

## A complex, colorful diagram of a brain filled with various mechanical and electronic components, representing a 'cognitive map' or a 'map of the mind'. The brain's outline is filled with a blue, marbled texture. Inside, a dense network of white lines and various icons (like gears, wires, and electronic components) are scattered across the surface, suggesting a highly organized and interconnected system. The components include gears, wires, and electronic components, all interconnected in a complex network. The overall image conveys a sense of intricate, interconnected thought processes.

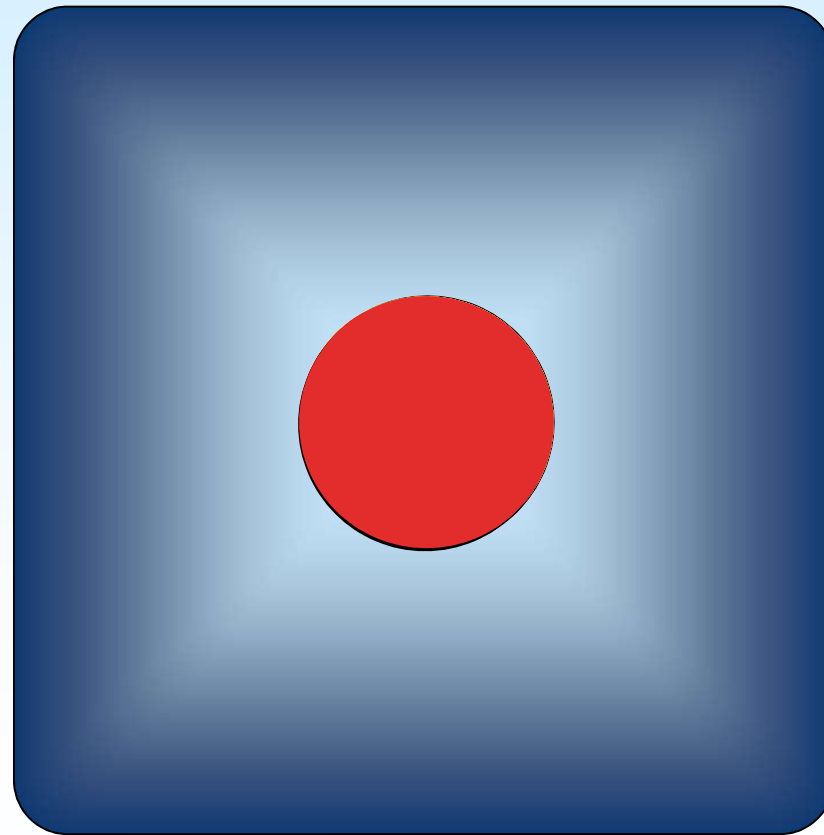
**Basel, 28.4.2017**

[www. neuroeconomics-bonn.org](http://www.neuroeconomics-bonn.org)

# Strategies of an Adaptive Brain

Guess:

*red* or *yellow*



# Strategy or Adaptation

plays game well

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- rats
  - goldfish
  - patients (left hem. deficits)
- genuine strategies**

does not play game well

---

- patients (right hem. deficits)
- healthy people

**adaptation (accountant)**

**strategy (visionary)**

## 2 Monkeys

**Capuchins  
reject  
unequal  
pay**

**w/ Dr. Sarah Brosnan**



## 2 Monkeys



# Fascination Brain

## Weight

- at birth: **400 g**
- at 2 years of age: **1000 g**
- adulthood: **1500 g**

## Number of neurons:

**100 billion**

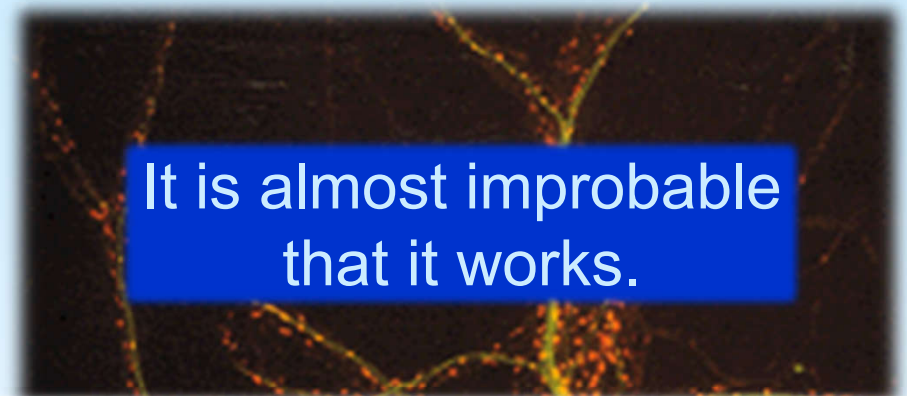
## Contact points of each neuron:

up to **15,000**

## Total number of synapses:

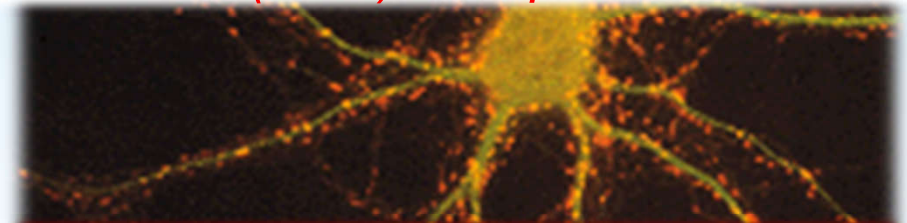
up to 100 trillion =

**100,000,000,000,000**



It is almost improbable  
that it works.

*For this, 50% of the genetic information  
(DNA) is required.*



***Permanent*** - newly formed  
and restructured synapses,  
receptors and ion channels

***Protein turnover : ca. 7 days***

w6

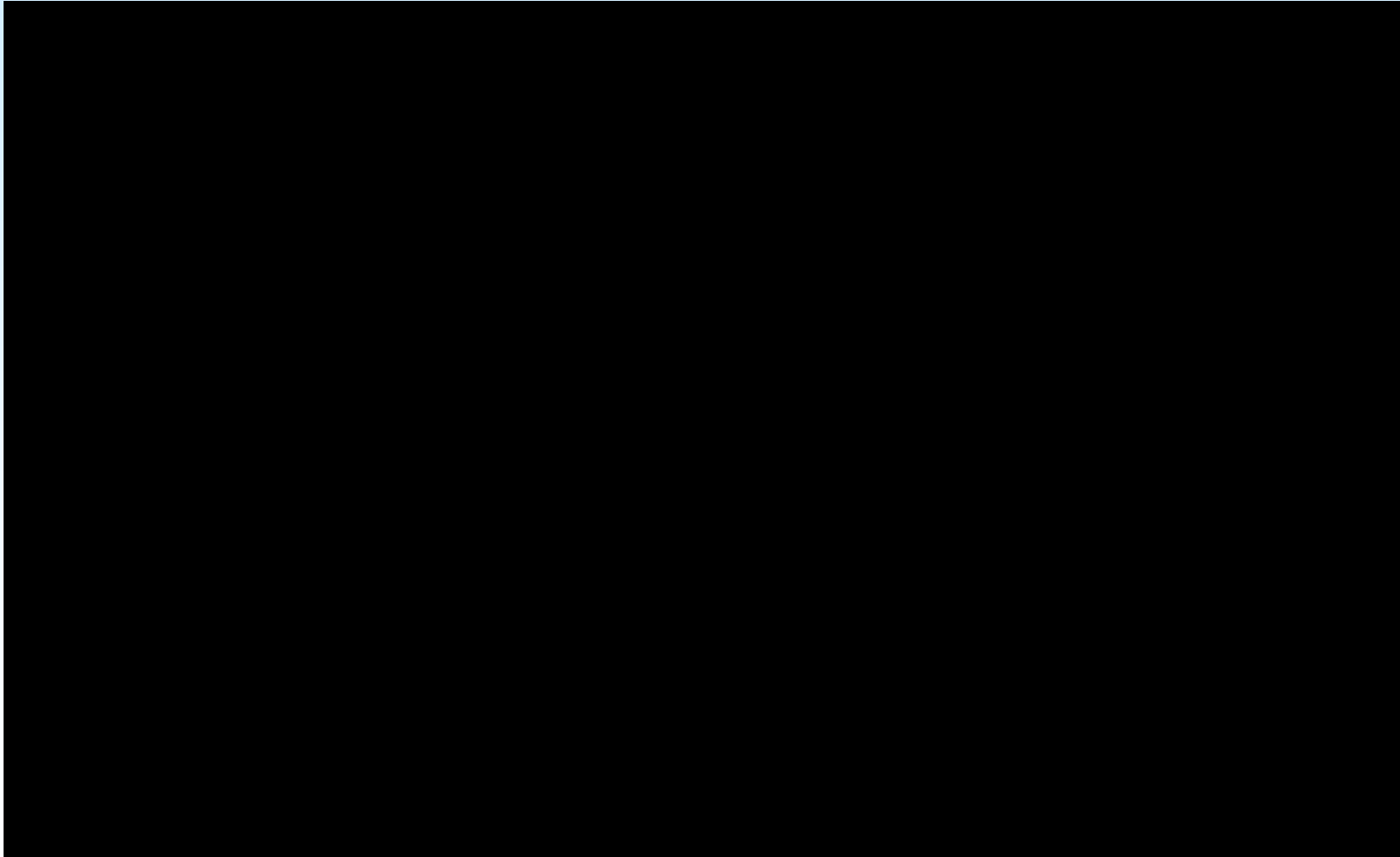
w6

?? Is this correct?

wörmann; 20.04.2017

# The Evolution of the Human Brain

## - Brain Development and Demands-<sup>w5</sup>



S.Kubrick, 1968, *2001 – A Space Odyssey*

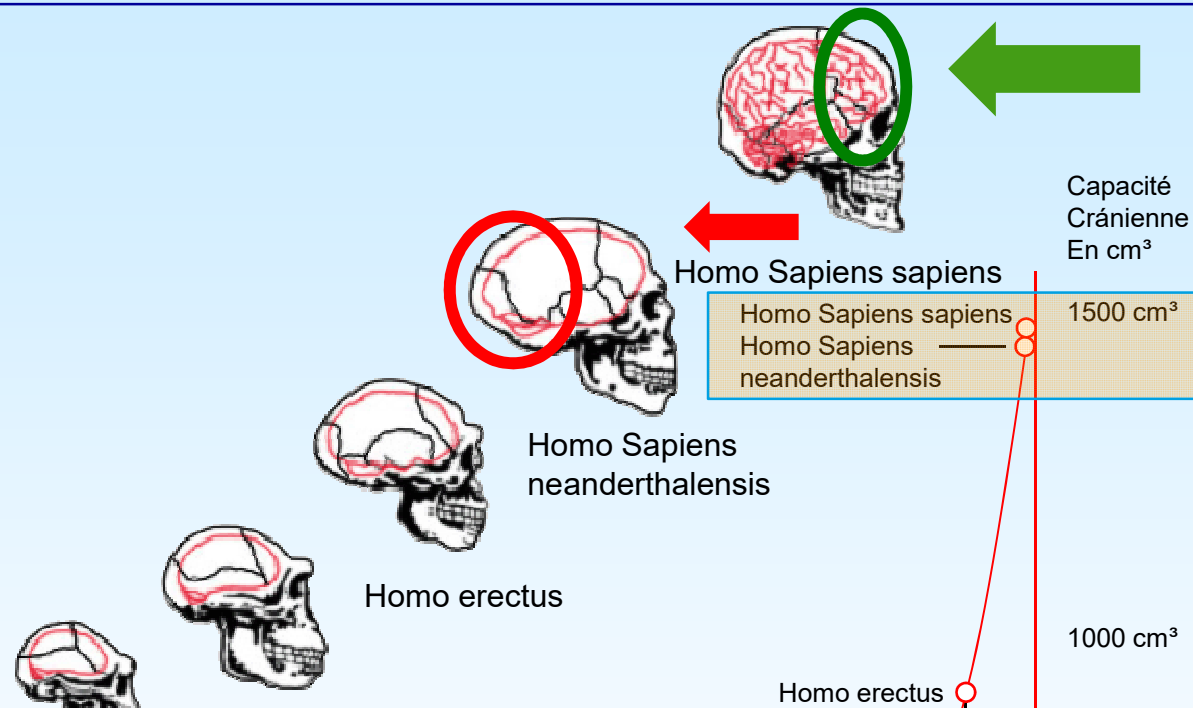


w5

not sure what this means in this context

wörmann; 19.04.2017

# The Evolution of the Human Brain- Brain Size



The growth of the human brain  
is unique in evolution!

There really isn't any reason for it to stop growing!

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 -0  
Millions d'années

# The Evolution of the Human Brain- Brain Size

forethought  
strategy,  
empathy,  
***individualization***  
etc.



.... but there are very archaic principles for making decisions

- ***Reactions become more complex.***
- ***The level of suggestibility appears lower.***

# The Evolution of the Human Brain

## - Brain Development and Performance-

In humans, there is a pressure to adjust what we do to brain development.

Brain development leads to higher performance.  
*“Brain size matters” → higher IQ*

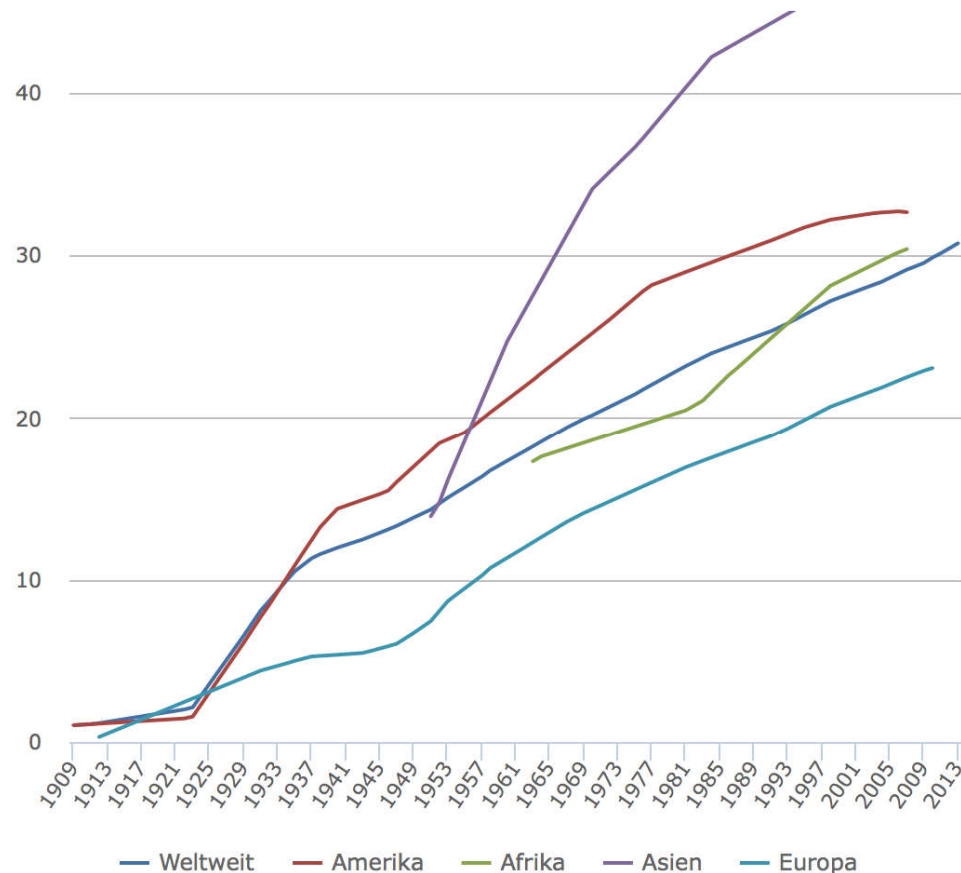
Changes in climate are thought to be most important.  
Challenge is positive for the brain.

***Cave: degeneration with reduced usage***

# Brain Development

## Gesamt-IQ

IQ-Änderung



Quelle: Universität Wien

Flynn-Effect – increase in IQ over time

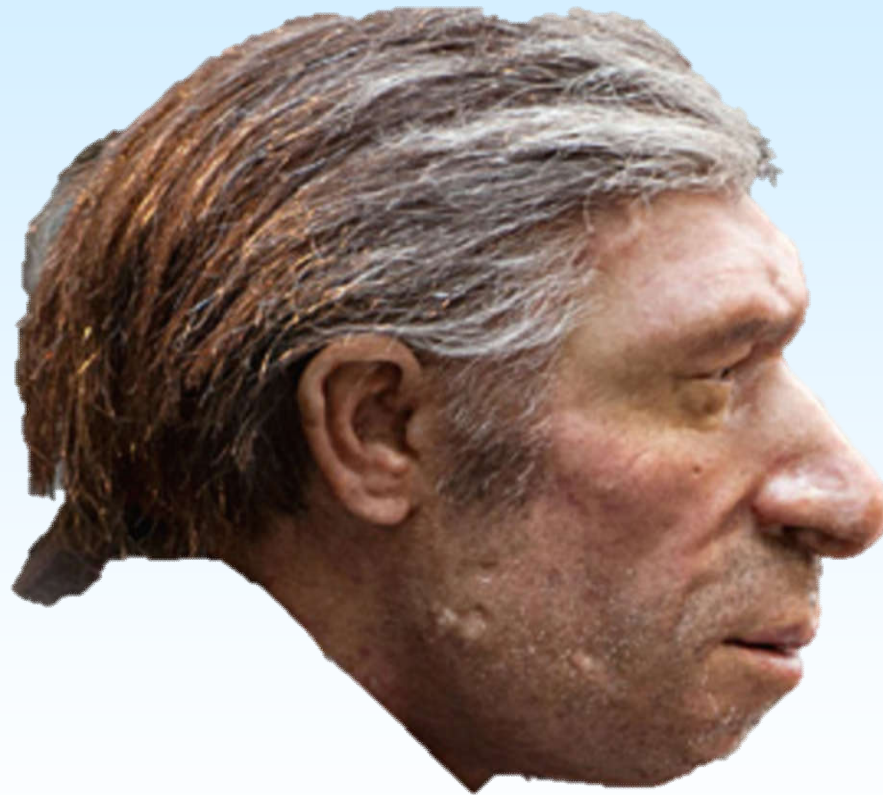


ca. 0.3 IQ/year

*Peitschnik and Voracek, 2015*

# Neuroeconomics

- Archaic -



# Dice Experiment, Honesty und Testosterone

## Imagine:

A group of men and women cast dice.

The result of the dice is visible to the individual, but not to the others.

Each person records his/her result in a list (women and men are separated).

*Which group had the higher number of points?*

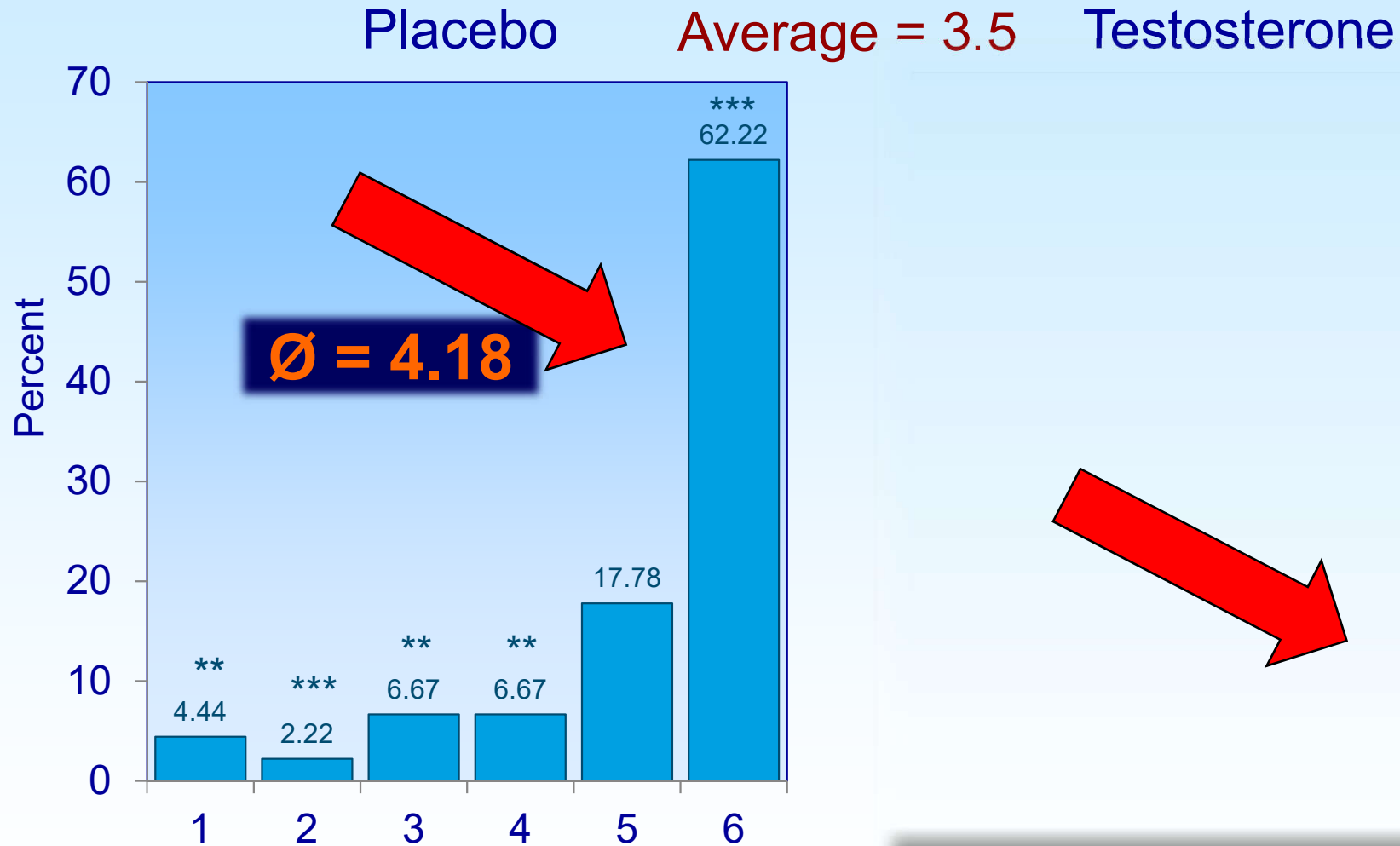
the  
women



the  
men

*fear of social decline*

# Testosterone Effect



\*\*\* indicate p-values from one-sided binomial tests that the observed frequency is smaller (larger) than 16.7%



# Honesty and Social Position



w7

This is called A Few Good Men, in English.

wörmann; 20.04.2017

# Men and Women



Chevaux de la grotte Chauvet (31 000 BP)  
Lieu de la découverte : Grotte Chauvet, Ardèche,  
France  
Date : 31 000 BP (Aurignacien)

Reproductive advantage for  
men:

***“Alpha Male”+++***

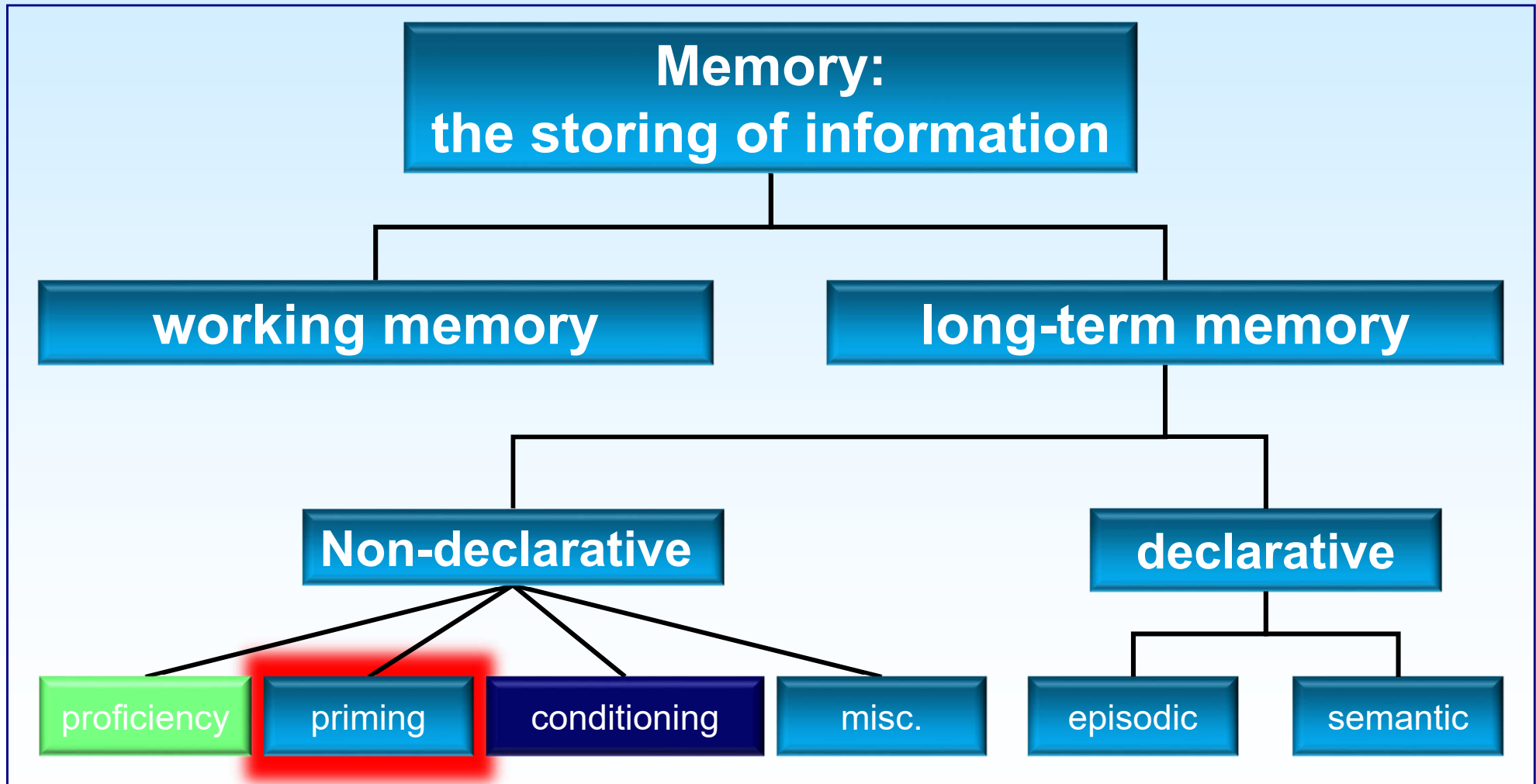
Reproductive advantage for  
women:

***“Alpha Female” ?  
Certainty in providing  
offspring +/- ?***

***Any other woman+ - ++***

# From Experience to Memory

## - Memory Formation in Humans -



# The Subliminal Techniques

## - Priming -

A pre-fixed, unconsciously <sup>w1</sup> perceived stimulus leads to “implicit memory formation” and can decidedly influence a subsequent action.

A completely underestimated effect in interpersonal interactions.

interpersonal interactions

w1

??

wörmann; 19.04.2017



# The Subliminal Techniques

## - Priming the “Study”



Berlin Neue Reichskanzlei, Das Arbeitszimmer des Führers

# Priming and Money

## Money and Self-disclosure

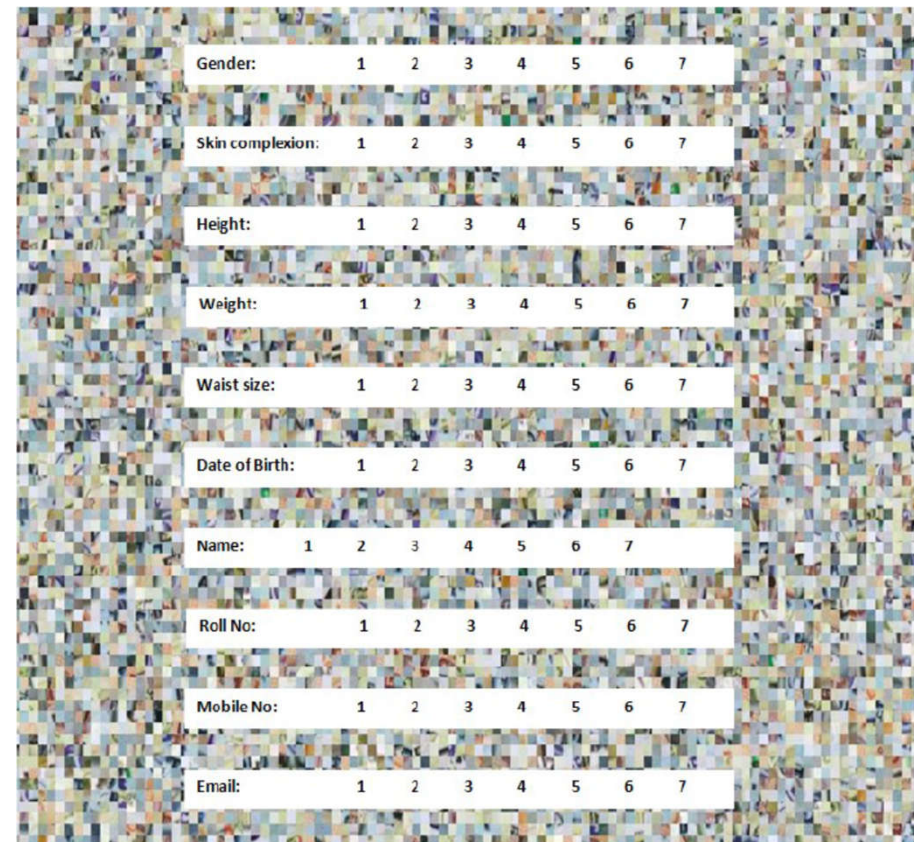
### Questionnaire with prime “money”



A questionnaire form overlaid on a background of Indian 500 and 100 rupee banknotes. The form contains ten rows, each with a label and a set of seven numbered boxes (1-7) for response.

Gender:	1	2	3	4	5	6	7
Skin complexion:	1	2	3	4	5	6	7
Height:	1	2	3	4	5	6	7
Weight:	1	2	3	4	5	6	7
Waist size:	1	2	3	4	5	6	7
Date of Birth:	1	2	3	4	5	6	7
Name:	1	2	3	4	5	6	7
Roll No:	1	2	3	4	5	6	7
Mobile No:	1	2	3	4	5	6	7
Email:	1	2	3	4	5	6	7

### Questionnaire without prime



A questionnaire form overlaid on a background of a dense, colorful, pixelated pattern. The form contains ten rows, each with a label and a set of seven numbered boxes (1-7) for response.

Gender:	1	2	3	4	5	6	7
Skin complexion:	1	2	3	4	5	6	7
Height:	1	2	3	4	5	6	7
Weight:	1	2	3	4	5	6	7
Waist size:	1	2	3	4	5	6	7
Date of Birth:	1	2	3	4	5	6	7
Name:	1	2	3	4	5	6	7
Roll No:	1	2	3	4	5	6	7
Mobile No:	1	2	3	4	5	6	7
Email:	1	2	3	4	5	6	7



# When are bankers honest – and when not?

Cohn, Fehr & Maréchal (2014) *Nature*

- Thesis: *The banking system encourages dishonesty.*
  - exclusively bankers
  - exclusively in their professional roles
  - Not in their private or leisure behaviours
- N = 128 bankers (from Zurich)
- randomised: *priming questions* at the beginning of the interview
  - Term *bank*: 7 questions relating to a work situation (active role)
  - Term *control*: 7 question not related to work

# When are bankers honest – and when not?

Cohn, Fehr & Maréchal (2014) *Nature*

- “Coin toss”- task
  - Toss the coin 10x and for each toss, note either “heads” or “tails”.
  - For “heads”, the participant receives 20\$.  
For “tails”, the participant receives nothing.
  - The money will only be paid out only if the participant has reached (at least) the average number of “heads” (*rules for bonus payout!*)
  - The participants were not monitored!
- Each individual could lie and hide behind the coincidence<sup>w3</sup>.
- But: the group results betray the fraud!

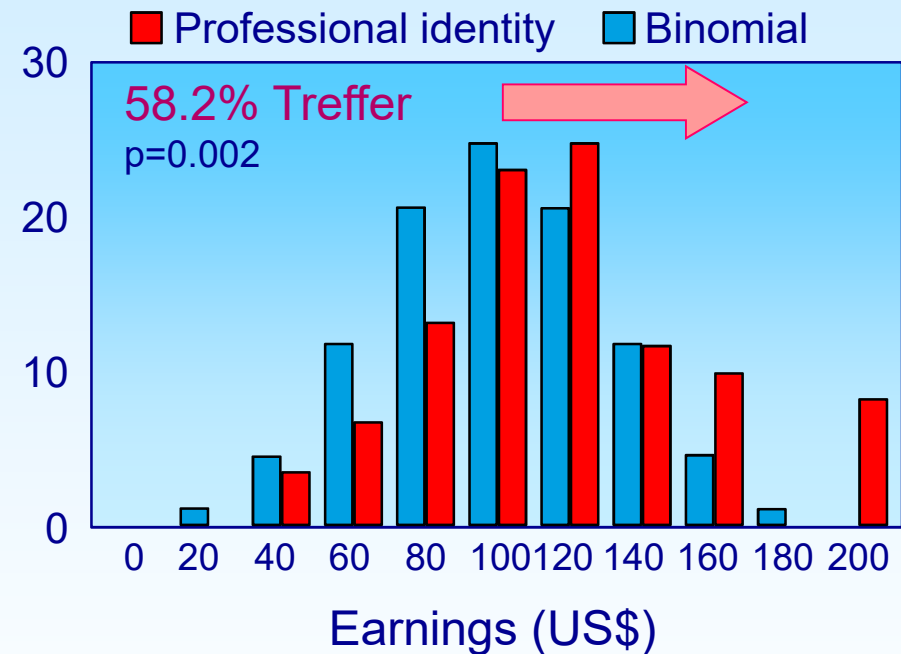
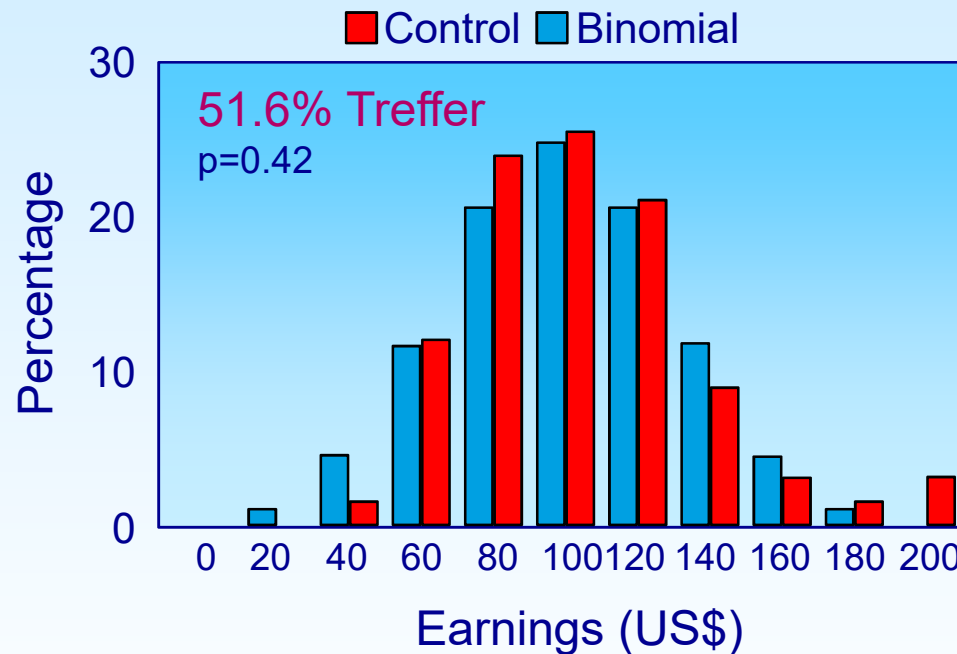
w3

?

wörmann; 19.04.2017

# When are bankers honest – and when not?

Cohn, Fehr & Maréchal (2014) *Nature*

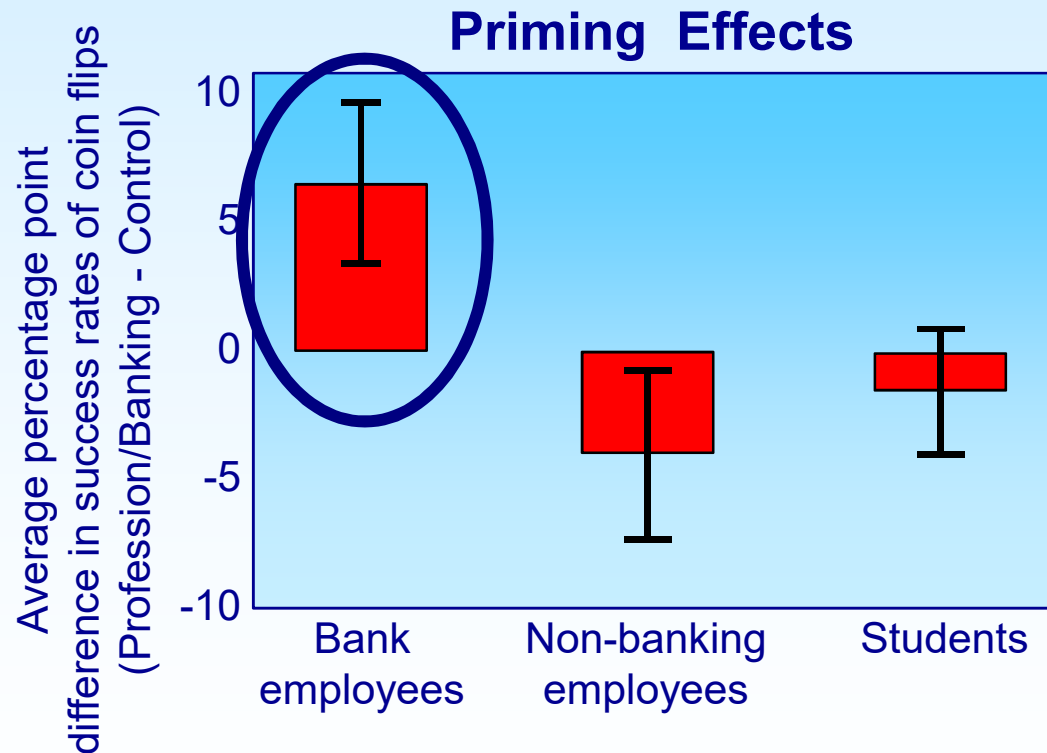


Binomial: expected random distribution  
Control: bankers who were not primed about their profession  
Professional: bankers who were primed about their profession

# When are bankers honest – and when not?

Cohn, Fehr & Maréchal (2014) *Nature*

The effect does **not** occur with other branches nor with students who were also primed with regard to money (additional experiments).



# When are bankers honest – and when not?

Cohn, Fehr & Maréchal (2014) *Nature*

“Our results thus suggest that the prevailing business *culture of the banking industry weakens* and undermines the honesty norm ....”



***Priming often goes unrecognized.  
Priming is not only underestimated,  
but also frequently  
used incorrectly or not used at all.  
Sensible priming makes almost  
everything easier!!!!***

# Neuromarketing

## - Relevant Brain Functions-





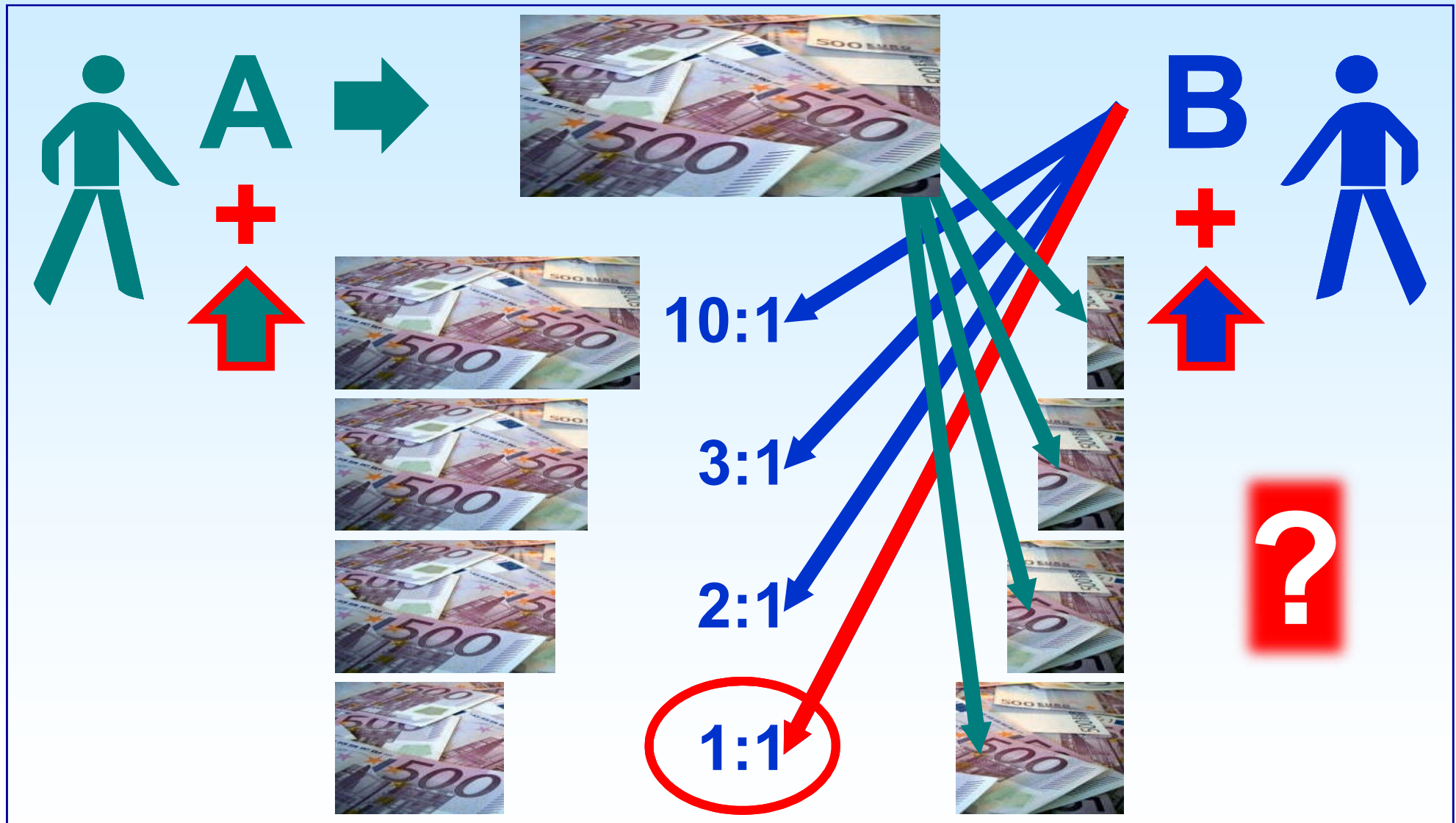
# The Reward System of the Brain

- Electric Stimulation of the Nc. Accumbens -

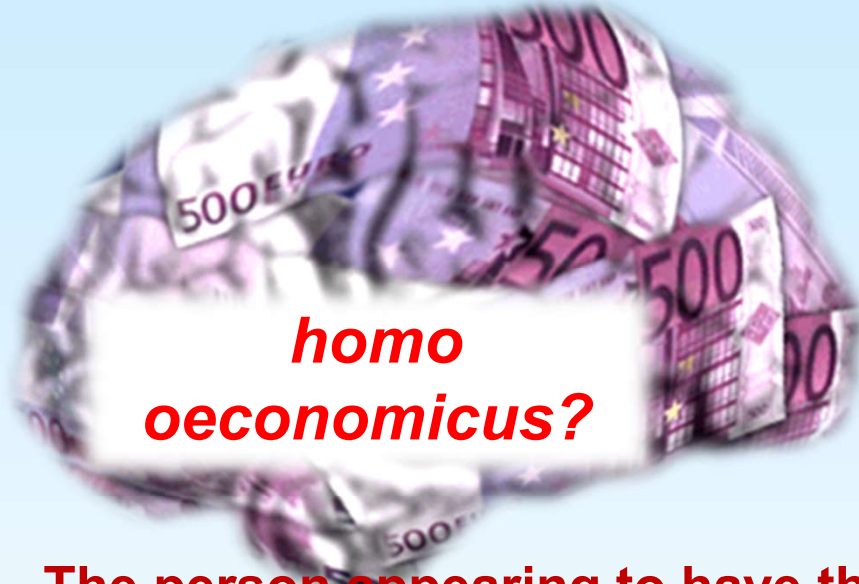


**All mammalian species  
- *including humans* -  
possess a reward system which plays a pivotal role**

# The Ultimatum Game or the “*homo non-oeconomicus*”



# The Ultimatum Game in the Brain

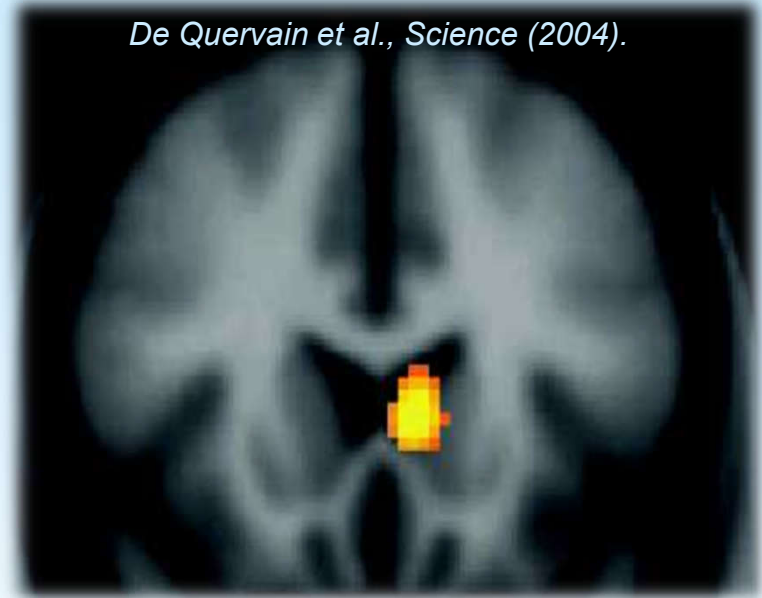


**homo  
oeconomicus?**

**The person appearing to have the most advantages punishes the others even though, in doing so, he foregoes every opportunity for making a profit.**

## **Altruistic Punishment**

Why do people reprimand others for social “**transgressions**”, even though it is costly for them?



*De Quervain et al., Science (2004).*

## **Solution:**

The punishment activates the reward system.

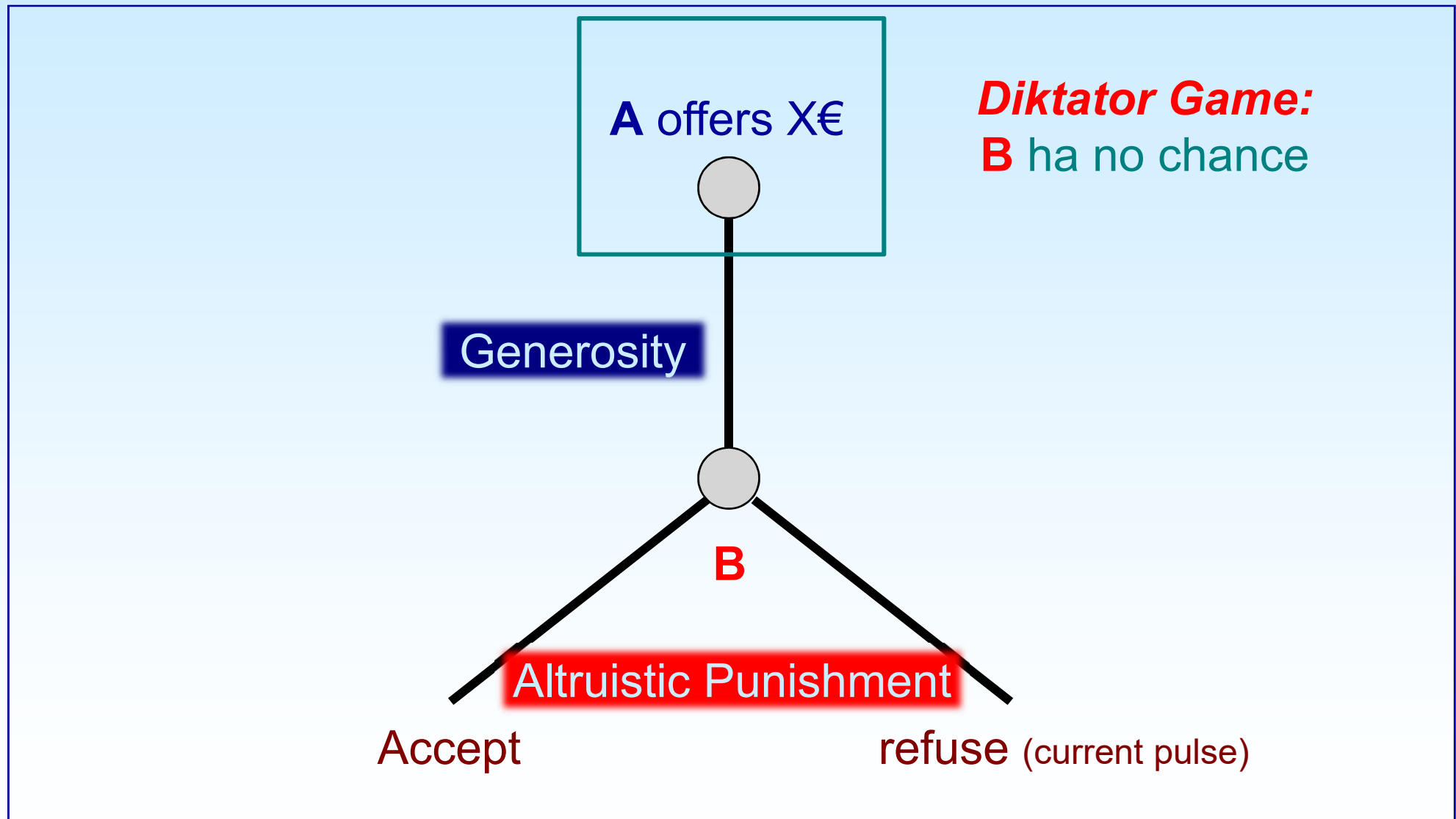
**An evolutionary  
advantage**

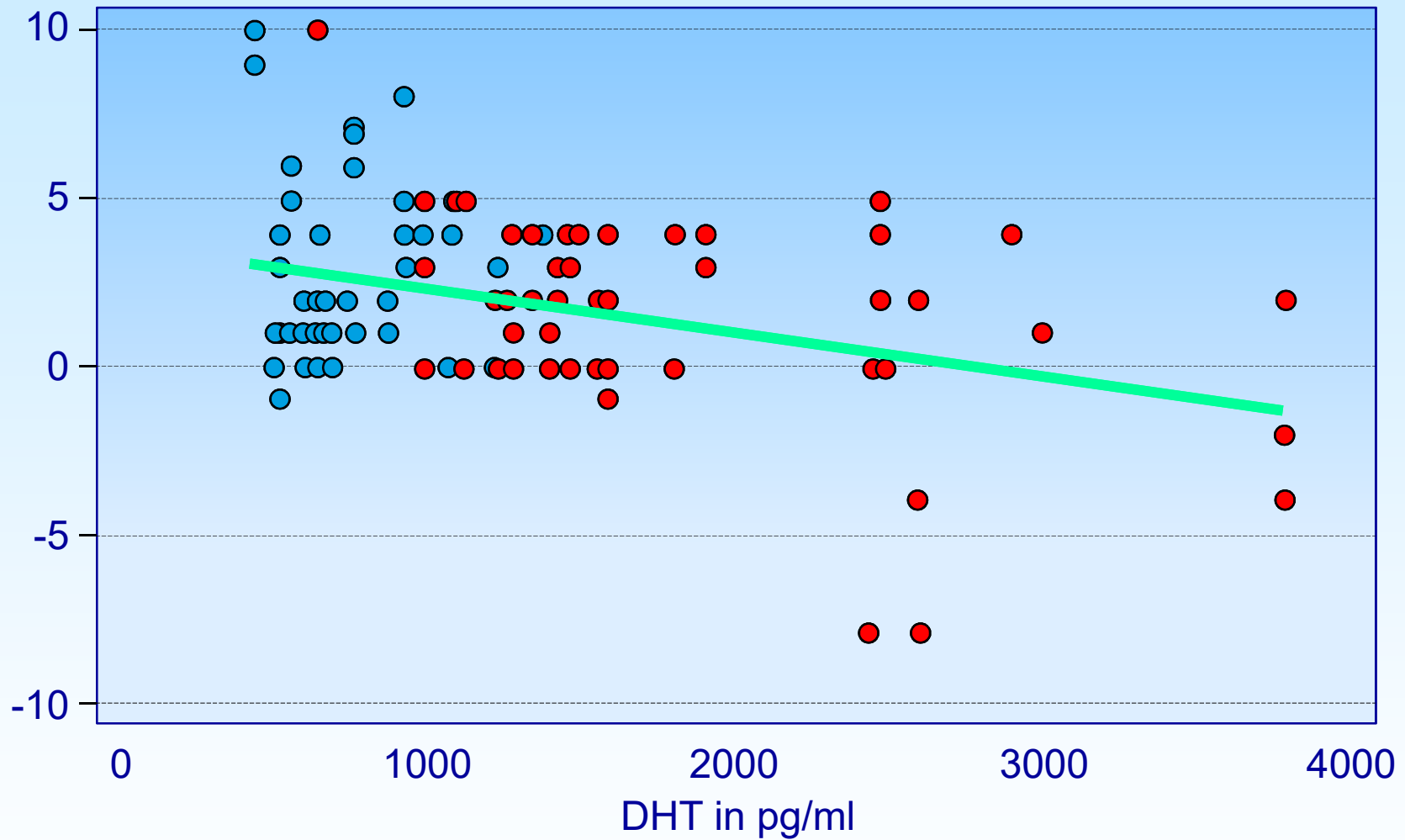
# The Reward System

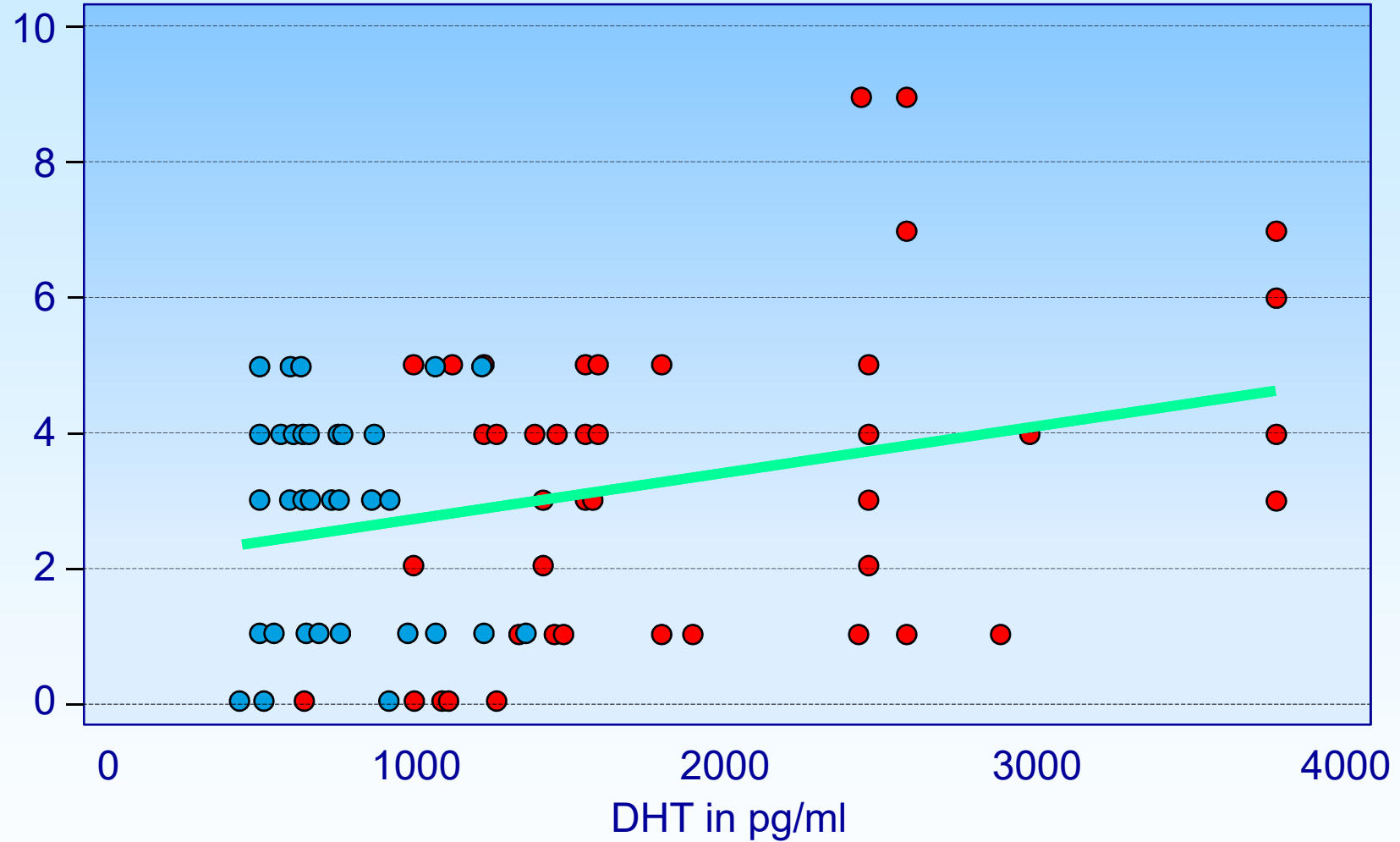
## - Altruistic Punishment-

- The system requires **fairness**, not *equality*.
- Income differences must be fair.
- Privileges must be appropriate.
- Behaviour must be on a level playing field.
- Costs must correspond to performance.

# Ultimatum Game and Testosteron



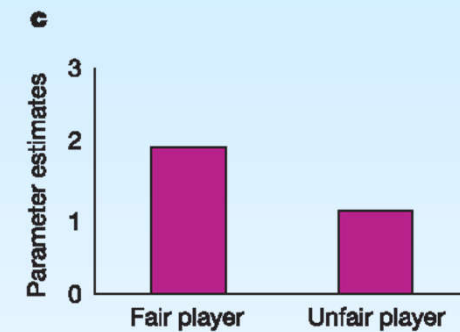
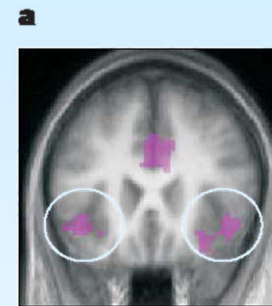
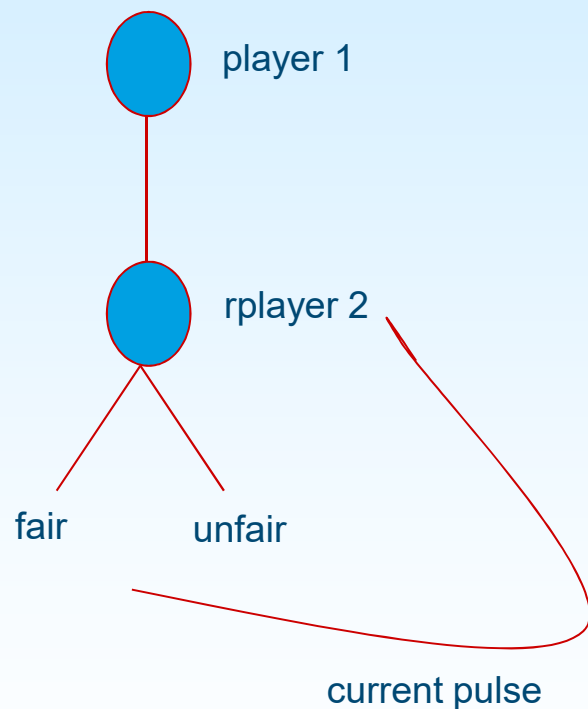




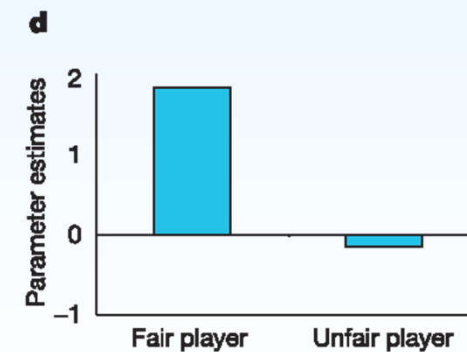
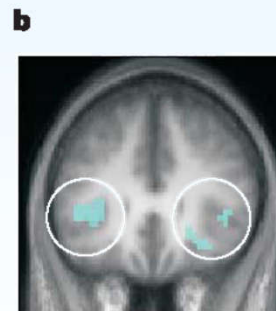
● Placebo Punishment in \$    ● Testosterone Punishment in \$  
— Fitted values

# Brain Function

## Event-Feature-Emotion-Complex (EFEC)



Women show empathy with fair as well as unfair takers

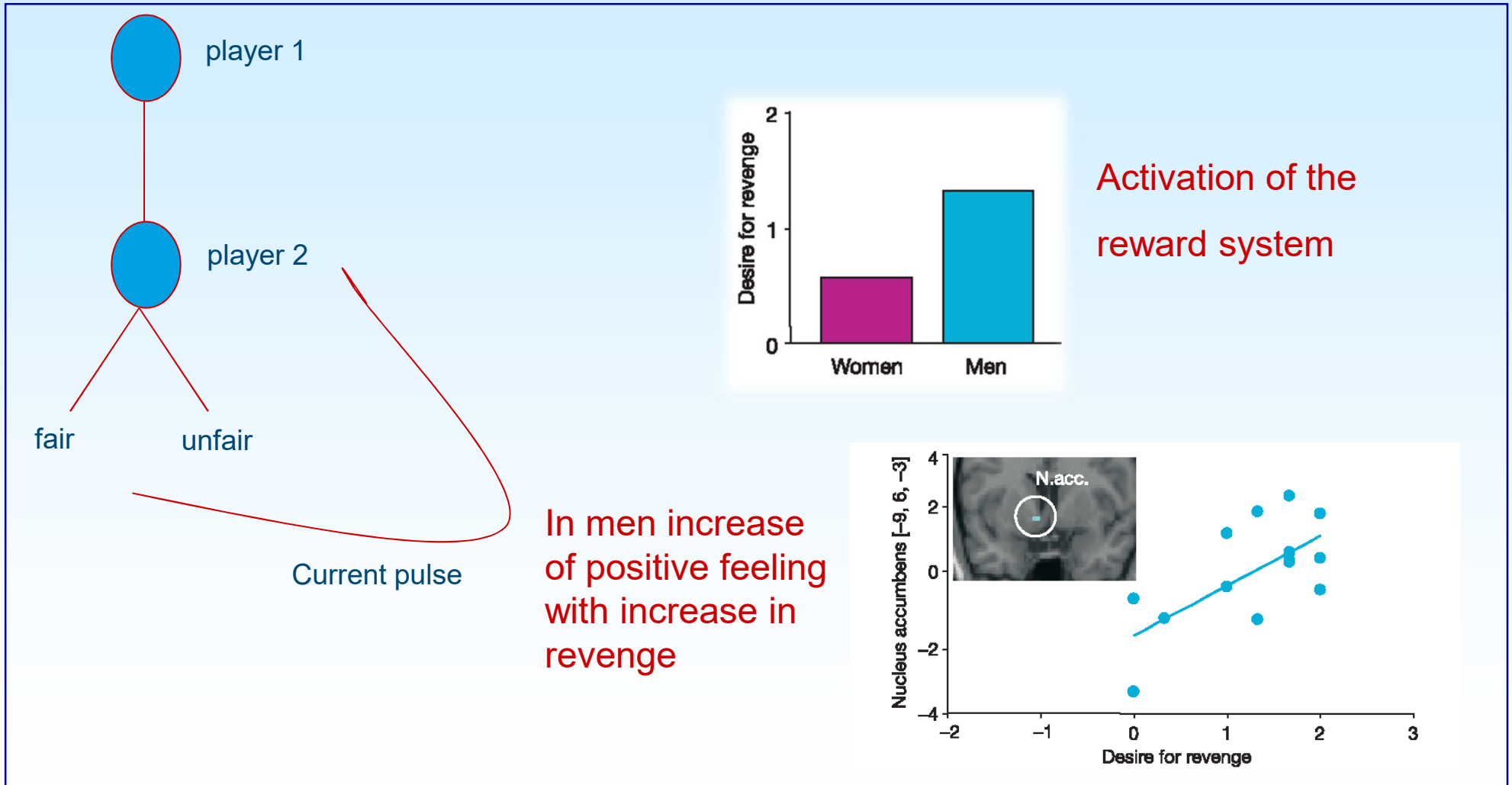


Men have mercy only with a fair, but not with an unfair taker



# Neuroökonomie

## Event-Feature-Emotion-Complex (EFEC)



# Men and Women

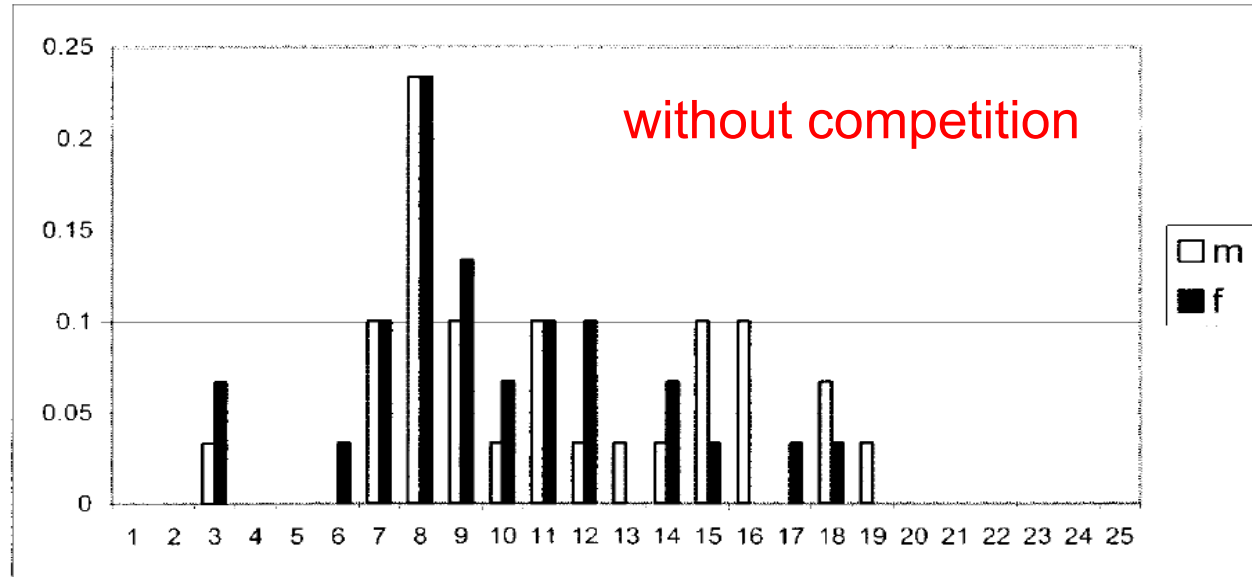
**“Gender Wage Gap”**  
**– Differences in Competitive Behavior –**

PERFORMANCE IN COMPETITIVE ENVIRONMENTS:  
GENDER DIFFERENCES\*

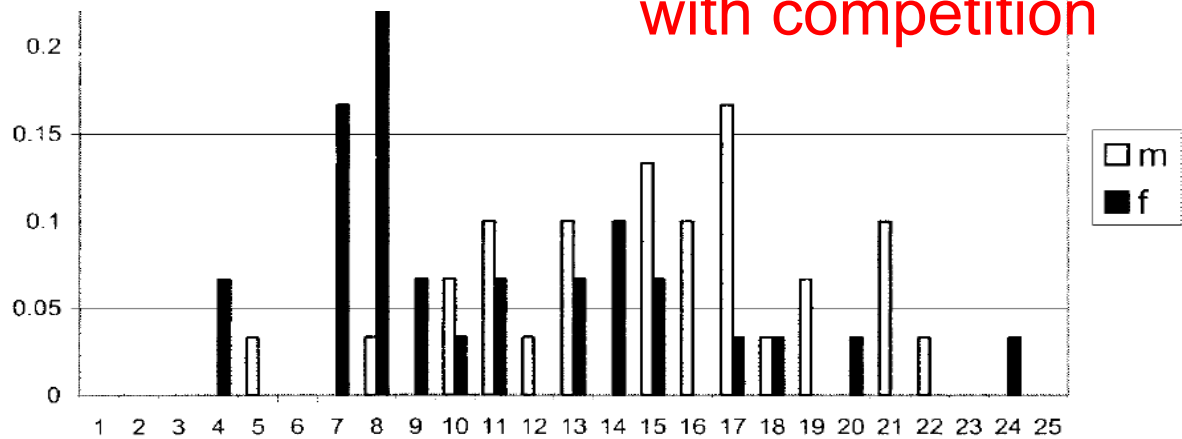
URI GNEEZY  
MURIEL NIEDERLE  
ALDO RUSTICHINI

*The Quarterly Journal of Economics*, August 2003

# Men and Women



Men improve  
with competition



# Pay Equity

## - Question-

What role does social comparison play in the perception of payment for equal work?

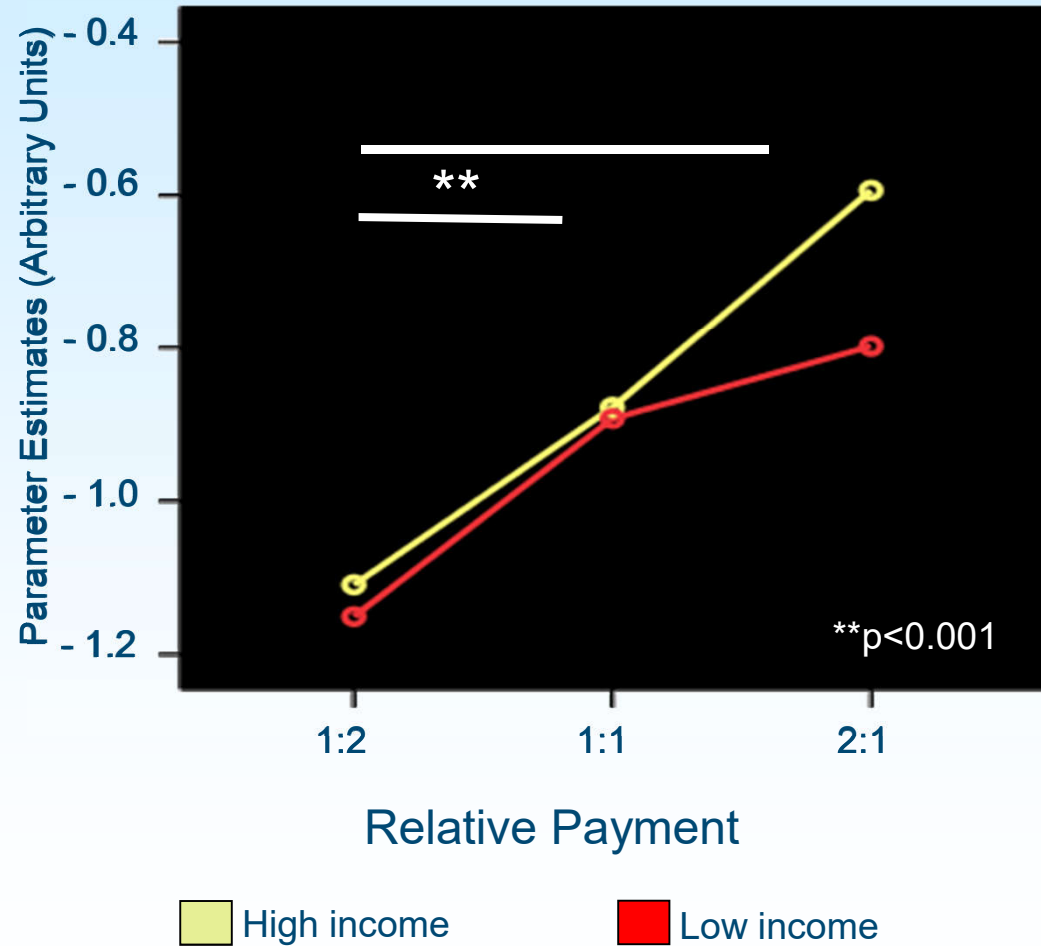
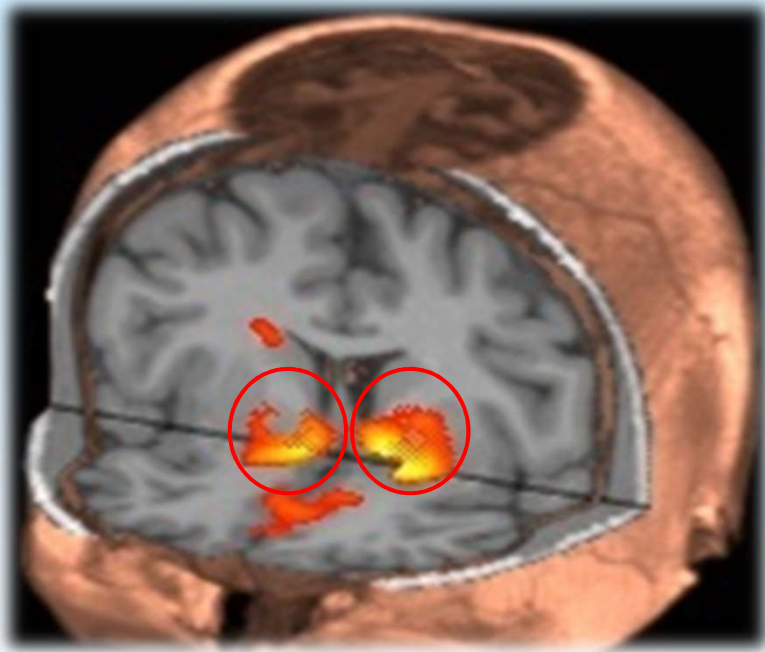


Is the absolute or relative payment decisive for motivating employees (compared to “colleagues”)?



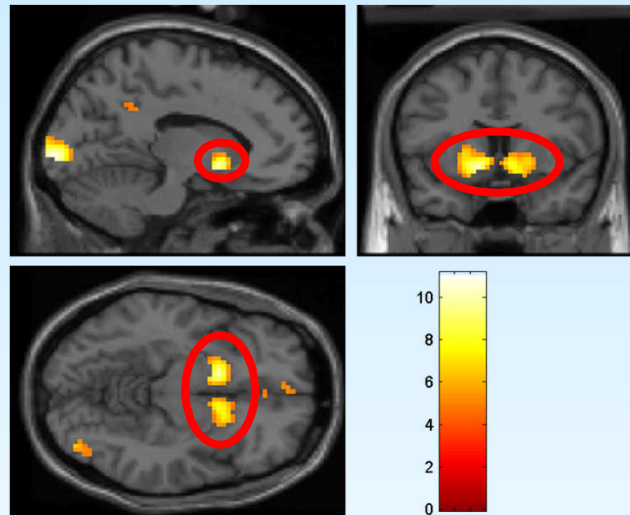
# Pay Equity

## - Activation of Reward Areas-

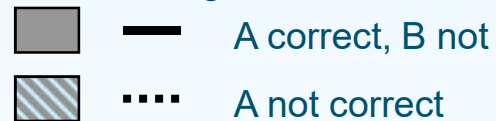


# Wage Differentials

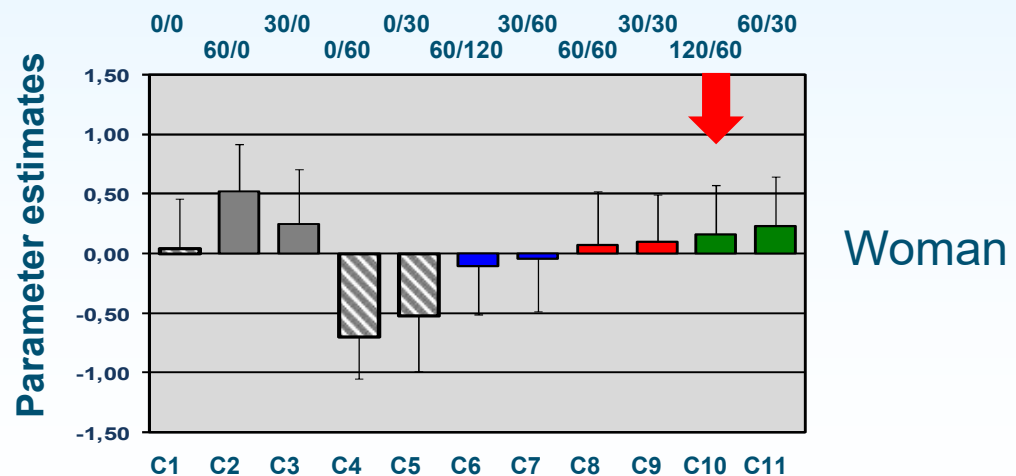
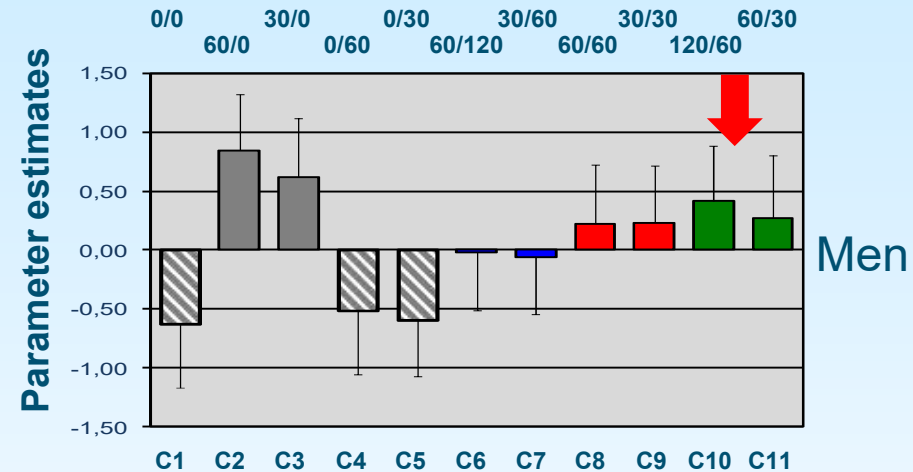
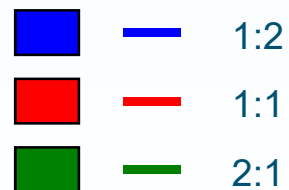
- Men vs. Woman -



ROI-defining conditions

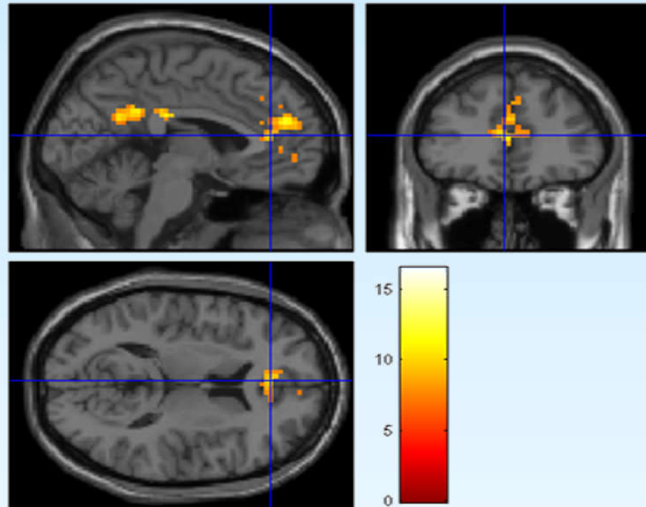


Conditions of interest (both correct)  
A's income : B's income

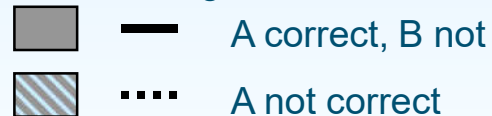


# Wage Differentials

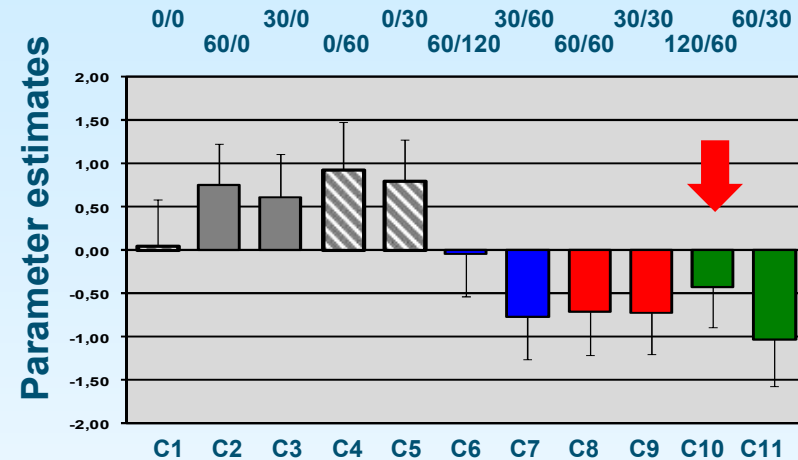
- Men vs. Woman -



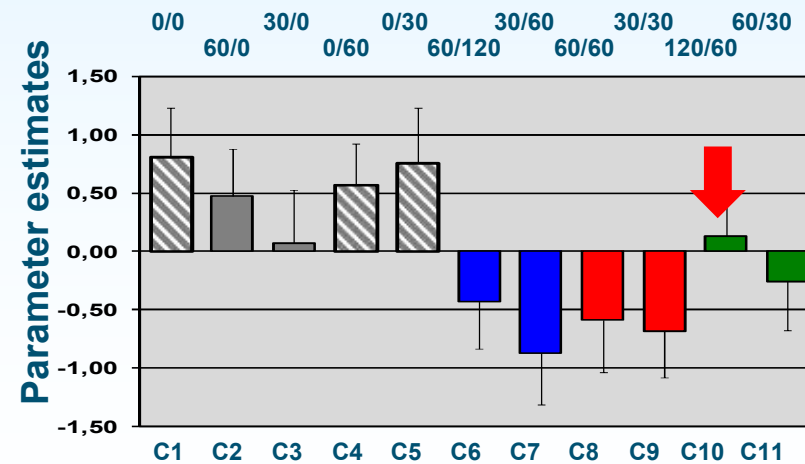
ROI-defining conditions



Conditions of interest (both correct)  
A's income : B's income



Men

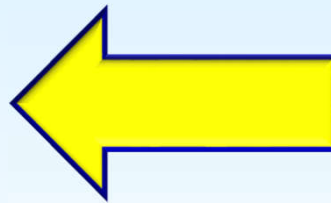
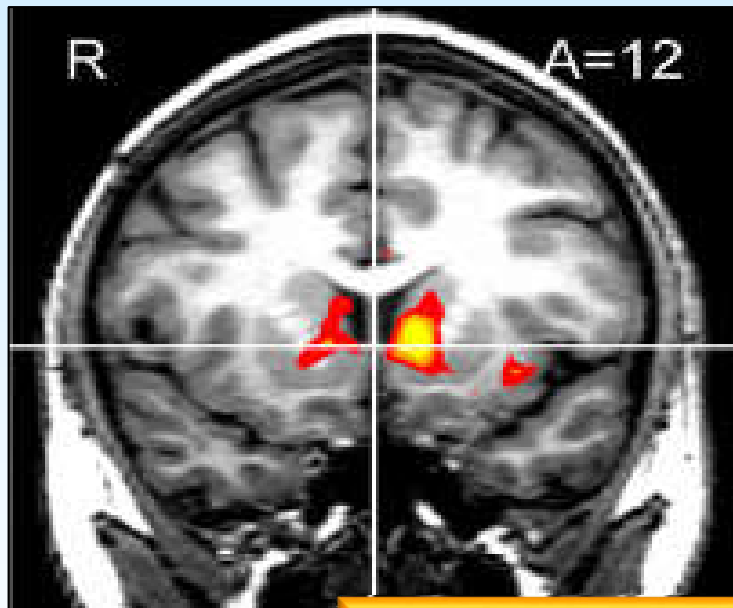


Women



# Reward System

## - Money-



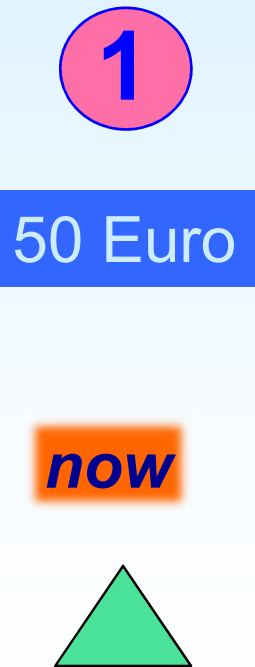
***5 € now >> 20 € in a week***

**Money activates our reward system significantly.**

# The Decision Process

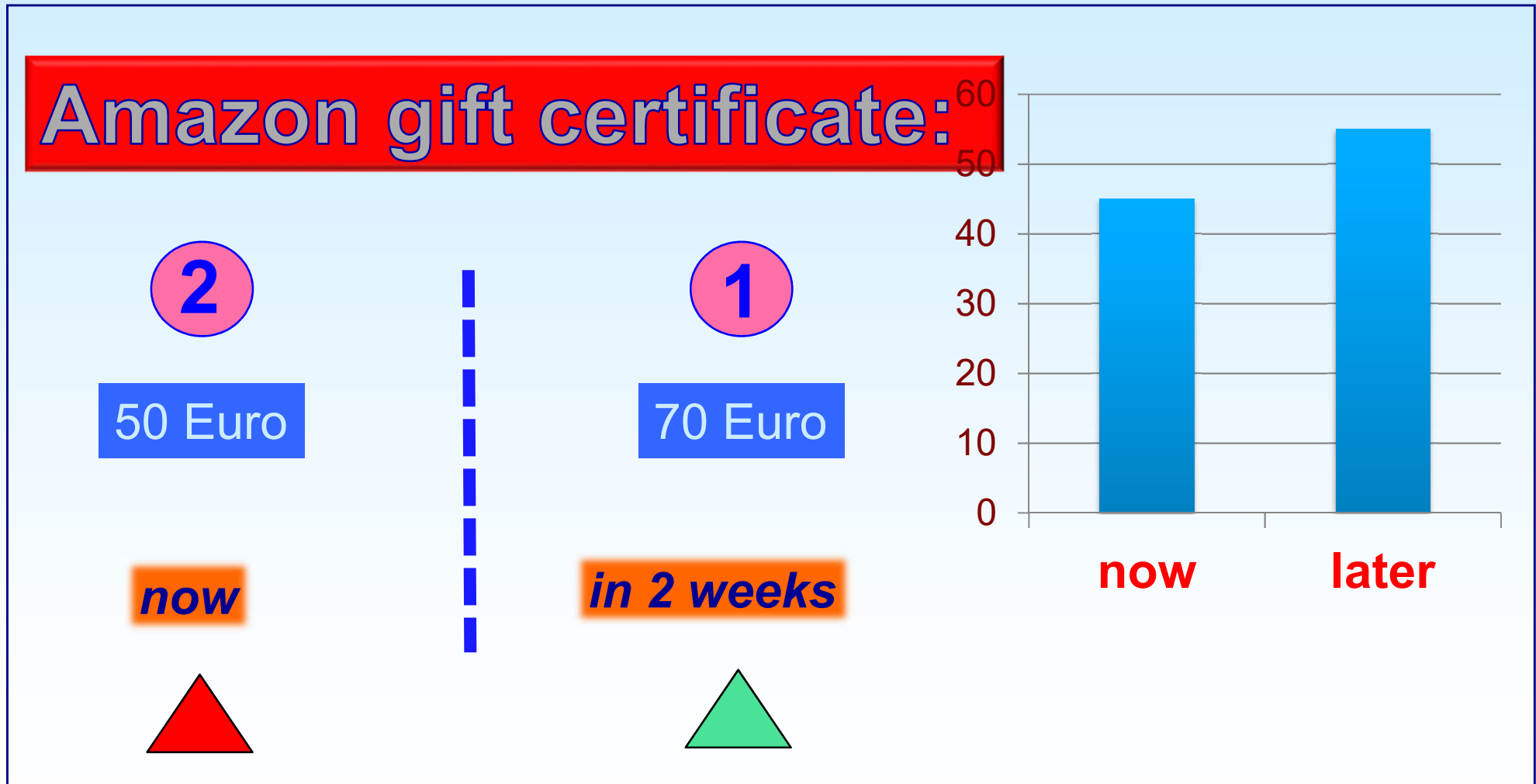
## - Supply and Positioning-

Amazon gift certificate:

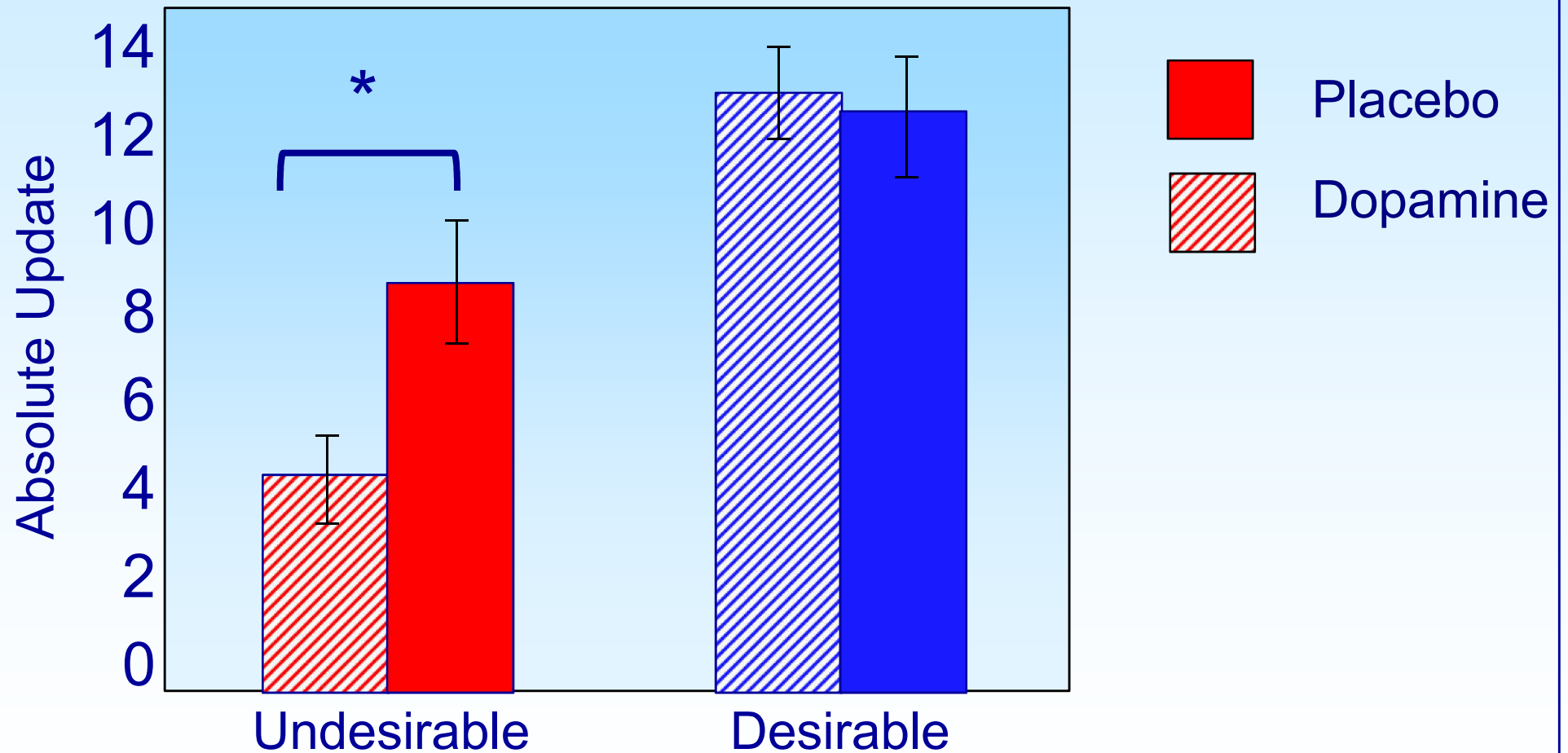


# The Decision Process

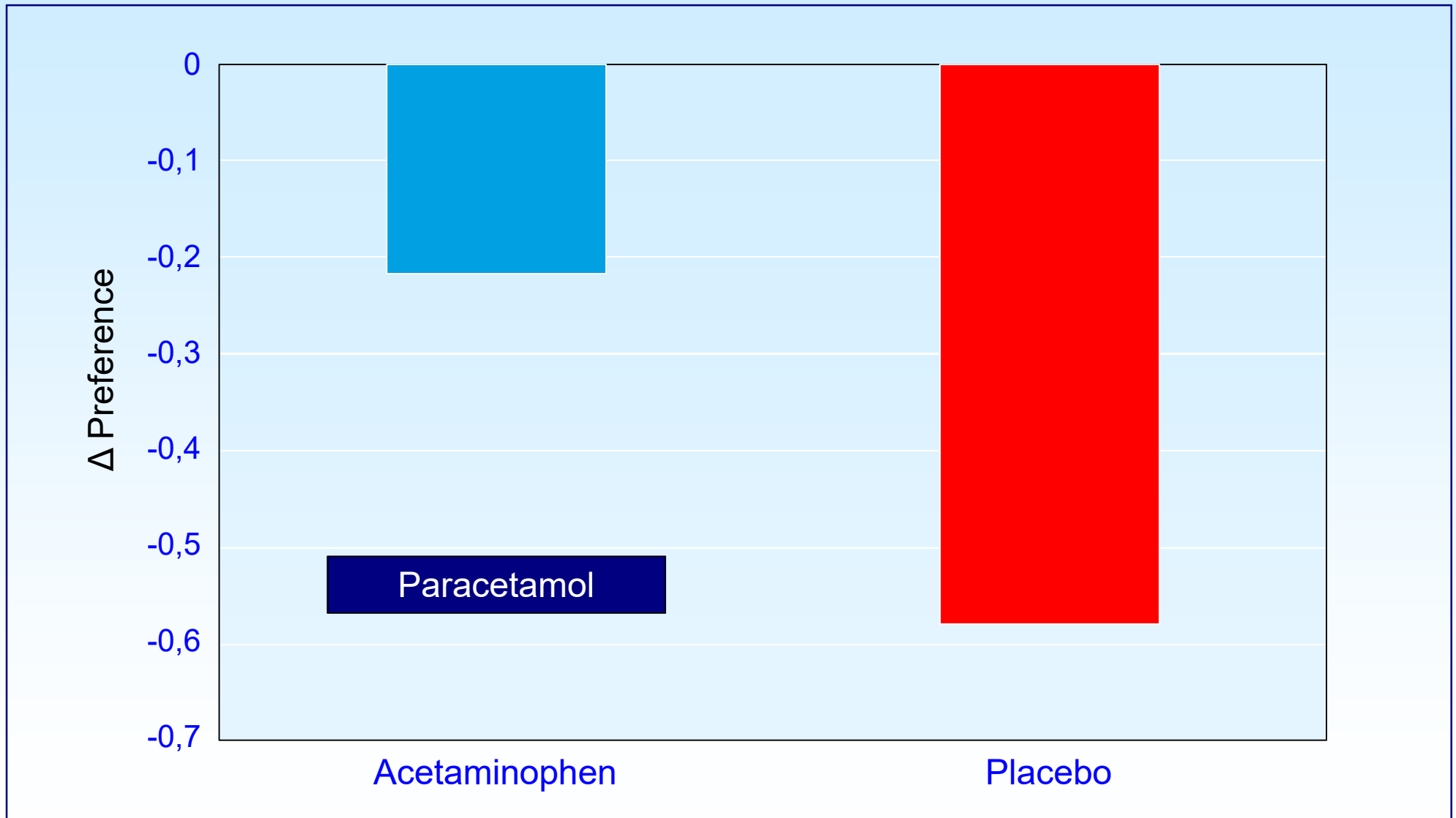
## - Supply and Positioning-



# Risk Assessment and Dopamine



# Changes in unchosen task preference by condition



# Risk and Reward

## - Gene Effects -

DA D2-Receptor: normal gene

3'... tc **G** aggcaggcgcccagctgg ...5'

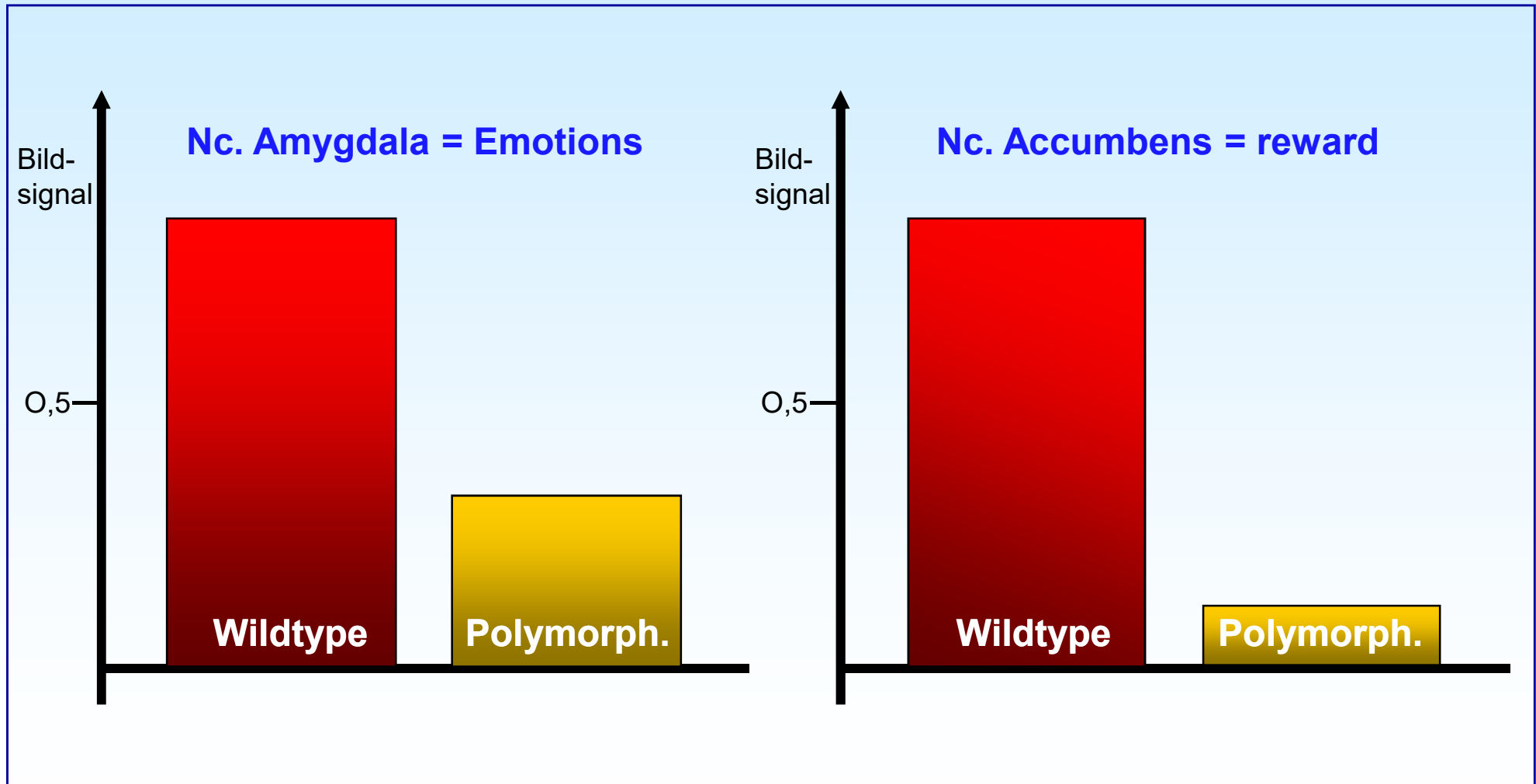


Polymorphism

3'... tc **A** aggcaggcgcccagctgg ...5'

# Risk and Reward

## - Gene Effects -





# Reward System

## - The „Incentive Super Response (ISR)“ -

- All creatures react on reward.
- **But -** Incentive and the intended effect have to match
- Humans react adaptive on incentives
- Thus, undesirable developments have to be expected
- **Example:**
  - The detection of mistakes is rewarded in relation to the severity
- People wait until the mistake becomes severe

## Overview: Rewards

- ✓ *Priming* is the big unknown.
- ✓ The *reward system* is central.
- ✓ One must be able to *use* both correctly.
- ✓ The *ultimatum game* applies everywhere.
- ✓ *Testosterone* is often better than it's reputation.
- ✓ *Women are different*, but this could change.

**With a brain, you are more powerful!**



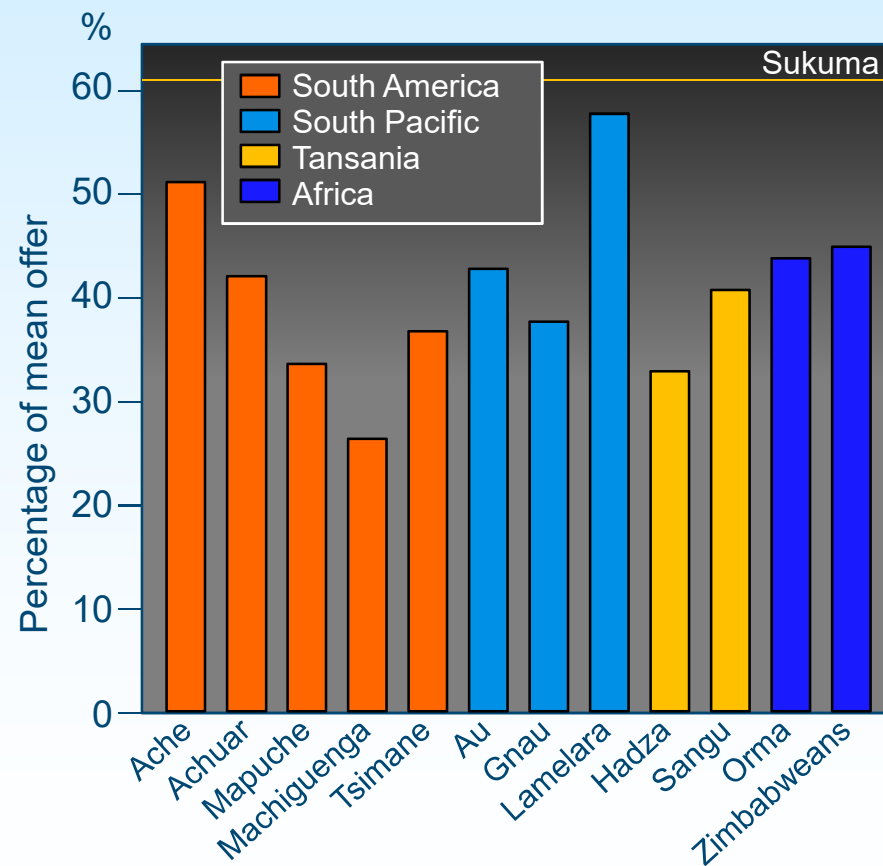
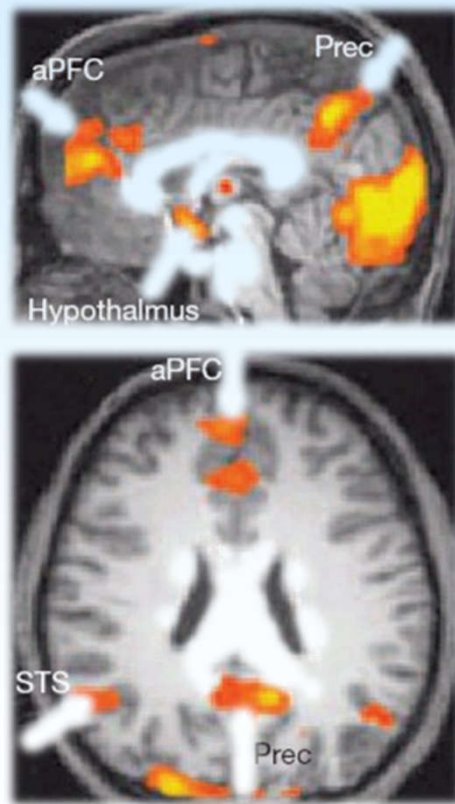
**Thank you for your attention.**



# Neuro Economy

## - The Ultimatum Game -

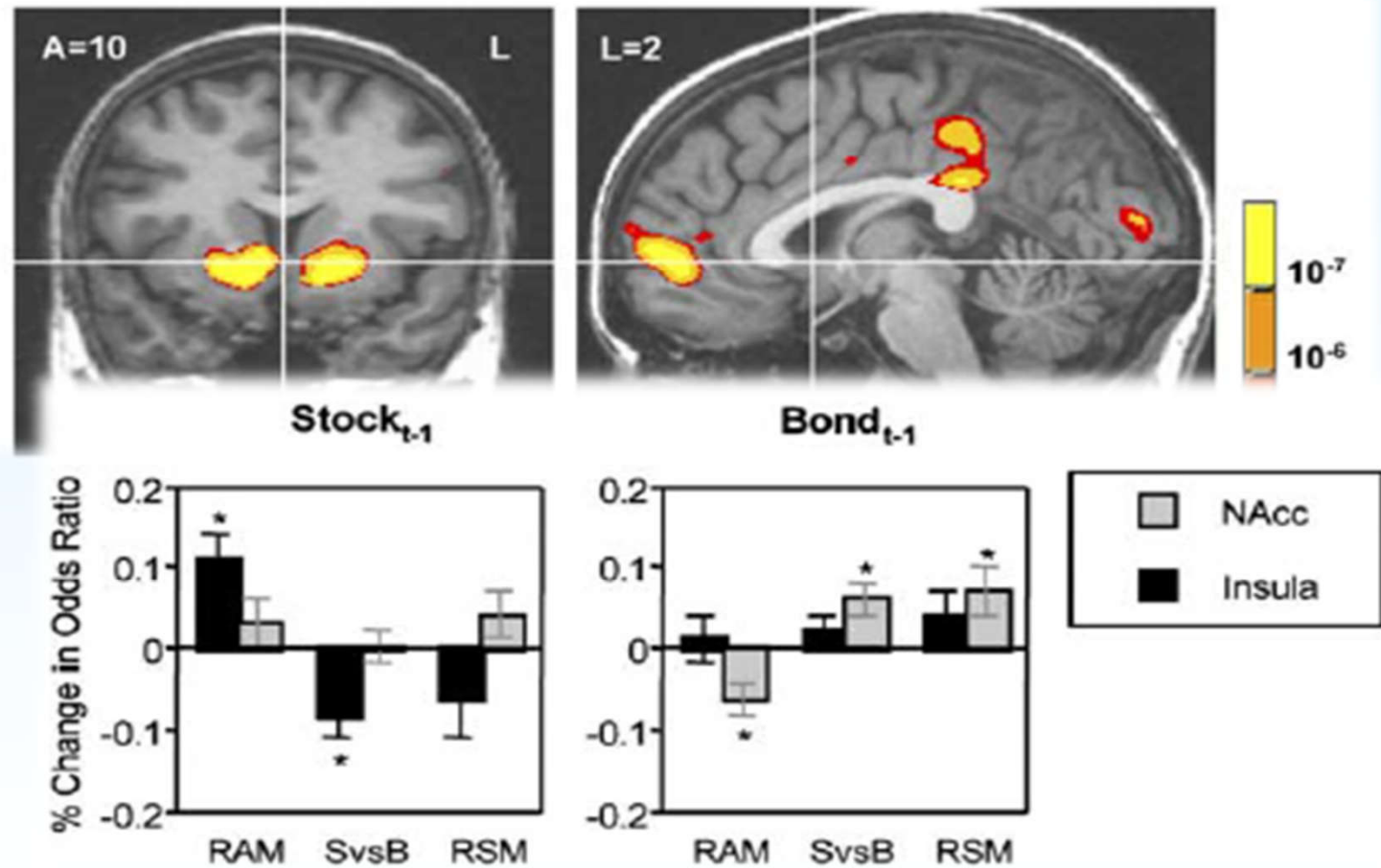
Starke kulturelle Einflüsse!



# Brain Functions

## - Financial Investment -

**Outcome:  
Gain vs. Loss**





# Activation of the Reward System

Positive Information upon  
the partner in a negotiation  
process activates the reward system



# „ECO Products“

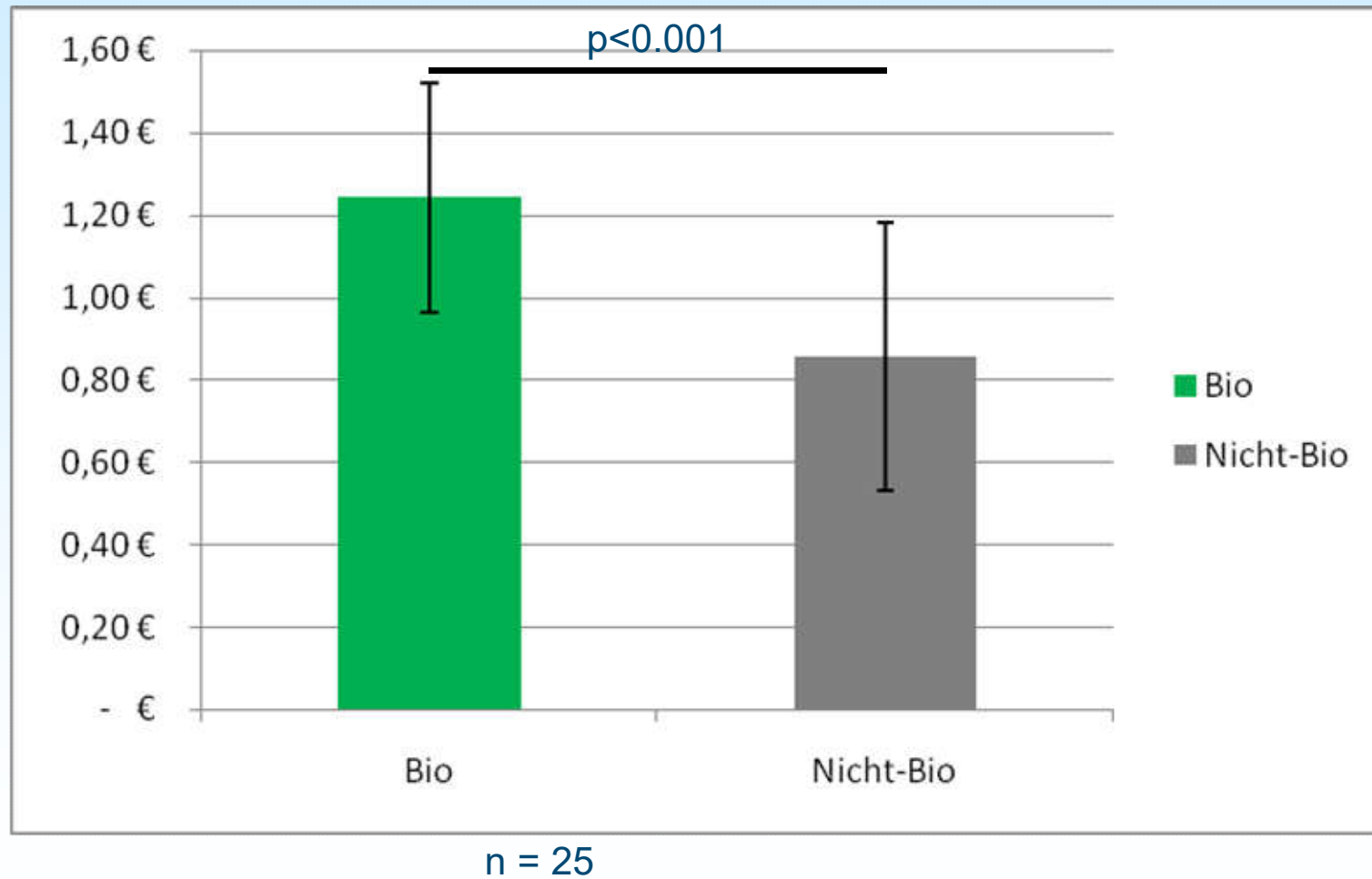
- What is Influence of the identification mark -



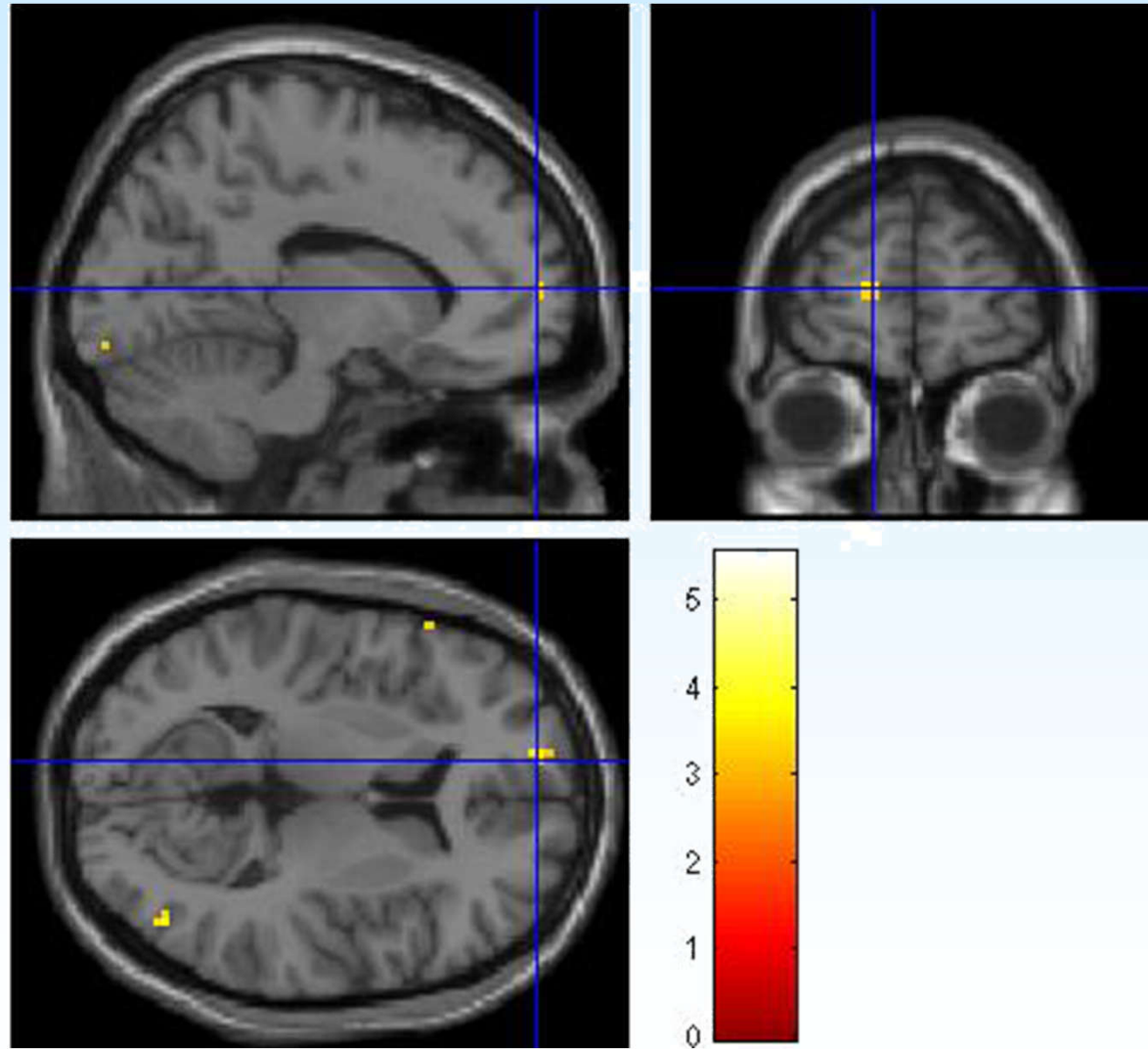
VS.



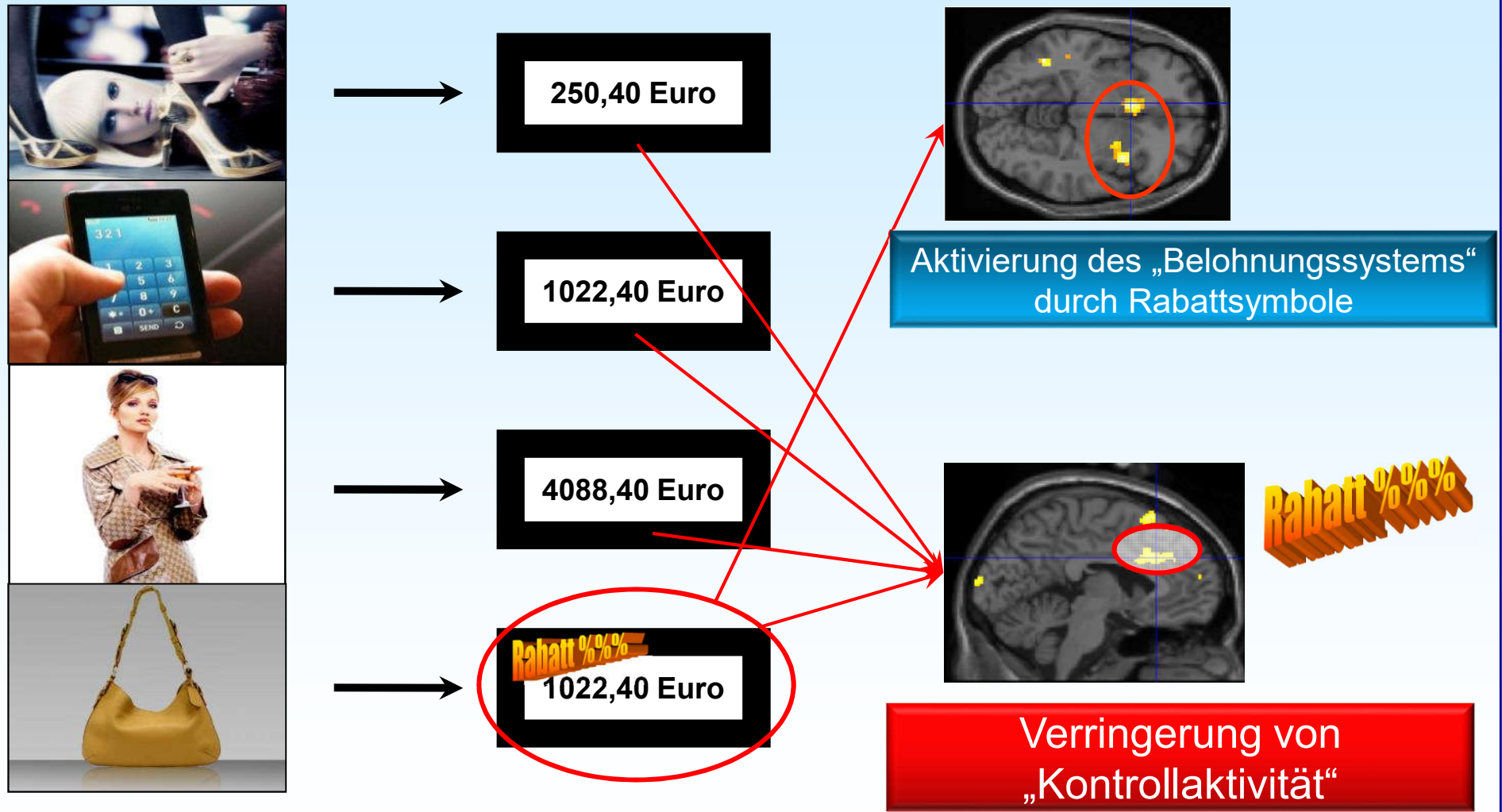
# ECO-Marking and Price Acceptance



# ECO and Non-ECO Products > Nichtbioprodukte



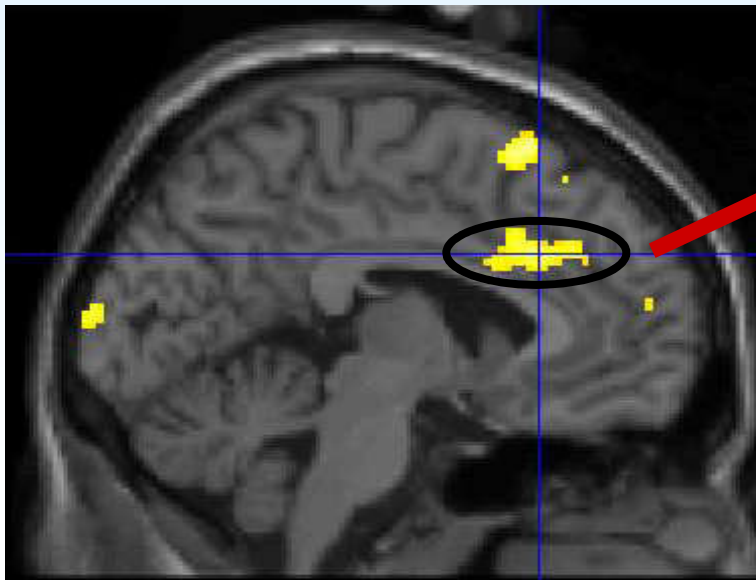
# Das „Erregende“ des Rabatts



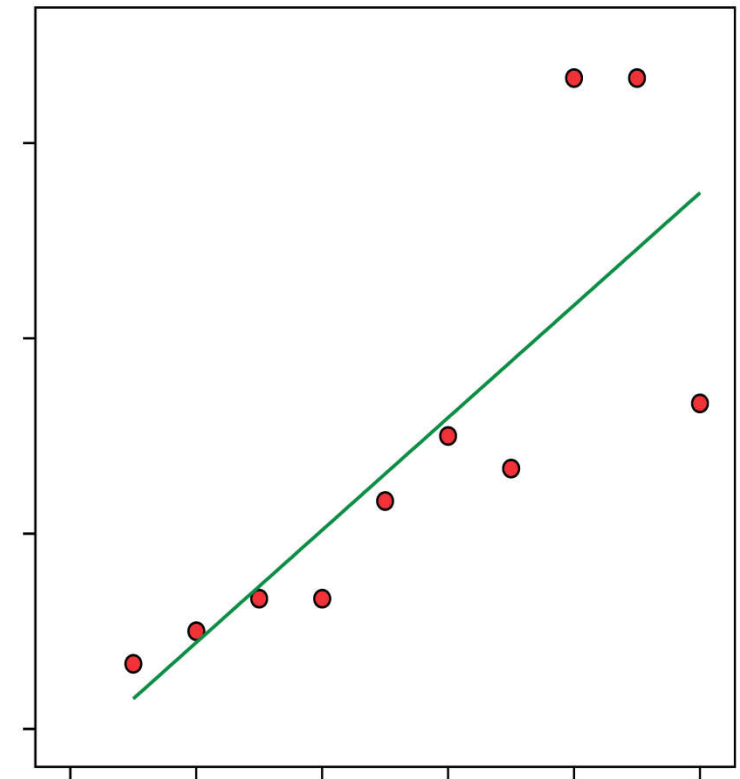
# Neuroökonomie

## - Ergebnisse zum „Rabatt“ II -

Computerkalkulation



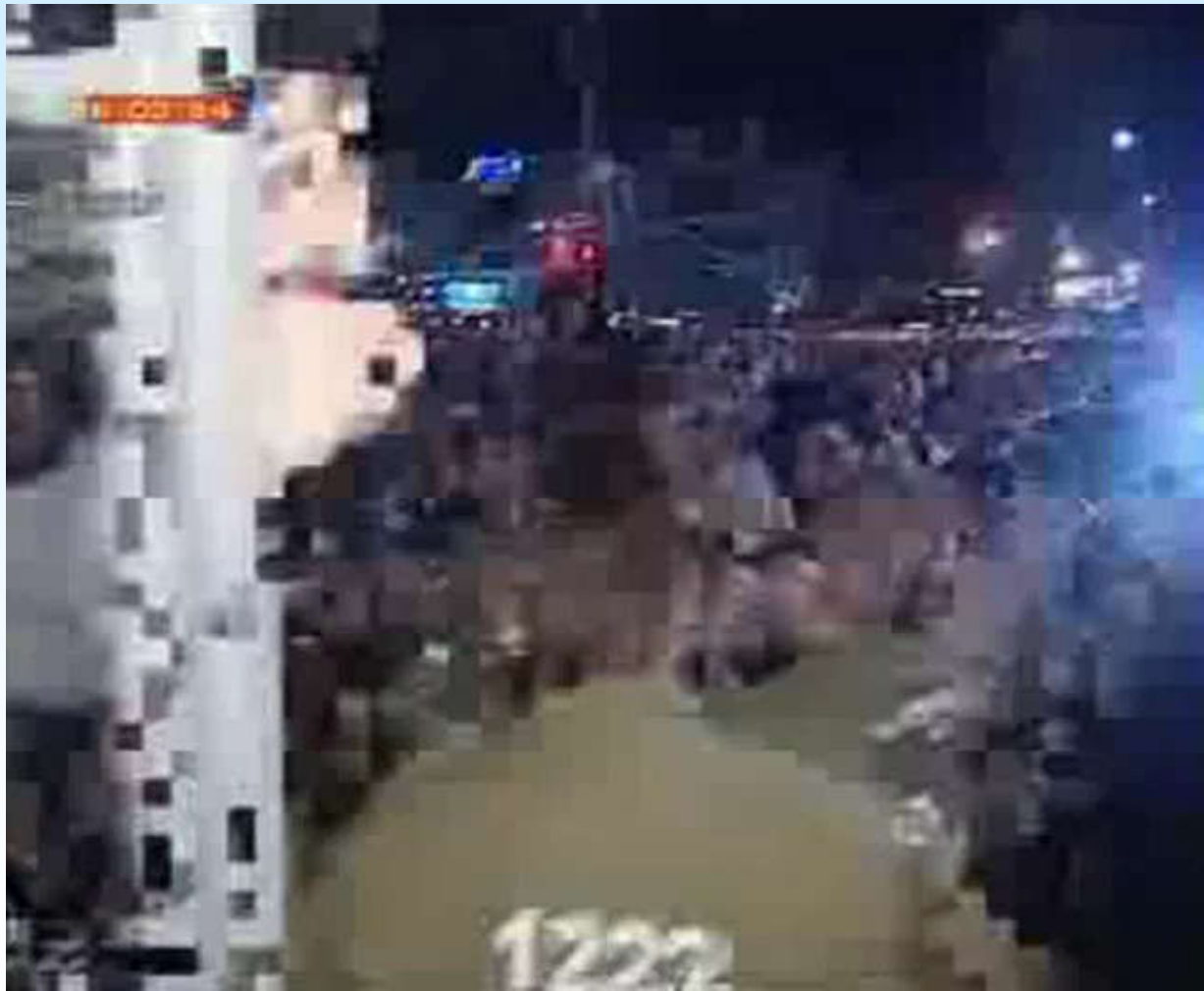
Anteil der Rabattstimuli



Abnahme des Aktivierungsniveaus

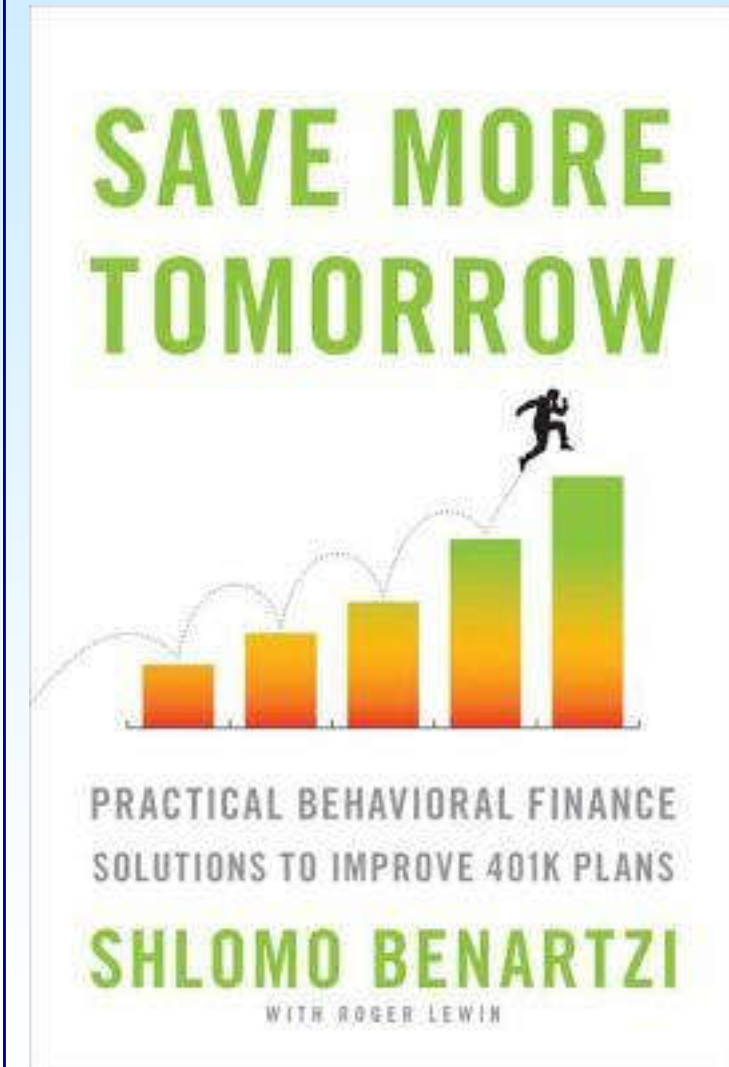
# Neuroökonomie

## - Ergebnisse zum „Rabatt“ II -





# Umsetzung neuroökonomischer Erkenntnisse



*Sparvorschlag in der Zukunft*

*Beginnend in einem Jahr*

*Jederzeit kündbar*

*Gebunden an die Lohnerhöhung*

***Feldversuch:***

***Teilnehmer:***

**3,5 -11,6%**

## Die *Take Home Message*



Das Belohnungssystem ist ein  
zentrales und ***dominierendes*** System

Es regiert uns.

***Es motiviert und korrumpiert uns.***