DOES LANGUAGE DETERMINE OUR SCIENTIFIC IDEAS?*

H.G. Callaway

This paper argues that the influence of language on science, philosophy and other field is mediated by communicative practices. Where communications is more restrictive, established linguistic structures exercise a tighter control over innovations and scientifically motivated reforms of language. The viewpoint here centers on the thesis that argumentation is crucial in the understanding and evaluation of proposed reforms and that social practices which limit argumentation serve to erode scientific objectivity. Thus, a plea is made for a sociology of scientific belief designed to understand and insure social institutional conditions of the possibility of knowledge and its growth. A chief argument draws on work of Robert Axelrod concerning the evolution of cooperation.[1]

1. Introduction

Disputing partisan political engagement in literature, Swiss writer Max Frisch argued that while we cannot perhaps escape ideology, still it is already a kind of engagement to "test language in use for its reality content." This is, as he puts it, "an engagement with reality, and thus a critique of ideology." Ideology requires this control—a control exercised by literature precisely when it lacks direct political engagement, practicing independent judgment and critique of language. For Frisch, advocate of self-knowledge and a Swiss tolerance, engagement with reality expresses itself in social criticism and innovative usage. The point and practice are important for literature, but also more generally. They suggest influence of language upon cognition, viewed as a sociological phenomenon—but also our ability to escape a role as passive victim. In fact, something similar to Frisch's "engagement with reality," and "critique of language in use"[2] is expressed in philosophy by orientation to science. For science is both crucial in human contact with reality and a forum of linguistic and methodological innovations for cognitive purposes.

Scientific orientation provides grounds for a critique of ideologies. From Frisch's perspective, given his sympathy for German, it becomes clear that an engagement with communities and their languages can be a form of engagement with reality—and at the same time a critique of language and ideology. Critical judgment is the link between social engagement and our orientation to reality. This requires strenuous attention to evidence, but beyond this it is a matter of commitment to specific intellectual values—including careful attention to argumentation and its social-intellectual roles. Of particular interest here are forms of communications and language involving "instrumentalized" distortions of interpretation—often functioning to further collective conflicts. Considering this or other phenomena, we must aim for as much scientific standing as possible: a sociology of belief, or better, of the institutions and practices of science and philosophy. The aim is to understand and insure the social conditions of the possibility of knowledge and its growth.

2. Cultural Influences on Cognition

Though fuzzy in details, some distinction between 'necessary' and 'possible' seems to be required to mark off things we can change from those which we cannot change. For example, we cannot change the basic laws of physics. They are beyond our control or influence. On the other hand, however difficult this may be at times, it is possible to change our forms of society and our patterns of social relationships; and, of course, it is possible to change our languages. An individual can give up one language in favor of another, and even entire societies can change their languages—leastwise slowly over time. Moreover, science shows that specialized forms of

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1. Axelrod, Robert 1984, *The Evolution of Cooperation*.
2. Frisch, Max 1985, *Stichworte*, pp. 118-119.

inquiry develop their own special languages. We change languages and change our languages intentionally, so we are also able to control, indirectly at least, the influence a language may have upon us. My claim is not that this is always easy, or always advantageous, but that it is possible. Hesitation on this claim points, in degree, to social constraints on language and its evolution: thus social constraints on cognition.

These points concerning language are as clearly true as things get. Still, there are considerable traditions of thought holding that conceptual systems embedded in languages, natural languages and the languages of philosophical systems in particular, constitute unavoidable, or virtually unavoidable, governing perspectives on the world. What other significance can we attach to the existence of absolutist metaphysics or ideology as a social-cognitive fact, and to the need to avoid them? We must assume that such systems have consequences in practice—often untoward consequences. Contrary to what a Peircean theory of meaning might lead us to expect, metaphysics and ideology have real effects—social effects. They organize or deform communities, and at the same time they can effectively organize (or distort) expectations, cognition and inquiry quite independent of scientific validity.[3]

Languages, viewed semantically, contain their own particular *Weltanschauungen*, then: they even inform what we will find in perception. After all, we cannot think of observation reports, as "unvarnished news." We must have some particular conceptual system at a given time, and it follows that concepts or system will influence, both what we perceive and what we think, believe or say. The idea that systems of concepts may constitute metaphysical impediments to science is fundamental in the positivist critique of metaphysics. There is no point in attacking what could make no difference. Thus, the positivist and empiricist attack on metaphysics indirectly recognizes their social roles. Given these roles, we have every right to expect social influences on language and cognition. But, cognition and science also have their influence upon society, language and communicative practices. There are no general grounds for comfortable acquiescence here.

Especially in light of the influence of B. L. Worf, Thomas Kuhn and Paul Feyerabend, related conclusions and suggestions have reverberated through contemporary philosophy, linguistics, and philosophy of science. Not without some reason, I think; though the points may be over-stressed. Thus, it has been argued that the use of a paradigm in research is "...by agreement, not because of compelling justifications. And the research in which it is used assumes it, and does not attempt its justification."[4] The reverberations are not empty, in spite of over-dramatization, partly because these themes make contact with more traditional scientific determinisms, in application to science itself—suggesting that cognition is under threat of extrinsic control just where we consider ourselves most sovereign. Even those most skeptical of Kuhn's work will agree, I think, that we stand in need of alternatives to such accounts of sociological influences within science. One crucial point here is that theories may be falsified even within the "theory-laden" terms which they contribute to observation.[5] Still, emphasis is needed upon sociological factors which contribute to, or detract from, our willingness to submit treasured conceptions to tests; and viewing absolutist metaphysics and ideologies as themselves sociological factors, embodying values, and at work as social forces, attention turns to examinations of social values embodied in the institutionalization of science and belief.

There seem to be important philosophical insights at work in Kuhn's interpretations of science, for he provides a sophisticated perspective from which to question traditional assumptions of empiricism—and of freedom of inquiry in the sciences. If what we observe and perceive stands under the formative influence of prior, culturally induced conceptions and practices, then, contrary to traditional empiricism, it seems implausible to hold that the recognized validity of knowledge claims can be traced merely to origins in sense-experience. Further, one expects just the kind of claim which Kuhn has occasionally emphasized: that education in

3. Cf. Albert, Hans 1991, *Traktat über kritische Vernunft*, Chp. IV and Peter Janich et al. 1974, *Wissenschaftstheorie als Wissenschaftskritique*.
4. Barnes, Barry 1985, "Thomas Kuhn," in Skinner, Quentin (ed) 1985, *The Return of Grand Theory in the Human Sciences*, p. 88.
5. Cf. Quine, W.V. 1990, *Pursuit of Truth*, pp. 7-8.

science, even on a "cursory inspection," is, as he put it, designed to induce "professional rigidity,"[6] that commitment to paradigms and scientific consensus is induced by potent mechanisms of socialization. The challenge is that the rationality of science seems to be explained away, in sociological terms. The challenge calls for analysis of social and linguistic factors which make for independent judgment and those which discourage it. For, in these terms we can seek to distinguish reasonable commitment to the yet-to-be-proved hypothesis, or theoretical approach, from institutionalized forms of self-immunization. If sociology of belief is to have scientific standing, then this will depend upon a scientific standing for the study of language and communications: a theme to which I now turn.

3. Language, Community and the Sociology of Belief

From a semantic point of view, it is best to consider a language as associated with a community: though there is a need for fine-tuned individuation of linguistic communities. To interpret language in use, we require recourse to evidence arising from (linguistic and non-linguistic) activities of the community in question—though we do not know at first who counts as a genuine member—we encounter the familiar phenomenon of recourse to theory to decide what to count as evidence.

Quine's thought experiments in radical translation illustrate fundamentals of the connections between semantics, community and linguistic usage—the use of language in observation. However, this approach to radical translation depends upon evidence available within a limited kind of observation game. Other imaginable language games provide broader access to evidence for semantic hypotheses.[7] Although access to argumentation within a society presupposes some mastery of observational language and logical system, it seems clear as well that argumentation and the kind of participation which lead to it are crucial for an overall understanding of language-systems. This is a point I have argued at length in a recent article.[8] Conclusions there indicate that tolerance of argumentation is a crucial factor in our escape from socially induced rigidities or over-systemization.

Language expresses and facilitates the typical activities and preoccupations of a community and constitutes the most articulate expression of the associated culture. Thus, though I resist the temptation to identify meaning and usage, it seems clear that broader access to the typical activities of a given community, and associated linguistic usage—argumentation included—, will provide a broader range of evidence useful for interpretation. Since members of a given community have, in the end, no access to it not in principle available to a guest, the degree of self-understanding of a community is largely a function of the degree of communications and openness to participation which it provides—just as we expect the work of radical translation to be facilitated by an openness on the part of the community we wish to understand. Thus, the degree in which a society will be able to overcome the limitations of its own culture and language depends upon sociological structures of interaction and flows of information.

Meaning is better viewed as a matter of systems of hypotheses designed to explain abstract elements of usage: those which respond to truth-conditions of sentences in particular. Or, in other words, "usage" is itself theory-laden, and is, therefore, not something which we can access directly, without formulation of complex theory: usage is partly a function of belief-system and partly a function of non-linguistic intentions. Deeper access depends on getting involved.

Mere imitation is one element in language acquisition as we are accustomed to think, but there is more. Imitation becomes less important as we move away from phonetic elements in the direction of syntax, semantics and pragmatics. Thus, optimal, as opposed to preliminary, situations for language acquisition are socially complex, eventuating in shared projects—where ends and the means to be employed are open to argumentation.

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6. Kuhn, Thomas 1963, "The Function of Dogma in Scientific Research," in C.A. Crombie (ed) 1963, *Scientific Research*, p. 350.
7. Callaway, H.G. 1991,"W.V. Quine, *Pursuit of Truth*," pp. 77-88 below.
8. Callaway, H.G. 1992, "Logic Acquisition, Usage, and Semantic Realism," pp. 111-137 below.

This approach to semantics and interpretation will also facilitate discussions of themes in the sociology of belief. It is possible to imagine a community in which the social determination of belief approaches maximum. An example here might be the orthodox Marxist picture of capitalism as ruled by relations of the forces of production and ending in all-controlling class ideologies. While it is not my view that such a society ever existed, it is possible to imagine it, and it would be possible, at least in degree, to remake society so as to substantially instantiate, something like Althusser's cognitive-sociological nightmare —where all beliefs come under ideological suspicions.[9] Paradoxically, Stalinism perhaps best approximates this Orwellian image of thought-control.

More generally, it is within the power of a given society (especially given hostile external conditions) to maximize the social determination of belief, and institutionally viable hypothesis, by means of control over the flow of information, and control over patterns of participation and interactions in the community. This requires, in addition, similar control over interaction between members of the community and various external influences. We should not expect overly conservative tendencies of cultural reproduction to fare extremely well in our age of electronic communications and global flows of information. Still, it seems we are at pains to escape such influences—and here rests the plausibility of sociological determinism. A chief antidote is emphasis upon the value of communications.

"Of all affairs," as Dewey says in *Experience and Nature*, "communication is the most wonderful." For by means of communications, things are able "to pass from the plane of external pushing and pulling," and "they come to that of revealing themselves to man..." For, "when communication occurs, all natural events are subject to reconsideration and revision..,"[10] and since man and human cultures are themselves natural phenomena—in Dewey's "cultural naturalism"—it followings that communications has the power to open man and human culture to our view. We are able to pass from the plane of external pushing and pulling within a society to one where community and culture are open to our view and, moreover, subject to reconsideration and revision—in ways that physical laws are not.

But where reconstructive possibilities are open to us, so are the opposite possibilities. We can, if we wish, remake society, in the opposite way, so that community comes to depend not upon our power to change it, or our power to communicate and form communities of discourse, but rather upon a refusal to make use of such powers—upon their proscription. As Popper has aptly put it, "the future is open." While we cannot always do what we want, we sometimes can. Moreover, such powers expand with our knowledge, and since knowledge cannot be predicted, neither can human potentialities. Knowledge of society and language has a particular importance here. It is even possible to change what we want, and what we may come to know about the viability of our projects and values has a crucial role to play in this. But our ability to change or preserve aspects of human society is ultimately dependent upon social conditions of the possibility of knowledge. Thus, the sociology of belief is important to science, and to the kinds of societies it makes possible. It can provide an understanding of the social-cultural presuppositions of science and of human control over these presuppositions. The sociology of belief could focus attention upon the values implicit in successful science.

The enlightenment changed Western civilization in fundamental ways—most importantly to facilitate the growth of knowledge. But the social forces and individual preferences which brought Western civilization to its prior feudalistic conditions were not thereby abolished. It remains crucial to understand these forces and to see them at work in contemporary forms. Further, since communication regarding language is itself so crucial to our capability to change and reform language, belief, and culture, discourse on language has a special role to play.

4. Socio-linguistic Regularity and Generalizations.

9. Cf. James, Susan 1985, "Louis Althusser," in Skinner 1985, pp. 141-58.
10. Cf. Dewey, John 1927, *Experience and Nature*, 2nd ed., p. 166; Callaway 1993, "Democracy, Value Inquiry, and Dewey's Metaphysics," pp. 13-27.

The human sciences are "special sciences" in the sense that they concern a limited range of phenomena.[11] Often, delimitation of their range of application cannot easily be distinguished from the failure of their generalizations. Moreover, since they concern human-created phenomena, their generalizations—in contrast to those of the "hard sciences," range over changing and variable phenomena.

It makes little sense to apply the generalizations of economic theory to a community without trade, money, or the division of labor. Generalizations concerning supply and demand apply to developed market economies; where there is no market, e.g., in a society based upon subsistence agriculture, one expects at best some precursors of the influence of supply and demand upon prices. Moreover, we expect to identify the presence or absence of markets and market-sustaining conditions by reference to the empirical failure or success of market mechanisms. Although high prices indicate scarcity, persistently high prices may indicate the artificial scarcity produced by restrictions on the entry of suppliers—*i.e*., connivance and/or market failure. Markets exist in various degrees, and hence the laws of the market apply only approximately as the idealizations are approached. Moreover, market-oriented societies may change, distorting themselves, or taking advantage of opportunities which become evident through economic theory itself. But none of this renders the theory of market economies non-empirical.

Similarly, a linguistic community is partly identified by reference to linguistic rules or generalizations obtaining within it. Understanding this, we come to expect that distinct linguistic communities correspond in no simple way to easily distinguished groups of speakers. Rather distinct linguistic communities overlap in complex patterns. For example, we might consider as a community all speakers of basic English—including both those highly accomplished in specialized areas of English and those just out of pidgin English. The domain of basic English might be made relatively distinct—for purposes of a test after a beginners course, or left vague where we wish to include those who might come to have a usable English. Speakers of basic English will also belong to many other linguistic communities. But none of this demonstrates that there are no genuinely law-like generalizations within the domain. Instead, we find a bewildering complexity of generalizations interrelated so as to drive contemporary linguistics to recursive function theory; and we find as well an accentuation of the problems posed by the need to select evidence in light of unsettled theory.

For present purposes, it is much to the point to consider semantic generalizations. I want to briefly consider semantic rules and regularities connected with the difference between classical and intuitionistic logic. Here the empirical differences between corresponding communities are relatively clear—in spite of the fact that they have not always been noticed. "Wanton translation," Quine had said, "can make natives sound as queer as one pleases. Better translation imposes our logic upon them ..."[12] But, if a community employs classical disjunction, then we expect, allowing for failures of understanding and vagaries in the individuation of communities, that they will assent to every disjunction of a sentence and its own negation. However, if the community employs an intuitionistic logic, then they will sometimes assent to such disjunctions and sometimes not.[13] Clearly this difference can be detected by empirical means.

Following Quine and Nozick on verdict tables,[14] observation sentences or standing sentences may be interpreted by reference to stimulus conditions, and assent and dissent to compounds will then allow us to identify not only the native equivalents of 'or' but also differences in the underlying logic of sentential connectives. The point has considerable significance for debates concerning the objectivity of semantic structures and conceptual systems. For, while I borrow my emphasis upon the role of linguistic communities in the individuation of language-systems partly from Davidson, it is inviting to think of Davidson's famous (or infamous) rejection of the notion of alternative conceptual systems[15] as rooted in a generalization of Quine's attributive approach to translating sentential connectives in *Word and Object*.[16]

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11. Cf. Fodor, Jerry 1974, "Special Sciences," and Callaway 1990, "J. A. Fodor, *Psychosemantics*."
12. Cf. Quine, W.V. 1960, *Word and Object*, p. 58.
13. Nozick, Robert 1986, "Experience, Theory and Language," in Hahn L. and P. Schilpp (eds.) 1986, *The Philosophy of W. V. Quine*, pp. 339-63, p. 361.
14. See also Quine, W.V. 1973, *Roots of Reference*, pp. 75ff.
15. Davidson, Donald 1974, "On the Very Idea of a Conceptual Scheme," reprinted in

Thus in "Radical Interpretation," (1973)[17] Davidson claims that to devise "a theory of truth for an unknown language," we are to "first look for the best way to fit our logic...on to the new language." He notes that "this may mean reading the logical structure of first-order quantification theory (plus identity) into the language..." In a footnote, he mentions that his method, in contrast to that of *Word and Object*, "forces quantificational structure on the language to be interpreted." Quine emphasizes the principle of charity only with respect to "pure sentential connectives," (a view he substantially modified in *Roots of Reference*, 1973), while Davidson applies the principle of charity "across the board."[18] Paradoxically, such ill-conceived "charity" seems to extinguish all conceptual differences as a condition of the possibility of translation! Being less "charitable," we may actually detect what is distinctive among our linguistic neighbors.

Though we may imagine various difficulties and complications in the application of empirical tests, there is little room to doubt that Nozick's test is serviceable. Thus, there is little reason to doubt that empirical evidence will allow us to distinguish versions of sentential logic and corresponding communities. Still, the discussion of this test is, quite properly, a scientific systemization of processes in normal language acquisition. If someone acquires classical logic by the normal routes of socialization, questions systematically revealing of logical system are unlikely to be involved. Other methods, focusing upon social cooperation, rather than linguistic investigations, suggest a more realistic approach to the details of language acquisition and the relation of this to social forces.

5. Cooperation and the Prisoner's Dilemma

One conclusion here concerns the importance of information concerning action to the acquisition of language. As Davidson has urged in other connections, game theory and considerations of action have a role to play in theories of the evidence available for interpretation.[19] Linguistic action is nested within systems of other sorts of action: thus both initial and more sophisticated interpretations of linguistic actions and linguistic expressions are able to draw upon a broad context of knowledge concerning who is doing what in particular situations. Acquisition of linguistic competence, and semantic competence in particular, is thus shown possible in ways dependent upon systems of interaction and the understanding of action in concrete situations. The point here depends upon a recognition that it is possible to (fallibly) note specific causal connections without, at the same time, acquiring a knowledge of covering laws.[20]

Though retaining the external perspective of one's own language and belief-systems, the application of game theory to problems of interpretation strongly argues that access to adequate evidence for translation/ interpretation requires the researcher to enter into the culture under study as an active participant. The attitude of distant and "objective" observer, in contrast, blocks needed evidence. So long as linguistic meaning is not identified with actual usage, it is evident that meanings are only imperfectly reflected in usage. Thinking of sentence meanings as truth-conditions, for instance, usage is not merely a function of what is believed true (or any other single factor). A great variety of extra-linguistic intentions and purposes (including many linguistic intentions beyond that of stating what one takes to be true) also play a role in determining the usage of language in a given community and on a given occasion. One objective here will be to explore this point, in a fairly rigorous way.

The point is worthy of illustration and deeper examination, because where we know independently what someone is trying to do, and especially what he is trying to do by means of his words, this information is of

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Davidson 1984, *Inquiries into Truth and Interpretation*, pp. 183-98.

16. Cf. Callaway, H.G. 1992, "Logic Acquisition, Usage, and Semantic Realism," below.
17. Davidson, Donald 1984, "Radical Interpretation," reprinted in Davidson 1984, *Inquiries into Truth and Interpretation*, pp. 125-140.
18. *Ibid*., p. 136.
19. See Davidson, Donald 1974, "Belief and the Basis of Meaning," reprinted in Davidson 1984, *Inquiries into Truth and Interpretation*, pp. 141-54; Davidson 1980, "Toward a Unified Theory of Meaning and Action," pp. 1-12.
20. Davidson, Donald 1963, "Actions Reasons and Causes," reprinted in Davidson 1980, *Essays on Action and Events*, pp. 3-20.

considerable import for understanding or interpreting what he has to say. Being in a position to distinguish a statement from an imperative, for example, is only the most obvious illustration of this type of phenomenon. We depend upon a wealth of common-sense knowledge of ordinary purposes and intentions to disambiguate and interpret as the need arises.

Similarly, we can appreciate how the game-theoretic concept of cooperation has a role to play in theories of the evidence available for interpretation. Where we attempt cooperation, goals and intentions are communicated and become clear on either side, or relatively clear in any case; and to the extent that someone's extra-linguistic goals and intentions can be treated as known, this will constrain interpretation of utterances and ultimately constrain the interpretation of the relevant linguistic system.

It will be useful, therefore, to consider some recent advances in game theory, highly relevant to the notion of cooperation, and capable of application to problems of interpretation and language acquisition. These are results related to the iterated prisoner's dilemma and strategies which have special relevance to social situations or processes which can be understood as instances of the iterated prisoner's dilemma. The development of cooperation depends in part upon a transfer of information between the parties involved; and conventions of language can be thought of as instances of the kind of information we need to communicate (or possess) in order to facilitate the special kind of cooperation involved in belonging to, or participating in, a particular linguistic community. All of this suggests modeling language acquisition, acquisition of semantic competence, and the transfer of semantic information in general, upon the development of cooperation which is possible under conditions of the iterated prisoner's dilemma.

The prisoner's dilemma is defined in terms of a payoff matrix such as the following which is adapted from Axelrod's *The Evolution of Cooperation* (1984):

		Column Player	
		Cooperate	Defect
	**********	**********	**********
Row	* Cooperate	R=3, R=3	S=0, T=5
Player	* Defect	T=5, S=0	P=1, P=1

Each player chooses simultaneously (or in ignorance of the other player's choice) one of the two options, either to cooperate or to defect. (What counts as cooperation or as defecting is usually assumed to be clear from the description of the specific situation, in other cases, this becomes clear by means of a series of interactions.) The two choices together determine the payoffs to the two players. Thus, for instance, if the column player chooses to defect while the row player chooses to cooperate, then the result is to be found in the upper right-hand corner where the row player gets S = 0, the "sucker's payoff" and the column player gets T = 5 which is "the temptation to defect." The lower right-hand corner shows the result when both players choose to defect—each gets one point. This is P = 1, the "punishment for mutual defection." Where each player chooses to cooperate, they each get 3 points— as is shown in the upper left-hand corner. This is R = 3, "the reward for mutual cooperation."

What is crucial to the prisoner's dilemma is not how these scores are interpreted—the particular rewards or punishments—, but rather the relative values of the outcomes (as defined for each player independently): $T > R > P > S$. So long as the temptation to defect is greater than the reward for mutual cooperation, and this in turn is greater than the punishment for mutual defection—which is greater in turn than the sucker's payoff—, then we have an instance of the prisoner's dilemma.

This involves a dilemma in view of considerations which arise independently for each player. Thus suppose you are the row player and you are trying to decide what to do. You must consider two options of the column player: the column player will either cooperate or defect. Suppose that the column player is going to cooperate. If you cooperate too then you get 3 points, the reward for mutual cooperation. However, if you defect then you get 5 points, the temptation to defect. Thus, where the other player will cooperate, then it is best to defect.

But suppose, on the contrary, that the other player will defect, you still have two choices. If you cooperate, then you get 0 points, the sucker's payoff; however, if you also defect, then you will at least get 1 point, the punishment for mutual defection. Thus, where the column player will defect, then it is better to defect yourself.

The dilemma is, then, that it appears to be always better to defect—regardless of what you think the other player will do—, and this in spite of the fact that both players will do better from mutual cooperation.

"What makes it possible for cooperation to emerge," Axelrod remarks, "is the fact that the players might meet again."[21] For, if we assume only one interaction, or that the interactions will be limited to a finite and know number, then there will be no incentive to cooperate. Assume, for instance that there will be only one interaction. The reasoning above will thus govern this single interaction and both players will have an incentive to defect. But, if they will both defect in the case of a single interaction, then the same reasoning leads to mutual defection on the last of a series of interactions of known and finite length. This reasoning tends to move back along the chain to the present.[22] (The point is evident, e.g., where employees change jobs in a bureaucracy. As the date approaches cooperation declines and hostility becomes overt.)

This quite simple scheme for a non-zero sum game expressed in terms of the iterated prisoner's dilemma has found application in analysis ranging from international relations to biological symbiosis, and it casts light upon a great variety of applicable situations. In a zero-sum game such as chess, in contrast, it makes no sense to attempt to cooperate with one's opponent, for there is no possibility in the nature of the game for a player to benefit by cooperation. Thus, the strategies of zero-sum games are typically quite complex and elaborate. It makes little sense in a zero-sum game to allow one's opponent to become aware of one's strategy or intentions. Strategies become Byzantine. However, Axelrod shows that in the iterated prisoner's dilemma, the best overall strategy to follow, in most situations, is a very simple one which combines a willingness to cooperate with the refusal to be exploited. Moreover, there is an advantage to having one's opponent aware of the strategy one intends to employ.

6. TIT FOR TAT and Linguistic Cooperation

The most important strategy in Axelrod's work is TIT FOR TAT. While this is not the best strategy to follow in every possible circumstance, it turns out to be a quite crucial strategy for a large number of possible situations. For example, if one's opponent is using the strategy ALL D, defecting on every move, then one cannot do better than to use the same strategy in reply. However, Axelrod does show, by means of computer simulations of tournaments involving a great variety of possible strategies, that TIT FOR TAT, is extremely robust and successful in a vast number of possible situations: both where it plays against similar strategies and where it plays against strategies which attempt exploitation.

Yet, TIT FOR TAT is a relatively simple strategy to apply and follow. It calls for a player to cooperate on the first move of a sequence and thereafter to do whatever the opponent did on the last move. Thus TIT FOR TAT cooperates with those willing to cooperate and defects from those who show unwillingness to cooperate in their actions. Making use of TIT FOR TAT, one stands the best chance of finding those players who are in fact willing to cooperate.

It will be useful here to think of language learning situations as involving a version of the iterated prisoner's dilemma where both sides make use of TIT FOR TAT (or other strategies). As we shall see, making use of these assumptions, it will be possible to think of a sequence of moves in a game of iterated prisoner's dilemma as a means for either side to communicate, quite wordlessly, what is to count as cooperation as viewed by the other side. This is a kind of information which is not always available at the start of a sequence of interactions—even where there is mutual intention to cooperate. Thus, focusing on linguistic cooperation, and especially the observance of semantic conventions, the iterated prisoner's dilemma provides an approach to the acquisition of semantic competence.

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21. Axelrod 1984, p. 12.
22. Cf. Luce, R.D. and H. Raiffa 1957, *Games and Decisions*, pp. 94-102.

In this context, willingness to cooperate amounts to a willingness to communicate. The point suggests that complexity of strategy is a direct functional indication of reluctance to communicate, and this suggests in turn that complexity of linguistic forms is indicative of reluctance to cooperate: as one might well expect, clarity and simplicity of expression are very important to wider communications. Further, since evaluation of claims made depends upon their being communicated and understood, we fully expect that scientific communications will be bound by simplicity and clarity of expression; obscurantism is simply a refusal to cooperate in the scientific enterprise.

7. Language, Cooperation and Social Structures

Axelrod explores factors giving rise to social structures among interacting groups in terms of the iterated prisoner's dilemma. Of special importance to language and language acquisition is what is called labeling. "A label is a fixed characteristic of a player, such as sex or skin color, which can be observed by the other player. It can give rise to stable forms of stereotyping and status hierarchies."[23] Clearly, there are linguistic as well as non-linguistic forms of labeling, and the effects connected with the labels of sex or skin color are also associated with observable linguistic features: dialect, social register and accents. In a highly intellectual atmosphere, the effects of labels can also be found associated with semantic differences, reflecting points of view and intellectual affiliations.

Labels are important because people can begin their interactions with strangers on the basis of expectations that they will act and react in known ways. The advantages of observing labels and of being labeled are directly connected with the creation of expectations:

> One of the most interesting but disturbing consequences of labels is that they can lead to self-confirming stereotypes. To see how this can happen, suppose that everyone has either a Blue label or a Green label. Further, suppose that both groups are nice to members of their own group and mean to members of the other group. For the sake of concreteness, suppose that members of both groups employ TIT FOR TAT with each other and always defect with members of the other group. ...Then a single individual can do no better than to do what everyone else is doing and be nice to one's own type and mean to the other type.[24]

In view of the incentives, "stereotypes can be stable, even when they are not based on any objective differences."[25] Moreover, the assumed conditions are not in the least unlikely. We are all aware, in degree, of effective stereotypes: those based on race, or skin color or national origin. Still, it is of special interest to appreciate how each individual has a strong incentive to participate in systems of stereotyping and discrimination. This is what Axelrod finds so disturbing in his results: he captures the social phenomenon of self-serving discrimination in game-theoretical terms. The account is compelling and chillingly simple.

Strategies tend toward collectively stability, as a function of the importance of future interactions in comparison with the present. If we assume the payoff matrix given above, then TIT FOR TAT will be collectively stable provided that the next interaction is 2/3 as important as the present interaction. Under such conditions, if everyone else is using TIT FOR TAT, then an individual player can do no better than by employing the same strategy. A group of players using this strategy in their interactions with each other cannot be invaded by players employing an alternative strategy. By definition, an alternative strategy will not come to replace a collectively stable strategy.

Thus, in a range of situations described, the stereotypes lead to incentives to conform to the system. Anyone who departs from it will see scores drop. For example, if a blue player attempts to break the stereotypes and use the strategy TIT FOR TAT in interactions with a green player, then since all green players use ALL D with the blue players, the blue player will get 0 points, the sucker's payoff, rather than 1 point, the punishment for mutual defection, whenever attempting cooperation with a green player. There are incentives, for each individual, to maintain the system and to act in accordance with the stereotypes. Now imagine the prospects of cooperative research between distinct traditions under similar conditions.

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23. Axelrod 1984, pp. 145-46
24. Axelrod 1984, p. 147.
25. *Ibid*.

Labels also play an important role in maintaining status hierarchies. Thus, suppose that everyone in a particular group has a particular characteristic in some definite degree. Examples are strength, or height, or skin tone, or an assigned position. Axelrod describes a status hierarchy in terms of strategies: "everyone is a bully toward those beneath them and meek toward those above them."[26] (Interestingly, German has a derogatory word for this: '*Radfahrer*'.) We can imagine that everyone uses a certain strategy in interactions with those above in the hierarchy: "cooperate unless the other player defects twice in a row, in which case never cooperate again." This strategy is relatively meek. The player allows himself to be a sucker on alternative moves. Still, it also shows some provocability—it will not tolerate more than a certain amount of exploitation. In contrast, when meeting subordinates in the hierarchy, one uses a "bully" strategy: "alternate defection and cooperation unless the other player defects even once, in which case never cooperate again."[27]

Obviously, the players at the top of the hierarchy will do very well, and those at the bottom less well. However, it is important to see that the situation will be stable where "the discount parameter is high enough"—that is, where future interactions in the same group are relatively important. (This factor is effected, e.g., by physical propinquity and geographical and professional immobility.) For in the case of an isolated revolt from below, that player's scores will sink drastically. The reason is that "it would be better to take one's medicine every other move from the bully than to defect and face unending punishment."[28] Thus, even those at the bottom of an insulated social hierarchy have considerable incentive to maintain it—especially given expectations of later advances in the hierarchy. Now, consider the effects on career advancement of a critical attitude expressed by a student within a hierarchical institutional environment.

These analyses illustrate the facility of game theory to illuminate the inner structure of social phenomena. We see a quite pervasive human social structure which can be made more specific by examples of tribalism and nationalism—or intellectual affiliations. So imagine that each tribe or nation uses a label which maintains its distinctness from every other and that a hierarchy is instituted within each group on the basis of the degree to which a particular person exemplifies the positively evaluated tribal or national traits. Whatever the value of the system to those who participate in it, disadvantages are also evident: quite pervasive human problems centered on collective conflict, conflicts we know to be avoidable in principle but which may appear inevitable. We know that such conflicts are avoidable in principle because we know that groups structured in terms of the above considerations could often benefit by breaking down stereotypes preventing wider cooperation. Still, conflicts among groups often appear unavoidable because we are familiar with the incentives which maintain the system.

8. Conclusions

I can only briefly suggest some implications of Axelrod's work for the sociology of belief and related issues regarding language and communicative practice. The chief implication is that communications highly structured by labeling with regard to intellectual affiliations and dependent upon strongly hierarchical institutional structures tend toward insularity and dogmatism.[29] Under such conditions, one also expects a development of language-systems suited to facilitate insularity and dogmatism: key terms playing the roles of labels for intellectual affiliations tend toward greater obscurity, general claims with similar social-institutional functions tend toward multiple and complex ambiguities. Language becomes stilted by attempts to insulate key expressions from deeper examination or criticism. These changes function to guard insiders against outsiders, to carry on mock debates with opponents, and to maintain social hierarchy.

Special dangers exist in socially defined and intensely hierarchical schools of thought—a point reflected in early modern disdain for "scholasticism." For, we expect that membership or advancement is only possible by strict adherence to stereotypical thinking, and disdain for critical attitudes—styles of education which overemphasize reproduction of isolated and internally defined tradition. The points here help clarify the connection

26. *Ibid.*, p. 149.
27. *Ibid*.
28. *Ibid*., p. 150.
29. Cf. Albert 1991, pp. 116-17.

between science, democratic participation and the social character of language. More democratic social relations are required for broader, deeper argumentation. Otherwise, emerging problems and innovative viewpoints remain under-developed, unarticulated or ignored. Unfortunately, in situations of intensive competition (of whatever sort) recognition for outsiders (or those with low status-ranking) is often the first victim. Yet these people are often key social representatives of criticism.

Failing deep moral concern for democratic participation based on the cognitive value of contributions, existing viewpoints and schools may reproduce in hot-house monocultures, cut off from improvements and corrections. We need ladders within existing social and institutional structures of scientifically oriented thought and bridges between traditions—things which over-competitive conditions strongly tend to eliminate. The hypothetical-deductive method, in particular, may come to resemble a rationalization for ideology or absolutist metaphysics, without due stress on the search for potentially falsifying evidence and deep consideration of alternative hypotheses. The social-institutional correlate of this, in science and philosophy as elsewhere, is engagement to "test language in use for its reality content:" an emphasis upon clear, tolerant, and unpartisan participation, including searching and critical argumentation and research. Failing this, language tends to deteriorate to the level and type of conflicts it serves. The root plausibility of sociological determinism appears linked to strategies of social-institutional reproduction arising from excessive competition and overly collectivized career identities. Objectivity is fostered by reaching, with tolerance and a critical eye, across the boundaries of cultures, generations, schools, and institutions.