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Fodor's contribution to the study of the cognitive mind

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Abstract

This presentation is intended as a general overview of the main issues that Jerry Fodor has addressed concerning the explanation of intelligent behavior. From a mosaic of different pieces of work, which sometimes may look unrelated and even conflicting, our purpose is to extract the global picture, trying to make explicit the links between its parts. Fodor's contribution to the study of the cognitive mind is sketched by means of three antinomies that express the scope and limits of that study. These antinomies are: 1) Functionalism versus Physicalism; 2) Computation versus Association; and 3) Modularity versus Globality.

Resumen

En esta presentación se intenta hacer un repaso general de los principales temas tratados por Jerry Fodor en el contexto explicativo de la conducta inteligente. A partir del mosaico formado por sus diferentes trabajos, que a veces pueden parecer inconexos y hasta contrapuestos, se trata aquí de proporcionar las claves para apreciar su extremada coherencia, destacando así las relaciones que se dan entre ellos. La decisiva aportación de Fodor al estudio de la mente cognitiva se resume a través de tres antinomias que expresan el alcance y los límites de dicho estudio, a saber: 1) Funcionalismo versus Fisicalismo; 2) Computación versus Asociación; y 3) Modularidad versus Globalidad.

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It is a great pleasure for me to open this seminar devoted to Jerry Fodor's contribution to the computational model of mind. From the beginning, I want to express my admiration and gratitude to Toni Gomila and to the Department of Philosophy at the University of the Balearic Islands for organizing this meeting, for making possible the presence of Jerry Fodor himself, and for bringing us to this charming island of Menorca, a wonderful scenery for intellectual enterprise, ... among other things.

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I'm supposed to make a presentation and to set some background for the oncoming lectures and discussions. For many of you this will be no more than a reminder, but in any case it is what has to be done at the very onset of the game: to put the cards on the table, or if you like this better, to set the frame.

And it is here where the troubles start, in setting the frame to capture what Jerry Fodor has done. (By the way, I suspect that frame problems, in one version or other, are going to be all around during these days). Well, the first difficulty in conceptualizing Jerry Fodor consists in his atypicality. He is not a typical philosopher, even though he was indeed trained as such, got his degrees at Princeton University, has been involved in so many arguments with philosophers, and has actually made so important contributions to the philosophy of mind. Nor is Jerry a typical psychologist, even though he was introduced into experimental psychology by such an authority in the field as Charles Osgood (University of Illinois) and was also the director of the Laboratory of Psycholinguistics at M.I.T. for twenty years, with so many publications in this field. Jerry is not a typical linguist either, and he even declares that his approach to linguistics has always been amateur; but, as it is well known, he was there, among Chomky's first graduate students and colleagues, giving birth to the Standard Theory, with a major contribution to the formulation of the semantic component of generative grammar.

Jerry is not a typical scholar in any of these fields. In dealing with philosophers, he has not worried about frequently going against the tide, mainly when operationalism, associationism, physicalism, intentional interpretationism, or meaning holism have been on fashion. When he comes into psychology circles, Jerry Fodor is viewed pretty often as a disturbing visitor who forces everyone to think of the sense of their work; in some cases, he is nevertheless acknowledged by psychologists for his contribution to the foundations of the discipline and for keeping them busy with new research problems. And if he shares the table of the linguists, then he sits down in a corner trying to keep track of their arguments, while thinking that what really matters is to understand how the mind works (this is also what he usually does when invited to the Artificial Intelligence meetings).

Perhaps, in order to set Fodor's own frame, it is this very interdisciplinary orientation which provides the first clue. For this is what is precisely at the core of that emerging field called Cognitive Science, and perhaps Howard Gardner is right when, in his book about the history of the cognitive revolution («The mind's new science») devotes an entire paragraph to Jerry Fodor considered as the prototype of the complete cognitivist. Gardner introduces this paragraph with the following words: «... it is

salutary to consider the work of Jerry Fodor, a full-scale cognitivist -one philosopher who seemingly has no reservations whatsoever about the common fate of philosophers and empirical scientists interested in issues of mind» (1985, p. 81).

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However, giving a name to an emerging field is not the same as having a clear idea of what are going to be the scope and limits of that field. And here again we have to face another frame problem, the one that refers to the feasibility of Cognitive Science as such, or for that matter, to the possibilities for psychology to count as a proper science. I think that Fodor's approach to this problem might be taken as his basic contribution to the study of the cognitive mind, where all the others stem from and get summarized.

Tracking Fodor's writings in the past 25 years, the to-be and not-to-be of Cognitive Science can be expressed in this three antinomies:

1) Functionalism vs. Physicalism
2) Computation vs. Association
3) Modularity vs. Globality

The left side of each antinomy represents the key value that defines the scope of research in cognition; the terms on the right represent the limits of that enterprise. The first contrast bears on the required level of explanation for intelligent behavior, so it sets up the playing-ground. The second one bears on the type of modelling that best suits the demands of mental operations underlying that behavior, thus providing the explanatory instrument. And the third contrast refers to two major kinds of properties that may be shown by mental operations, which in turn may be more or less accessible to productive research and explanation. Both kinds of properties contribute to the configuration of an architecture for the cognitive mind, with some components that are better understood than others.

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Functionalism vs. Physicalism

The possibility of studying mental states and processes depends on the assumption that there is a functional level of explanation wherein those states and processes are involved in the causation of behavior without being reduced to the neurological ones. So it is assumed that behavior is a complex function of internal properties of the system and that for capturing those properties we need a sufficiently abstract level of description, one which is not provided by the more basic sciences (all the way down from neurology). Fuctionalism preserves psychology (and cognitive science) from two major kinds of reductionism (physicalist and behaviorist) and, at the same time, sheds a new light on the mind-body relation, avoiding ontological dualism: mental types cannot be reduced to neural types, even though mental tokens are physically instantiated by neural tokens (or, for that matter, by tokens of other hardware substances).

On the other hand, functionalism, at least as Jerry Fodor understands it, does not entail that the explanatory power of the so called «special sciences» should be diminished with respect to basic science. The difference between special sciences and

basic science is in the abstraction level they adopt and, correspondingly, in the more or less restrictive character of their respective laws. (The only science which claims to apply to everything is basic physics; as soon as you consider higher order properties, the extension of the laws gets reduced, there are more exceptions.). But, in spite of this difference in extension, there is no reason why the laws discovered in both cases shouldn't have the same explanatory capacity and why the notion of causality can not be applied in the same way (viz., as succession of events governed by a law).

This relates to a further and very important point that has to be made when considering functionalism in the context of behavioral sciences. The attribution of explanatory power to psychology is contigent upon the atribution of causal powers to mental states and processes. Moreover, what distinguishes mental events from other kinds of events is that they are intentional, or referential, or if you like this better, they have informational content. But then we are committed to adopt a strict realistic position with regard to intentionality. Mental events are not just a way of talking (or «a façon de parler») about neural or physical events. There are intentional laws that express causal relations between mental events, just like there are physical laws, biological laws or economical laws that bear on other types of events.

Fodor's insistence on this point has been remarkable, in spite of so much skepticism that he has met around, coming from philosophers like Dennett or Stich (or even from old functionalists like Putnam). This skepticism also comes from many psycholgists and A.I. people, that try to keep their scientific enterprise as something «special», but in the precarious sense that it may live without ontological commitments. (By the way, this is very surprising, because the same psychologists that charge Fodor for having reduced the field so much are often the ones that don't care about or are even against intentional realism, the very conditioning factor for the possibility of psychology.)

The intentional character of mental states goes hand in hand with the vindication of propositional attitudes (remember, for example, Fodor's «Three cheers for propositional attitudes» in 1979), and at the same time, reconciles psychological science with commonsense psychology (remember, for example, the first chapter of *PSYCHOSEMANTICS*, 1987). Propositional attitudes are just relations that organisms bear to mental representations. If we thus consider mental states as propositional attitudes, we already have got the way to individuate the objects of our science: mental states are individuated by the kind of relation and by the representational content expressed by propositional attitudes.

So far, so good. But now we have to face the problem of how in the world mental states enter into causal interactions and may finally produce intelligent behavior. It is now when Fodor's computational theory of mind comes onto the stage.

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Computation vs. Association

The starting point here is the very notion of mental representation. Mental representations are symbolic entities, and just like all symbols, they have both semantic content and syntactic form. Because they have semantic content, our mental states have

content, that is, they are intentional (or referential). Because they have syntactic form, which makes them suceptible to different combinations and transformations, our mental states can intervene in causal interactions. In this sense, the mental processes that make these interactions possible are computational. Computations, after all, are no more than formal operations defined over representations.

The arguments and supporting evidence for this theory of mind have been developed in many different pieces of work beginning from 1975 landmark *THE LANGUAGE OF THOUGHT*. I am not going to review them all here, but just remind you that if mental causation is computation, it must have at its disposal a medium or vehicle for computation, that is, the system for mental representations that constitutes the language of thought or mentalese. What is known about the human mind and its main achievements (in perception, learning, problem solving, language, reasoning, etc.) suggests that mentalese has to be a pretty abstract language, with a high expressive power, a rich vocabulary and a rich syntax, mostly innate, flexible, and subject to a rational and efficient exploitation by the individual.

To adopt Fodor's view of mind entails certain consequences for setting up the limits of the theories in psychology and cognitive science. First of all, the language of thought story precludes an associationist view of mind, be it in the traditional flavour of the British empiricists or in the more recent versions of the connectionists. The mechanisms of mental causation provided by associationists (contiguity, resemblance, statistical inference, etc.) are just inadequate to account for the properties shown by cognition at large (such as productivity, sistematicity, constituency, etc.).

So this is mainly an empirical issue. In this respect, it is important to notice that associationism may recognize the central role of mental representations and, for that matter, be mentalist and honor the constrainsts of a functional level of explanation. What happens is that it has not got right the mechanism of mental causation.

Notice also that computability as such doesn't do the work. Associacionist functions are indeed computable, as connectionists are showing all the time; but it is one thing to deploy a computational apparatus to formalize the theory and to make the model work, and quite another to consider the mind as really computational, at least in the sense in which a Turing machine is computational. Connectionists are not computational in this respect, and that's why, according to the available evidence, their model of the cognitive mind is not the right one. The case made out by Fodor against connectionism is not very different from the case made out by Chomsky against finite state grammars more than thirty years ago (see Fodor and Pylyshyn, 1988, and Fodor and McLaughlin, 1990).

Another unavoidable consequence of adopting Fodor's theory of mind is the exclusion of semantics from the territory of psychology. Remember that the causal properties of our mental states and processes are derived from the formal-syntantic aspects of mental representations. The content can still play a role in the individuation of mental types, but only to the extent that it is subject to that *formality condition*, and not as subject of such semantic properties as truth, reference, meaning, and so on. These semantic notions could be necessary to face the epistemological (or perhaps ontological) problem of how our thoughts match with reality, but they simply are not psychological categories in charge of explaining mental causation.

This point has been one of the main guidelines of Fodor's work in both the empirical side (let's remember« The psychological unreality of semantic representations» in 1975, or «Against definitions» in 1980) and the theoretical side (from his arguments based on the intensionality of mental states -presented in «Methodological solipsism», 1980- to the more sophisticated ones against Meaning Holism, developed in his latest books). At the same time, this point has also been the one that perhaps has raised more controversy and reserve, and I suspect that these will be also raised during these days (so we'll have time to discuss it). What I think has to be clear from the beginning is the coherence of Fodor's view: if cognition is computation, then Cognitive Science (or just Psychology) is not Semantics. (To be or not to be).

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Modularity vs. Globality

We can now proceed to examine the third antinomy that configurates the study of the cognitive mind. In this case, the issues are more neutral with respect to the status of Cognitive Science. But assuming that human cognition is the prototype to be reproduced by machines, the matter becomes of enormous importance for the actual development of our science. So here the limits, if there are any, will be internal to the field, once we have opted for the first parts of the two former antinomies (a functional level of explanation and a computational theory of mind). And here the underlying questions are entirely open to empirical contrast, and they finally consist in knowing how much we can understand of the human mind. Depending on the answer to this question we'll know to what extent we are going to be able to construct really intelligent machines (at least as intelligent as us).

It is needless to remark Fodor's important contribution to these issues since the publication of *THE MODULARITY OF MIND* in 1983, perhaps one of the most influencial and provocative books in the field. For the present purposes, and given that almost half of this seminar is going to be devoted to modularity, I will only make a few observations to prepare the ground.

In the first place, Fodor proposes a *computationally-based taxonomy* of the mind components. According to certain properties that can be shown by mental processes, a fundamental distinction is drawn between modular and non-modular systems; a distinction that has important consequences for the characterization of the functional architecture of the cognitive mind. I think that, in this respect, it is important to emphasize the computational base of the taxonomy. In one sense, because computation is the common feature of all processes, being modular or not (the language of thougt story still keeps its force). In another sense, because the differences between systems are differences in their kinds of computations and the critical properties are properties of those computations. In this latter sense, Fodor goes beyond a mere informational modularity (à la Chomsky) where the structure of mind would be based on the structure of knowledge, but not on the nature of its operations.

Secondly, Fodor identifies the bunch of *critical properties* that contribute to make the distinction between modular and non-modular processes and, at the same time, are used for diagnosis. The former ones are domain specific, informationally encapsulated, mandatory, etc., whereas the latter ones are global, isotropic, etc. The former mainly correspond to input systems and the latter to central systems. The available evidence shows that processes like sentence parsing could be considered as prototypical cases of the modular ones, while inductive reasoning could be the paradigm of the non-modular (or central) processes. So far so good. There are many details to be filled in, but this is the general picture of the cognitive mind proposed by Fodor. However, there is still something more to be said.

The third and final observation refers to the prospects for the study of these two classes of systems. According to *Fodor's First Law of the Nonexistence of Cognitive Science*, «the more global a cognitive process is, the less it is understood» (Fodor, 1983, p. 107). So now the internal limits of the field become explicit. The properties used to sort out modular from non-modular systems are critical for assesing progress in psychological research (or in Cognitive Science). As I said before, this is basically an empirical issue open to disconfirmation. Nevertheless, Fodor doesn't resign himself to showing the evidence for his own Law, but goes much further trying to disentangle the possible reasons for the existing limits in understanding non-modular (or, say, unencapsulated) processes. Those reasons can be summarized in just one: the frame problem (but now, leaving rhethoric aside, in its more genuine and technical sense, as it was first raised in the A.I. circles). When a system has a very large data base at its disposal, with so many unconstrained potential relations among them, the question is how to choose the appropriate ones in order to solve a problem, make a decision, plan a course of action, etc. The frame problem is then the problem of how to manage relevance, and it is the problem that, in the first instance, non-modular unencapsulated systems have to solve and, as a matter of fact, do solve very efficiently. Secondarily, it is the problem that has to face the cognitive scientist in order to finally understand intelligent behavior and design really intelligent machines. But in this case, given what we have got so far, the prospects are not very optimistic. As Jerry likes to say, there is something here that we just don't understand. Something that seems to depend on the global properties of the computations performed by our central systems.

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Well, I think that this is enough for a first encounter with Jerry Fodor. I am not sure if he would put his signature to all I have said, but at least on this occasion we won't get lost in hermeneutic disputes. This meeting gives us the opportunity to hear Fodor's own position about all this (and more) as told by himself. I have just tried to give a very general overview of the main issues that he has addressed concerning the study of the cognitive mind. From a mosaic of different pieces of work, which sometimes may look unrelated and even conflicting, my purpose has been to extract the global picture, trying to make explicit the links between its parts.

However, I don't want to finish without pointing out some questions that still remain open and that could be located near the boundaries we have set for studying the cognitive mind. Or if you prefer, you can take them as a pretext for provoking your discussion from the very beginning.

The first one. According to the former picture, psychology is mainly concerned with cognition (viewed as computation). However, there are still other types of relations between organisms and representations instantiated by propositional attitudes, such as desires, motives, emotions, etc., which may also intervene in the intentional causation of behavior. Question: Are all these mental states susceptible to scientific treatment beyond what is assumed by folk psychology?

Second. The computational theory of mind is based on the syntax of mental representations. In this respect, minds are like computers. But mental representations have also semantic content, and in this respect minds are very different from ordinary computers (remember «Tom swift and his procedural grandmother» from 1978). Even though semantics is not part of psychology (or cognitive science), meaning is still a characteristic of our thougts. To what extent psychology can move toward a better understanding of the implications of meaning in the explanation of behavior?

Third question. Is there any hope to overcome the problems raised by the frame problem? And another related to this: Why computer technology has made more progress in the domain of their putative central processes (reasoning, problem solving, expert systems, etc.) than in the domain of their putative perceptual capabilities (visual processing, speech perception, natural language understanding, etc.)?

And the last one. The functional architecture of cognition is taken to be mostly innate. Thus it may be relevant for its study to take into account the biological character of this innate endowment, since the software properties of a computer are not entirely independent of its hardware constraints. To what extent, then, can the study of the cognitive mind get rid of its neurobiological substratum and ontogenetic conditions?

I can assure you that these are really unbiased questions, at least in the sense that I don't have a clue of how to answer them. So any help from the audience will be wellcome.

Thank you.

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