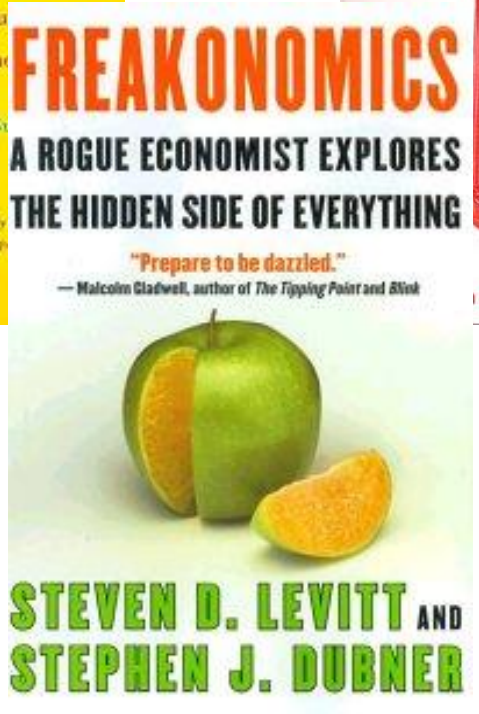
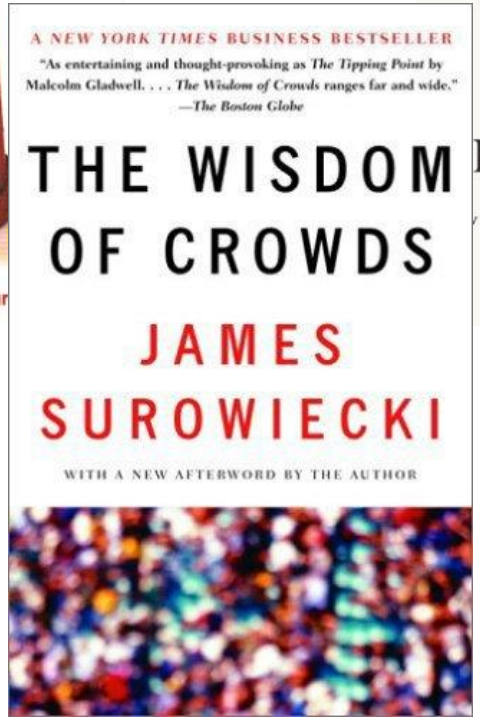
There are other experts on behaviour!











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The BBC's love of Daniel Kahneman

DESERT ISLAND DISCS

Don McLean
American Pie
THE VERY BEST OF DON MCLEAN, EMI

Tino Rossi
Bohémienne aux grands yeux noirs
LAURENT ROSSI PRÉSENTE 40 TITRES D'OR, COLUMBIA

Betty Klein
Shirat Hanoded (The Wanderer's Song)
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Danny Kaye
Ugly Duckling
JUNIOR CHOICE VOLUME 2, EMI

The Beatles
Eleanor Rigby
THE BEATLES 1962-1966, PARLOPHONE

Wolfgang Amadeus Mozart
Clarinet Quintet in A major
Soloist: Gervase De Peyer Orchestra: Amadeus Quartet
MOZART & BRAHMS: CLARINET QUINTETS, DEUTSCHE GRAMMOPHON

Johann Sebastian Bach
French Suite No. 2 In C minor - 2nd movement
Performer: Daniel Kahneman's grandson
PRIVATE TAPE

Daniel Kahneman charms Jeremy Paxman - Newsnight

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Daniel Kahneman - Conjoined Twins

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24 February 2014 Last updated at 02:28

How do we really make decisions?

By Toby Macdonald
Producer, Horizon: How You Really Make Decisions

See all previous episodes from All

> Last on
Mon 17 Mar 2014
21:30
BBC Radio 4
See all previous episodes from Start the Week

Decision-making with Daniel Kahneman and Michael Ignatieff

Tom Sutcliffe discusses how we make decisions with the Nobel prize-winning psychologist Daniel Kahneman. Moral choices in politics can be a complicated business, according to the academic and former politician Michael Ignatieff, who explores whether the age of international intervention is over. Doctors work under the oath 'do no harm', but the neurosurgeon Henry Marsh says the decision whether to operate on a brain is rarely that simple. High emotion can cloud your judgement... > SHOW MORE

Duration: 43 mi

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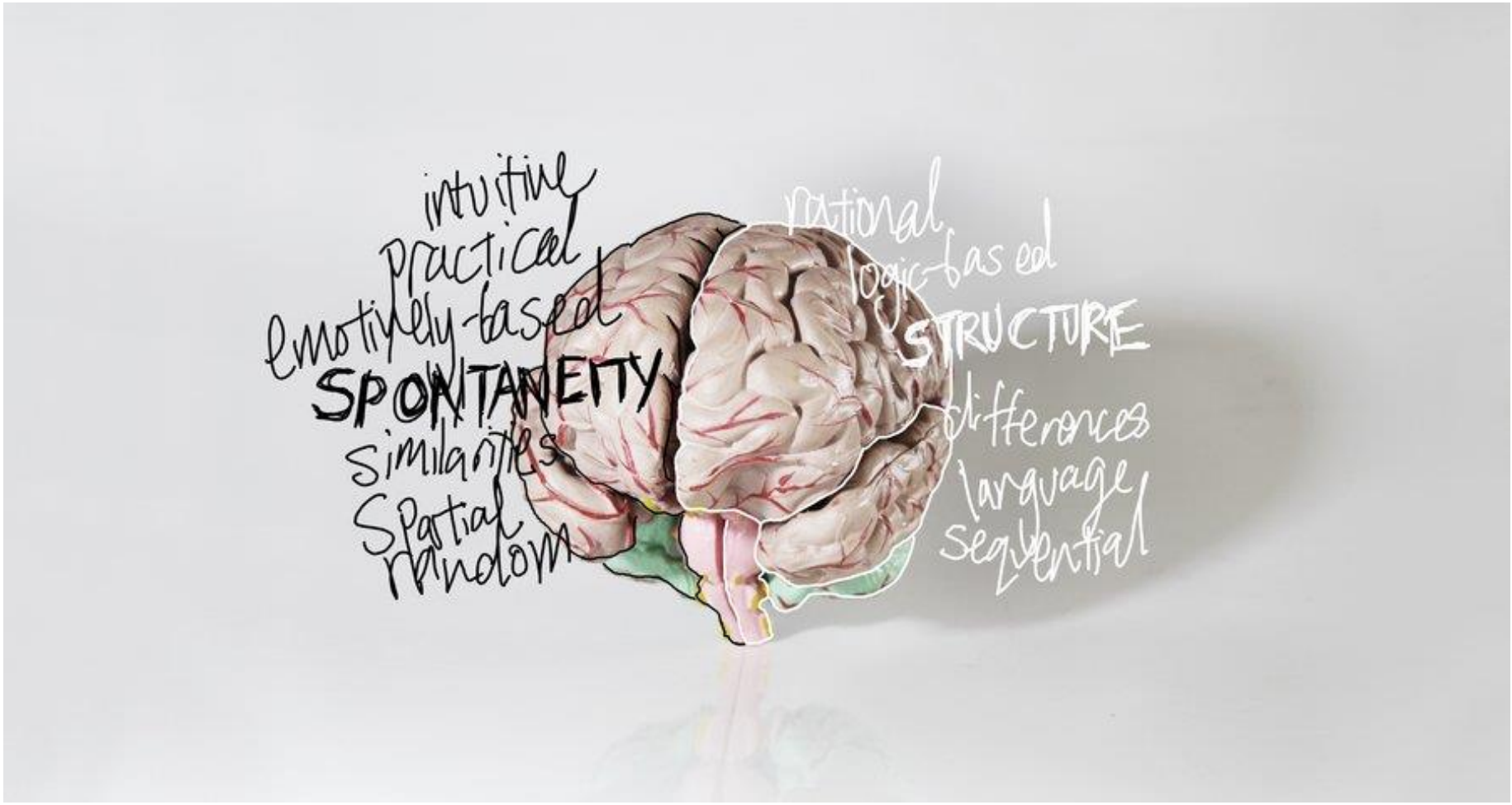
System 1 *vs* system 2 – fast *vs* slow



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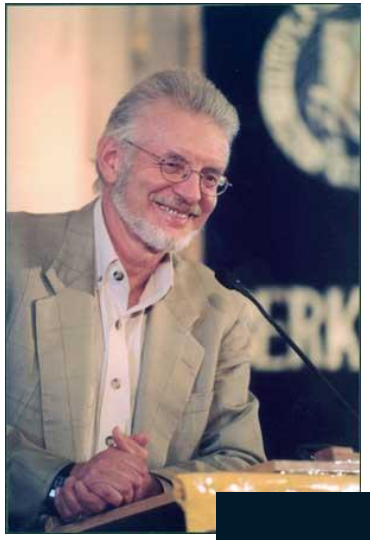
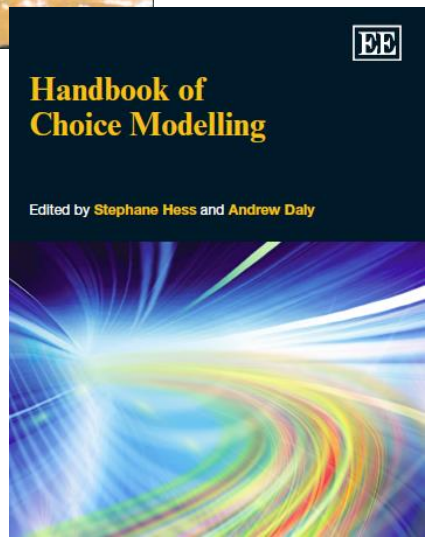
A new dawn?





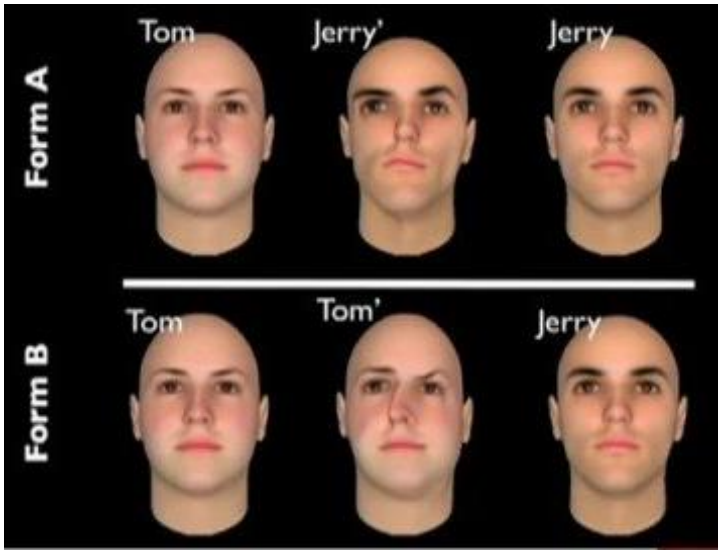
- "… synthesize a new behavioral science of pleasure [extending] into areas of individual sensation of well-being and choice in the context of social network information and approval …"

Do these theories apply in real world behaviour?

Or in hypothetical choices?

Modelling not just for the sake of it

vs.



Alternative A	Alternative B
0.1% chance to win €6,000	0.2% chance to win €3,000
99.9% chance to win nothing	99.8% chance to win nothing

What would you choose?

A ○ B ○

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Zero cost: Ariely chocolate experiments

$0.15 → 73%

$0.14 → 31%

$0.01 → 27%

$0.00 → 69%

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… an example from real life

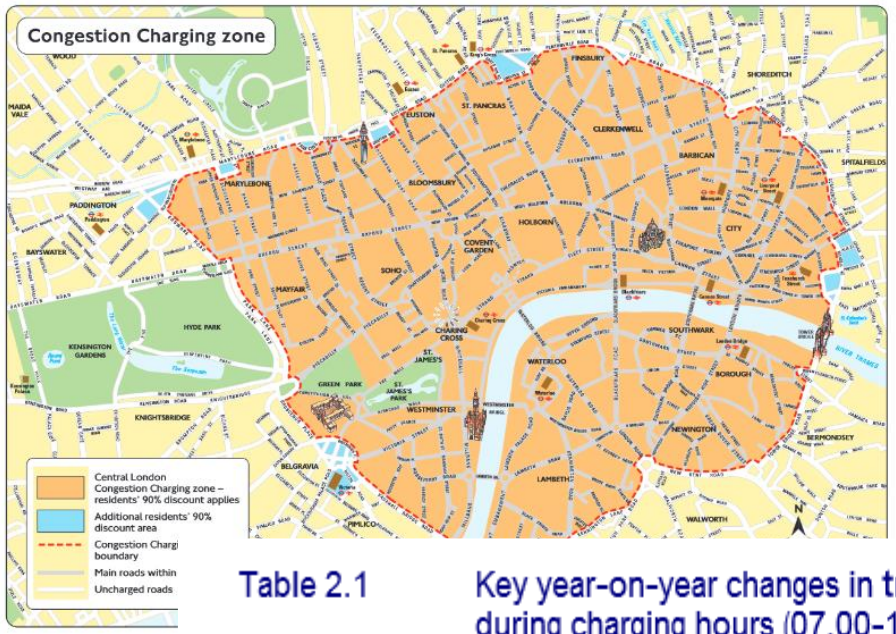

Table 2.1 Key year-on-year changes in traffic entering the central London charging zone during charging hours (07.00-18.30).

£0 to £5

£5 to £8

	Change in inbound traffic				
Vehicle type	2003 vs 2002	2004 vs 2003	2005 vs 2004	2006 vs 2005	2006 vs 2002
All vehicles	-14%	0%	-2%	0%	-16%
Four or more wheels	-18%	0%	-3%	0%	-21%
Potentially chargeable	-27%	-1%	-3%	+1%	-30%
- Cars and minicabs	-33%	-1%	-3%	0%	-36%
- Vans	-11%	-1%	-3%	+2%	-13%
- Lorries and other	-11%	-5%	-4%	+6%	-13%

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… and it happens in SP too

Make your choice given the route features presented in this table, thank you.

	Details of Your Recent Trip	Road A	Road B
Time in free-flow traffic (mins)	50	25	40
Time slowed down by other traffic (mins)	10	12	12
Travel time variability (mins)	+/- 10	+/- 12	+/- 9
Running costs	$ 3.00	$ 4.20	$ 1.50
Toll costs	$ 0.00	$ 4.80	$ 5.60

	Option with lowest toll chosen	Willingness to pay higher toll for reduced slowed down time
No zero toll option	40.6%	AUD 13.2/hr
Zero toll option available	74.7%	AUD 11.9/hr

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Framing & mental accounts

Testing this with SP

Time vs money (5 tasks)

	Option A	Option B
Travel time	58 mins	48 mins
Travel cost	£9.00	£11.00
Your choice	X	

Time vs safety (5 tasks)

	Option A	Option B
Travel time	54 mins	49 mins
Injuries per year	4,000	4,500
Your choice		X

Safety vs money (5 tasks)

	Option A	Option B
Injuries per year	3,500	4,500
Travel cost	£12	£8
Your choice		X

	time vs cost (p/min)	safety vs time (min/ 1000 acc)	safety vs cost (£/ 1000 acc)
estimated	11.07	42.75	3.34
inferred	7.81	30.15	4.73
bias in inferred	-29.47%	-29.47%	41.79%

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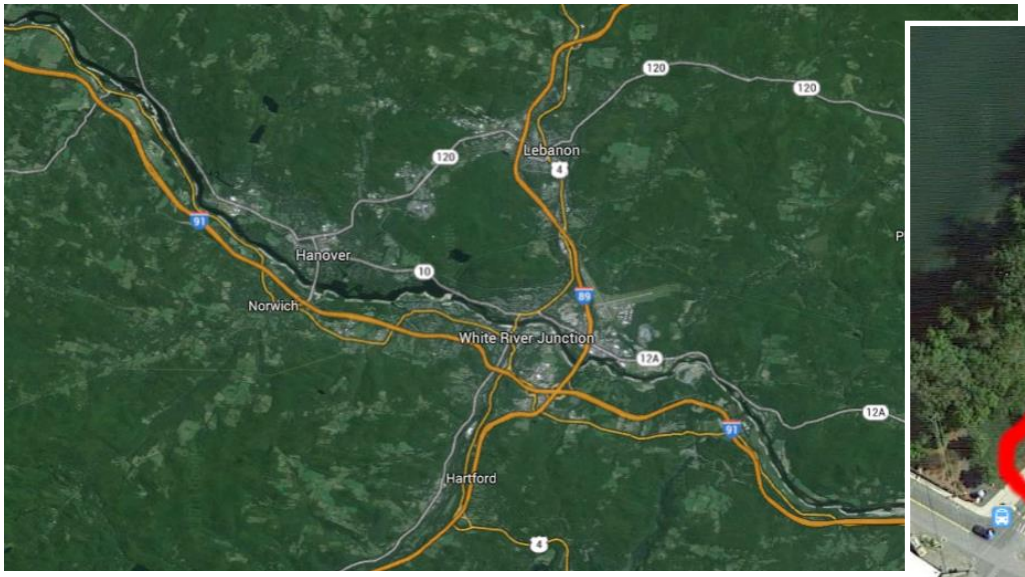
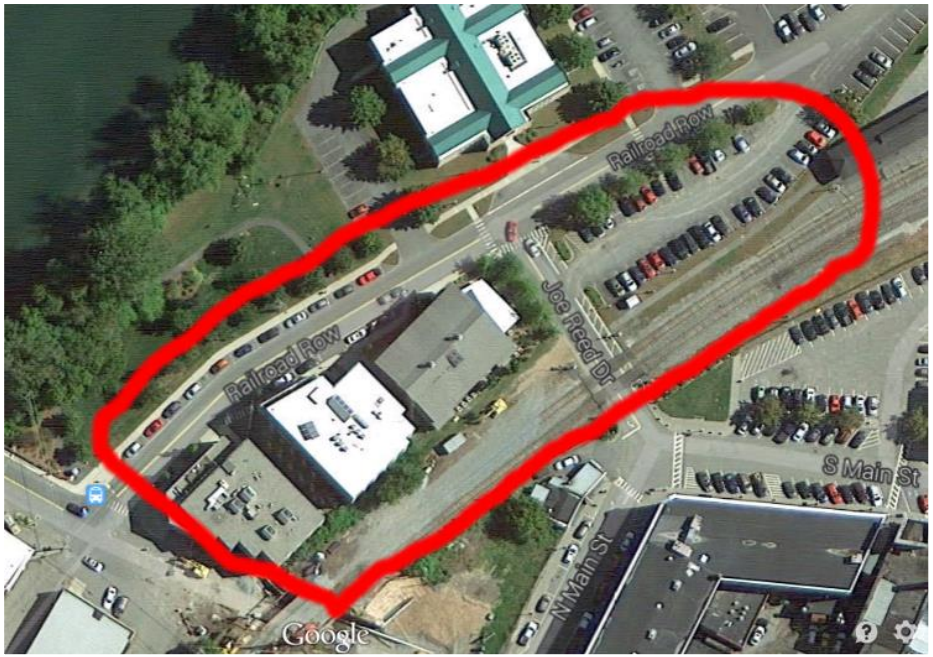
Impact of peers, attitudes, and nudging





	Share of hybrid vehicles
United States	ca 3% (vehicles)
RSG	22% (employees)
RSG (drive to work)	26% (employees)

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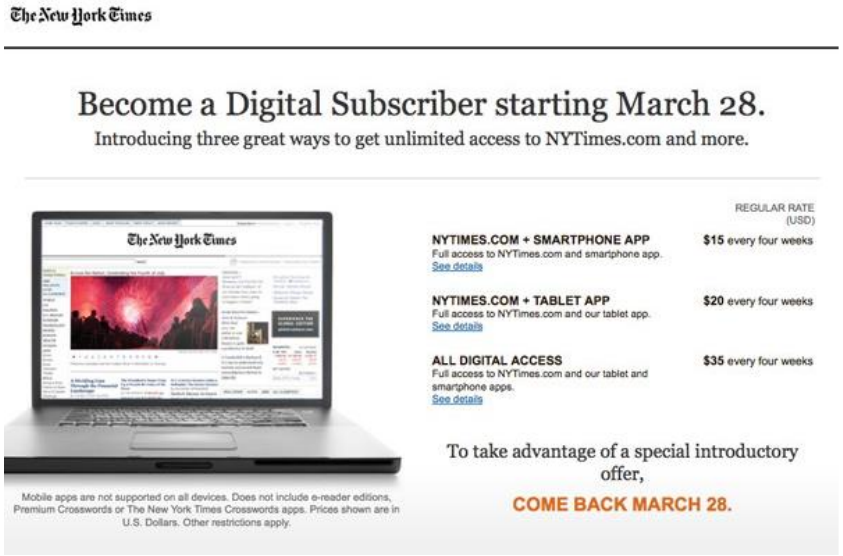
Anchoring: real life cost referencing



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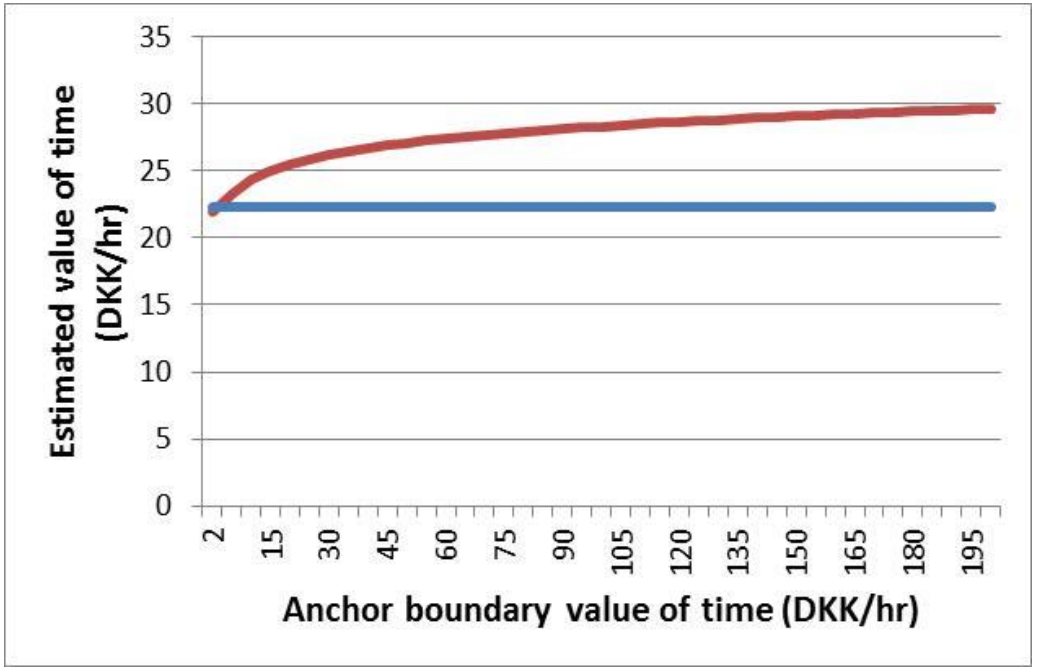
… similar effects in value of time work

Route 1	Route 2
45 minutes	37 minutes
25 DKK	31 DKK
○ Choose route 1	○ Choose route 2

Base model:
22.28DKK/hr

With anchor (at mean):
26.95DKK/hr



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Choice sets can influence the choices

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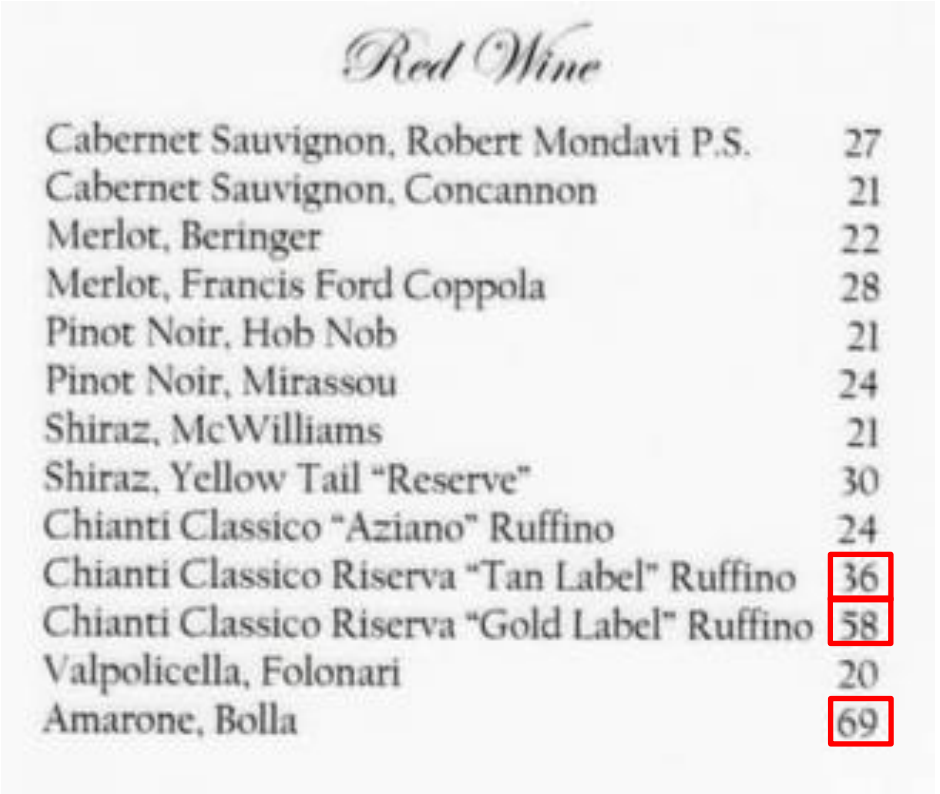

Red Wine

Cabernet Sauvignon, Robert Mondavi P.S.	27
Cabernet Sauvignon, Concannon	21
Merlot, Beringer	22
Merlot, Francis Ford Coppola	28
Pinot Noir, Hob Nob	21
Pinot Noir, Mirassou	24
Shiraz, McWilliams	21
Shiraz, Yellow Tail "Reserve"	30
Chianti Classico "Aziano" Ruffino	24
Chianti Classico Riserva "Tan Label" Ruffino	36
Chianti Classico Riserva "Gold Label" Ruffino	58
Valpolicella, Folonari	20
Amarone, Bolla	69

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… we tend to ignore this in modelling

If the following vehicle options were available to you, which would you choose?
Please carefully examine all the attributes of each vehicle and then select the one you will most likely purchase by filling in the circle below your choice.

Vehicle Choice 1	Vehicle A	Vehicle B	Vehicle C	Vehicle D
Vehicle type	Midsize car	Compact SUV	Midsize car	Compact van
Fuel type	Gasoline	Natural Gas (NGV)	Plug-in Hybrid (PHEV)	Clean Diesel
Age of vehicle	New (2009)	New (2009)	New (2009)	New (2009)
Purchase price	$29,400	$36,600	$31,100	$20,900
Incentive	--	--	$1,000 tax credit	--
MPG or equivalent	29 MPG	15 MPG	60 MPG	31 MPG
Fuel cost per year	$1,090	$1,950	$780	$1,170
Fuel availability		1 in 50 stations		
Refueling time		10 Minutes at station, 4 hours at home		
Driving range		300 Miles		
Maintenance cost per year	$460	$370	$350	$550
Acceleration (0-60 mpg)	10.2 seconds	11 seconds	8 seconds	11.8 seconds
Select One:	○	○	○	○

	WTP
large vs compact, only one fuel type available	$1,638
large vs compact petrol, large hybrid available	$5,963
large vs compact hybrid, large petrol available	$14,731

… predictably irrational?

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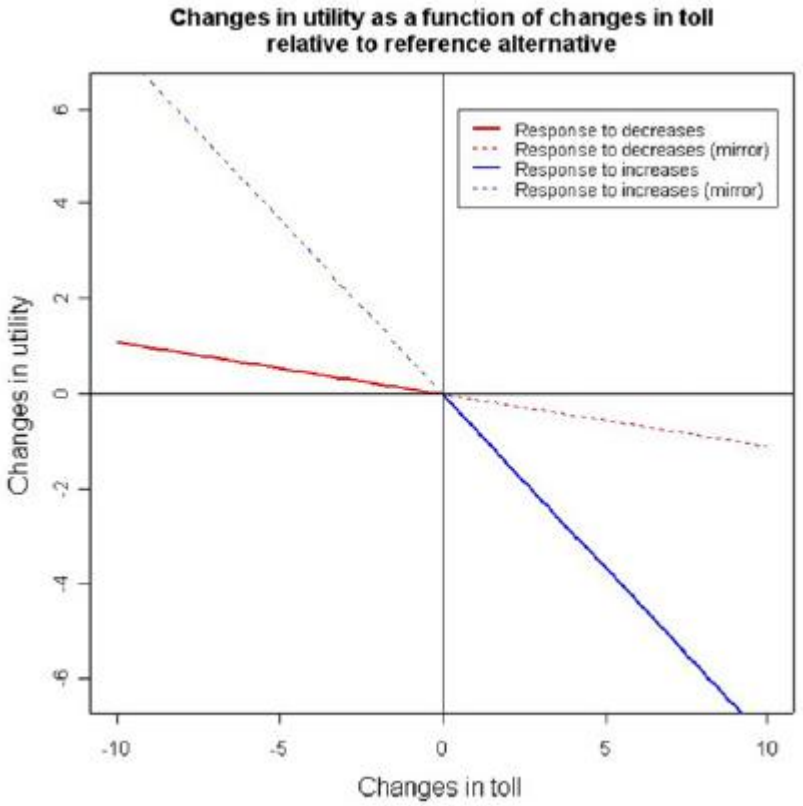
Losses are more painful than gains



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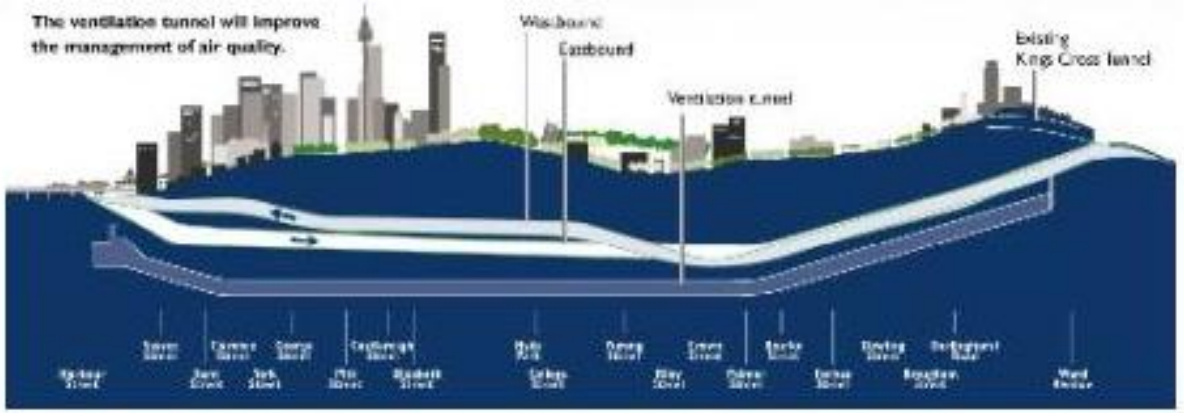
… but reality is complex



Date	Toll	Vehicles per day
August 2005 (opening)	AUD 3.5	20K
October 2005	AUD 3.5	23K
November 2005 (free month)	free	50.5K (+27.5K)
December 2005	AUD 3.5	26.5K (-24K)
March 2006 (half toll)	AUD 1.75	34K (+7.5K)
July 2006	AUD 3.5	30K (-4K)

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Does it matter?

What are the challenges and opportunities?

Does a richer individual representation make much overall difference?

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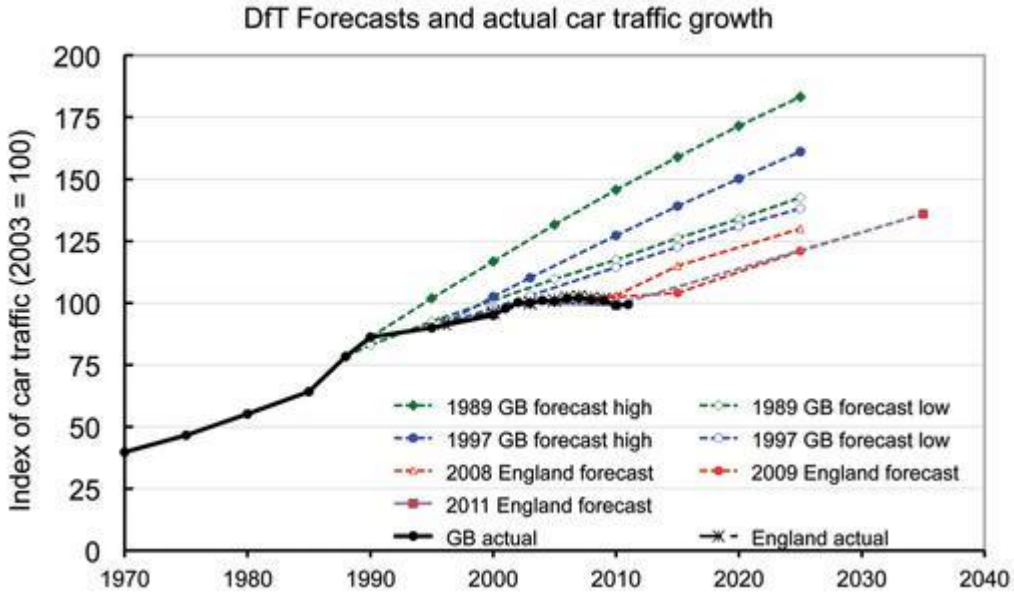
Observation/understanding *vs* prediction



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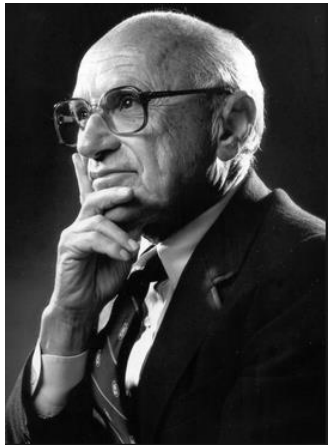
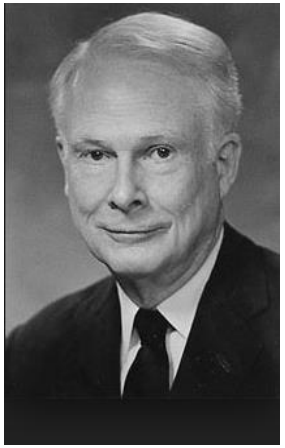
Is SP (or other experimental) data valid?

Thurstone (1930s): hypothetical choices

Wallis and Friedman (1942):

"The responses are valueless because the subject cannot know how he would react."





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Best (& big) data often not accessible to us

switch

NHS choices

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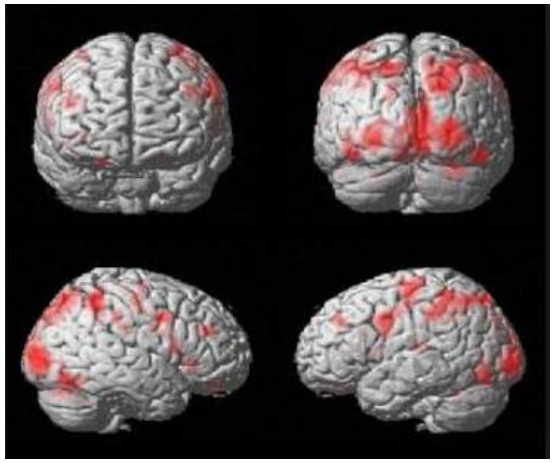
What should we do next?

Lots of exciting things are happening already



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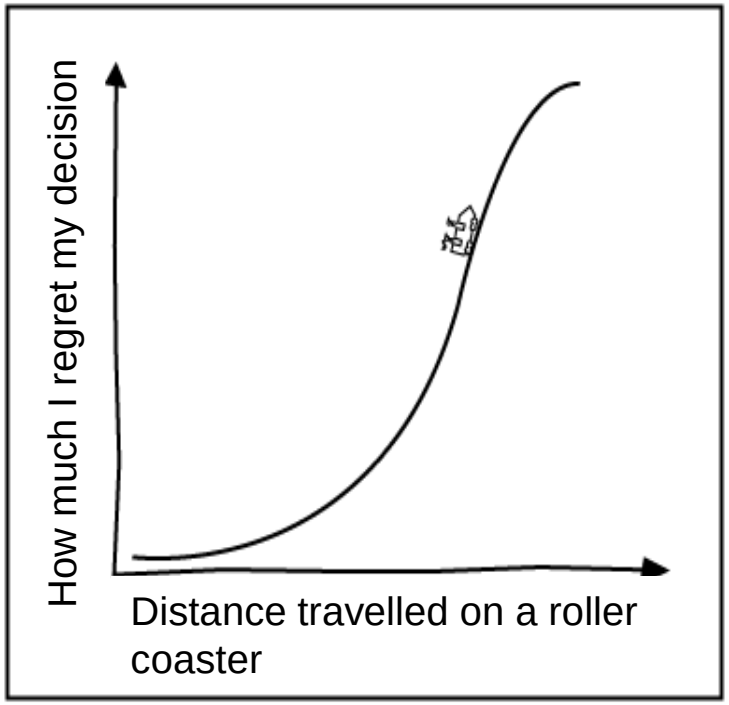
Let's not kill RUM yet!



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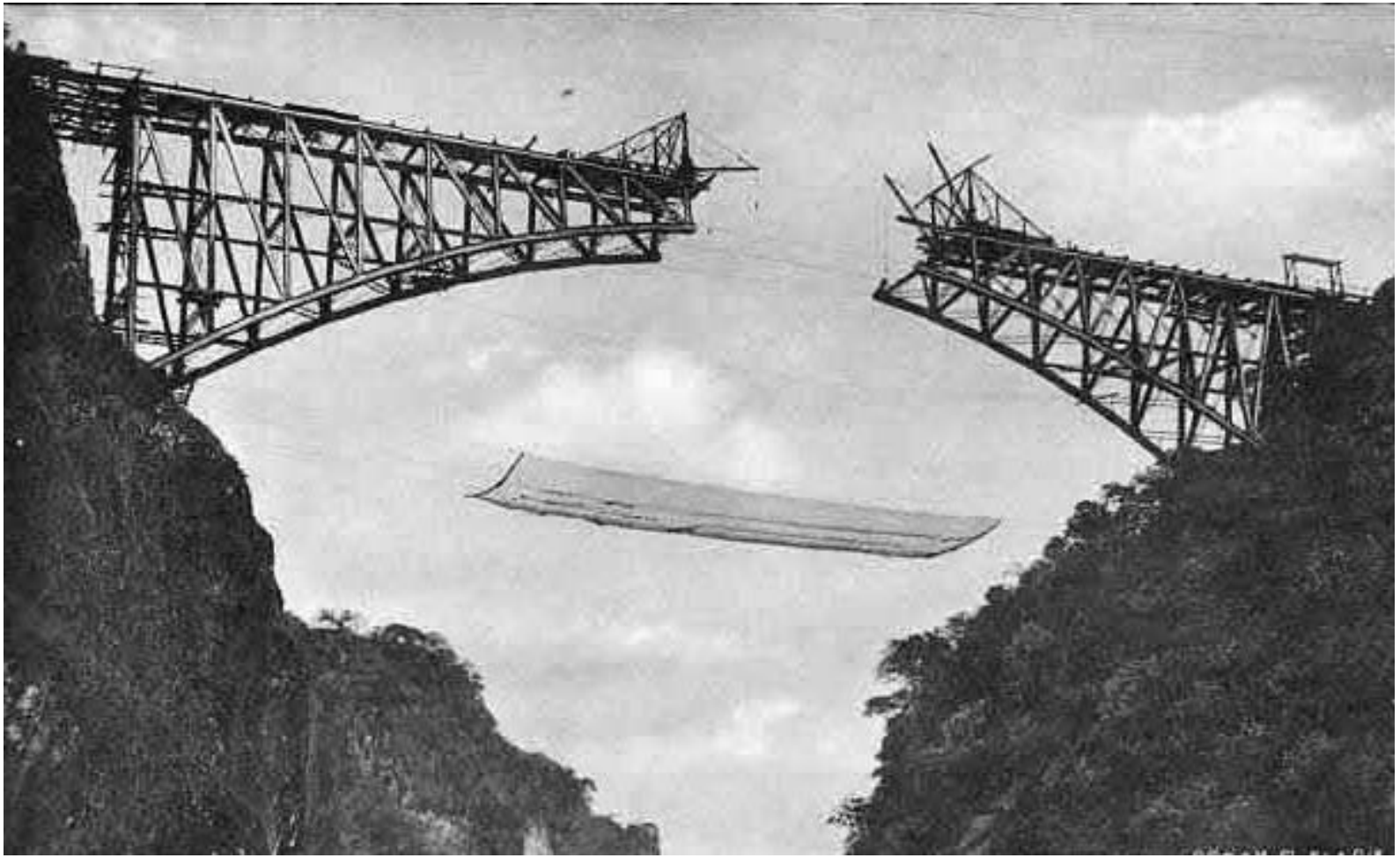
Build bridges



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