unfettered choice, and perhaps even hope to influence their opponents, is quite irrelevant (Wegner 2002).

The burgeoning literature on social dilemmas suggests that individual behavior in these situations presents a more poignant dilemma to the investigators than to the participants. However modest their predictive successes may be, experimental studies of social behavior rest on a bedrock assumption of determinism. In this spirit, experimentalists assume that individuals' judgments and decisions are fully determined (Bargh & Ferguson 2000). It is ironic that research participants who are cast into the PDG or confronted with Newcomb's problem can satisfy norms of rationality only by denying any determining effect on their own behavior that would make them act like most others.[1] They are enjoined to choose defection without drawing any inference as to what this might say about their opponents' choices. Evidentialists, in contrast, can maintain a deterministic outlook without being perplexed. They need only assume that cooperators choose "as if" they were free.

Incidentally, players working on the assumption that their own choices will likely be reciprocated are also comfortable with common-interest games. They do well without experiencing the puzzlement of orthodox game theorists and even without resorting to von Stackelberg's best-bet heuristic. Perhaps more importantly, evidential reasoning preserves *methodological individualism* in common-interest games. Collective preferences, as entailed by team spirit, are unnecessary. A game in which players are paid only if their choices do not match, however, would be a true puzzle to the evidentialist and the orthodox alike. Even team spirit, no matter how lofty its intent, cannot overcome this hurdle.

NOTE

1. In iterated PDGs, the assumption of determinism is more apparent than in one-shot games. Players' choices are assumed to be controlled by the design of the game (i.e., the experimenters) and by each other's choices in preceding rounds (e.g., Rachlin 2002).

Let's cooperate to understand cooperation

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Abstract: The importance of understanding human cooperation urges further integration between the relevant disciplines. I suggest ideas for bottom-up and top-down integration. Evolutionary psychology can investigate the kinds of reasoning it was adaptive for humans to employ. Disciplines can learn from each other's approaches to similar problems, and I give an example for economics and evolutionary biology.

Understanding the factors that facilitate and constrain human cooperation is of the greatest importance. I suggest here ways in which disciplines with a convergent interest in cooperation might fruitfully interact, with an emphasis on theoretical modelling.

Colman describes "nonstandard forms of reasoning" that help to explain irrational social decisions. Psychological game theory should employ the methods of evolutionary psychology (Tooby & Cosmides 1992) to determine both the kinds of social problems that early humans were selected to solve, and the kinds of reasoning that were adaptive to employ. Such an analysis of social problems has shown that human reasoning is well-designed for cheater detection, for example (Cosmides & Tooby 1992). An evolutionary analysis of kinds of reasoning could start with team reasoning (target article, sect. 8.1), for which two potential adaptive explanations seem worth pursuing. Team reasoning might be favoured where cooperation benefits the group, or where maximizing collective payoff raises one's reputation and thus brings future rewards (Milinski et al. 2002). Evolutionary game theory is the tool for analyzing the evolutionary fate of competing modes of reasoning.

Knowledge of social decision-making in dyads and small, unstructured groups is a starting point for understanding cooperation at the higher levels of structured groups, firms, institutions, communities, and states (cf. Hinde 1987). Table 1 (see overleaf) lists disciplines sharing an interest in cooperation, indicating their interests, methods, and levels of analysis; it is not exhaustive (e.g., nothing on military strategy). Its purpose is to indicate the multidisciplinary nature of cooperation, to encourage further interdisciplinary work (following, e.g., Axelrod 1984; 1997; Frank 1988), and to act as a reference point for the following proposals in this direction.

Colman shows that there is much to be done before we understand cooperative decision-making at the lowest level, although understanding should be advanced by reference to the social psychological foci in Table 1. To bring greater psychological reality to decision theory in the structured groups of institutions and societies, game theory models and psychological game theory findings should be combined with the decision-making models of economics and related disciplines (Table 1; see also Axelrod 1997).

This bottom-up approach should be complemented by psychological game theory adopting top-down insights gained from analyses of real-life economic behaviour. Decision-making in these real-life contexts may reflect evolved predispositions, and may tap motivations at work even in the economically elementary scenarios of the psychological laboratory. For example, studies of the way in which communities govern their own use of common pool resources (CPRs), such as grazing pastures (Ostrom 1990), may reveal evolved influences on cooperative decision-making, and even evolved modes of reasoning, because the hunting and gathering activities of early humans also have CPR properties. Successful CPR decisions are characterized by: a clear in-group/out-group distinction; resource provision in proportion to need and sharing of costs in proportion to ability to pay; and graded punishments for the greedy (Ostrom 1990). Whether these characteristics apply to decision-making in other kinds of cooperative relationship is open to evolutionary psychological and empirical analysis. It would be valuable to know whether cooperation was rational and evolutionarily stable in CPR scenarios.

In addition to bottom-up and top-down integration, different disciplines can surely learn from each other's approaches to similar problems. I close with an example. In economics, a common pool resource is "subtractable," because resources removed by one person are unavailable for others. In contrast, a pure public good (e.g., a weather forecasting system) is "nonsubtractive" in that its use by one person leaves it undiminished for others (Ostrom 1990, pp. 31–32). In evolutionary biology, parental investment in offspring is of two kinds, "shared" and "unshared," respectively, the identical concepts just described from economics. Food for the young must be shared among them, whereas parental vigilance for predators is enjoyed by all simultaneously. Modelling in the evolutionary biology case has examined the influence of the number of users on the optimal allocation of investment, and on conflict between producer (parent) and user (offspring) (Lazarus & Inglis 1986). Could economists use these results? Have economists produced similar results that evolutionary biologists should know about?

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Table 1 (Lazarus). *Approaches to cooperation*

Discipline	Focus	Levels of Analysis	Methods	Sample References
Ethology	Cooperation in the animal kingdom	Dyad Group	Field work; Laboratory experiments	Dugatkin 1997
Evolutionary biology	Biological and cultural evolution	Dyad Group	Game theory; simulation and analytical modelling; evolutionary stability	Axelrod & Hamilton 1981; Boyd & Richerson 1991; Roberts & Sherratt 1998
Artificial intelligence	Artificial societies; computing applications; trust	Group Network	Agent-based simulation modelling; complexity theory	Andras et al. 2003; Axelrod 1997; Schillo et al. 2000
Psychology				
Evolutionary psychology	Evolutionary origin, adaptive biases, brain modularity	Dyad Group	Laboratory experiments	Cosmides & Tooby 1992
	Commitment and the emotions	Dyad Group	Evolutionary theory; laboratory experiments	Frank 1988
Psychological game theory	Rationality; biases in decision-making; framing effects; influences on cooperation	Dyad Group	Game theory; laboratory experiments	Milinski et al. 2002; Colman, target article
Developmental psychology	Moral development	Dyad Group	Laboratory experiments and natural observations; Cross-cultural comparison	Kohlberg 1984
Social psychology	Egoistic or altruistic motivation?	Dyad Group	Laboratory experiments	Batson 1987; Cialdini et al. 1987
	Empirical notions of reciprocity; equity; desert and fairness	Dyad Group	Questionnaire studies; evolutionary psychology	Buunk & Schaufeli 1999; Charlton 1997; Wagstaff 2001
	Cooperation within and between groups	Group(s)	Laboratory experiments; field work	Feger 1991; Rabbie 1991
	Trust	Group	Field work, discourse	Hardin 2002; Kramer & Tyler 1996
Anthropology	Social exchange; social hunting	Dyad Group	Field work	Kaplan & Hill 1985; Kelly 1995
Sociology	Trust	Group	Discourse	Hardin 2002
Economics	Trust	Group	Field work	Kramer & Tyler 1996
	Common pool resources	Common resource group	Game theory; field work; historical studies	Ostrom 1990
	Public choice	Public goods	Economic decision theory	Margolis 1982; van den Doel & van Velthoven 1993
Political philosophy	Collective action	Community State	Game theory	Taylor 1987
	Distributive justice	Community State	Discourse	Rawls 1999
	Trust	Community State	Discourse	Hardin 2002
Ethics	Moral behavior	Dyad Group	Metaethics; Cross-cultural comparison	Arrington 1998; Yeager 2001

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