to act, selfishly or otherwise, is a testament to the importance of cooperation in both the processes and the outcomes of evolution (Buss 1987; Maynard Smith & Szathmáry 1995/1997; Michod 1999; Ridley 2001).

If any field, including the study of behavior, is to lay claim to being a true science, it must without hesitation relinquish any assumptions or models that do not conform to ongoing and unbiased observations of empirical reality.

The integrative framework for the behavioural sciences has already been discovered, and it is the adaptationist approach

DOI: 10.1017/S0140525X07000817

Michael E. Price,[a] William M. Brown,[a] and Oliver S. Curry[b]

[a]*Centre for Cognition and Neuroimaging, School of Social Sciences and Law, Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom;* [b]*Centre for Philosophy of Natural and Social Science, London School of Economics, London WC2A 2AE, United Kingdom.*

michael.price@brunel.ac.uk
http://people.brunel.ac.uk/~hsstmep/
william.brown@brunel.ac.uk
http://people.brunel.ac.uk/~hsstwmb/
o.s.curry@lse.ac.uk
http://www.lse.ac.uk/darwin

Abstract: The adaptationist framework is necessary and sufficient for unifying the social and natural sciences. Gintis's "beliefs, preferences, and constraints" (BPC) model compares unfavorably to this framework because it lacks criteria for determining special design, incorrectly assumes that standard evolutionary theory predicts individual rationality maximisation, does not adequately recognize the impact of psychological mechanisms on culture, and is mute on the behavioural implications of intragenomic conflict.

The unification of the behavioural sciences, and their integration with the rest of natural science, is currently taking place within a neo-Darwinian framework which views all organisms as bundles of adaptations (Tooby & Cosmides 1992). Gintis's "beliefs, preferences, and constraints" model (BPC) provides no convincing arguments for why it is a meaningful addition to the existing framework. Below we summarize why the existing framework is a necessary and sufficient one for unifying the disciplines.

An adaptation is a phenotypic device that was designed by selection to allow its encoding genes to outreplicate genes for rival devices. As the fundamental organisational principle of organismal tissue, adaptation is as indispensable to understanding human behaviour as it is to understanding any organismal trait. This does not mean, of course, that all traits are adaptations, but rather that, in order to understand organismal design, one must determine whether particular traits are adaptations, by-products of adaptations, or random noise. In order to establish that a trait is an adaptation, there must be evidence of special design (Williams 1966); that is, evidence that the trait was designed by selection for the specific purpose of solving a particular (set of) problem(s). Because BPC does not include criteria for testing for the existence of special design, it is often unable to determine whether a trait is an adaptation or not.

For example, Gintis notes that subjects in economic games often violate the predictions of traditional economic theory, and he concludes that their behaviour evidences an evolutionary process that favoured those who consistently behaved in individually fitness-damaging ways. However, people engage in many kinds of apparently fitness-damaging behaviours in novel environments (including experimental economic laboratories), and the observation of such behaviour is not a sufficient basis on which to conclude that the behaviour evolved for the purpose of producing a fitness-damaging outcome. It is as if, upon observing that many men spend significant time and money consuming pornography, thereby irrationally foregoing real mating opportunities, one were to conclude that a "preference" for pornography is the product of selection for fitness-damaging behaviour. However, pornography's popularity is more likely a result of semi-autonomous psychological mechanisms that evolved in a pornography-free world. Because there is no evidence that these mechanisms were specially designed for pornography, pornography's popularity is not evidence of selection for individually fitness-damaging behaviour.

Because BPC does not recognize that adaptations are not necessarily predicted to produce adaptive outcomes in novel environments, it overestimates the degree to which evolutionary theory predicts behaviour that maximizes fitness and/or utility. The psychological mechanisms governing behaviour are conditional decision-rules that respond to specific environmental information by producing specific psychological and behavioural outcomes. Therefore, evolutionary theory casts individuals as "adaptation executers," not "rational choosers" or "fitness maximisers" (Tooby & Cosmides 1992). This framework can, in principle, explain individual performance on a range of decision tasks; it can explain why people are good at reasoning about some problems and not others, why they make particular kinds of systematic mistakes, and so on. However, Gintis regards evolutionary psychology as predicting that individuals are rational actors who choose the available course of action that they expect will maximise their fitness. Therefore, according to Gintis, irrationality presents a problem for evolutionary theory, one that BPC attempts to solve by incorporating a host of ad hoc – albeit well-measured – anomalies, constraints, preferances, and biases.

BPC explains cultural transmission in terms of psychological mechanisms for various forms of imitation (prestige-biased, popularity-related, etc.), and this appears to be an effort to ground cultural evolution in genetic/brain evolution. Although we endorse this effort, the ways in which psychological mechanisms generate and embrace/reject cultural characteristics are far richer than can be captured by an emphasis on general-purpose imitation mechanisms alone. Differences in cultural evolutionary trajectories are largely the products of psychological mechanisms responding to different environments. For example, in an environment offering many benefits from group cooperation (one characterized by large game, coalitional conflict, etc.), psychological adaptations for cooperation may be deployed more often than in an environment offering few such benefits, and the environment offering more benefits may therefore elicit a more cooperative culture. In both cultures, certain specialized imitation mechanisms may indeed help individuals learn how to behave; however, an emphasis on imitation alone would overlook the psychological mechanisms that determined each culture's orientation in the first place. Moreover, a more useful theory of, say, prestige-biased imitation would illuminate not just the potential benefits of imitating successful individuals, but also the potential costs (for example, if a subordinate acts as if he or she has as much power as a dominant individual, this may anger the dominant individual).

BPC's ability to predict sophisticated imitation processes is also limited by its failure to recognize the potential importance of intragenomic conflict in decision-making and social behaviour (Haig 2000). A focus on strategic genes influencing the design of psychologcal mechanisms helps elucidate why imitating a model individual may have differiential costs to matrilineal versus patrilineal inclusive fitness (Brown 2001; Trivers 2000). Indeed, BPC is predictively mute on all forms of intragenomic conflict, and therefore on how individual preferences may conflict and/or be suppressed by rival psychological mechanisms (e.g., see Haig [2003] on intrapersonal reciprocity). This suggests that BPC is not up to the task of uniting the social and natural sciences, especially in the age of genomics.

In conclusion, we favour increased integration among the behavioural sciences. However, BPC would be inhibited in achieving this goal, and in achieving the more ambitious and productive goal of integrating the social and natural sciences, because it does not identify the modern theory of adaptation by natural selection as the core integrating principle. Integration would be better accomplished by the non-zoocentric adaptationist framework that already exists (Darwin 1859; Haig 2003; Hamilton 1964; Tooby & Cosmides 1992; Trivers 1971; 1972; 1974; Williams 1966), and it is not clear that BPC contributes to the progress that this framework continues to make.

Information processing as one key for a unification?

DOI: 10.1017/S0140525X07000829

Michael Schulte-Mecklenbeck

Department of Marketing, Columbia Business School, New York, NY 10027.
research@schulte-mecklenbeck.com
http://www.schulte-mecklenbeck.com

Abstract: The human information-acquisition process is one of the unifying mechanisms of the behavioral sciences. Three examples (from psychology, neuroscience, and political science) demonstrate that through inspection of this process, better understanding and hence more powerful models of human behavior can be built. The target method for this – process tracing – could serve as a central player in this building process of a unified framework.

The unification of different scientific disciplines such as economics, biology, psychology, and political science under the rubric of the "behavioral sciences" can ultimately provide a better understanding of human beings' cognition, behavior, and interactions. Based on Gintis's framework in the target article, questions would be asked differently, and their answers would have a broader impact. Such a unification demands the rethinking of theoretical and methodological issues in each of the affected disciplines. In this commentary I argue that the detailed inspection of the human information-acquisition process in different disciplines helps in building such a framework. In particular, process tracing can serve as a central method in this endeavor.

Process tracing has been primarily studied in the psychology of decision making (Ford et al. 1989) and uses different methods for recording what information is attended to and when that attention occurs and shifts. Thinking aloud, eye tracking, protocol analysis, and information boards are common methods. They rest on the assumption that the recorded information-acquisition steps resemble closely cognitive processes within the human brain. A substantial body of evidence (Harte et al. 1994; Payne et al. 1993; Russo 1978; Schkade & Johnson 1989) has been developed over the last 20 years to support this claim. Here I will highlight three examples from different domains to show how process tracing methods have been used and what benefits arise in comparison to more traditional input-output models.

The first example uses an information board approach to find underlying patterns in information acquisition when simple gambles are used. Brandstätter et al. (2006) suggested a simple descriptive model of people making decisions between two gambles (with two and five outcomes). This method, called the Priority Heuristic (PH), sets the focus (for two-outcome gambles, in decreasing order) on the minimum gain, probability of the minimum gain, and the maximum gain. Using the PH, the authors predicted choices given the use of the heuristic, and prescribed in detail the sequence in which the different items should be accessed. Johnson et al. (under review) compared the process steps of the PH with their observed usage in a process tracing study using the same gambles. It becomes clear when the data of this study are inspected that there are some predictions of PH actually met in the process data; for example, more attention is set to gains in a first reading phase than to probabilities. However, there are several predictions which do not hold when the process level is examined. One of the stronger predictions PH makes is that there should be no transitions between gains and their corresponding probabilities. However, in the Johnson et al. data, this is the most frequent transition found across the different gambles and can be interpreted as integration of the gain-probability pairs into an expected value.

The second example brings us into the domain of neuroscience. Fellows (2006) used an information board approach to identify differences in information-acquisition strategies in a group of participants with damage in the ventromedial frontal lobe (VFL) in comparison with a healthy group (as well as with a frontal lobe–damaged group where the VFL was still intact). Strong differences between the VFL and the control groups were found in terms of which strategy was used to gather information. Generally, a preference for attribute-based search strategies was found. In the VFL group, a different pattern, with dominating search in alternative-based order, resulted. One important detail of this study is that the absolute amount of information and the time taken to come to a decision were the same in both groups – nevertheless, the underlying strategy in information acquisition differed strongly.

The third example demonstrates the usage of process tracing techniques in the political sciences. Redlawsk (2004) examined the information search process of voters in an election experiment. Because of the dynamic structure such an environment has, a modified version of an information board study was used. In this dynamic information board, cell content is updated during the information search process. This means that the participant has to make two decisions – first, which information is of interest and, second, when is the right time to access certain information. Redlawsk compared a static information board with a dynamic one and found a switch from compensatory to non-compensatory strategies with an increase in complexity. Additionally, more information was acquired for the finally chosen candidate in comparison to the rejected one. Both findings will not surprise scientists working with process tracing, because they are well documented in many studies in this field. The lesson from this study is the applicability of the method in a very different domain than is generally used in decision-making studies – the domain of political science and policy building.

The points I want to make with these examples are twofold. First, the three studies show that despite the different perspectives on human behavior, at least some approaches in psychology, neuroscience, and political science use the same methods to gather insights into human information acquisition. However, the adaptation of new methodologies from other areas often takes a long time, and one should be aware that the cited studies (despite their quite recent publication dates) refer to methods that have existed in psychology for more than 20 years.

The second point is that better models of decisions can be built when the input-output level is left and the process actually happening during the information-acquisition phase of a decision is examined. Put simply, process models of human decision making require process data. Using process methods, we can learn when and where the participant sets her focus in her information search through the timing and number of acquisitions of particular information items. As such, we can get closer to underlying processes in the brain when we observe transitions between information items. All of this information would be unavailable if the level of data collection were confined to only the responses of the participants – that is, to their final choices. The wealth of information participants emit when thinking and deciding is valuable, and perhaps critical, in developing unified models in all of the behavioral sciences.

ACKNOWLEDGMENTS

I want to thank the Swiss National Science Foundation (grant PBFR1-110407) for their financial support, as well as Anton Kühberger and Ryan O. Murphy for comments on the draft.