

Morality and the Brain

What can we learn from experimental moral psychology?

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What is an “Experiment”?

- P An experiment is the carefully and rigorously designed test of a courageous, non-trivial hypothesis with the help of unbiased observations.
- P Such hypotheses can only be confirmed (not proven) by discounting plausible alternative hypotheses about the same kind of phenomena.

Wrong conceptions about experimental psychology

- P It does not reduce human beings to physical objects
- P It does not prevent us from experimental studies of psychological aspects of human behavior
- P It does not mean that human behavior must be manipulated
- P It does not exclude pure observational studies
- P It does not confine research to the study of simple, mono-causal hypotheses

Characteristics of experimental (physio-)psychology

P Data base

- ▶ Behavior which can be *observed* directly in an experimentally chosen situation. Behavioral intentions and self-reports may be studied as behavior in their own right but are not taken as valid substitutes for the direct observation of behavior that is to be studied.

P Measurement objects: Certain aspects or properties of behavior like

- ▶ Orientations (affects, motivation, values, attitudes, etc.)
- ▶ Competencies (cognition, schema, structure, etc.)

P Method of measurement:

- ▶ Assessment and analysis of certain *aspects* (time, distance, change of electro-magnetic properties etc.) of *reaction patterns* to systematically designed *stimulus pattern*.

P Epistemological Principles

- ▶ Conceptual clarity and parsimony: "Entities are not to be multiplied without necessity." (William Occam)
- ▶ Setting up of non-trivial, courageous hypotheses and rigorous attempting to falsify them: Survival of the best (Karl Popper, Imre Lakatos)

How can one look into the brain without opening it up?

Functional Measurement

P Short overview on the origin and development of “functional measurement”

- ▶ Fechner: Peeking into the soul
- ▶ Donders: How can we experimentally prove “thinking”?
- ▶ Piaget: Eliciting moral emotions through moral dilemmas
- ▶ Damasio: Drawing inferences from brain damages
- ▶ Hamlin et al.: Studying moral orientations of preverbal babies
- ▶ Lind: Functional measurement through Experimental Questionnaires (example: Moral Judgment Test, MJT)
- ▶ fMRT – functional magnet-resonance tomography

Lind, G. (1982). Experimental Questionnaires: A new approach to personality research. In: A. Kossakowski & K. Obuchowski, eds., Progress in psychology of personality, pp. 132-144 Amsterdam, NL North-Holland.

Fechner's Peek into the Soul: The Beginning of Functional Measurement

- P Fechner's self-experiments with afterimages caused photophobia and near blindness. He had to stay in dark rooms without light for months.
- P When his sight returned and he could step into his garden for the first time again, it appeared to him as if he could see "the soul of the plants."
- P In order to put his intuitions on a scientific basis, he hypothesized a mathematical relationship between objective stimuli and subjective sensations, and attempted to corroborate his hypothesis through experiments:
- P Experimental finding: Indeed, the strength of a sensation (light, weight, heat) showed to be proportional to the logarithm of the intensity of the objective stimulus (Weber-Fechner-law).



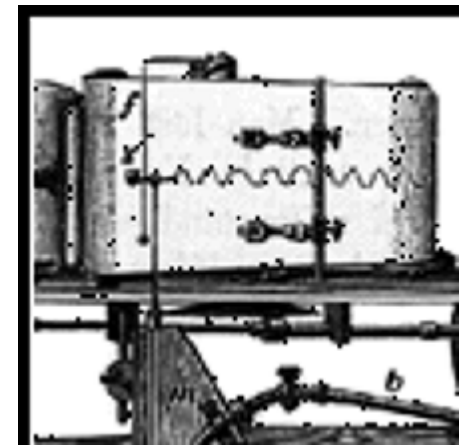
Figure 37
Gustav Theodor Fechner (1801-1887)
Courtesy of the Archives of the History of American Psychology.



How can we observe thinking?

F. C. Donders (1818 - 1889)

- Donders' question: How can we show that people not only *react* to stimuli but that they do *think*?
- His ground-breaking Experiment:
 - ▶ Hypothesis: Certain tasks require thinking and thinking needs time.
 - ▶ The experimenter asks the participant to respond as fast as possible by repeating a meaningless syllable like "ki." He measured the elapsed time between the stimulus and the reaction with his newly created chronograph. The mean reaction time was 39 ms.
 - ▶ When he presented three different syllables (**ki**, **ko**, **ku**) in a random order, the participants needed more time to react, namely 75 ms. Besides the reaction time, obviously, the participants need time for thinking, exactly 36 ms = 75 - 39 ms.
- "This was the first determination of the length of a well-defined psychological process. ... It concerned the decision of a dilemma and of an act of thinking that corresponded to this decision."
(Donders, 1868)



Donders, F.C. (1868). Die Schnelligkeit psychischer Prozesse. Reichert's und du Bois-Reymond's Archiv.

How can we make moral affects observable?

P Jean Piaget: Through the Dilemma-Method

- ▶ Through the confrontation of a participant with a situation, in which moral emotions demands mutually exclusive courses of action. This way moral affects become conscious and assessable for observation.

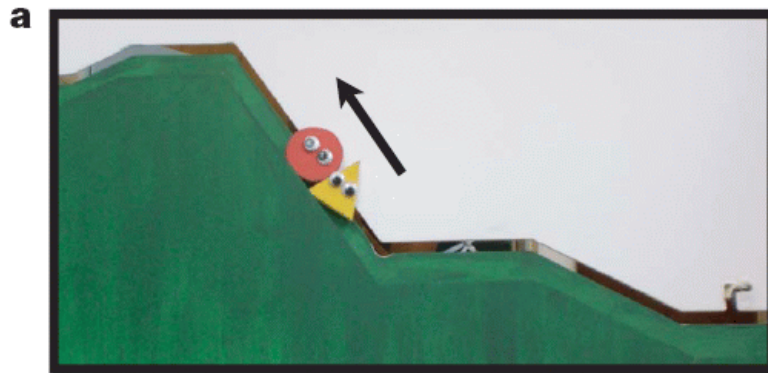
P Methodological problem: The situation which elicits the dilemma feeling is often ambiguous:

- ▶ The dilemma lies in the eyes of the beholder

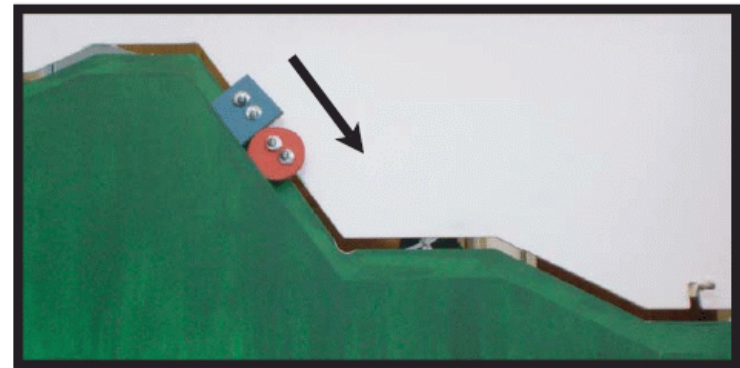
How can one observe moral orientations in preverbal infants?

The experiment by Hamlin et al., 2007

Yellow: Cooperation



Bleu: competition



Quelle:

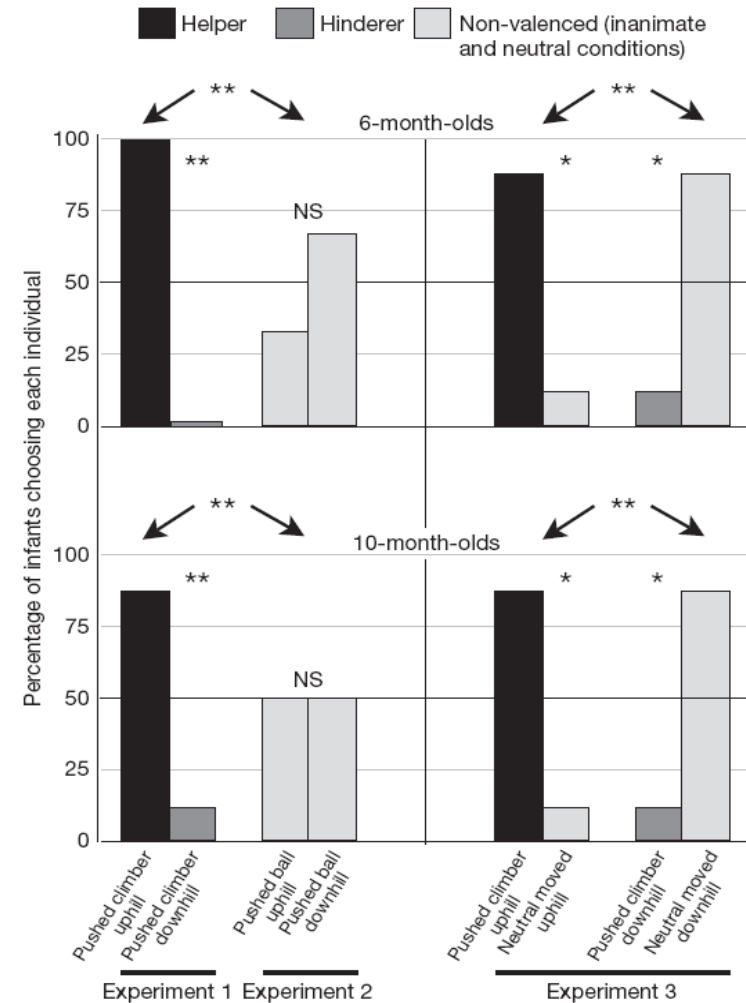
Hamlin, J. K., Wynn, K., & Bloom, P. (2007). Social evaluation by preverbal infants. *Nature*, 450, 557-560

Hamlin's Experiment

Result:

Preverbal infants chose almost only helping actors (black bars), and not hinderers (grey bar).

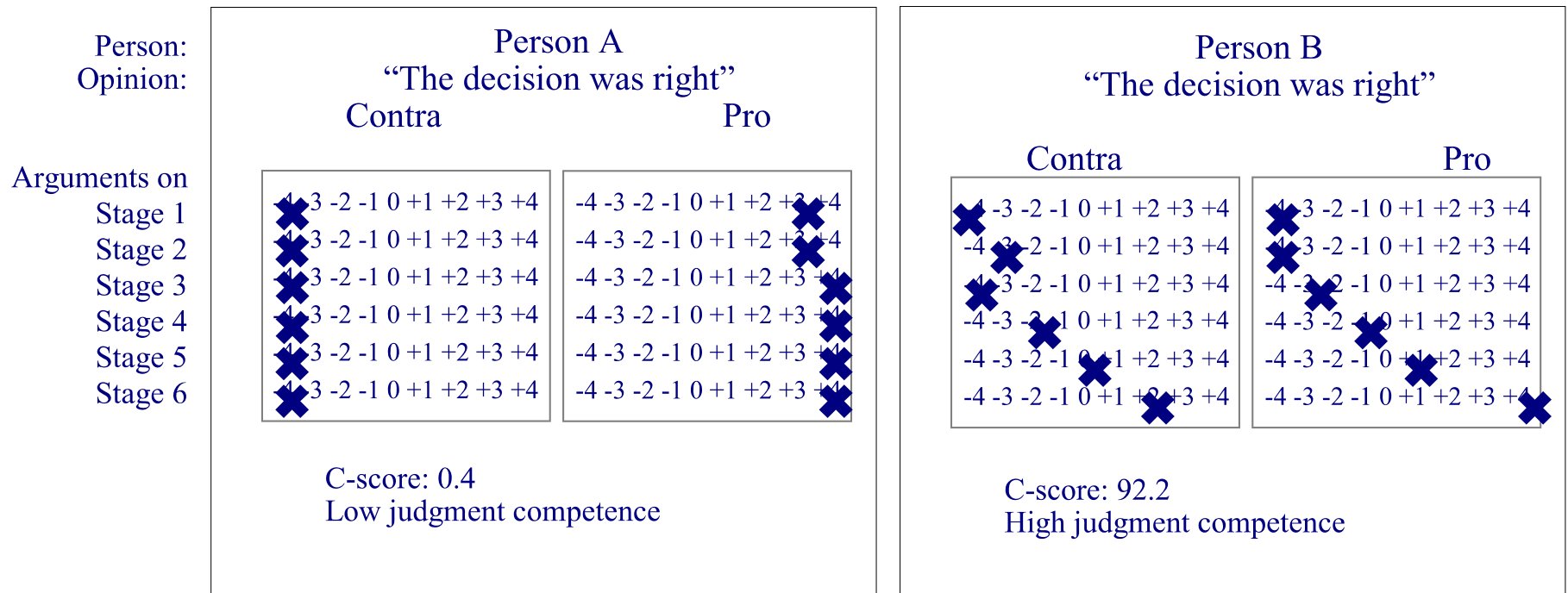
“Our findings indicate that humans engage in social evaluation far earlier in development than previously thought, and support the view that the capacity to evaluate individuals on the basis of their social interactions is universal and unlearned.” (p. 559)



Hamlin, J. K., Wynn, K., & Bloom, P. (2007). Social evaluation by preverbal infants. *Nature*, 450, 557-560.

Experimental Questionnaire: a 2 x 2 x 6 design

The Response Pattern of Two Participants With Different **Competence-scores**



Lind, G. (2008). The meaning and measurement of moral judgment competence revisited - A dual-aspect model. In: D. Fasko & W. Willis, Eds., Contemporary Philosophical and Psychological Perspectives on Moral Development and Education, pp. 185 - 220. Cresskill, NJ: Hampton Press.

The *Moral Judgment Test* as an “intra-individual Experiment”

Its experimental, 6 x 2 x 2 multi-variate design:

P The Moral Task (dependent variable)

- ▶ Rating Supportive and Counter-Arguments in Regard to Their Moral Quality

P 6 x 2 x 2 Experimental Factorial Design

- ▶ Factor a: Moral Quality of Argument (6 Stage Orientations)
- ▶ Factor b: Opinion-Agreement of Argument (Pro and Contra)
- ▶ Factor c: Dilemma-Context of Argument (Two Dilemmas)

P Functional Scoring (organization of manifest items)

- ▶ Multi-variate Analysis of Variance
- ▶ Index of Moral Judgment Competence: C-score

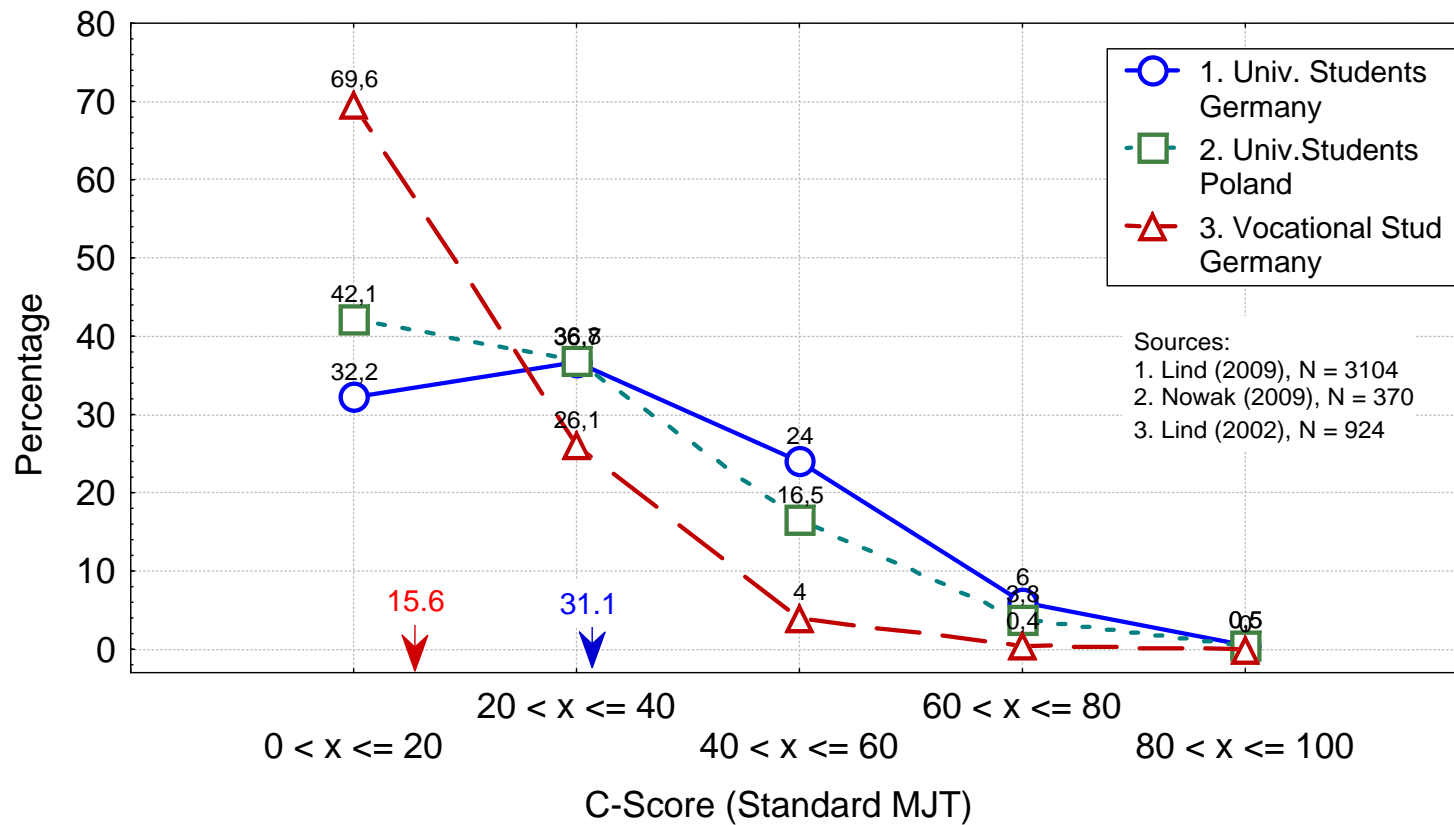
Nine Steps for Scoring of the MJT: C-index of Moral Judgment Competence and Six Indices of Moral Attitudes
(the numbers in the cells represent the item numbers)

(C) 2004 Georg Lind

| Dilemma: | <i>Workers´ Dilemma</i> | | | | <i>Doctor´s Dilemma</i> | | | | | |
|---|---|-----------------------|--|-----------------------|---|-----------------------|-------------|-----------------------|---|------------------------------------|
| Opinion: | <i>disagree (-3 --1) / agree (0 - +3)</i> | | | | <i>disagree (-3 --1) / agree (0 - +3)</i> | | | | | |
| | <i>Pro*</i> | | <i>Con*</i> | | <i>Pro*</i> | | <i>Con*</i> | | Sum up the arguments for each Stage | Square the sums in the left column |
| Stage: | <i>X</i> | <i>X</i> ² | <i>X</i> | <i>X</i> ² | <i>X</i> | <i>X</i> ² | <i>X</i> | <i>X</i> ² | ① $\sum X_{1-4}$ | ② $(\sum X_{1-4})^2$ |
| 1 | 1 | | 12 | | 3 | | 10 | | | |
| 2 | 5 | | 9 | | 4 | | 11 | | | |
| 3 | 3 | | 11 | | 6 | | 7 | | | |
| 4 | 2 | | 7 | | 5 | | 12 | | | |
| 5 | 6 | | 10 | | 2 | | 8 | | | |
| 6 | 4 | | 8 | | 1 | | 9 | | | |
| Sum up all columns and check total sums ! | A | | B | | C | | D | | ③ Total sum | ④ Sum of column = |
| Sum of all pro items and of all con items (optional): * | $\sum_{i=1}^6 x_{i,pro} = A + C =$ | | Optional | | $\sum_{i=1}^6 x_{i,con} = B + D =$ | | Optional | | Use ⑥ and ⑦ | ⑨ C-index: |
| $SS_{Tot} = \sum (x^2) \Rightarrow$ Square all data and add up the squares | ⑤ | | Use ④: $SS_{Stage} = \sum_{St=1}^6 (\sum_{j=1}^4 x_{ij})^2 / 4 - SS_M \Rightarrow$ | | ⑧ | | | | $100 * \frac{SS_{Stage}}{SS_{Dev}} \Rightarrow$ | |
| $SS_M = SS_{Mean} = (\sum x)^2 / 24 \Rightarrow$ Use ③, square this sum and divide by 24 | ⑥ | | $SS_{PC} = \sum_{j=Pro}^{Con} (\sum_{i=1}^{12} x_{ij})^2 / 12 - SS_M \Rightarrow$ | | Optional | | | | $r_{PC}^2 = \frac{SS_{ProCon}}{SS_{Dev}} \Rightarrow$ | Optional: PC-Index |
| $SS_{Dev} =$ $SS_{Tot} - SS_{Mean} \Rightarrow$ | ⑦ | | $SS_{DH} = \sum_{j=Work}^{Doc} (\sum_{i=1}^{12} x_{ij})^2 / 12 - SS_M \Rightarrow$ | | Optional | | | | $C^* = \frac{SS_S}{SS_{Dev} - SS_{DH}} \Rightarrow$ | Optional: C*-Index |

* This calculation is optional. If used, Pro and Con are to be scored according to the subject's *opinion*. Rule: If the subjects agrees in one case with the solution given in the story AND disagrees with the solution of the other story, then the columns must be added like this: A + D and B + C.

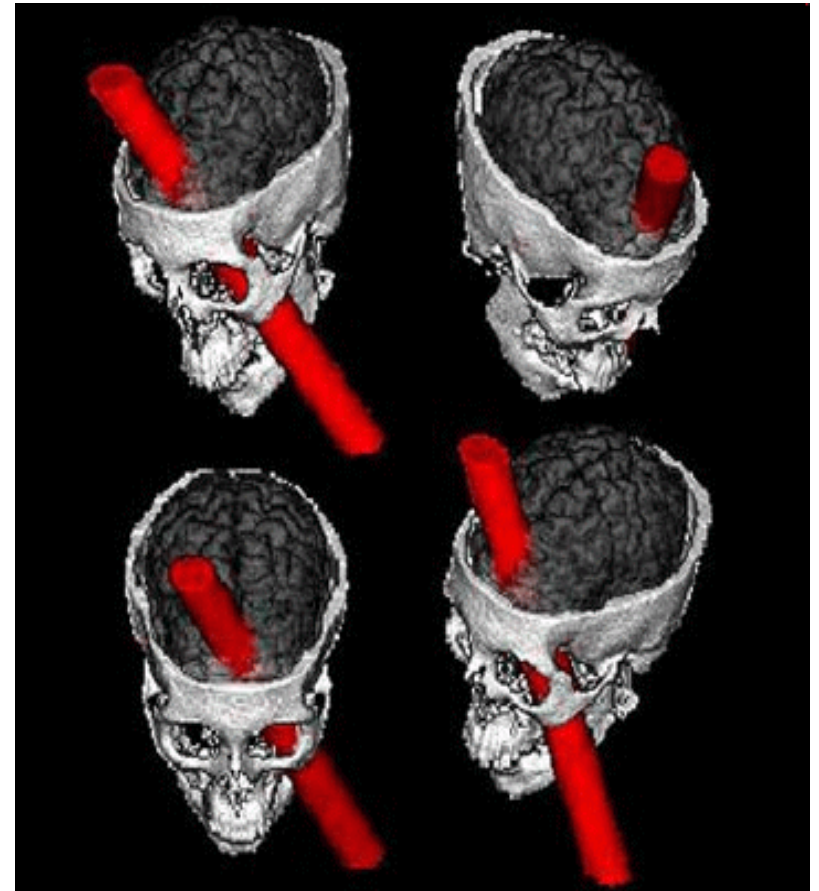
... the moral task of the MJT is difficult: Many fail



Moral Competence: The trail leads to the frontal brain

The railroad engineer Phineas P. Gage (1823-60) was badly hurt by an iron rod. He survived, but he lost, as it is said, his moral integrity. (Reconstruction by Dr. Hanna Damasio.)

Conclusion: „The observation of abstract moral principles requires ... a highly developed human frontal brain.“
(Jorge Moll et al., 2006)



Moll, J., Kruger, F., Zahn, R., Pardini, M., Oliviera-Souza, R. de, & Grafman, J. (2006). Human fronto-mesolimbic networks guide decisions about charitable donation. *Proceedings of the National Academy of Sciences of the United States of America*, PNAS, 103 (42), Oct 9, 2006, 15623-28

Modern Brain Research: The Experiment by Prehn et al.

P Task: The participants had to evaluate 48 sentences whether they were correct or not.

- ▶ Half of the sentences violated a grammatic rule, for example: “Heinz **go** twice to the store.”
- ▶ The other half was grammatically correct but violated a moral norm, for example: “Jack **smashes** a window with a stone.”

P The researchers measured the oxygen level of the blood -- an indicator of neural activity -- in the frontal cortex with the help of functional magnetic resonance tomography (fMRT).

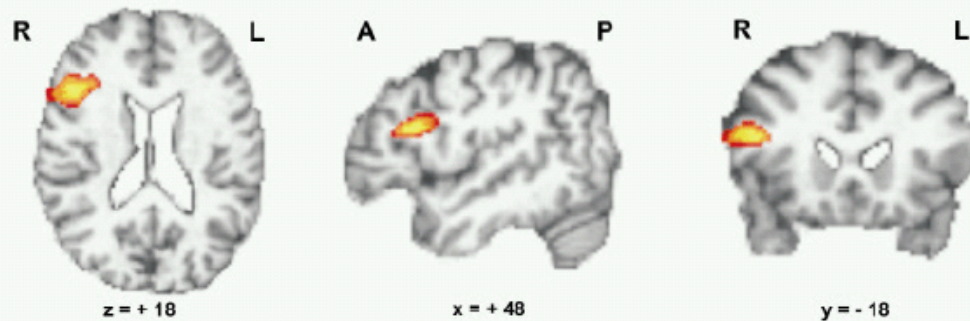
P They also measured moral competence using the Moral Judgment Test (MJT).



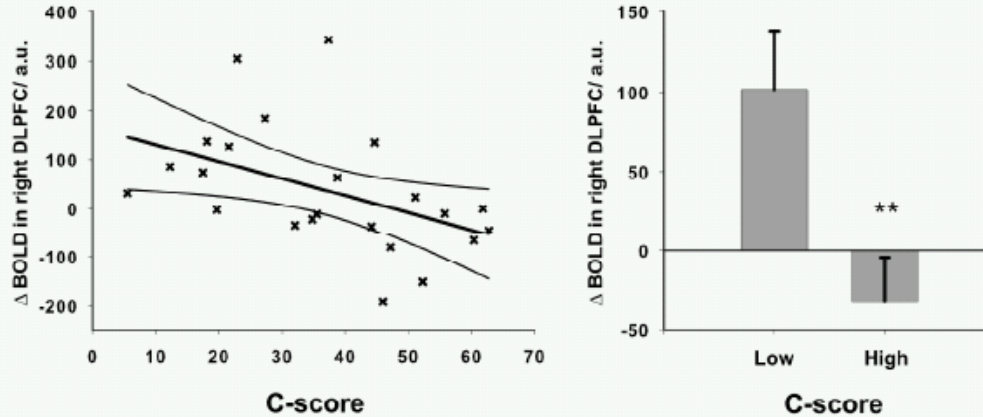
Prehn, K., Wartenburger, I., Mériaux, K., Scheibe, C., Goodenough, O.R., Villringer, A., van der Meer, E., & Heekeren, H.R. (2008). Influence of individual differences in moral judgment competence on neural correlates of socio-normative judgments. *Social Cognitive and Affective Neuroscience*. 3(1), 33-46.

Neural Correlate of Moral Competence

a) Covariation of C-scores with BOLD responses in right DLPFC



b) Socio-normative judgments



The Experiment

N = 23 women

Dependent variable: Indicator for activity in the right dorsolateral prefrontal cortex (DLPFC)

Method: fMRI

Independent variable

a) Task: Judgment on the norm-conformity of statements (contrasted with judgments on the grammaticality of statements)

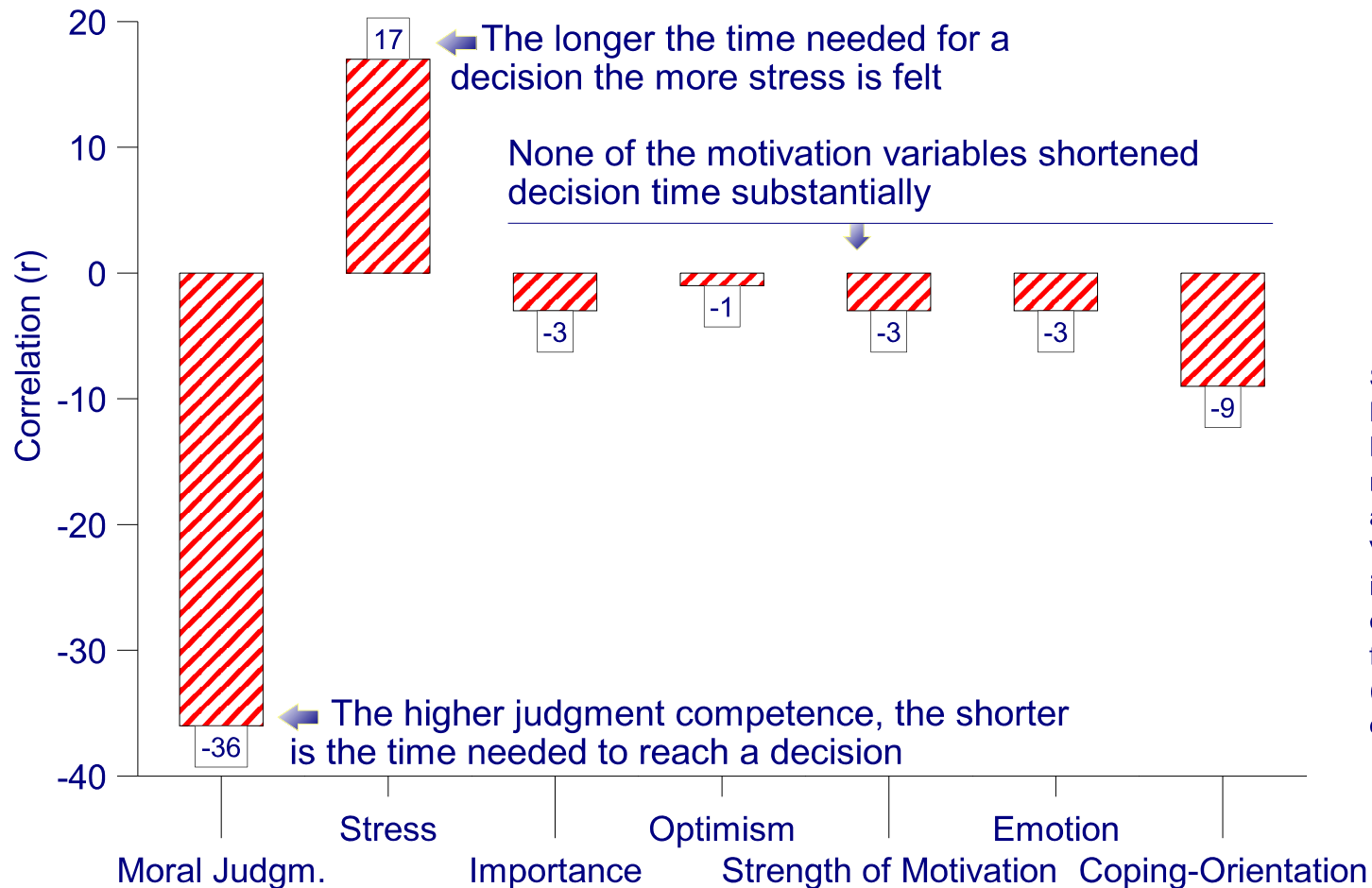
b) Moral Judgment Competence (C-Wert, MJT)

Finding

Persons with high C-score could solve the task with less activity in the right DLPFC than persons with low C-score. Effect size $r = .45$

Prehn, K., Wartenburger, I., Mériaux, K., Scheibe, C., Goodenough, O.R., Villringer, A., van der Meer, E., & Heekeren, H.R. (2008). Influence of individual differences in moral judgment competence on neural correlates of socio-normative judgments. *Social Cognitive and Affective Neuroscience*. 3(1), 33-46.

Mansbart's Experiment: Judgment competence is a better predictor of decision-making ability than motivation



Source:
Mansbart, F.-J. (2001).
Motivationale Einflüsse der
moralischen Urteilsfähigkeit
auf die Bildung von
Vorsätzen [Motivational
influences of moral judgment
competence on the
formation of intentions.]
(Diploma thesis, University
of Konstanz)

Descartes' Error

- P Descartes believed that body (brain) and mind are two separate things, which are connected to each other by the pineal gland (Zirbeldrüse).
- P Later it turned out that the pineal gland has a different function. How can we solve then the body-mind problem?
- P Gilbert Ryle and Jean Piaget suggested a solution to Descartes' problem:
 - ▶ Ryle: Brain and mind belong to two different conceptual categories and are not two things that belong to the same categorical level. While brain describes the anatomy of a human organ, mind describes its psychological functioning.
 - ▶ Piaget: Brain and mind are two aspects of human behavior rather than two separable things or components. They can be clearly distinguished (like the colour and the shape of a ball) but cannot be separated from each other.

Methodological Summary: Functional Measurement as a Condition for Scientific Progress

P Category problem

- ▶ Cognition and affect belong to a different category than behavior: They are *aspects of behavior*.
- ▶ Cognition and affect are *aspects* but not components, that is, they can be distinguished but not separated like things.

P Measurement problem

- ▶ In the assessment of affects there are always cognitive processes involved, and vice versa. Therefore, they have to be measured simultaneously.

P Consciousness problem

- ▶ The affective and cognitive aspects of behavior are to a great extent unconscious and not assessable through introspection. Therefore, they must be inferred from a person's pattern of reactions to a pattern of experimentally designed stimuli.

P Parsimony problem

- ▶ The number of constructs of a theory should be kept to minimum.

Summary: The *Dual-Aspect-Theory* (DAT) of Moral Behavior and Development

- P *Aspects*: Moral behavior must be described by two aspects, namely by cognitive aspects (moral competence) and by affective aspects (moral orientations).
- P *Unconscious*: In everyday life, our decisions are largely automatized and mostly determined by unconscious moral orientations and abilities.
- P *Dilemmas*: Only when automatized decisions are confronted with a difficult dilemma situation, when we feel a moral conflict, then we become aware of our moral orientations and competencies, and reflect on them and discuss them with others.
- P *Moral learning*: The confrontation with difficult moral dilemmas then can trigger a moral learning process: We can educate our moral feelings and reactions and develop, through this, new behavioral automatization on which we will have to rely in the future.

Lind, G. (2008). The meaning and measurement of moral judgment competence revisited - A dual-aspect model. In: D. Fasko & W. Willis, Eds., *Contemporary Philosophical and Psychological Perspectives on Moral Development and Education*, pp. 185 - 220. Cresskill, NJ: Hampton Press. large PDF-facsimile | small PDF-copy (password: kohlberg)

Thank you!
