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Bioinformatics and biological reality

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Abstract

Many bioinformaticians seem to shy away from believing that we can have knowledge about a mind-independent biological reality. This paper attempts to show that this tendency is neither well-founded nor harmless. Even though most bioinformaticians work only with terms and concepts, they cannot altogether disregard the question whether these terms and concepts have any real referents. The paper consists of three parts. Part I clarifies three different positions in the philosophy of science with which it would be good for the philosophical outlook of bioinformaticians to become familiar, and it defends one of them, Karl Popper's epistemological realism. Part II discusses a distinction which is necessary for epistemological realism and is of practical importance for bioinformatics, the distinction between the *use* and *mention* of terms and concepts. Part III, finally, contains some brief concluding words about realism, both in general and in relation to bioinformatics.
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1. Introduction

Many bioinformaticians seem to shy away, if not from believing that there is a mind-independent biological reality, at least from believing that we can have knowledge about such a reality. The aim of this paper is to try to eliminate this tendency towards epistemological anti-realism. The paper consists of two main parts and a brief concluding part. Part I clarifies three different positions in the philosophy of science with which it would be good for the philosophical outlook of bioinformaticians to become familiar. When they are spelled out in some detail it becomes evident that these positions are mutually exclusive, but when seen only vaguely, the false impression may arise that one can sometimes rely philosophically on one position and sometimes on another. I will label them "Myrdal's Biasism", "Popper's Epistemological Realism", and "Vaih-

inger's Fictionalism", respectively.[1] I will defend Popper's position. Part II infuses new blood into the common semantic distinction between the *use* and *mention* of terms and concepts;[2] both the red and the white blood corpuscles in this new fluid come from the philosophy of intentionality. The view here defended both underpins the epistemological realism defended in part I, and shows that this realism is not only important for bioinformaticians' philo-

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[1] The content of this paper has gradually come to fruition over the course of many conferences and workshops concerned with philosophy and informatics. The conference "Ontology and Biomedical Informatics" in Rome, 29 April–2 May 2005 finally triggered me to make these thoughts as clear as possible—even to myself. Both biasism (but not Myrdal's) and Vaihinger's fictionalism were, quite independently of me, put on the agenda in Rome by Alexa McCray's talk "Conceptualizing the World: Lessons from History."

[2] I will deny my own preferences and use "term" and "concept" instead of "word" and "meaning", respectively, in order to conform to the usage of bioinformaticians. To a non-Platonist philosopher such as myself, the term "concept" suggests too many allusions to entities that exist in some extratemporal realm of their own, independently of human beings. "Meaning", on the other hand, has no such associations. Meanings exist directly only in people.

sophical self-understanding, but is also sometimes of direct relevance for their ordinary work.

2. Part I

2.1. Myrdal's biasism

Now and then we think of, and even perceive, the world in a way that is closer to how we would like it to be than how it really is. In such situations, we are biased. But how often does this occur? And what are the consequences of such bias for scientific research? One position in the philosophy of science can be captured by the following thesis and proposal:

• Thesis: Every conceptualization and theory is biased.
• Proposal: Admit that you are biased and make the causes of this bias (valuations, social positions and backgrounds, etc.) explicit, both to yourself and to your readers.

This position, nowadays widespread, was first put forward in the fifties by the economist Gunnar Myrdal (who shared the Nobel Prize in economics with Friedrich Hayek in 1974), but only as a thesis about conceptualizations in the social sciences [1–3, Chapter 7]. Myrdal's views quickly reached the general philosophical audience thanks to Ernest Nagel's criticism of them in his classic *The Structure of Science* [4].

At the time Myrdal was writing, it was commonly assumed that scientists in their research activities ought to be, and mostly were, neutral with respect to valuations and values that are not purely scientific in the way some methodological norms are.[3] In criticism of this assumption, Myrdal claimed (a) that it is impossible for social scientists to free themselves from all such valuations, and (b) that such valuations necessarily distort research. According to Myrdal, since the value-neutral social scientist is a myth, social science is always more or less biased and more haunted by conflicts than the natural sciences are, and the only thing that scientists can do to become more objective is to find out and clarify, both for themselves and their readers, what kind of valuations they have. Looking at the historical development of the natural sciences, one might then add that even though there is much scientific consensus among natural scientists at most points in time, there is nonetheless a great divide between natural scientists belonging to different epochs (contrast Europe, for example, at the times of Newton and Einstein). Such differences, it has been argued, are due not to the discovery of new facts but to the different cultural values of the centuries and scientists in question. In this way, many people have moved from Myrdal's own biasism, which is restricted to the social

sciences, to the generalized version, which applies to all sciences that are not purely formal. Logic and mathematics are mostly regarded as being outside the scope of biasism, but I have seen no claim that bioinformatics should be so regarded.

As I will show, biasism (in whatever version) contains at least three serious philosophical flaws, each of which is sufficient reason to reject it.

Flaw 1.

It makes no sense to speak of something being to the right if there is nothing that can be said to be to the left; similarly, it makes no sense to speak of bias if it cannot be contrasted with truth. Biasism does not in Myrdal's writings, and cannot without losing its sense, take the concept of truth wholly away. What it does do is to claim that we cannot *know* truths and that we should therefore speak of research results as being true-for-certain-valuations instead of being just true.

Biasism does not say that *sometimes* scientists are biased and put forward research results that are distorted and therefore false. The claim of biasism is that this is *always* the case; either only in the social sciences (the restricted thesis) or in all the non-formal sciences (the general thesis). Let me compare biasism in science with issues of legal jurisdiction. Judicial procedure seeks to find non-biased judges and jury members. If biasism were applied to such procedures, it would amount to the claim that there are no non-challengeable persons at all. Because of this generality, the thesis of biasism has to be applied to itself. It then implies the following disjunction: Either biasism is false or it is true, but in the latter case it says of itself that it is biased and therefore false. That is, it is necessarily false. Therefore, of course, it should not be adhered to.

However, the self-referential paradox of biasism can be taken away. The defenders of biasism merely have to claim that their thesis lies outside the harmful influences of valuations and that they, therefore, are in a position to state a known truth: "All theories are biased, except the theory of biasism." But now another problem rears its head. They have to explain why their thesis—a thesis which belongs to the sociology of knowledge—is, in contradistinction to all other scientific and philosophical hypotheses, not influenced by valuations. If their thesis really is true, then it seems to be a mystery why not also scientific assertions of other sorts can be true. As far as I know, no one has solved this problem; I think it is unsolvable.

There are at least two reasons why many otherwise good researchers do not notice the paradoxical character of biasism. First, it seems to be natural for people who make assertions such as "Humans are always fools" and "Humans are always liars" to place themselves outside the scope of what they say; if not altogether, at least at the moment of making the assertion. Those who have asserted "Humans are always biased" might have followed this habit without noticing it. Second, in the case in hand, it is easy to make a so-called fallacy of composition. That is, from the fact that something is possible in *each* case, one falsely

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[3] Myrdal prefers the term "valuations", since he thinks that the term "values" gives rise to misleading associations of being something objective; see [2, p. 8].