

RSM Erasmus ERASMUS UNIVERSITY

Erasmus Centre for Neuroeconomics



Neuromarketing

Ale Smidts


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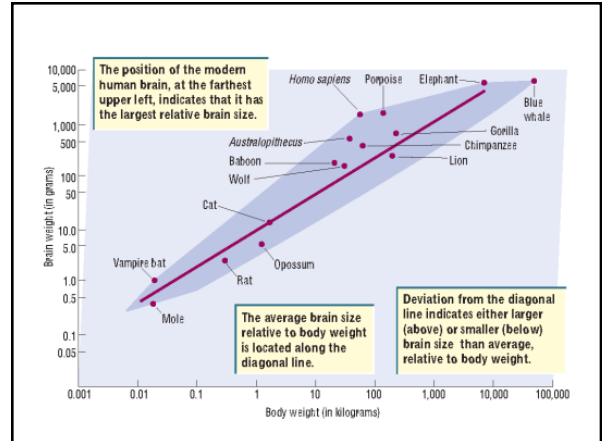
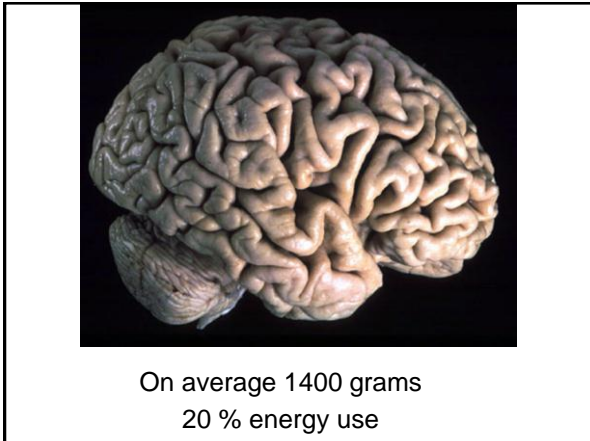
February 7, 2013 Psychologie van de klant, Amersfoort

Erasmus Centre for Neuroeconomics


www.irim.eur.nl/neuroeconomics

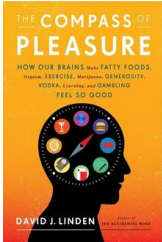
- Collaboration between:
 - ❖ Marketing Department, Rotterdam School of Management, Erasmus University
 - ❖ Donders Institute for Brain, Cognition and Behavior, Radboud University, Nijmegen

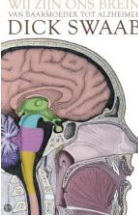





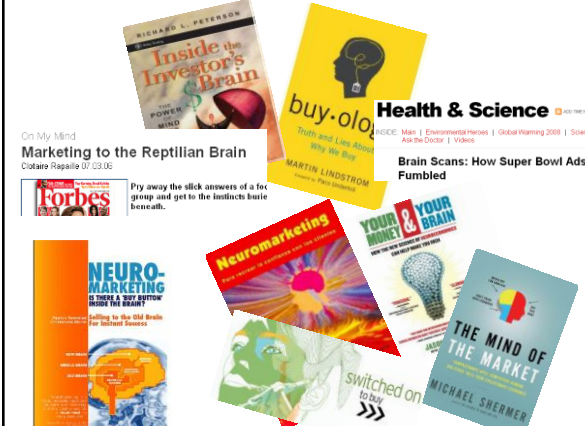
Many popular books on the brain (also in the Netherlands)







Many news articles referring to "Buy buttons"



On My Mind

Marketing to the Reptilian Brain

Brain Scans: How Super Bowl Ads Fumbled

Neuromarketing

THE MIND OF THE MARKET



Neuron, Vol. 44, 379-387, October 14, 2004, Copyright ©2004 by Cell Press

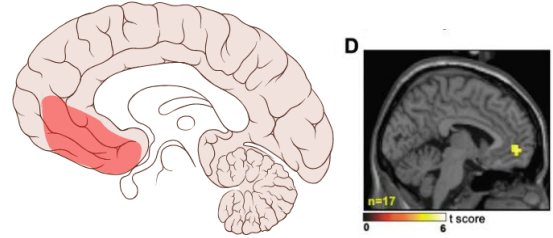
Neural Correlates of Behavioral Preference for Culturally Familiar Drinks

Samuel M. McClure,^{1,2} Jian Li,¹ Damon Tomlin,¹ Kim S. Geyer,¹ Litané M. Montague,¹ and P. Read Montague^{1*}
 Department of Neuroscience
 Menninger Department of Psychiatry

neural responses, and the modulation of both by non-odor or nonflavor stimuli—that is, the sensory problem. Ultimately, such sensory discriminations and the variables that influence them serve to influence expressed behavioral preferences. Hence, there is another large

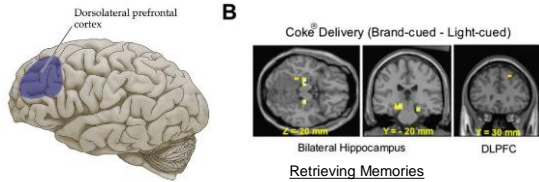
The first neuromarketing study: The Pepsi Challenge in the scanner

Blind taste test Coke vs Pepsi in the scanner



- Subjects DO have a taste preference for Coke or Pepsi
- vmPFC tracks this actual (i.e. blind) taste preference

Coke brand name induces Hippocampal and DLPFC activity (not Pepsi)



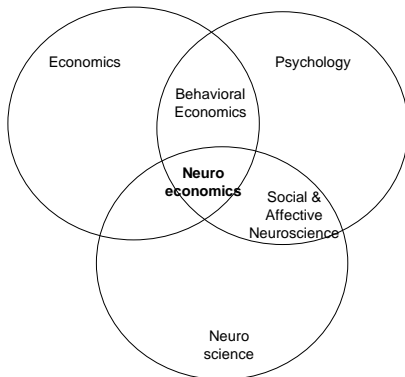
Results suggest:

- vmPFC predicts sensory preference
- Brand knowledge biases choice (in particular for Coke)
- Two separate systems are involved in generating preferences:
 - Independent circuitry for sensory and “cultural” (marketing) information

Choice can be seen as the outcome of competing neural networks (balance)

Neuroeconomics

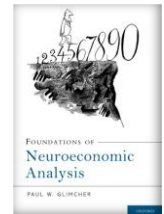
- Neuroeconomics (or Decision Neuroscience) is integrating knowledge from neuroscience, psychology and economics into one unifying theory explaining human choice behavior



Neuromarketing: part of Neuroeconomics

- In 10-years time, enormous progress in understanding fundamental brain processes underlying preferences and choice

• See, for example, Paul Glimcher's book



- Similarly, strong developments in Social & Affective Neuroscience

Neuromarketing is clearly in the take-off phase



And becoming serious business:



26 May 2011 - Nielsen Acquires NeuroFocus

LEADING NEUROMARKETING FIRM BECOMES PART OF NIELSEN'S PRODUCT INNOVATION PRACTICE

Finding out how and why the customer reacts to marketing actions



- Product
- Assortment
- Price
- Advertising
- Sales Promotion (buy 2 + 1 free)
- Shop lay-out
- ...



- Registration of behavior
 - Scanning 'buying'
 - TV-viewing
 - Loyalty cards
 - Web behavior
 - ...
- Self-report
 - Questionnaires
 - Focus groups
 - Social media
- Experiments
- Neuro-imaging

Neuromarketing

- Doel:

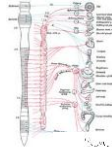
Het beter begrijpen van de klant en haar reactie op marketing stimuli door de processen in de hersenen direct te meten en in de theorievorming en stimuli-ontwikkeling te betrekken (Smidts, 2002; *Kijken in het Brein: Over de mogelijkheden van neuromarketing*)
- Marketing stimuli:
 - producten
 - advertentie
 - gedrag verkoper
 - assortiment
 - Web page design
 - ...

Neuromarketing – (too) broadly defined in practice



- EEG
- fMRI
- Eye tracking
- Face reading
- Heart rate
- Skin conductance

Neuroimaging



- Hormones
- Neurotransmitters
- Genes

Biometrics

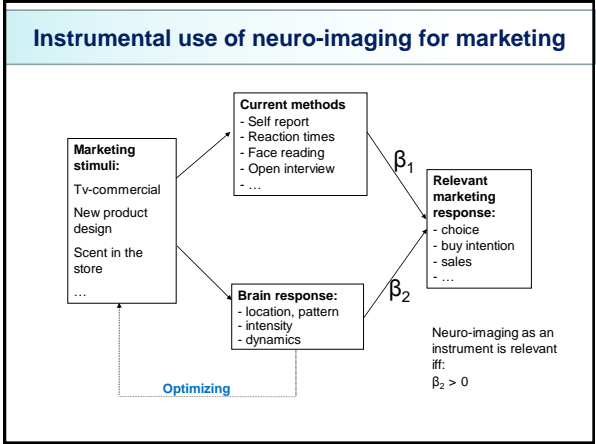


Rapid growth of Neuromarketing in practice

- Estimated number of neuromarketing companies:
 - 2008: 13
 - 2012: 60
- Includes companies applying general biomeasures such as heart rate, skin conductance and face reading
- EEG most favorite method
 - NeuroFocus
 - Neuroinsight
 - Sands Research – Neuro ranking of Super Bowl Ads
- Relatively few companies apply fMRI
 - Neurensics

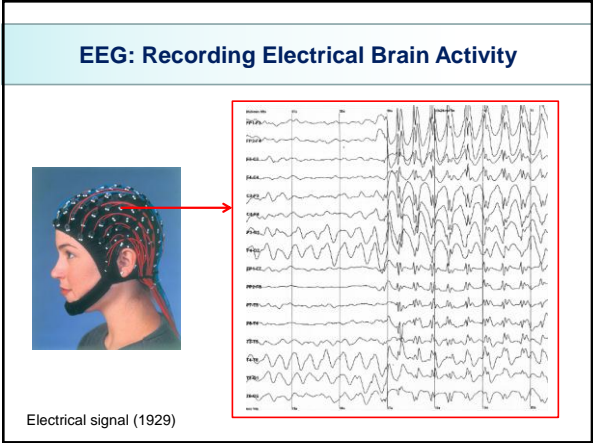
Two main goals Neuromarketing

- **Understanding the underlying process**
 - How price affects the evaluation of a product
 - Celebrity effects in advertising
 - Peer group influence
 - ...
 - Academic consumer neuroscience research
- **Assessing the quality of a marketing stimulus** ('stimulus centered approach')
 - Can we learn something about marketing stimuli that we cannot learn from conventional research methods?
 - Can we improve prediction?
 - Can we use brain responses to improve the stimulus (product development process)?
 - Starting academic research, but predominantly activity by neuromarketing consultancy firms



- ### Today's menu
- Very brief introduction into brain anatomy and neuroimaging methods + classic examples
 - Case 1: Impulsiviteit
 - Case 2: Persuasieve communicatie
 - Why are celebrity endorsements effective in advertising?
 - Case 3: Sociale beïnvloeding
 - Why do we conform to our peer group?

- ### Brain imaging methods (neuro-imaging)
- **Methods based on electro-magnetism:**
 - EEG **Electro-encephalography**
 - MEG **Magneto-encephalography**
 - **Methods based on local blood flow:**
 - PET **Positron emission tomography**
 - fMRI **Functional magnetic resonance imaging**

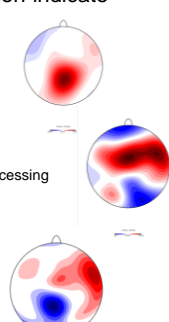


"NeuroFocus' Wireless EEG Helmet Lets Advertisers See Into Your Mind"

neuroFOCUS
 A Nielsen Company

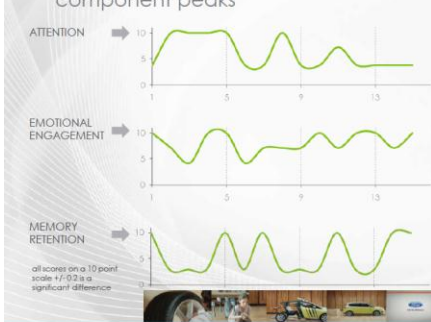
EEG Oscillations

- Brain wave frequency + spatial location indicate specific brain process
- Attention/arousal:
 - Alpha waves** (8-12Hz): Low alpha = high attention
 - Location: parietal cortex
- Cognitive processing:
 - Theta waves** (4-8Hz): high theta = high memory processing
 - Location: medial frontal cortex
- Approach / avoidance:
 - Frontal asymmetry (left vs. right):
 - Right alpha > Left alpha = Approach** motivation
 - Left alpha > Right alpha = Avoidance**



What drives effectiveness? component peaks

SAMPLE



ATTENTION → KPI Attention score **6.1**

EMOTIONAL ENGAGEMENT → KPI Emotional Engagement score **8.1**

MEMORY RETENTION → KPI Memory Retention score **5.7**

all scores on a 10 point scale + F/32 is a significant difference

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Example of our own research with EEG: Predicting movie choice behavior from tracking brain response (EEG) to movie trailers



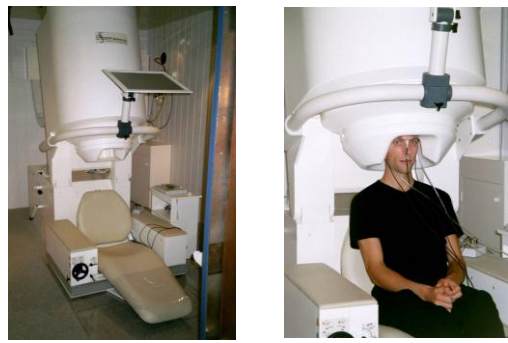
- Watch 18 trailers
- Take home 3 DVDs



- Approach / avoidance:
 - Frontal asymmetry Alpha waves (left vs. right):
 - Right alpha > Left alpha = Approach** motivation
 - Left alpha > Right alpha = Avoidance**

Boksem & Smidts (in progress)

MEG scanner




Magnetic field signals (1995)

EEG: Advantages vs. Disadvantages

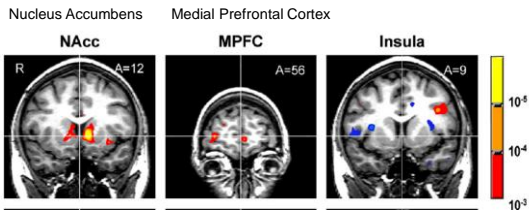
- EEG is relatively cheap
- Natural viewing conditions (& high mobility)
- Perfect time resolution:
 - “when stuff is happening” (e.g. enabling analysis of individual scenes in a commercial)
- Relatively bad spatial resolution
- For high spatial resolution: fMRI
 - “where stuff is happening”

fMRI scanner



BOLD – signal (Blood Oxygen Level Dependent) 1990


Three core brain areas involved in final buying decision



P(buy) = reward + value - 'price pain'

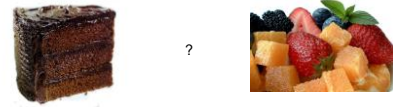
Knutson et al (2007), Neural predictors of purchases

fMRI: Advantages vs. Disadvantages

- Good 3D resolution (high spatial resolution & deep brain areas)
 - Indirect (measures changes in blood flow)
 - Bad timing (few seconds time resolution)
- 
- Has restrictions for subjects (alone in scanner, not moving, ..)
 - Has restrictions for testing stimuli:
 - Visual, auditory, odor: excellent
 - Taste, chewing, tactile: severely limited

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?



Dual processing

(see book Kahneman)

System 1 Affective system

Automatic
Fast
Effortless
Unconscious
Associative
Slow learning
Emotional



System 2 Deliberative system

Controlled
Slow
Effortful
Conscious
Rule-based
Fast learning
Affectively neutral

Temporal discounting / Impulsivity



- Now 20 euro or 22 euro in 4 weeks
- Now 20 euro or 24 euro in 4 weeks
- Now 20 euro or 26 euro in 4 weeks
- Now 20 euro or 28 euro in 4 weeks

- Yields a measure of impulsivity
- This measure predicts actual behavior such as obesity, gambling, unsafe sex, saving behavior

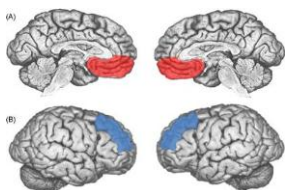
Temporal discounting / Impulsivity

- Choice can be seen as the outcome of competing neural networks (balance)
- In the case of temporal discounting (McClure et al., Science (2004))
 - 'beta areas': immediate rewards (striatum, Medial OFC):
 - choose NOW
 - 'delta areas': reflecting on abstract rewards (dorsolateral PFC):
 - choose LATER



- Balance of beta and delta activation drives the 'present bias':
 - if $\delta > \beta$: choose later rewards (thus less impulsive consumer)

Prefrontal Cortex (PFC) in more detail



- A. Ventromedial Prefrontal Cortex-**
- Processing of (affective) value (utility)
 - Reward and Punishment
- B. Dorsolateral Prefrontal Cortex**
- Executive functions
 - Planning, Inhibition, Attention, Memory

Temporal discounting / Impulsivity

- Balance can be easily disturbed, thus affecting choice
- For example:
 - Distraction / cognitive load: delta activity ↓

Hoofd en hart in conflict

Zaal A

Shiv & Fedorikhin, JCR 1999

Zaal B

Resultaten

Experiment



40% kiest taart
60% kiest fruit

of



63% kiest taart
37% kiest fruit

23



5738496



Temporal discounting / Impulsivity

- Balance can be easily disturbed, thus affecting choice
- For example:
 - Distraction / cognitive load: delta activity ↓

- Boost beta areas:



- See: "Bikini's instigate generalized impatience in intertemporal choice", Bram van den Bergh et al. J of Consumer Res 2008

- Compulsive buyers (koopverslaving): stronger beta activations
- Boost delta areas:
 - Mindfulness training

WAKKER WORDEN!

70% van de Nederlandse consumenten is nog nooit overgestapt van energieleverancier. Dat noemen ze in onze sector 'slapers'. Daarom zeggen wij: WAKKER WORDEN!

BESPAAR HONDERDEN EURO'S

Nederlandse Energie Maatschappij

STAP NU OVER

Some big failures too ...

Celine Dion for Chrysler cars

Why use celebrities in advertising? And which?

- Well-known and popular
- Physically attractive
- Trustworthy
- Likable
- Role model

Of crucial importance however:

→ **Knowledgeable** about the product or service ('credible')

A,B,C brain process underlying celebrity effects in advertising

A. Well-known and popular

- Familiar face → attracts attention
- Will cut through the advertising clutter

B. Make sure there is a believable link between celebrity and product ('expertise')

- Improves memory encoding of product / brand
- Induces trust to the brand leading to higher purchase intention

Jane Fonda for L'ORÉAL PARIS

BEEL PRO-ACTIV HOUT ACTIEF DE OPNAME VAN CHOLESTEROL TOEG.

Elke dag Beel pro-activ verlaagt het cholesterol aanzienlijk.

Person and product pairings



Expertise

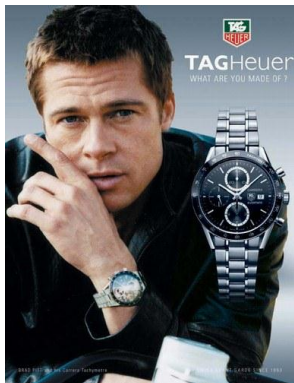


No expertise

What black object is shown here?



Context drives your perception (and evaluation !)



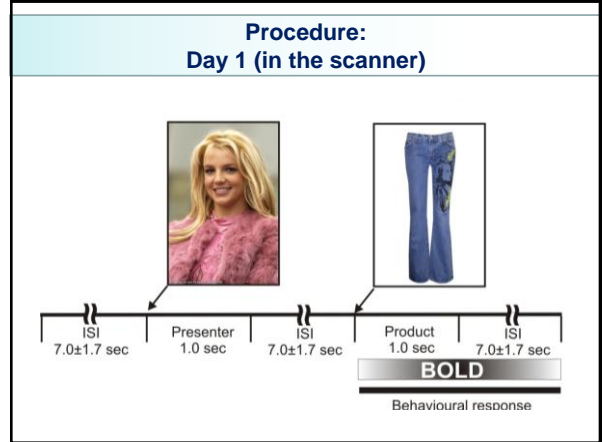
Experimental Procedure

Participants:

- 24 females (age 18-25) who are very familiar with many celebrities
- are lying inside fMRI scanner
- See a picture of a celebrity (1 second)
- Followed by a picture of a product (1 sec)
- And this is repeated 180 times
 - 90 times product + 'expert'
 - 90 times product + 'no expert'



+

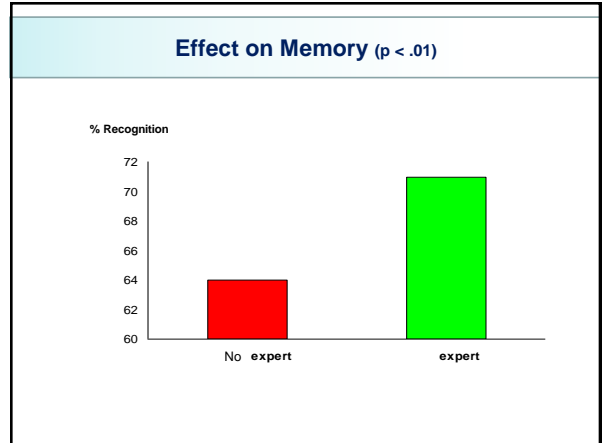


Day 2: (unexpected) Recognition Test

- 180 previously shown products were mixed with 180 unseen, comparable products
- Recognition test of the 360 products

Seen yesterday?
(chance level 50%)

JA NES



Experts enhance memory processing

An expert ('a believable link') generates strong activity in left hemisphere (semantic memory elaboration)

What makes you remember a product presented by an expert?

Hippocampus

A Hippocampus



Brain Anatomy: The Hippocampus

- Hippocampal damage: anterograde amnesia (inability to form new memories)



Day 2: Measuring Buying Intention

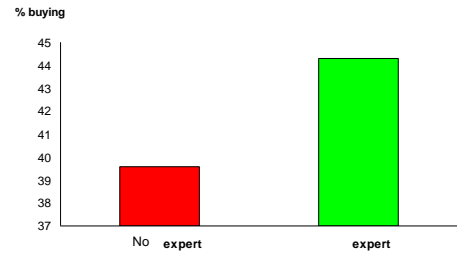
What is the probability of you buying this product?



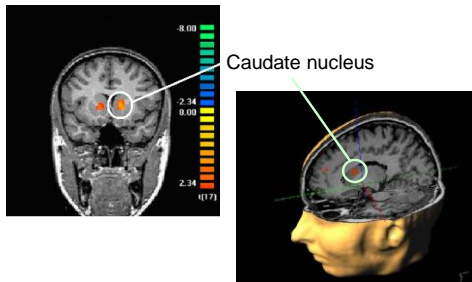
0 10 20 30 40 50 60 70 80 90 100%

- For all 180 products

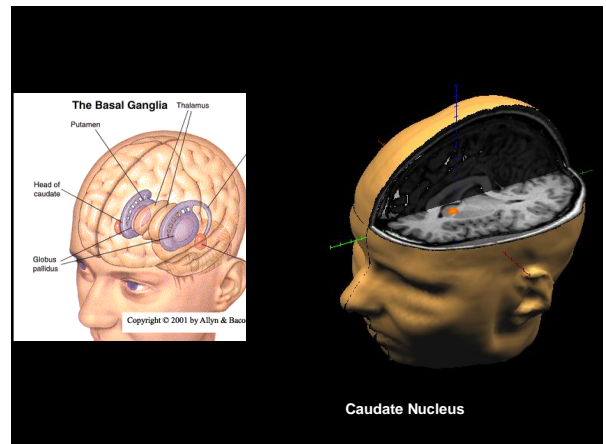
Effect on buying intention ($p < .001$)



What makes you buy a product presented by an expert?



"The expert induces trust to the product"



A,B,C brain process underlying celebrity effects

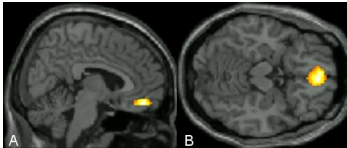
C. Given 'well-known' and 'expert'

Maximize:

- Physical attractiveness
- Likability
- Trustworthiness
- Identification / role model



-> Transfer of affect from celebrity to product at mOFC



Conclusion: What did we learn?

- Conventional consumer theory:
 - Presenters are 'a peripheral cue'
 - Choice heuristic: 'experts are usually correct'
- Our studies detail the persuasion process and show what is really going on:

Fame and Expertise ('an obvious, believable link')

- Induce more memory processing on the celebrity-product pair, leading to
- a deeper encoding of the product, and
- an emotional induction of trust to the product
- This brain process is:
 - fast and unconscious, and
 - results in better memory for and a more positive attitude towards the product / brand

Conclusion – cont.

- The transfer of positive affect originates from the retrieval of semantic and episodic memories (left hemisphere)
- Implication for advertisers: any cue to improve memory retrieval may help in the transfer and thus effectiveness of the celebrity
 - Adding name
 - Refer to the movie
 - ...



<http://www.youtube.com/watch?v=9n6BwgPcaow>



Endorsements can be hugely effective ... unless ...

Today's menu

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- **Case 3: Sociale beïnvloeding**
 - Why do we conform to our peer group?

Case 3: Conforming to your peer group: Why is it so difficult to be different?



TELE2

See:

- Klucharev, Smidts et al., *Neuron* 2009 - fMRI study
- Klucharev, Smidts et al., *J of Neuroscience* 2011 - application of TMS
- Stallen, Smidts et al., The herding hormone, *Psychological Science* 2012

get in line

THE NEW YORK TIMES BOOK REVIEW
Best Sellers August 6, 2006

I don't smoke

I don't smoke

I am cool, I don't smoke!

TELE2

Social norms

- **Injunctive norm** – perception of common (dis)approval of a particular kind of behavior
 - What you *should* do
- **Descriptive norm** – particular behavior that is most common in a given situation
 - What people actually *do*

RSM
ERASMUS



Sheer information on others' behavior can be very influencing

Re-use of towels in hotel rooms

(field experiment; Goldstein, Cialdini, Griskevicius, *JConsRes* 2008)

- 'Help save the environment' 34%
- '75% of guests who stayed in this room used their towel more than once' 49%

People generally underestimate the influencing power of descriptive social norms (Cialdini, 2007, Nolan et al., 2008).

Relevant for Social Norms campaigns

De kracht van de sociale norm

- Sociale normen hebben een directe en vaak onbewuste invloed op het gedrag

Sociale normen marketing:

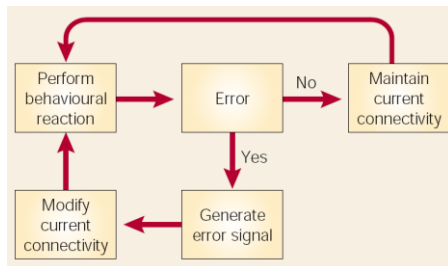
- Om ongewenst gedrag te verminderen of gewenst gedrag te bevorderen
- Als alternatief voor campagnes gebaseerd op het geven van veel informatie, of campagnes gebaseerd op angst.

The recent 'yes, yes, yes, no, yes, yes' campaign for signing up for organ donation in the Netherlands



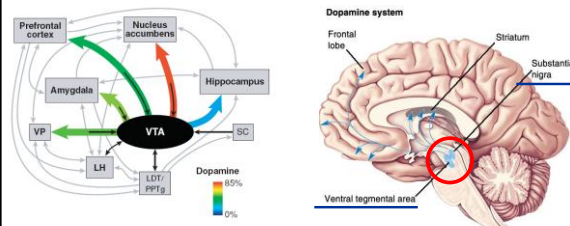
Hypothesis

A deviation from group' behavior (i.e. a conflict with group norms) evokes activity similar to *Error Related Activity* in reinforcement learning.

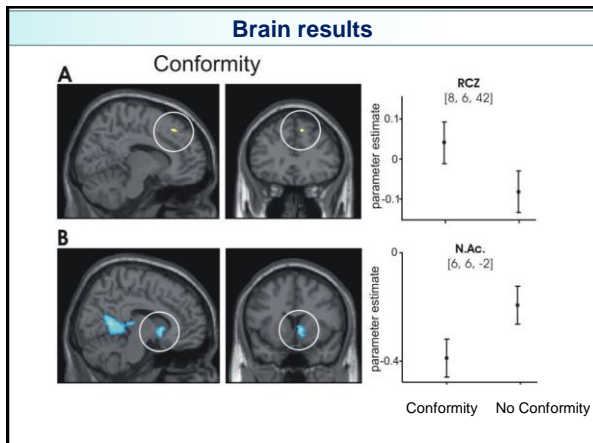
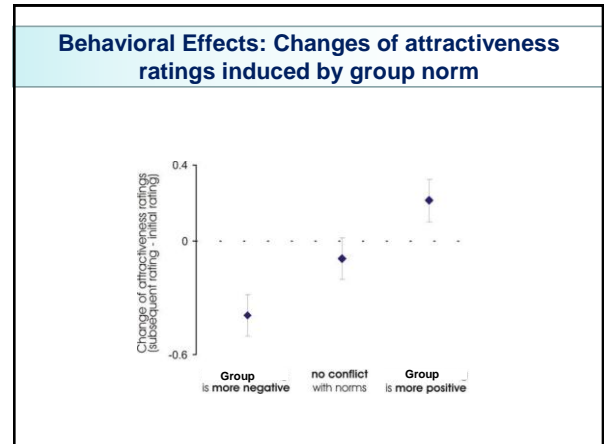
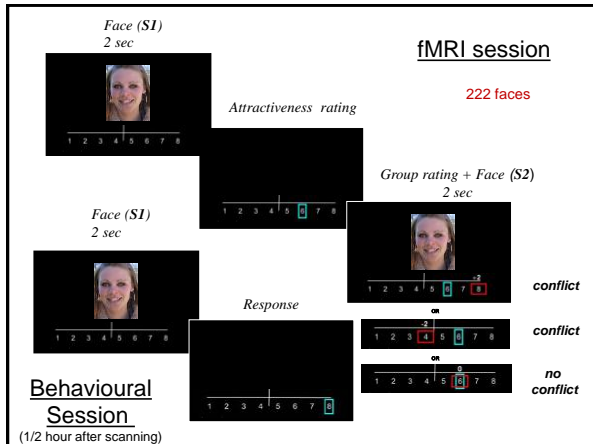


Dopamine response = Reward occurred – Reward predicted

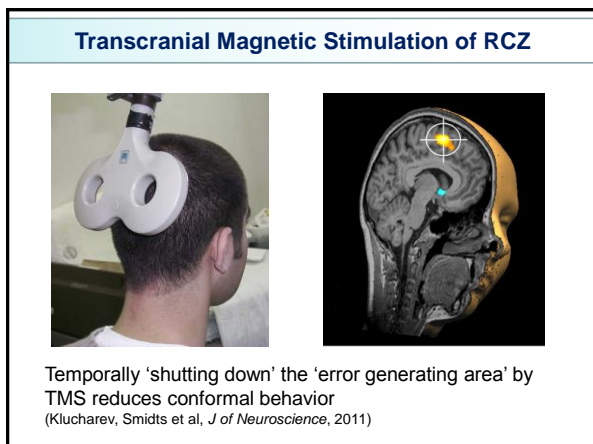
- Prediction error – the discrepancy between an actually received reward and its prediction.
- Learning is proportional to the prediction error.



Fields et al 2007



- ### Summary
- ✓ Afwijken van de groep genereert een 'foutmelding' in de rostral cingulate zone (RCZ) en de nucleus accumbens (NAc)
 - ✓ Conformisme (het aanpassen van de mening in de richting van de groep) wordt gedreven door activatie van de RCZ en met name de-activatie van de NAc.
 - Afwijken van de sociale norm wordt ervaren als een fout en voelt als een straf
 - ✓ De mate van aanpassing verschilde tussen personen (die samenhang met de grootte van de neurale activiteit)
 - ✓ Fundamentele principes van leren van straf en beloning liggen ten grondslag aan conformisme



- ### Social Norms campaigns
- High chance of success because it relies on a basic principle
 - But, precisely because of that: carefully craft the message to prevent 'boomerang effects'
- RSM ERASMUS UNIVERSITY

Effect of descriptive norm information on energy use

Schultz et al., Psych Science (2007), Field experiment

- Households received info on their own and on the average energy use in their neighborhood
 - HHs consuming more than average, *decreased* their energy use
 - HHs consuming less than average, *increased* their energy use

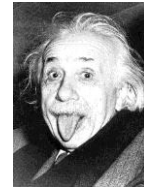
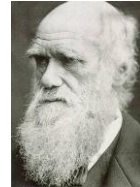


Wrap-up

- Enorme groei van kennis over de neurobiologie van besluitvorming in slechts tien jaar tijd
- Vergeet niet dat naast fMRI juist ook EEG in de praktijk goed toegepast kan worden voor marketing vraagstellingen
- Keuze en gedrag is de uitkomst van wedijverende neurale netwerken met emotionele en rationele kanten
- Impulsief klantengedrag laat deze wedijver heel fraai zien
- Baseer campagnes met een beroemde persoon op het hiërarchische brein proces van 1) aandacht trekken, 2) evidente fit van persoon met het product/merk en 3) maximalisatie van emotionele transfer. Geheugen processen zijn daarbij cruciaal voor het welslagen.
- Peer groups hebben invloed op klantengedrag via een basaal en automatisch proces van leren door straf en beloning

Conclusie: Hype or Hope?

- Neuromarketing is 'here to stay'
 - Zowel wetenschappelijk als praktijkonderzoek in neuromarketing groeit sterk en is een zeer boeiend terrein met veel nieuwe inzichten
- Neuroimaging methoden nog sterk in ontwikkeling
 - Patroonherkenning: Multi Voxel Pattern Analysis ('mind reading')
 - Grotere steekproeven om verschillen tussen individuen te begrijpen
 - Longitudinaal onderzoek bij individuen: kind, puber, volwassene, senior
- Praktisch nut moet nog objectief aangetoond worden
 - Branche is gediend met investering in en stimulering van onafhankelijk wetenschappelijk onderzoek om toegevoegde praktische waarde van neuromarketing aan te tonen !



Questions and Discussion

