NWO Research Programme

Social Science Research Council (MAGW)

Council for the Earth and Life Sciences (ALW)

Evolution and Behaviour

Evolutionary approaches to behaviour, culture, society and economy

Programme bureau
Dr. Henri Gooren
Dr. Annemieke van der Kooij
Laan van Nieuw Oost Indië 300
2593 CE Den Haag
Postbus 93461
2509 AL Den Haag
E-mail: E&B@nwo.nl

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1. Introduction

Man is surely the most intelligent species of animal. We domesticate plants for food and animals for work and meat, we build bridges and cities, we communicate across the globe and fly to the moon, we harness lethal diseases, we compete through technological innovation. Soon we will manipulate our own genes. No wonder that we have come to view rationality as the driving force of our own behaviour. At the same time we engage in seemingly futile contests for social status, we are prone to joy and to violence, we destroy our environment. The most robust of our behaviour patterns, the daily cycle of sleeping and waking, can hardly be attributed to rational decision-making. Our ratio does not seem to offer an explanatory framework for love, depression, religion, addiction, and aesthetic experience. Indeed the "rational model" has only limited value as a general approach to understanding human behaviour.

In recent decades, Charles Darwin's idea that human behaviour is the product of evolution and natural selection has gained solid contours. Evolution is not an alternative for rationality, but it offers a much broader functional context in which both rational and non-rational behaviour can be placed in an explanatory framework. The principles of natural selection as the basis for behavioural patterns enjoy ever sharper and broader attention in biology. Models for cost-benefit analysis of behaviour in terms of the maximization of evolutionary fitness are being refined in theory and experiment. Evolutionary explanations are being sought and tested for countless social processes such as group formation, group composition, social relationships, and distribution of reproductive investment in animal groups and populations. Behavioural biologists are aware of the potential implications of their work for understanding human behaviour. In the social and psychological sciences the view is gaining support that evolution is an indispensable guide in studies of individual and group behaviour – where the discipline of *evolutionary psychology* has become established – as well as in studies of the (non-genetic) evolution of human societies and socio-

economic systems. Cultural anthropology has a particularly long-standing tradition of evolutionary approaches.

A wide gap has grown in the 20th century between the life sciences and the social-behavioural sciences. In recent years, a fair number of creative thinkers have explored this gap, and on both sides one occasionally takes notice of developments across the divide; but there is little integration and interaction on the work floor. This is probably attributable to old cultural differences in approaches and methodology, and to the different options for experimentation between human and animal systems. Be this as it may, there is a rich and fertile ground for innovative science in this gap between biology on the one hand and the social and behavioural sciences on the other.

Within the programme Evolution and Behaviour, NWO will promote attempts to explore this interdisciplinary ground. In evolutionary research, a comparative perspective is indispensable. The programme aims to support evolutionary approaches to human behaviour with studies of similar phenomena in animals, or to base them upon concepts developed and testable in animal models. It will also be necessary to embark upon interdisciplinary collaborations between researchers on both sides.

There is considerable significance to society of developing deeper insight in evolution and behaviour. The primary threats to the functioning of modern society arise from human behaviour, from over-reproduction, criminal offence, addiction, depression, racism and cultural conflict, to name a few of the culprits. Insight in the evolution of behaviour will surely not solve these problems, but it may provide the context within which one can search for explanations and solutions.

2. Goals of the programme

To stimulate these developments NWO has decided to launch the programme *Evolution and Behaviour*, with the following goals:

- Expanding the insight in the evolutionary basis of human behaviour.
- Stimulating the adoption of evolutionary approaches in the social and behavioural sciences at large.
- Promoting active collaboration between scientists from the life sciences and the social and behavioural sciences.

3. Research agenda

Research supported by the programme will focus on three general areas: the evolutionary process itself, the adaptive nature of human behaviour, and the evolutionary principles of social and economic institutions. These areas are briefly outlined below along with examples of potential research themes. These examples are by no means exhaustive.

a. The evolutionary process

The basic process of evolution by natural selection has become reasonably well understood. This is less true for the evolution of behaviour, which is the complex outcome of many influences. Besides natural selection, there is non-genetic transmission of behavioural characteristics, both *vertically* via learning and parental influence, and *horizontally* among unrelated individuals within cultures. Behaviour in turn influences the selection process through mate choice and sexual selection, which remain poorly understood in the human species. The recent unravelling of the human genome now provides a starting point for much deeper understanding of the genetic contributions to human behavioural variation, as well as of the evolutionary history of the human species. Studies on the evolutionary process with respect to human behaviour may address for instance the following issues:

- The *theory* of multilevel evolutionary processes, including in particular the interaction of genetic and cultural evolution and the roles of tradition and communication *(language)* as elements in the evolutionary process.
- The distinction between genetic and non-genetic - both parental and non-parental - effects on the ontogeny of behaviour. This theme would include the general evolution of *phenotypic plasticity* in behaviour, *i.e.,* the reversible or irreversible adjustment of the behavioural phenotype to environmental conditions.
- *Genetic* contributions to variations in behaviour, as assessed in classical approaches, but now expandable to the level of genomic variation.
- The relative contributions of *sexual selection* and natural selection to evolutionary change in the human species. We know preciously little about the determinants of mate choice in humans, including issues such as the preference for dissimilar Major Histocompatibility Complexes. There is ample room here for clarifying basic biological and inter-disciplinary studies both of a theoretical and experimental nature.
- *Rates of evolutionary change*: Some scientists feel that an evolutionary approach to humans implies that adaptive explanations should focus on a remote past history. Has evolution really been halted for the past few thousand years? Can genomic analysis contribute to our understanding of evolutionary change in human behaviour?

b. The adaptive nature of human behaviour

There is a wide range of prominent questions concerning the interpretation in the Darwinian sense of aspects of human behaviour as contributing to maximizing the individual rate of gene propagation (*i.e.,* fitness). This is the area of evolutionary psychology. It is also the area where particularly fruitful interaction between cultural anthropologists and biologists is anticipated. Cross-cultural variations, as studied traditionally by historical sociology without an explicit evolutionary context, will often be a major ingredient in many such studies. Conspicuous questions to be addressed in this area regard such diverse aspects of behaviour as life history patterns, social behaviour, group mechanisms, emotionality and consciousness.

- *Reproduction and life history.* A major unsolved question from an evolutionary perspective is why the rate of individual reproduction has so steeply decreased in modern affluent society. A related and potentially fruitful topic of investigation is the extent of parental investment, via number of offspring, via transfer and protection of knowledge, and of social and material resources (inheritance decisions!). Another promising topic is the temporal organization of reproduction, both seasonal and in the lifetime of individuals. This research theme encompasses the physiological fitness costs of activity and the trade-offs between activity and rest. The unique post-reproductive survival of humans (menopause) calls for specific attention. Most intimately connected with fitness are those behavioural decisions concerned with reproduction, *e.g.,* the adaptive nature of variation in mating systems (polygyny, polyandry, monogamy), pair bonds, mate choice and sexual orientation. To the biologist, human population records offer unique and under-exploited data sources for the assessment of individual fitness consequences of behavioural decisions.
- *Social behaviour.* Altruism and cooperation have long been hotly debated as being at variance with evolutionary theory, until the introduction of the concepts of inclusive fitness and reciprocal altruism. These concepts clarify the fitness benefits of altruism among relatives and recognized individuals in close groups. They are hardly sufficient to explain the adaptive nature of altruism and cooperation as they occur among humans on a much larger scale. Recent progress in identifying altruistic punishment calls for follow-up studies.
- *Group mechanisms*. This realm includes the important issues of aggression and violence, appeasement and conflict resolution within groups, as well as the development of solidarity and individual identification with group interests. Status competition and hierarchy formation are further keywords.
- *Functionality of automaticity, heuristics and emotions.* Many decisions and preferences of humans occur outside of conscious awareness, and behaviour can indeed be influenced by stimuli that are presented subliminally. People may, for example, assess the valence of a stimulus

without being able to describe the stimulus. They may automatically assess features such as gender, status, trustworthiness, aggressiveness and attractiveness of others before consciously perceiving these others. Do such automatic processes have adaptive significance? Do some processes become more easily automatic because they played an important role in our evolutionary past? Similar questions can be asked with respect to the many heuristics and the emotions people use in decision-making, and which appear to render decision-making more efficient.

- *Reasoning and consciousness, play and art.* Many other aspects of human behaviour, among which those that most sharply distinguish us from most animals, are worthy of a closer examination of their adaptive significance. Among other things, this diverse category of human nature includes the religious experience and our tendency towards ritualization of behaviour.

c. Evolutionary principles of social and economic institutions

Many of the social, economic and technological changes studied in the social sciences exhibit the characteristics of an evolutionary process. The changes are fast, much faster than those due to genetic evolution. But the principles of creation of variation and selection are sometimes similar. They may be found in long-term processes, such as changes in industrial structure, technologies and institutions, as well as in short-term processes like learning, market organization and group interactions. The application of formal evolutionary and selection theory is expected to be helpful in unravelling the basic characteristics of socio-economic change. In particular, the following research themes seem potentially fruitful in this field[1]:

- *Economics of exploiting resources.* Questions about the foundation of economies range from the functional organization of foraging behaviour

[1] For more extensive discussion see: *Voorbij het Rationele Model: Evolutionaire Verklaringen van Gedrag en Sociaal-Economische Instituties*, J.C.J.M. van den Bergh and D. Fetchenhauer, a background document of the strategic plans of NWO and MAGW 2002-2005 (available from the programme office).

in pre-industrial societies, the different roles for the sexes among hunter-gatherers, through the impact of the domestication of plants for the invention of storable food resources and storage strategies, to the effects of storable wealth on other aspects of behaviour. Cooperation among biologists and economists can be particularly worthwhile here. For extrapolation to future situations, it will be of major importance to judge whether human behaviour is sufficiently flexible and controllable to retain faith in sustainable development. Insights from biology and evolutionary psychology may be integrated with insights from public policy analysis.

- *Cultural and social history.* Which combination of genetic and non-genetic evolutionary theories can be used to understand the appearance and spread of major innovations in human social history: the invention of fire, the rise of agriculture, urbanization, industrial revolution, *etc.*? Do genetic and non-genetic factors reinforce or oppose each other? To what extent do natural environmental factors affect historical, social, spatial and economic developments? Research on technological innovations is partly based on evolutionary approaches. It is an open question whether economic-technological history can be fully explained along evolutionary lines. Do policy implications arise from evolutionary approaches that are different from mainstream economic theories of technical change? Which psychological and organizational factors determine the rate of innovation?
- *Social organizations.* Social and economic historical change is characterized by the emergence of new organizations such as firms, labour unions, schools and governments. The variation in organizational structures is large. Innovation is partly random and partly planned, while selection assures that some organizational models dominate. Important theoretical questions are how adaptation, imitation, various types of individual and organizational learning, and norms interact, and which selection mechanisms dominate. With respect to public institutions, policy and politics, research might focus on unravelling the hierarchy and co-evolution of institutions and policy.

- *General theory, methods and models.* In order to develop a useful extension of evolutionary theory to the social sciences, several fundamental questions have to be dealt with. For instance, what are the relevant units of selection: products, individuals, groups, societies, enterprises, technologies, norms or institutions? Does selection ultimately involve market competition? Or can other mechanisms of selection be identified, such as public regulation, geographical-environmental conditions, take-overs and mergers, political re-organization, military conquest, *etc*? Which research methods are useful in the context of evolutionary thinking within the social sciences? A range of methods is available: experiments, historical analyses, comparative research, multi-agent models, analytical models (*e.g.,* evolutionary game theory). Theoretical and methodological meta-questions and comparisons are particularly relevant for the social sciences, as evolutionary theory and methods are still at an early stage of development here.

4. Implementation

Call for proposals

NWO and its Social Science Research Council (MAGW) and the Council for the Earth and Life Sciences (ALW) have allotted a total of 5.8 million euro (M€) to the programme *Evolution and Behaviour*. Research grants will be awarded in two rounds. The first round will total about 2 M€, the second 3 M€. The deadline for submission of proposals in the first round is **October 1, 2002**. For the second round the deadline is expected to be January 15, 2004.

In the first round, grants will be awarded as lump sums in the order of either 0.2 M€ (single projects) or 0.4 M€ (double projects). Single project grants cover the salary of a PhD student (AIO) for four years, or for a three-year postdoctoral fellow, plus a fixed amount for research expenses. Double projects are explicitly interdisciplinary, with two tightly interconnected projects (postdoc or AIO) in different research groups. Policy with respect to grants in the second round will be based on experience with the first.

Selection procedure

Grant proposals will first be ranked by the committee with respect to the criterion "*close fit to the objectives of the programme Evolution and Behaviour*". A maximum number of single (s) and double (d) project proposals will be selected, such that s+2d = circa 30 in the selection round 2002. These will be reviewed by independent external experts. The proposals will be evaluated with respect to the following main criteria:

- Probability of a significant contribution to the main goal of the programme *Evolution and Behaviour*.
- Quality of the proposal.
- Quality of the research group(s).

Applicants will be given the opportunity to respond to the evaluation reports. Subsequently, the programme committee will prioritize the proposals, aiming to award about 30%, or maximally such numbers of single and double projects that s+2d = 10 in the first round, depending

on quality of the proposals. The final decision, which will be taken by a committee (the "stuurgroep") overseeing the whole NWO theme *Cognition and Behaviour,* is expected in April 2003.

More detailed information on the evaluation criteria and on the submission procedure can be found in the Call for Proposals, which will accompany each selection round.

Programme symposia

Three full-day symposia are envisaged: one to introduce the topic of *Evolution and Behaviour* (2003), one to review the projects half way (2006), and one to evaluate the programme towards its end (2008). The first symposium is expected to be held in June 2003 and to comprise presentations by all successful applicants in the first round.

5. Programme preparation committee

Prof. dr. J.J.M. van Alphen, Animal Ecology, Universiteit Leiden
Prof. dr. J.C.J.M. van den Bergh, Environmental Economics, Vrije Universiteit, Amsterdam
Prof. dr. A.P. Buunk, Social Psychology, Rijksuniversiteit Groningen
Prof. dr. S. Daan, Ethology, Rijksuniversiteit Groningen (chair)
Prof. dr. P. Hogeweg, Theoretical Biology, Universiteit Utrecht
Prof. dr. J.A.R.A.M. van Hooff, emeritus Professor, Ethology, Universiteit Utrecht
Prof. dr. J.M.A. Riksen-Walraven, Developmental Psychology, Katholieke Universiteit Nijmegen
Prof. dr. N. Wilterdink, Sociology of Culture, Universiteit van Amsterdam

Programme bureau

Dr. H.P.P. Gooren, staff member Social Science Research Council (MAGW)
Dr. M.J. van der Kooij, staff member Council for the Earth and Life Sciences (ALW)