Erasmus Centre for Neuroeconomics

Neuromarketing

Ale Smidts

Rotterdam School of Management, Erasmus University
Erasmus Center for Neuroeconomics

April 10, 2014 **Psychologie van de klant, Amersfoort**

Erasmus Centre for Neuroeconomics

www.erim.eur.nl/neuroeconomics

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

Who is Who at Erasmus Centre for Neuroeconomics

Ale Smidts (RSM) & Alan Sanfey (Donders)

Maarten Boksem (neuroscientist)

Clement Levallois (economist: studies development of the field)

- PhDs:

Vincent Schoots

Voorspellen met het brein

Catalina Ratala

Breinproces mbt 'gratis'

Linda Couwenberg

Brein en motivatie: Doelen bereiken

Esther Eijlers

Brein en emoties

Today's menu

- Case 1: Impulsiviteit
- Brief intro to Neuromarketing
- Case 2: Sociale beïnvloeding
  - Why do we conform to our peer group?
- Case 3: Persuasieve communicatie
  - Why are celebrity endorsements effective in advertising?
- Predicting behavior (better) by brain markers. First evidence: See presentation Victor Lamme

OF

OF

http://www.youtube.com/watch?v=QX_oy9614HQ

Dual processing

(see book Daniel Kahneman: Thinking fast and slow)

System 1 **Affective system**		**System 2** **Deliberative system**
Automatic		Controlled
Fast		Slow
Effortless		Effortful
Unconscious		Conscious
Associative		Rule-based
Slow learning		Fast learning
Emotional		Affectively neutral

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

Temporal discounting / Impulsivity

amazon.com
Gift Certificate

- 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

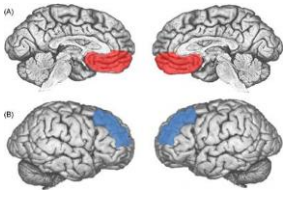
- Yields a measure of an individual's impulsivity
- This measure predicts actual behavior such as obesity, gambling, unsafe sex, saving behavior

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

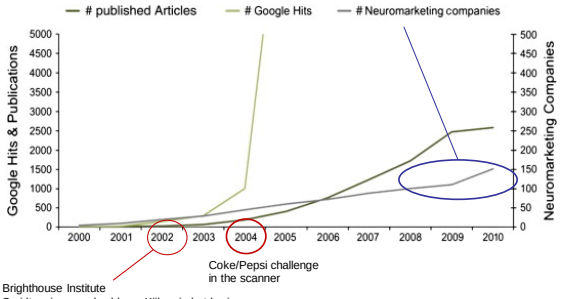
Temporal discounting / Impulsivity

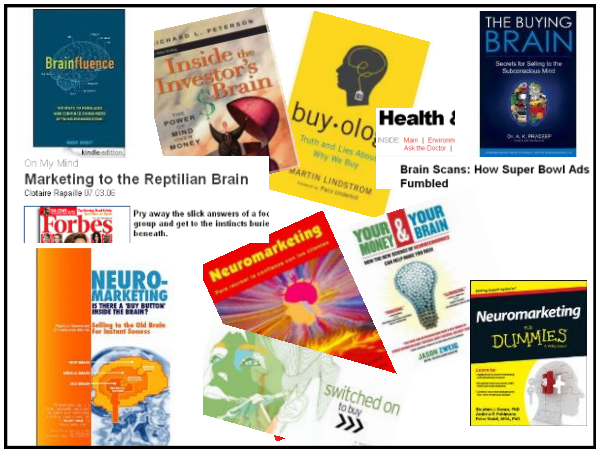
- Balance can be easily disturbed, thus affecting choice
- For example:
  - Distraction / cognitive load: delta activity ↓
  - Boost beta areas: 
    - See: "Bikini's instigate generalized impatience in intertemporal choice", Bram van den Bergh et al. *J of Consumer Research 2008*
  - Compulsive buyers (koopverslaving): stronger beta activations
  - Boost delta areas:
    - Meditation, Mindfulness training?

Today's menu

- Case 1: Impulsiviteit
- **Brief intro to Neuromarketing**
- Case 2: Sociale beïnvloeding
  - Why do we conform to our peer group?
- Case 3: Persuasieve communicatie
  - Why are celebrity endorsements effective in advertising?
- Predicting behavior (better) by brain markers. First evidence: See presentation Victor Lamme

Growth of interest in applying neuroscience to marketing





Practice

Neuromarketing is clearly in the take-off phase

And becoming serious business:

neuroFOCUS
A Nielsen Company

26 May 2011 - Nielsen Acquires NeuroFocus

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

Linked to Berkeley University – Prof. Bob Knight

neurofocus
A Nielsen Company

NEURO|NSIGHT

SANDS RESEARCH

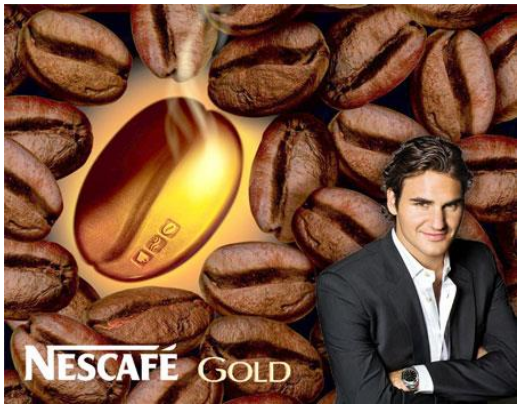
NEURENSICS
neuro-economic research

NeuroCompass
Deeper Brain Insights

Why would / should a marketer be interested in neuroscience & neuroscience methods?

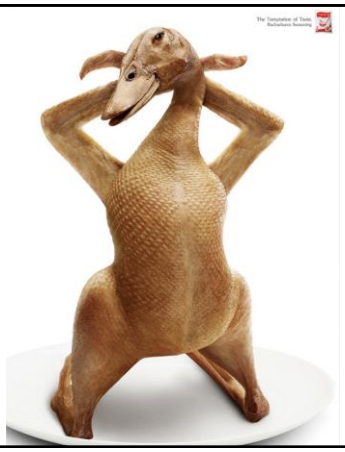
What is driving buying behavior?

An Effective Ad ?



And what about this?

Or this?



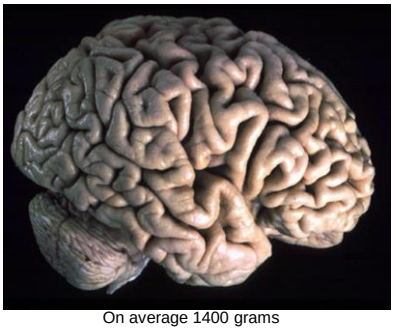
Finding out how and why the customer reacts to marketing actions

Marketer → **Customer** → **Marketing researcher**

- 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

Promise of Neuromarketing:
Measure implicit processes (emotions, needs, wants …) in a reliable way using neuroscience methods



On average 1400 grams
20 % energy use

Main hope (or hype)

Brain imaging:

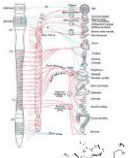
"Reaches parts that other methods cannot reach"

See also Ariely & Berns (2010). Neuromarketing: The hope and hype of neuroimaging in business.

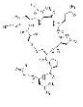
Neuromarketing – broadly defined in practice

- EEG
- fMRI

Neuroimaging



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

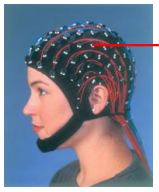


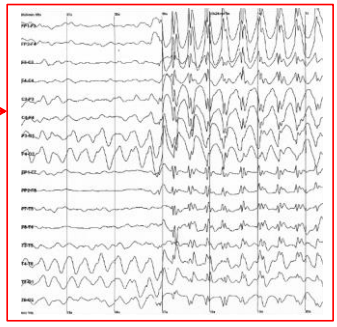
- Hormones
- Neurotransmitters

- Genes

Biometrics

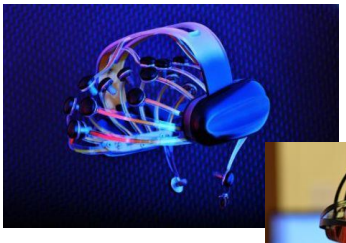
EEG: Recording Electrical Brain Activity

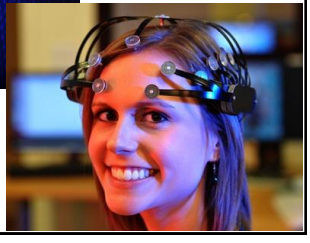




Electrical signal (1929)

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





neuroFOCUS
A Nielsen Company

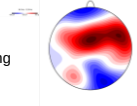
Mobile eye-tracking and EEG device

NEURONS INC

EEG Oscillations

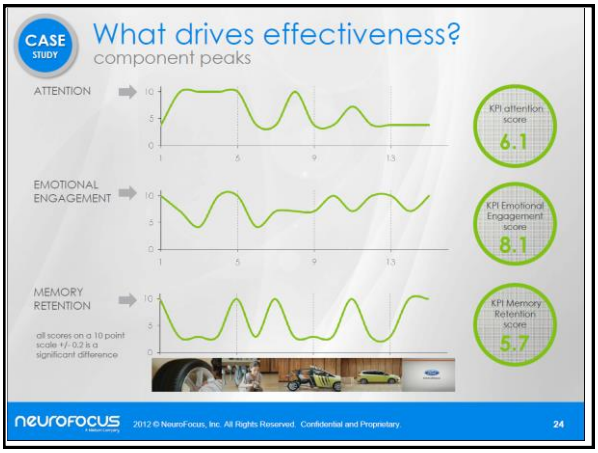
- Brain wave frequency + spatial location indicate specific brain process

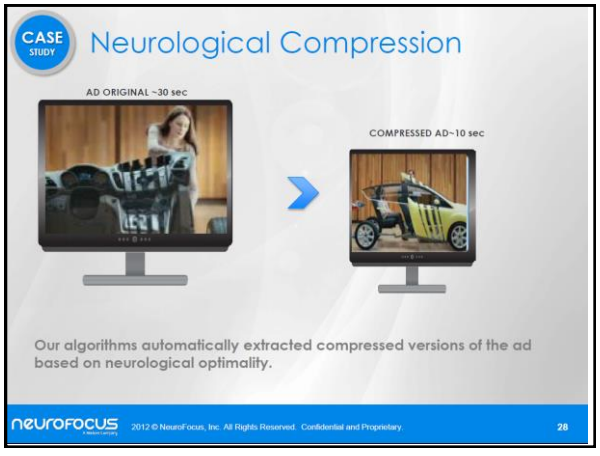
- Attention/arousal:
  - **Alpha waves** (8-12Hz): Low alpha = high attention
  - Location: parietal cortex



- 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**



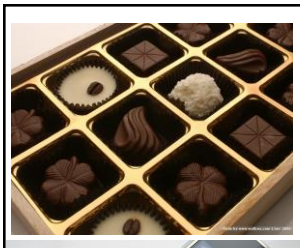


EEG: Advantages vs. Disadvantages

- 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 –> **optimizing the Ad**)
- Relatively bad spatial resolution
- For high spatial resolution: fMRI
  - "where stuff is happening in the brain"

fMRI scanner

BOLD – signal (Blood Oxygen Level Dependent) 1990

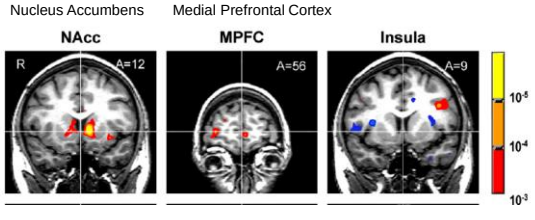


What drives buying behavior?

Shop task in the scanner

Knutson et al (2007), Neural predictors of purchases

Three core brain areas involved in final buying decision



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

Koopkans

Keuze = het resultaat van wedijverende neurale netwerken (balans)

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

Rapid growth of Neuromarketing in practice

- Estimated number of neuromarketing companies:
  - 2008: 13
  - 2014: 80
- Includes companies applying general biomeasures such as heart rate, skin conductance and face reading
- EEG most favorite method (often in combination with eye-tracking or face reading)
  - Nielsen Neuro (previously NeuroFocus)
  - NeuroInsight
  - Sands Research – Neuro ranking of Super Bowl Ads
- Relatively few companies apply fMRI
  - Neurensics (Victor Lamme & Martin De Munnik)

Wrap-up: 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

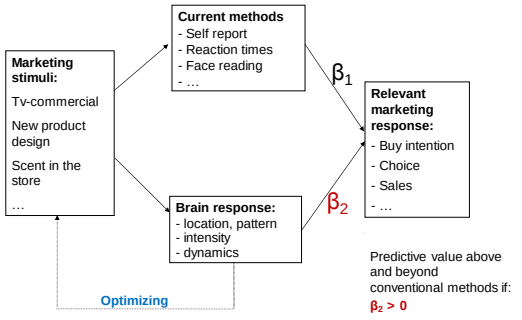
  (Smidts, 2002; *Kijken in het Brein: Over de mogelijkheden van neuromarketing*)

- Marketing stimuli:
  - producten
  - advertentie
  - gedrag verkoper
  - assortiment
  - Web page design
  - …

Twee hoofddoelen Neuromarketing

- **Begrijpen hoe het werkt …**
  - Een beroemde persoon in reclame
  - Peer group invloed
  - Effect van prijs op oordeel over het product
  - …
    - Academisch neuromarketing onderzoek: 'niets zo praktisch als een goede theorie'
- **Wat kunnen we er praktisch mee?**
  - Kunnen we iets leren over marketing stimuli wat we niet kunnen leren met gebruikelijke marktonderzoeksmethoden?
  - Kunnen we gedrag beter voorspellen?
  - Kunnen hersenreacties gebruikt worden voor verbetering van de stimulus (productontwikkelingsproces)
    - Beginnend academisch onderzoek, maar vooral 'neuromarketing companies'

The predictive value of a Neural Focus Group 'above and beyond' conventional methods



Today's menu

- Case 1: Impulsiviteit
- Brief intro to Neuromarketing
- **Case 2: Sociale beïnvloeding**
  - **Why do we conform to our peer group?**
- Case 3: Persuasieve communicatie
  - Why are celebrity endorsements effective in advertising?
- Predicting behavior (better) by brain markers. First evidence: See presentation Victor Lamme

Case 2: Conforming to your peer group: Why is it so difficult to be different?

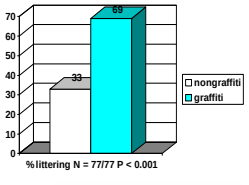
See:
- Klucharev, Smidts et al., *Neuron* 2009 - fMRI study
- Klucharev , Smidts et al., *J of Neuroscience* 2011 - application of TMS
- Stallen, Smidts et al., The herding hormone, *Psychological Science* 2012

Conformity

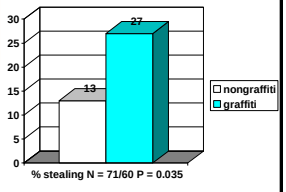
a type of social influence in which individuals change their attitudes, judgments, or behavior in order to adhere to existing social norms

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*



The Spreading of Disorder
Kees Keizer, *et al.*
Science **322**, 1681 (2008);



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

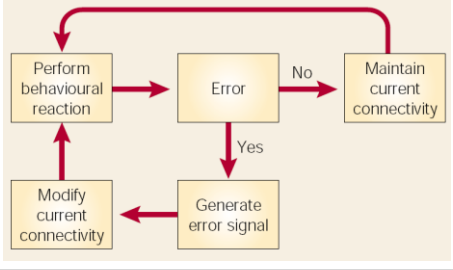
Sociale normen marketing:

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

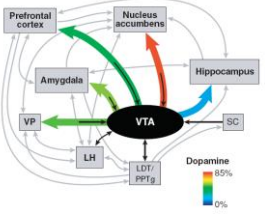
Hypothesis

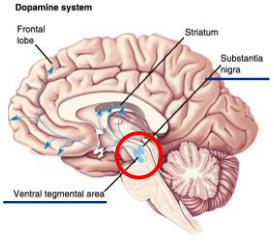
A deviation from group' behavior (i.e. a conflict with group norms) evokes activity similar to *Error Related Activity* in reinforcement learning.



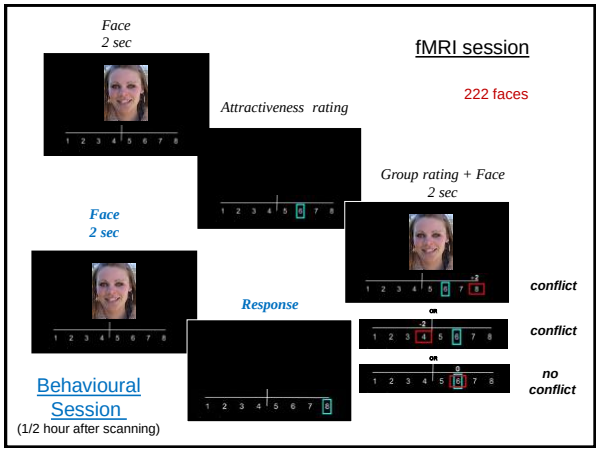
Dopamine response = Reward occurred – Reward predicted

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

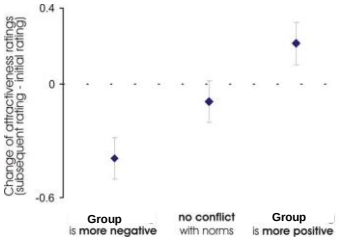




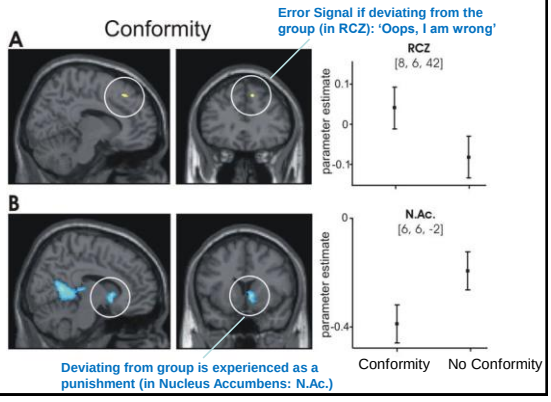
Fields et al 2007



Behavioral Effect: Change in face attractiveness ratings induced by group opinion

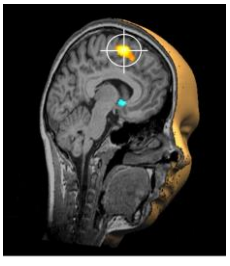


Brain areas driving conformity



Transcranial Magnetic Stimulation of RCZ:

Testing the causal role of the RCZ in social conformity



Temporally 'shutting down' the 'error generating area' by TMS *reduces* conforming behavior

(Klucharev, Smidts et al, *J of Neuroscience*, 2011)

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 samenhing 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'

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!

Today's menu

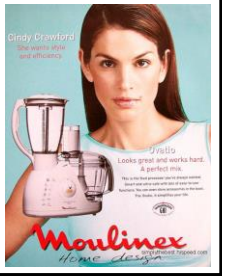
- Case 1: Impulsiviteit
- Brief intro to Neuromarketing
- Case 2: Sociale beïnvloeding
  - Why do we conform to our peer group?
- **Case 3: Persuasieve communicatie**
  - **Why are celebrity endorsements effective in advertising?**
- Predicting behavior (better) by brain markers. First evidence: See presentation Victor Lamme

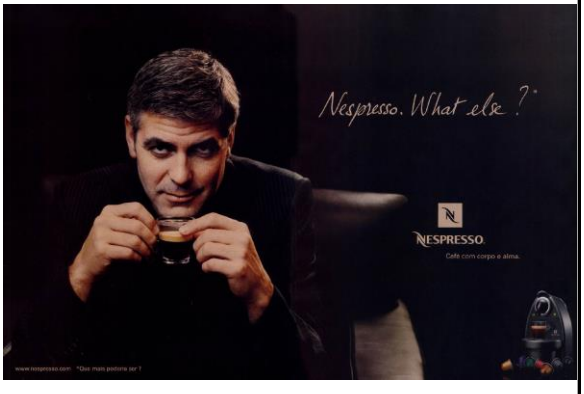
Case 3: Advertising your brand: Why are celebrity endorsements effective?

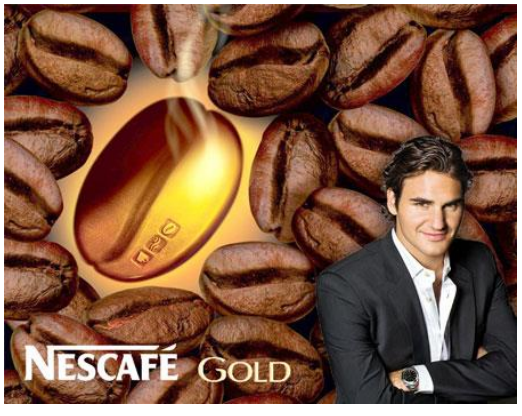
Brain mechanisms of persuasion: How 'fame' and 'expert power' affect memory and attitude

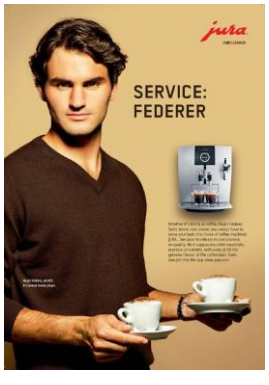
See: Klucharev, Smidts et al. (*SCAN*, 2008)
Stallen, Smidts et al. (*J of Econ Psych*, 2010)

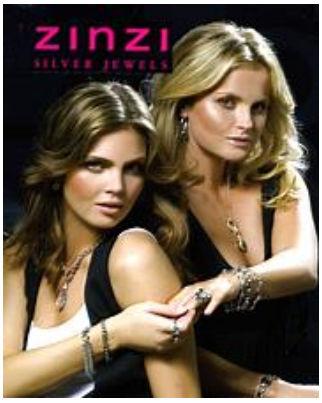
LOUIS VUITTON











Ronald Koeman voor HAK

Some big failures too …

Celine Dion for Chrysler cars

Frequent use of celebrities in communication

- US: 15% of prime time TV commercials
- Japan: 20 %
- Netherlands: quite popular too

- BUT: About ½ of presenter campaigns don't work

(Rossiter & Bellman 2005 estimate)

Why use celebrities in advertising? Which characteristics matter?





Why use celebrities in advertising? And which?

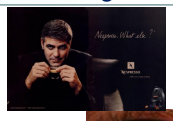
- Well-known and popular
- Physically attractive
- Trustworthy
- Likable
- Role model

Of crucial importance however:

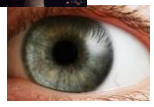
→ **Knowledgeable** about the product or service ('credible')

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

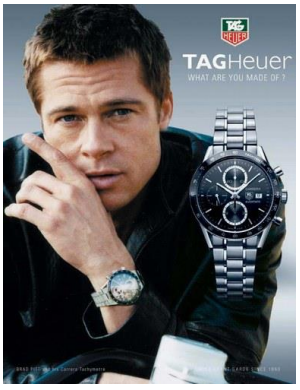
Person and product pairings

Expertise

No expertise

What black object is shown here?

Context drives your perception (and evaluation !)

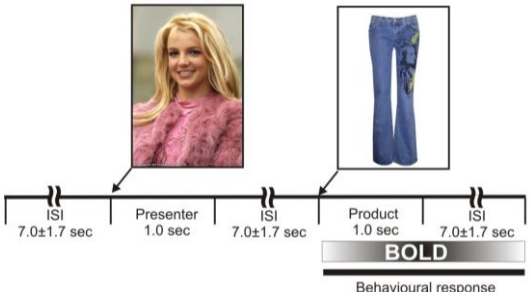


Experimental Procedure

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'

Procedure: Day 1 (in the scanner)



Day 2: (unexpected) Recognition Test

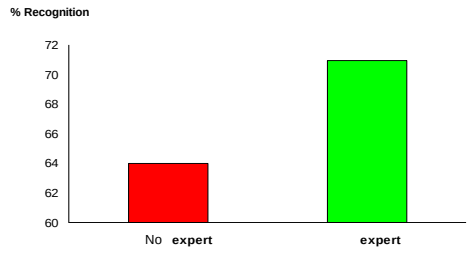
- 180 previously shown products were mixed with 180 unseen, comparable products
- Recognition test of the 360 products

Seen yesterday?

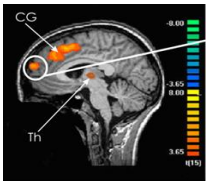
(chance level 50%)

JA NEE

Effect on Memory ($p < .01$)

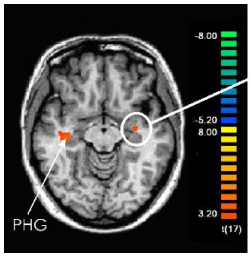


Experts enhance memory processing

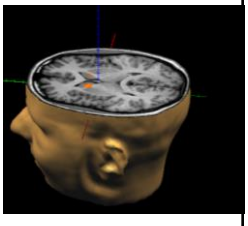


An expert ('a believable link') generates strong activity in left hemisphere (semantic memory elaboration)

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)**

See book: S.J. Watson, *Before I go to sleep* (thriller)

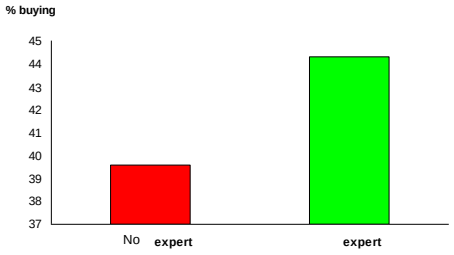
Day 2: Measuring Buying Intention

What is the probability of you buying this product?

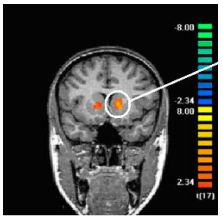
0 10 20 30 40 50 60 70 80 90 100%

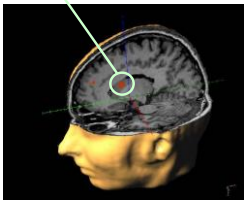
- For all 180 products

Effect on buying intention (p < .001)



What makes you buy a product presented by an expert?





"The expert induces trust to the product"

Follow-up research

Celebrities and shoes on the female brain: Neural correlates of product evaluation in the context of fame

Stallen et al., *J of Economic Psychology* (2010)

The value of FAME

- Does hiring a celebrity presenter improve attitude towards the brand or is an attractive non-famous person equally effective ?
- To study the net effect of FAME:
  - manipulate famousness
  - and control for all other presenter differences, such as expertise, physical attractiveness, trustworthiness, …

A,B,C brain process underlying celebrity effects

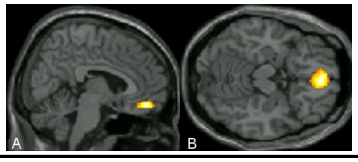
C. Given 'well-known' and 'expert'

Maximize:

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

-> Transfer of affect from celebrity to product at mOFC

Driven by memory associations



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
- an emotional induction of trust to the product, and
- transfer of positive emotions 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
  - …

Conclusie

- 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
- Peer groups hebben invloed op klantengedrag via een basaal en automatisch proces van leren door straf en beloning: Het WERKT!
- Baseer campagnes met een beroemde persoon op het hiërarchische breinproces 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.
- Steeds meer evidentie dat neural focus groups voorspellend zijn van gedrag in de markt

Neuromarketing: 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 !

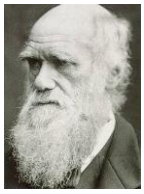
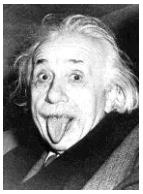
Neuromarketing: Hype or Hope?

"The future of neuromarketing is bright, but only if it is evidence-based"

Ale Smidts

Keynote speech at the first NMSBA World Conference

Amsterdam, 1 Feb 2012

Questions and Discussion