

The Brain, Rationality, and Economics:
A Symposium in honour of Rudolf Hernegger



The Brain, Rationality, and Economics: An Introduction

THIS SYMPOSIUM consists of a collection of papers presented at the 6th Hamburg Workshop in Applied Game Theory on ‘The Brain, Rationality, and Economics’ held on 5 December 2003 and organized by the Institute of SocioEconomics (IAW), University of Hamburg and the University of Liverpool Management School (ULMS). The workshop was held in honour of Rudolf Hernegger (now in his mid-eighties and lives in München) who is a member of that dying breed of serious independent scholars and writers. Over the past forty years he has written seven books on questions of personal and collective identity, religion, and the evolution of consciousness. His most recent book is *Die Sprache des Bewußtseins: Gene – Sinne – Nervensystem (The Language of Consciousness: Genes – Sense – Nervous System)*, which was published in 1998 by Logos, Berlin. Sadly a severe stroke has brought his writing career to a premature end. (A list of Hernegger’s books is given below.)

The idea of holding a workshop with a focus on the emerging field of neuroeconomics came about in the course of discussions with Giorgio Coricelli at the 3rd Joint Hamburg–Siena Workshop in Applied Game Theory held in Siena 10–13 April 2003. It was during these discussions that Giorgio pointed out that while there is now an increasing amount of empirical work in the area of neuroeconomics, there is still a paucity of theory development. Hence we created a workshop programme that brought empirical studies and theory together.

The symposium is made up of four papers. The first is one of the later pieces written by Hernegger. Although it is not directly related to neuroeconomics, but concerns – as its title suggests – the evolution of consciousness more generally, we publish it as a way of stating the idea that the next thrust of development in decision theory has to have a naturalistic basis, which means accounting for the brain and consciousness. Whether this will prove fruitful for economics, we cannot say. These are early days in this territory.

The next three papers constituted the workshop. The contributions by Daniel Zizzo and Giorgio Coricelli are concerned with the challenging issue of integrating emotions into rational choice theory, while Werner Güth and Hartmut

Kliemt's paper addresses the more general question of equilibrium properties in theories of bounded rationality.

In his contribution, Zizzo uses neurobehavioural evidence on anger to argue against the orthodox neuroscience emotion–cognition dichotomy. Zizzo's main idea is that given the nature and complexity of becoming angry, cognition must be involved. The orthodox dichotomy – which also finds its expression in economic theory in that we generally contrast reason with emotion – is expressed by the belief that emotions come into being with little mediation of that part of the brain where cognition is primarily associated, known as the prefrontal cortex. Zizzo argues that available evidence does not substantiate this at all. Instead he points to evidence that anger-related prefrontal cortex activity can be observed and predicts that the level of intensity of such activity is dependant upon the complexity of the decision theoretic experimental setting. His view is that adherents to the orthodox view have misinterpreted experimental observations.

Of essential importance is that Zizzo criticizes the orthodox dichotomy on the grounds that not only does it downplay cognition and prefrontal activity, but also in that it overestimates the role of one particular part of the brain, known as the amygdala, as 'central emotional computer'. According to Zizzo, the evidence we have suggests no such role for the amygdala when it comes to anger in humans. As a result, Zizzo challenges the idea of attributing a single common neural substrate and the same neurobiological mechanisms to all emotions. It is therefore questionable whether emotional phenomena can be subsumed under a single scientific category.

The importance of this research for economics is considerable. In many situations anger is an important component of bargaining behaviour, tax payment choices, and work effort. According to Zizzo, problems for rational choice theory do not emerge because anger is opposed to cognition, but mainly because of the cognitive complexity related to anger episodes.

Giorgio Coricelli's contribution also investigates particular emotions, namely regret and disappointment, both of which are related to undesired outcomes but with one crucial distinction: regret involves a feeling of responsibility. In his experimental study, subjects had to repeatedly chose between two gambles which could be distinguished in terms of the inducement of disappointment and regret. Coricelli's results show that, contrary to the expectations of standard decision theory, the unobtained outcome significantly modulates the emotional response to the actual outcome of the gamble. The impact is more pronounced in the case of regret. Interestingly, subjects who had particular lesions of the brain (orbitofrontal) experience disappointment but show no regret.

In a manner similar to Zizzo's study of anger, Coricelli points to the cognitive aspects of regret and disappointment, which are based on counterfactual comparisons. This leads him to highlight cortical top-down modulation of emotions

in addition to the emotional bottom-up influences on cortical decision processes discussed in the literature.

The third paper, by Werner Güth and Hartmut Kliemt departs from the neurobiological scene. Instead it is an exercise in theory development that is closest to that area of decision theory which tries to incorporate emotions: bounded rationality. Güth and Kliemt's contribution is to apply the concept of bounded rational behaviour to the process of theory formation itself.

Their central concern is whether theories of bounded rationality are what they term 'absorbable', i.e. whether they can 'survive' their own acceptance. A theory is fully absorbable if a boundedly rational agent has no reason to deviate from its prescriptions in a situation in which he knows that all agents know the theory and use it to predict the behaviour of others and if, having followed its prescriptions, he will be satisfied with the outcome. Güth and Kliemt find a striking similarity between the concept of theory absorption and the traditional equilibrium analysis, in that there must be no reason for unilateral deviation. In that sense an absorbable theory fulfils minimum conditions for a 'reflective equilibrium'.

Both theory absorption and the traditional equilibrium analysis assume true expectations. However, while the full rationality assumption of the canonical approach implies optimality, a bounded rationality approach may content itself with satisfaction. Güth and Kliemt give two examples of interactive situations in which satisficing behaviour allows for absorbability, while optimizing behaviour excludes plausible candidates for equilibria.

The first example concerns a game in which the maximin strategy leads to the same payoff as the Nash strategy prescribed by the theory of full rationality. Maximin is more plausible in the sense that it makes the player independent of the behaviour of the second player, but it is no equilibrium strategy assuming optimality. But if both players are satisfied with the maximin outcome, then a theory prescribing maximin is fully absorbable.

The second example is a game in which the players may repeatedly choose to contribute to a public good. Assuming optimality, certain prescriptive theories are absorbable only if a participation threshold is perfectly matched, while under satisficing behaviour these theories are absorbable also in the case of having a sufficiently large number of contributors. In this example it is not the absorption of the theory by all agents, but the stability of its partial absorption that matters.

Güth and Kliemt conclude that the equilibrium notion is more fundamentally related to full absorption than to full rationality. The examples indicate that theory absorption may even be more easily achieved under bounded rationality.

As a final word, the symposium clearly indicated that the field of neuro-economics poses a special challenge to the theory of bounded rationality, although the theoretical implications have not been properly explored to date.

We hope that with the publication of this symposium we will stimulate further work in this area.

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Matthew Braham, Daniel Friedrich, & Frank Steffen

Books by Rudolf Hernegger

Macht ohne Auftrag. Die Entstehung der Staats- und Volkskirche. Freiburg: Walter (1963).

Der Mensch auf der Suche nach Identität: kulturanthropologische Studien über Totemismus, Mythos, Religion. Bonn: Habelt (1978).

Gesellschaft ohne Kollektiv-Identität, München: Verlag Holler (1981).

Psychologische Anthropologie: von der Vorprogrammierung zur Selbststeuerung. Weinheim und Basel: Beltz (1982).

Vom Reflex zur Selbststeuerung: das neurophysiologische Substrat der Kontroll- und Ichfunktionen. München: Profil (1985).

Anthropologie zwischen Soziobiologie und Kulturwissenschaft: Die Menschwerdung als Prozeß der Selbstbestimmung und der Selbstbefreiung von den Determinismen der Gene und Umwelt. Bonn: Habelt (1989).

Wahrnehmung und Bewußtsein: Ein Diskussionsbeitrag zu den Neurowissenschaften. Heidelberg: Spektrum (1995).

Die Sprache des Bewußtseins: Gene – Sinne – Nervensystem. Berlin: Logos (1998).