

# Herd Behaviour and Keeping up with the Joneses

*FH Gruen Lecture, Australian National University, Canberra, 2012*

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**I would like to understand ‘herd behaviour’ in humans.**







***"Men ... think in herds; they go  
mad in herds, ... they only recover  
their senses slowly, and one by  
one."***

**C. Mackay**

**Extraordinary Popular Delusions  
and the Madness of Crowds, by  
Charles MacKay, published in  
1841.**

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and the Madness of Crowds, by  
Charles MacKay, published in  
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**Far from the Madding Crowd, by  
Thomas Hardy, published in 1874.**

**Herd behaviour is very often  
natural and individually  
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# **Today we'll look at:**

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## Brain scan evidence



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**Statistical evidence**



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## **Brain scan evidence**

## **Statistical evidence**

## **The mathematics of herd behaviour**



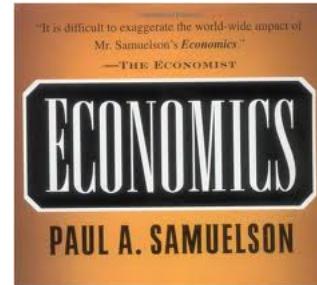
I'll propose a number of other ideas.



#1

**‘Happiness’ data offer us interesting potential as proxy-utility data.**

$$u = u(y, z, \dots)$$



# The distribution of life-satisfaction levels among British people



N = 74,481

#2

**Empirically, there are strong  
relative effects on utility:**

#2

**Empirically, there are strong  
relative effects on utility:**

$$u = u(y, y^*)$$

**eg. if  $y^*$  is others' incomes.**

# #3

**A crucial role in social-science behaviour is played by the second derivative,  $v''$ , of the function**

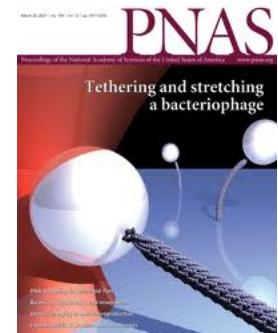
***utility =  $v(relative\ status)$ + ..***

# In humans (I shall argue)

- ***Concavity of  $v(\cdot)$  leads to imitation and herd behaviour***
- ***Convexity of  $v(\cdot)$  leads to deviance.***

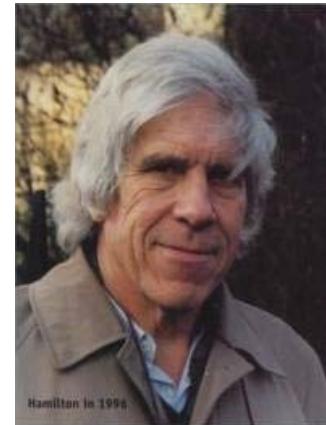
# #4

The next 20 years are likely to see economists work more and more with physiological and hard-science data.



**The classic article on real herd behaviour:**

- Hamilton, W. D. (1971).  
"Geometry for the Selfish Herd". *Journal of Theoretical Biology* 31 (2): 295–311.



***So why does herding happen?***

# ***So why does herding happen?***



**When a T Rex dinosaur comes  
in the room, it is your relative  
position that matters.**

**So suggested:**

**Hamilton, W. D. (1971).**  
**"Geometry for the Selfish Herd".** *Journal of Theoretical Biology* 31 (2): 295–311.

**The standard theory in biology had been that herds had an inexplicable communitarian instinct.**

*Instead, Hamilton argued:*

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**A rational animal clusters  
with the others –**

*Instead, Hamilton argued:*

A rational animal clusters  
with the others – because its  
relative position is what  
matters.



**For biologists and zoologists,  
Hamilton's is now the dominant  
theoretical explanation for herd  
behaviour.**

*By contrast*

*By contrast*

**Most economists who study herd behaviour prefer to view it as ‘informational learning’.**

**Banerjee in the QJE, etc.**



**Yet fashion is ‘pure’ imitation**

# Yet fashion is ‘pure’ imitation



Oranges

**So I reckon we need to think  
about human imitation caused  
by *sheer keeping-up desires*\***

**\*even if heavily subconscious**

**Before getting to equations,  
let's start with everyday  
empirical evidence.**

***Consider your wrist.***



# 5 euros





# 500000 euros



# 5 euros



# 500000 euros



**“A watch defines a man's look  
and tone.”    Rolex advert.**

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and tone.”    Rolex advert.**



**Subconsciously, humans seem frightened of falling behind.**



- So let us hypothesise that human beings care about their relative position.

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**Duesenberry, Easterlin, Frank, Hirsch, Layard, Runciman, Veblen, ...**

# There are now results

- From fMRI scans



- From statistical work on well-being

## **This includes new empirical work:**

**Armin Falk and colleagues on relative-income images in the brain (Science, Journal of Public Economics)**

**Peter Kuhn and colleagues on car purchasing by neighbours of lottery winners (AER forthcoming)**

**Ori Heffetz on visible goods (REStats forthcoming).**

**David Card, Alexandre Mas, Enrico Moretti, Emmanuel Saez on peers and satisfaction.**

**Two papers I would greatly  
recommend.**

- Title: Social comparison affects reward-related brain activity in the human ventral striatum

Author(s): Fliessbach K, Weber B, Trautner P, et al.

Source: SCIENCE Volume: 318 Issue: 5854  
Pages: 1305-1308 Published: NOV 23 2007

- Title: Relative versus absolute income, joy of winning, and gender: Brain imaging evidence

Author(s): Dohmen T, Falk A, Fliessbach K, et al.

Source: JOURNAL OF PUBLIC ECONOMICS

Volume: 95 Issue: 3-4 Special Issue: Sp. Iss.

SI Pages: 279-285 Published: APR 2011

**We are now able to look  
inside the brain.**

# Armin Falk et al



# **Armin Falk et al**

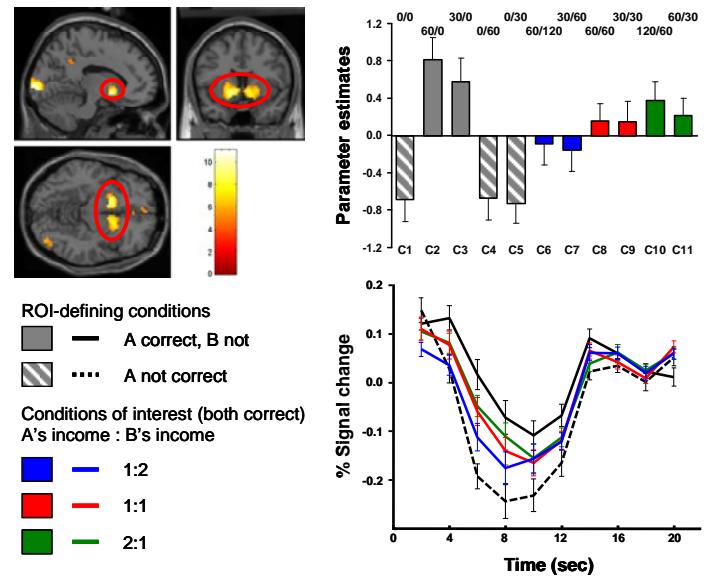
**While being scanned in adjacent MRI scanners, pairs of subjects had to perform a task with monetary rewards for correct answers.**



**Variation in the comparison  
subject's payment affected blood  
oxygenation level-dependent  
(BOLD) responses in the ventral  
striatum.**

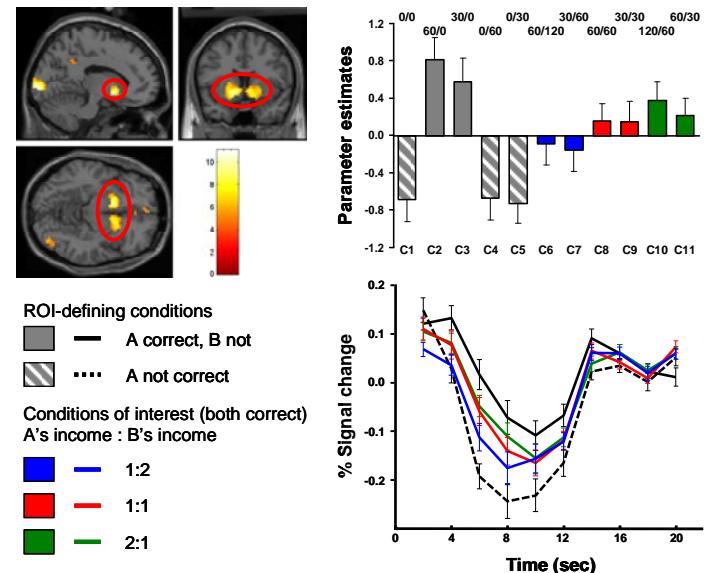
**Variation in the comparison subject's payment affected blood oxygenation level-dependent (BOLD) responses in the ventral striatum. This brain region is engaged in the registration of primary rewards.**

# Falk et al in Science and JPubEcon



# Falk et al in Science and JPubEcon

- “The mere fact of outperforming the other subject positively affected reward-related brain areas.”



**The next slide -- very briefly --  
is for specialists.**

# Blood-oxygenation equations

Table: Activation and Income

Dependent variable: ventral striatum activation

	(1) all conditions	(2) conditions 2-11	(3) conditions 6-11
Own Income (in 100 Euro)	0.916*** [0.109]	0.868*** [0.102]	0.327*** [0.091]
Other's income (in 100 Euro)	-0.666*** [0.087]	-0.714*** [0.086]	-0.353*** [0.090]
Constant	-0.119 [0.144]	-0.061 [0.145]	0.068 [0.167]
Observations	704	640	384
R-squared	0.059	0.063	0.011

OLS estimates; clustering on individuals, robust standard errors in brackets; \*\*\*  
p<0.01, \*\* p<0.05, \* p<0.1

- (similar with fixed effects, main variation across Ss)

# So, inside your brain

# **So, inside your brain**

**You simply want to be high up  
the monkey pack**



**Here is a different kind of data  
and evidence.**

*It has been found that*

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**Relative-income variables show up consistently in well-being equations.**

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**E. Luttmer, Quarterly Journal of Economics 2005**

**A. E.Clark et al, JPubEcon 1996, JELit 2008**

**GDA Brown et al, Industrial Relations 2008 and Psychological Science 2010**

**D. Card et al, NBER paper, 2011.**

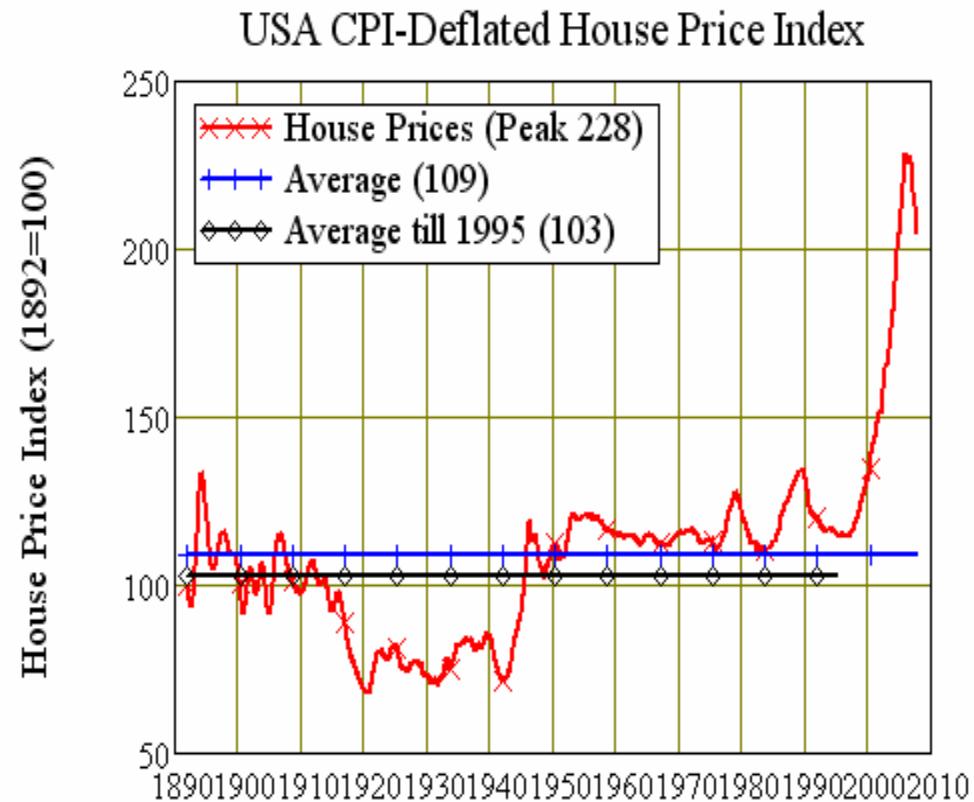
**A person's happiness and  
mental health = f(their relative  
income).**

**Andrew E Clark**



**Why would we care about these things?**

# Real house prices in the United States over the century



# The dotcom bubble: 2000-1

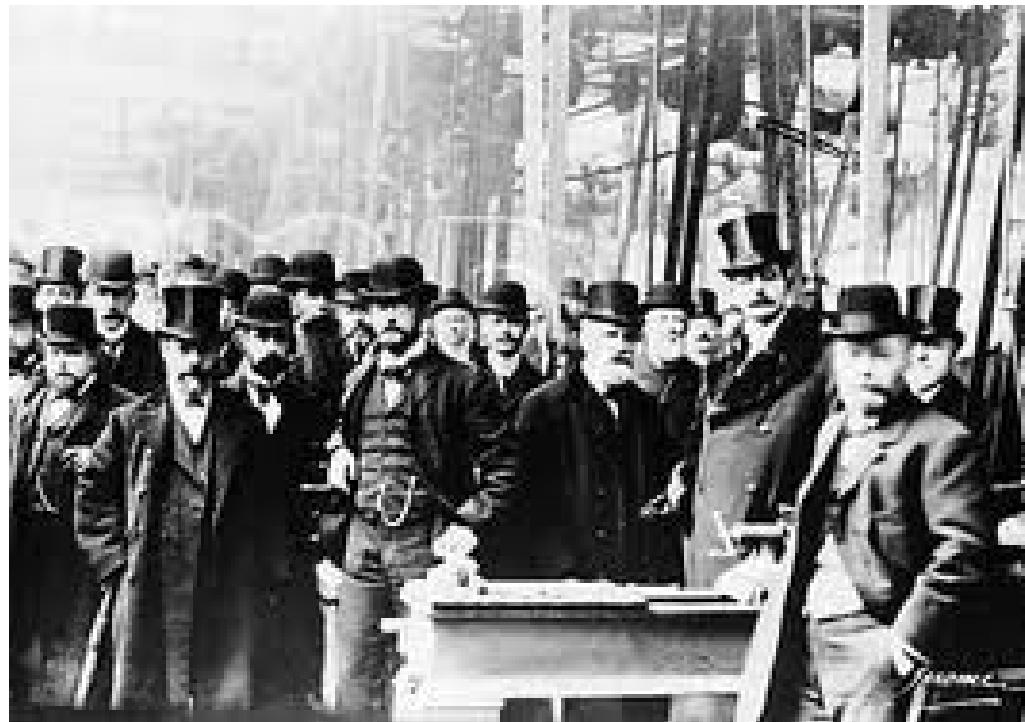


**But potentially this issue goes far beyond economics.**

# The hair ‘bubble’



# Hat mania



# Peers and health choices



# Perhaps even 2011 in the UK

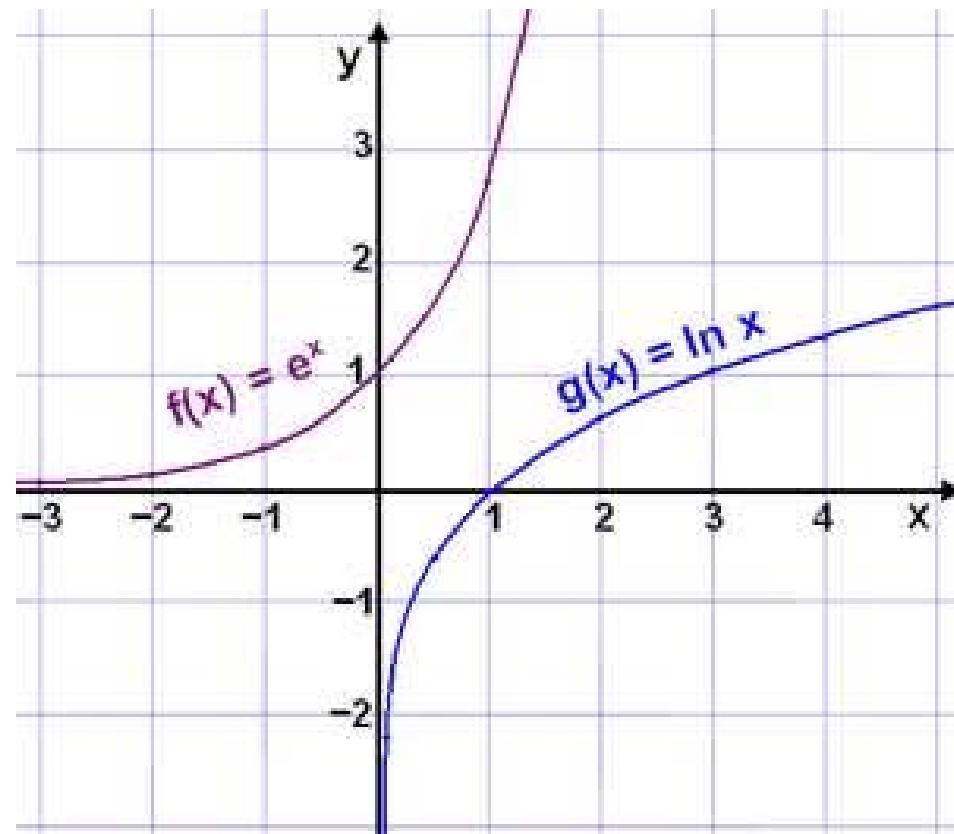


# Social norms in other ways



**Now let's think of the likely mathematics.**

**Much in the next few slides will rest on whether the happiness from status is accelerating or decelerating.**



**Which of them is true of you,  
do you think?**

**Does your happiness from  
status accelerate as you go up  
in status?**

**Does your happiness from  
status accelerate as you go up  
in status? [convex]**

**Does your happiness from status accelerate as you go up in status? [convex]**

**Or do you get diminishing marginal returns?**

**Does your happiness from status accelerate as you go up in status? [convex]**

**Or do you get diminishing marginal returns? [concave]**

**Imagine a person is choosing an action  $a$  to get the greatest utility:**

**where  $a^*$  is what everyone else is doing.**

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**Maximize  $u(a) + v(a - a^*) - c(a)$**

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- $u(a)$  is the direct bit of utility

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- $v(a - a^*)$  is the indirect bit of utility

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*(if my car can go fast then  
subconsciously I feel superior to  
others as I drive to Oxford)*



# **Putting these together**

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**Maximize  $u(a) + v(a - a^*) - c(a)$**

**$a^*$  is what other people are doing**  
 **$a$  is my action**

- Let's think back to watches.  
What is your rational choice of action, a?



**Do I buy a better watch when  
you do?**

**Do I buy a better watch when  
you do?**

**Well the sign of**

**da/da\***

**is given by the sign of the second  
derivative of  $v(a-a^*)$ .**

- ***Concavity of  $v(\cdot)$  leads to emulation***
- ***Convexity of  $v(\cdot)$  leads to the opposite.***

Joint work with Andrew Clark

**This matters because, for example, we need to have an explanation for the simultaneous occurrence of obesity and anorexia.**



# When might $v(\cdot)$ be convex?

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**The utility increment going from 3<sup>rd</sup> in the world to 2<sup>nd</sup> in the world is going to be much bigger than going from 8<sup>th</sup> to 7<sup>th</sup>.**

- So maybe  $v(a - a^*)$  goes convex at the extreme end of a status distribution.

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- This parameter  $v''(a - a^*)$  is one of the most fundamental in all of social science.
- Yet we have little idea of its size or even often what sign it takes.

# **So what?**

**Why might it matter to social  
scientists if utility depends on  
relative things?**



**A second possibility: excessive herding.**

**The importance of relative things to well-being may provide an important clue about what has driven the Credit Crunch.**

# **When rewards depend on your relative position**

**it will routinely be**

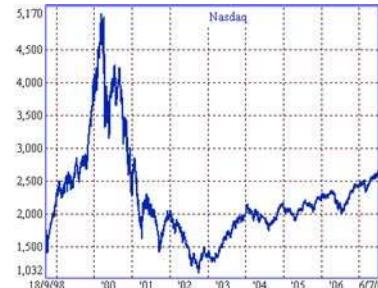
- (i) dangerous to question whether the whole group's activity is flawed**
- (ii) rational simply to compete hard within the rules that govern success.**

# When rewards depend on your relative position

it will routinely be

- (i) dangerous to question whether the whole group's activity is flawed
- (ii) rational simply to compete hard within the rules that govern success.

**Correct dotcom analysts were fired.**



In financial markets, people are now routinely rewarded in a way that depends on their relative performance. Top quartile, second quartile, etc.

# That's dangerous:



*To conclude*

# The main ideas

1. Imitation is central to human life.
2. It is often driven by relative feelings; this links it to biology and real herds.
3. The crucial parameter is  $v''(a - a^*)$ .
4. We need to understand herd behaviour better in social science.
5. The madness of crowds will be back.

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