Jerry Fodor, Jaegwon Kim, and Scientific Reductionism

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While there is a generality of physics that allows the science to be applied to many different domains, does it mean that all science can be unified under physics? This is what Jerry Fodor discusses in his essay titled Special Sciences, or the Disunity of Science as a Working Hypothesis. More specifically, he argues that reductionism (the idea that predicates, entities, or states can be equivalently described through more fundamental phenomena) is too strong a claim and accepting it would be "too strong a constraint on the unity of science" (Fodor, pg. 101). Instead, Fodor argues that the weaker claim of token physicalism should be adopted to understand the sciences, as it would preserve the unity of science as a whole. Under token physicalism all the events science postulates are defined as physical events. As a result, the generality of physics and its importance to other sciences is preserved, while also ensuring that other sciences are not in danger of being reduced to physics when that is not their epistemological aim (meaning being reduced is not the purpose of scientific fields) (Fodor, pg. 101).

It is important to note that Fodor is assuming reductionism entails token physicalism to preserve a model of reductionism whose bridge laws (laws that connect the predicates of a non-physics science to the predicates claimed in physics) express event identities rather than simply relations between two predicates (so as not to allow for a non-physical reductionism). In this case, predicates can be defined as claims and assertions made in a specific science whose variables are bound to the laws of the science. Therefore, reductionism "is the conjunction of token physicalism with the assumption that there are natural kind predicates in an ideally completed physics which correspond to each natural kind predicate in an ideally completed special science" (Fodor, pg. 100). A special science is a non-physics science, and natural kinds can be defined as the predicates or events investigated in a specific science.

Fodor argues against reductionism based on four main principles, which target the claim that there are corresponding predicates between the sciences (why every predicate in a non-physics science is unlikely to correspond to a predicate in physics).

1. Generalizations can be made about events whose physical descriptions have nothing in common by applying counterfactuals.
   - Ex If person A had met the diagnostic criteria for depression, then they would have had depression.
2. The degree to which two predicates are related to each other often does not seem relevant to the truth of the descriptions or have much epistemological value.
   - Ex. Just because depression is manifested in two different instances (presuming different people), doesn't tell us anything about what depression is.
3. Generalizations are built into the laws of the non-physics sciences.
   - Ex. The psychological laws that define depression based on mood and behavior are generalized to account for future cases of depression and for depression in different people.
4. If reductionism is true, then the non-physics sciences assume predicates whose disjunctions could equally be proved using the same bridge predicates for physics (p).
   - Ex. Depression is defined as brain state s1, s2, s3, or s... and physical predicates p1, p2, p3, or p...

Note: defining depression as s1, s2, s3... is satisfied by point 3

The fourth point is the most crucial mistake for reductionism because, in its effort to reduce all science to physics, it must be that there is a law in each of the sciences that satisfies this condition. It should feel weird that within psychology or economics, there are laws built into

the theories that ensure their reducibility, especially considering that their laws are often not laws governing physical predicates like the ones in physics or biology. Such a claim (in point 4) would also mean that the predicates of a non-physics science could be manifested in an essentially infinite number of predicates in physics as long as all the laws are satisfied. How could one establish a scientific law for depression if each instance of depression is equivalent to a specific arrangement of atoms in physics that satisfy the laws of physics and don't contradict those in psychology? Depression is complex enough that it would be ridiculous to assume each case of depression is the same physically in every single instance, and this problem would only get worse as it's reduced to biology, chemistry, and physics.

There is another, more important, problem that arises from the fourth point; If reductionism is satisfied, and there are disjunctions of predicates in physics that are equivalent to predicates in any science, then the disjunctions of the predicates in physics must themselves be a law, meaning that it must be that no predicate in a non-physics science could be reduced to only one predicate in physics. This is the most fundamental rule of multiple realizability (the idea that a single entity, state, or, in this case, predicate can be manifested in multiple other predicates). For example, the idea that depression can be realized in different people while remaining the same thing (depression). There are varying strengths of multiple realizability (MR), ranging from intrapersonal arguments to those comparing the human brain to computers and aliens. However, an interpersonal perspective is the most common stance taken by traditional psychology and is more than strong enough to create problems for a reductionism that contains multiple realizability.

The consequences of the problem of disjunctive predicates are shown in the following statement, where P and Q are predicates in physics, and R and S are predicates in a non-physics science.

$(P \leftrightarrow R) \ \& \ (Q \leftrightarrow S)$

This can be rewritten to $(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)$

Fodor illustrates this problem of applying reductionism to two sciences with bridge laws which each have their own disjunctive predicates in the following example:

Law: Irradiation of green plants by sunlight causes carbohydrate synthesis

Law: Friction causes heat

Therefore, either irradiation of green plants by sunlight or friction causes either carbohydrate synthesis or heat.

It is unlikely the disjunction of 'carbohydrate synthesis or heat' is an actual law in a basic science.

So, if a science like psychology is reducible to physics, then psychology is not an autonomous science. Under this argument, the only reason psychology is an autonomous science is an epistemological problem that will be resolved as the sciences continue to succeed in discovering or creating knowledge. Fodor's argument shows that this argument is flawed and that the special sciences will remain autonomous because they resist reductionism, regardless of scientific progress; There is no law in physics that is disjunctive, and therefore there is no natural kind that is constituted by an either-or statement.

For Fodor, all one has to do to fix the problem of disjunctive laws and the explosion of predicates is "not require that bridge statements must be laws, then either some of the generalizations to which the laws of special sciences reduce are not themselves lawlike (meaning they don't conform to how Fodor sees the relationship between law and causality), or some laws are not formulable in terms of natural kinds [Kinds meaning predicates. Natural meaning scientific]" (Fodor, pg. 110). As a result, one no longer requires that each predicate or event of a basic and special science corresponds, while still maintaining that physical reductionism and its bridge laws express token identities. For example, what it means to be

depressed could be reduced to a more basic science, but the same is not true for every instance of depression. If the definition of depression is resistant to reduction (which it probably is) it is either because the definition is not lawlike (meaning there are predicates that don't need to satisfy the laws, or that the laws are adaptable to the predicates, thereby jeopardizing their status as laws in science), or the laws of depression can't be seen as a physical law. Therefore, we still can see science as holistic and have the conceptual differences between the sciences that can be applied to other sciences, and the sciences whose predicates might be restricted within their field and laws.

While Fodor has his own possible objections or workarounds to his argument against reductionism and multiple realizability that involve taking special sciences to be exceptionless or basic sciences to have exceptions (and why such options lead to plainly false or epistemically disastrous conclusions respectively) they are not the only objections; Jaegwon Kim and his essay titled Multiple realization and the metaphysics of reduction, also provides a compelling rebuke as shown in the following statement: The correct conclusion to draw from MR and reductionism is not the safety of the special sciences but that special sciences like psychology cannot be a science with a unified subject matter. The construction of an argument for this claim is that "disjunctions of heterogeneous kinds are unfit for laws." (Kim, pg. 318). Initially, it seems like Fodor would agree with this, as disjunctions are the basis for why he argues against predicates and their corresponding laws from being connected to those in other sciences. But Kim's claim on disjunctions is referring to more than just the disjunctive predicates in a specific science, it is claiming that the generalizations that we base our laws on through inductive reasoning (Fodor would likely disagree as inductive reasoning forming the basis of most of our laws rather than the other way around), often cannot fit it any sort of laws because they are not lawlike, because

multiple realizability ensures that they must be disjunctive. The inductive power that lawlike generalizations must have in order to fit within laws is seen in the following example:

Typically, all Fs are Gs can be confirmed by eliminating all potential falsifiers. But "lawlike generalizations are thought to have the following further property: observation of positive instances, Fs that are Gs, can strengthen our credence in the next Fs being G. It is this kind of instance-to-instance accretion of confirmation that is supposed to be the hallmark of lawlikeness" because it helps us extrapolate or generalize based on a limited set of observations or data (Kim, pg. 319). This is what Kim calls "projectability", meaning the ability to be confirmed by observation of "positive instances" (Kim, pg. 319). If a law fails to be projectable in this sense, then it is not a law. At best, it's a conjunction of laws, and at worst there are no laws for the predicate. Take the following example to see why laws are subject to projectability (Ls denote laws):

(L) Jade is green

Jade is composed of jadeite and nephrite and therefore (L) is the conjunction of the two laws:

(L1) Jadeite is green

(L2) Nephrite is green

Before we knew the composition of jade, we collected evidence via induction and projectability proving that L is a law. However, in all those instances of data collection, we were only observing jadeite. Therefore, L is no longer supported because "jade is a (...) disjunction of two heterogeneous nomic [nomic meaning resulting from a law] kinds which, (...), is not itself a nomic kind" (Kim pg. 320). If we go back to the Fs and Gs example, we can see why such a disjunction prevents L from being confirmed by projectability:

All Fs are Gs

All Fs or Hs are Gs (Jadeite can be Fs, Nephrite can be Hs and Jade can be Gs)

"Any statement implied by a well-confirmed statement must itself be well confirmed" (Kim, pg. 320)

Therefore, all Hs are Gs.

However, the claim that all Hs are Gs is only confirmed by the observation that all Fs are Gs, which doesn't make any sense in terms of how we use evidence to derive relationships. The failure of disjunctive kinds in producing laws is not just seen in jade; "Psychology, like the theory of jade, gives way to a conjunction of structure-specific theories" (Kim, pg. 325). A good example of the parallels between the two is the psychological theory of pain. Under MR, pain can be manifested in many ways. The number of ways pain can manifest is greater than the two chemical compounds that make up jade! Given this view, pain is not a lawlike generalization (is not nomic) that can be applied to create laws of pain. This claim is further justified by Kim: "If pain fails to be nomic, it is not the sort of property in terms of which laws can be formulated; and 'pain' is not a predicate that can enter into a scientific theory that seeks to formulate causal laws and causal explanations. And the same goes for all multiply realizable psychological kinds — which, according to MR, means all psychological kind" (Kim, pg. 325). Kim takes the failure of disjunctions in producing laws to mean that specific fields of psychology are stuck within their domains as defined by laws that are only manifested in a specific kind or number of states (typically based on the manifestation of the same functional state backed by some computational or evolutionary theory). If this was not the case, then multiple realizability would inevitably lead psychology to the same problem jade faces, while also leaving it a science with no unified subject matter which could jeopardize it being a science.

Regardless of which argument I like more or find more useful, I think Fodor's argument is more plausible. First, there are three reasons why I find Kim's argument more implausible than Fodor's:

1. It is not clear to me when a specific field begins to have lawlike generalizations (derived from induction) that are too multiple realizable to the point where the laws of the science are no longer unified in what they seek to investigate. Kim addresses this objection in relation to intrapersonal changes in psychology by saying that neuroscientists, cognitive psychologists, and alike seem to think there are similarities, or else those fields wouldn't exist. He also states that such an objection is not important metaphysically. I have a problem with the former point for two reasons:
    a. In a paper that is very technical and detailed, it seems weird to default to arguments of intuition. It is obvious that there are differences between humans but in virtue of what? I don't think this is a question that can be excused as being something only neuroscience answers because if scientists are the only ones who can determine the boundaries of MR that fit within a science, then how can Kim be justified in arguing for the upper limits of MR (upper limits meaning MR concerned with interspecies, aliens, computers, etc...)? He must have a stance on this because he is using a non-scientific argument to justify the MR limits of pain.
    b. The limits of what appears multiply realizable seem to be always changing in relation to specific fields. The more we learn about the world the more we see parallels between things we did not expect to. Nearly all organisms use DNA to code information, all life is carbon-based, drugs are tested on animals because they have similar brains to us, the UK passed legislation further protecting

cephalopod molluscs and decapod crustaceans, including octopuses, lobsters, and crabs due to recent neuroscience research supporting their sentience (Lobsters, octopus and crabs recognised as sentient beings, 2021) and some humans have more Homo-Sapien DNA than others. How can we place limits on what specific fields should investigate based on what it currently seems like their limits of multiple realizability are? If scientific fields were restricted in what they could investigate then we would not have science that is as specialized, collaborative, and successful as we do today. Kim might object by saying that it would "remain true that the psychology of each of us was determined by, and locally reducible to, their neurobiology", regardless of any of these examples, thereby maintaining the metaphysical integrity of his argument (Kim, pg. 330). While this may be true, it might limit the scope of how such an argument can inform the epistemological aims of science and why science is important to begin with.

2. While Kim states early on in the essay that there is a circularity problem to his argument that he would later fix, I'm not sure if he found a suitable reason to claim that "badly heterogeneous disjunction[s]" (meaning disjunctions of predicates under two different laws) are unsuited for laws (Kim, pg. 318). Kim uses "nomic kinds" to create laws if the nomic kinds are sufficiently inductively projectable (Kim, pg. 320), but nomic means "to be resulting from a law" (Blackburn, 2008), so what laws are the nomic kinds derived from? Fields such as neuroscience do not contain laws because they are purely based on inductive reasoning and experimentation, but this does not seem to be what Kim is thinking of.

3. Fodor's argument encompasses science as a unified domain. While one can apply Fodor's argument to any field of science and derive unique consequences, I am not sure If Kim's argument succeeds in dismantling the unified subject matter of fields beyond psychology. Is reduction for everything below psychology safe from Kim's argument? Additionally, I think in some ways Kim's claim is not as contradictory as is claimed. Kim states that while Fodor thinks psychology is an irreducible and autonomous science, it is actually not a science with a unified subject matter. This would naturally lead to the claim that psychology is not an autonomous science, but instead, Kim argues for "locally reducible" fields within psychology to prevent the problem of heterogenous disjunctions (Kim, pg. 328). In my opinion, this is claiming something very similar to Fodor, because these local fields of psychology are autonomous themselves, with the main difference between the two arguments being that Kim is creating more specified fields of psychology. One could do this, but I think in doing so one runs into the criticism I discussed in point #1.

Fodor's argument is more plausible broadly because it allows for the unity of science and places important metaphysical restrictions (as seen in $(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)$ on MR-Reductionism, while still allowing for reductionism of type physical laws. Fodor's argument also raises concerns about the epistemic problems of MR-Reductionism, due to the explosion of token disjunctive predicates (token meaning literal entities in the world that we take to exist), while also not letting this exclude reductionism altogether. Local reduction as used by Kim is not as plausible as Fodor's construction because it is circular in how it forms laws, is primarily concerned with psychological reductionism, and is too restrictive on the conceptual bounds for specific fields of science, thereby limiting interesting investigation which underpins all science.

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