Abstract:

This paper argues that hylomorphism – defining reality in terms of form and matter -- is the most obviously correct metaphysical structure given the observations of chemistry and physics. *Matter* proves to be the 'stuff' that becomes bosons, quarks, electrons, atoms of gold, molecules of water, bowling balls, people, and stars. *Form* is a little less mysterious than in the ancient sense: it is simply a way in which the matter is organized and structured. Forms often fit together, somewhat like puzzle pieces, so that we can speak of "higher" forms and "lower" forms of organization: for example, you can think of the water molecule as a higher form of organization than the atoms of hydrogen and oxygen that compose it. Those in turn are higher than the forms of organization, such as electrons and protons, that were organized into the form of the atom of oxygen or the hydrogen.

In section one this paper proves the strength of hylomorphism against the views of D. M. Armstrong, Alexander Bird and the Humean mosaic view they criticize in common. Section two proves that form, and not matter as such, is the only candidate for something that can properly be named an enduring or perduring object on a 4Dist picture of spacetime. Form is not a part of an object, as suggested by Kathrin Koslicki. Rather, it is the only candidate for something we could call a persisting object. The form *is* the object.

Section two also demonstrates another reason that a "mosaic" metaphysic is unworkable: unlike forms, which can nest "lower" forms into "higher" ones, a mosaic piece cannot be analyzed. This importation of Hume's epistemological critique into a metaphysical claim about the nature of reality thus forces us to abandon, in metaphysics, the lessons of physics and chemistry.

The third and final section of the paper considers the nominalist critique of hylomorphic metaphysics, and proposes a solution: that individuality is an emergent property. This solution builds on the argument from the second section, combined with Aristotle's notion that a potential is a kind of first actuality. In addition to resolving the nominalist critique, an actuality solution disposes of the need for other "possible worlds" as a truthmaker for counterfactual claims.

"The Form is the Thing"

Introduction

Aristotle wrote that "the facts harmonize with a true account, whereas the truth soon clashes with a false one." Our leading contemporary metaphysics clash with the facts we discover in physics and chemistry. We need an account that harmonizes with the facts if we are to hope for it to be a true account. I shall propose that a new form of a very old metaphysics, the metaphysics of form and matter, is capable of answering this need. In addition, I shall propose that this updated model allows us to

derive new insights into questions of parts and wholes, and whether we need possible worlds to serve as truthmakers for counterfactual claims.[1]

It is necessary to begin with clear definitions, to distinguish the updated account from the ancient one. *Matter* is defined as the basic 'stuff' that becomes bosons, quarks, electrons, atoms of gold, molecules of water, bowling balls, people, and stars. *Form* is a little less mysterious than in the ancient sense: it is simply a way in which the matter is organized and structured.

I. The Plausibility of this Model

Physics currently theorizes about what we are calling matter, because it lies below our capacity to observe it directly (or even indirectly except at several removes). It is possible to establish matter's necessity, however, from the observation that the interference of energetic wave forms gives rise to what we encounter as physical objects. Waves are forms of organization of energy, for example, they have a regular frequency. If waves were the basic stuff of reality, they could not interfere with each other. There must be a substrate (to borrow a term from Aristotle's *Physics*) that is affected by waves of different kinds. It is that substrate that allows two different kinds of waves to interfere with each other, thus enabling the process. This substrate, this matter, must be there in order for interference to occur.

This substrate, matter, may not have any character other than the capacity to be ordered into things like waves with regular wavelengths. If so, we will have a matter that is precisely what Avicenna theorized "prime matter" to be. It may be that it has a slightly richer character, which science may someday be able to discover. Perhaps the universality of the laws of conservation may be explained on this ground. In any case, today we cannot examine it except theoretically, and so it suffices that we

[1] Aristotle, *Nicomachean Ethics*, 1098b8-12.

have an argument from our leading theories of physics to show that it is necessary. That Avicenna found the same necessary ground from an earlier physics ought also to be encouraging, because that physics was grounded in direct physical observations of medium-sized objects, in ignorance of the quanta that gave rise to contemporary theories. Starting in two very different places and using two very different sets of tools to measure the same reality, we get the same results. This is a good reason to accept the necessity of matter.[2]

The evidence for forms is straightforward. Consider a bit of water and another bit of salt, at room temperature at sea level. One will be liquid, the other solid. Mix them together and the salt dissolves. Why does this happen? It happens because the water and the salt are each organized in such a way that they are ionized, and thus they fit together like parts of a puzzle. It is their structure that gives rise to this disposition of salt to dissolve in water: the structure of the salt molecule and the structure of the water molecule are compatible. Their forms of organization, in other words, gives rise to their properties.

The water has the properties it has because of what happens when hydrogen and oxygen are ordered in a certain way. This form of organization *is* water. Other forms are nested in it. One cannot make water out of nitrogen and hydrogen. The form of organization that is oxygen is compatible with the form that is hydrogen in such a way that the form of water exists as a potential because of the existence of the forms of hydrogen and oxygen. These, in turn, are made possible by the existence of forms such as electrons and protons. We can therefore speak of 'higher' and 'lower' levels of organization, and also emergent properties: the property of being able to dissolve salt emerges at the level of organization we call water, but does not exist at lower levels of organization (i.e., hydrogen or

[2] This also happens to give us an answer to the problem of how different substances can interact, which bedeviled Leibniz among others. The answer is that there is a way in which everything is the same substance – the matter is the same for everything – and thus there is no problem of wholly different substances or "kinds" interacting. This also solves the problem of Aristotle's physics related to substantial change. Because all is matter that is simply organized differently, there is no mystery about how the interaction is possible.

oxygen do not dissolve salt). That property – or disposition, if you like – is a function of the form. The form therefore has priority over the dispositions the form enables.

Think how odd it would be to hold, instead, that the disposition was primary. If one were a dispositional monist, one would hold that what defines water is its disposition to dissolve salt. Yet of course we know that water doesn't always dissolve salt: it does so only until it is saturated. If dispositions were prior to substances, that's very mysterious. But if form is prior to dispositions, it's obvious: these forms fit together like puzzle pieces, and when the puzzle is full, of course there's no room for more of the salt-pattern to fit into the water-pattern. The appearance of the disposition is not problematic because the forms explain it, but even more significant is that the *disappearance* of the disposition is non-problematic. The forms explain that too.

An example of this problem appears in Alexander Bird's *Nature's Metaphysics*. If we take dispositions as prior, we have to explain why stimulus S1 ('salt is added to water and stirred') ceases to give rise to manifestation M1 ('salt dissolves') when the water becomes saturated. Since we are limited to stimulus and manifestation as tools, we have to explain a second 'stimulus' S2 that somehow interferes with M1 and produces M2 ('salt does not dissolve') instead. Is 'being saturated' a stimulus? No: it would not produce M2 ('salt not dissolving') without the additional stimulus of more salt being added and stirred (S1). The disposition of water to dissolve salt until it is saturated ends up being fairly difficult to explain, instead of an obvious and straightforward consequence of what it means to be water and salt – that is, what it means to have the form of water, and the form of salt. Form gives rise to dispositions, and is therefore prior to them. It is not the case that a thing is defined by its dispositions, but just the opposite: a kind of thing is defined by how it is structured, and the dispositions it has follows naturally from its structure.[3]

[3] Alexander Bird, *Nature's Metaphysics* (Oxford & New York: Oxford University Press, 2007), 24.

A similar point holds for Stephen Mumsford's idea of "powers."[4] If powers are real at all, they are consequences of forms of organization. Whatever disposition or power you want to ascribe to a thing is adequately explained either by its order and structure, or by the basic nature of matter.[5] A thing is soluble if it is structured in such a way that water, given water's own structure, will dissolve it. Salt, then, does not need an additional 'power to dissolve' or 'disposition to dissolve when put in water.' Its structure *as salt* already explains what the dispositions or powers are being invoked to explain.

The form is real – the salt really does have a specific chemical structure, which in turn is based on the subatomic structures of sodium and chloride, which in turn is based upon the internal structures of subatomic particles, and so forth all the way down. Water's form of organization is likewise really in the thing: it is having the form of being organized as H_2O that makes it water. It isn't clear where the power "is." In fact, it isn't clear that the power "is," since if the power is we need an explanation for why the power vanishes at the point of saturation. The salt's form and the water's form explain why the one will dissolve into the other, as well as why and just when they will stop. No other metaphysical entities are necessary for this.

These are reasons to accept a metaphysics of form and matter. But there are other reasons.

II. Form and Endurance

Consider yourself. You were born, some time ago, and you have continued to live until this day. At some point in the future, barring major advances in medical science, you will die. During all this time

[4] Stephen Mumford, *Laws in Nature* (New York: Routledge, 2004), 170, 174-5.

[5] I said in the first part that science might someday discover things of this sort, and so wish to leave room for them here. One reasonable candidate might be the law of conservation, which could be a consequence of the character of matter itself.

people have known you, and you in return have known them. You may have childhood friends you haven't seen in many years, but when you come together again there is a joyous meeting and you talk about the times you shared together.

What, exactly, are you?

We've tended in recent years to accept a materialist answer to this question. There's a good reason for this: whenever we go to check, we find a material being. But the individual molecules of water or atoms of oxygen that were the parts of you when you were a child are not the ones that are present in you today. Possibly every single part of you has been exchanged for other bits of matter organized in the same way. You eat in order to obtain proteins, minerals and other components just because your body requires regular substitutions of this type. So when your friend recognizes you, and you your friend, what is being recognized is not the material object that they were ten or twenty years ago.

If you subscribe to a Perdurist (or 4D-ist) viewpoint, it is possible to graph your lifeline in the fourth dimension as a kind of "worm." It extends from when you begin to when you end, and because the fourth dimension is the dimension of time, it is static. But what is being graphed? What exactly is this worm? It certainly cannot be a particular collection of carbon and oxygen, etc., or the worm that contains who you were as a child would not contain you as you are today.

It turns out that the only thing that can be a "worm" that correctly graphs your life in the fourth dimension, is a specific form of organization. The individual carbon or oxygen is swapped out, but the new carbon or oxygen is put into the enduring order. This order is sustained as an actual physical object in ways we are beginning to understand, as for example by DNA structures – themselves highly specific forms of organization. It is this form that endures, so that even though every part of your physical body

may have been exchanged with other parts from your environment, "you" remain around to be recognized by your old friend. The form *is* the enduring object.

This explanation gives us a couple of interesting insights, one of which has to do with what it means to be an individual human being: it means to have a unique form. If such a form is actualized and sustained by your genetics, we can say that you are an actual individual human being from the moment that your genetic code is set. Another consequence is that we can begin to get quite specific about what your essential form really is, and what is accidental to it. A child can grow up without ceasing to be the same person, for example, so that physical size is not essential to being as we experience it. Age is not essential. We can pursue this road a long way.

This view of form as the object contrasts with the view of Kathrin Koslicki. She approaches structure by saying that it is a *part* of the object. She defends this view against a problem raised by Verity Harte, who suggests that Koslicki's view gives rise to a regress of the type Aristotle discusses in *Metaphysics* Z.17. Assuming for the sake of argument that Koslicki is right that Harte's objection is not adequately framed, there is another reason here to think that form isn't just part of the object. It is clear enough in the case of organisms that parts can be changed – carbon, proteins – without the object being lost, because the form acts as an organizing principle to put new parts in the right places.[6]

That seems clear enough in the case of organisms, but it also holds for artifacts. Consider the Delian ship described by Socrates in Plato's *Phaedo*. The ship was supposed to have been the one that the hero Theseus took to Crete. Because of its ritual importance to the cult of Theseus, it was maintained even though every part of it had been replaced. Is it the same ship? By analogy to organisms, it would seem to be: just as the form of an organism serves as an organizing principle that can take new material from your environment and turn it into *part of you*, so the organizers of the ship

[6] Kathrin Koslicki, *The Structure of Objects* (Oxford and New York: Oxford University Press, 2008), 108-110.

took new wood from the environment and turned it into part of the ship. Now the organizing principle is external to the artifact, while it is internal to the organism. That means that the organizing principle can't be simply *part of the ship*, because it is partially external to the ship. The ship is organized as it is, so you can say (as Aristotle might) that *in a way* the form is in the ship. But in another way, the form is also in the minds of the organizers because they are the ones who are putting new material into the ship according to the ship's proper form.

Can we treat the ship, or an organism, as a Humean mosaic tile? It is possible, but only at an extraordinary cost. The mosaic view takes the position that reality is a collection of events, structured similarly to the tiles of a mosaic. Reality just is this collection of tiles, which are arranged in a particular way but need not have been. We get the laws of nature once we understand how the mosaic is formed, but only as a kind of accident: there aren't really any laws at all. Rather, what we think we are discovering to be laws are just regular features about the arrangement of the tiles, which have no necessary dependence on each other.[7]

On this model, "you" are just a mosaic tile. If we speak in 4Dist terms, your "worm" is a graph of that tile's position within the mosaic of spacetime. Notice what is lost, though. What are you? A tile. But why are *you* the tile and not the atoms of carbon and oxygen?

Well, because you are a conscious being and your friends recognize you over time. So you must be a tile. But what, then, of the carbon atoms that are parts of your body? They can't have any necessary connection to you at all – not only not these particular ones, but any ones. We lose any metaphysical ground for recognizing that human beings are physically made out of things like water and carbon. Science can continue to talk about that, but philosophers must pretend it is an accident with no metaphysical consequences.

[7] Mumsford gives a helpful account of the mosaic view and its origins on pp. 21-4 of his work.

We saw before that forms can nest, so that we can talk about how lower forms can be organized into higher ones, and we can make sense of emergent properties. On the Humean view, there can be no nesting. The tiles bear no relationship to each other except the accidental one of being located together in the mosaic. Why the insistence on this non-necessity?

The Humean critique is a combination of David Hume's insights in *An Enquiry Concerning the Human Understanding*, § II, with a challenge he raises in *A Treatise of Human Nature*, III.iii.1. In the *Enquiry*, he gives us a model for how he thinks human beings understand the world by dividing our immediate impressions from our memories or thoughts about them. He suggests that our creative mental powers are just about rearranging these thoughts or memories in new ways. That divides the actual experience of the world from anything we might do with it. In the Treatise, he raises a challenge against the idea that we can rely on our ideas to predict the future by asking why he might not see something he recognizes as a snowflake, but that feels like fire. Why should our future experiences be like our past ones – or more specifically, like our ideas about our past ones?

It should be clear that this is a question of how we know the world, and what kinds of things we can know by direct experience, and not a question about what the world is really like. It is a question of epistemology, that is, not metaphysics. However, the challenge he raises actually has an answer in the form/matter metaphysics we are talking about. The reason a snowflake will not feel like fire is that it is made up of matter that is structured as water, and matter so structured only takes the form of a snowflake under particular temperature conditions. It cannot feel like fire, unless it is not a snowflake. We are certainly subject to the epistemological problem Hume raises – we can be wrong in thinking that the thing we are observing is a snowflake – but that does not imply a metaphysical or ontological problem. In fact, if we did observe an object that was shaped like a snowflake but had heat like a fire,

we would necessarily find it was structured otherwise than as water. Water's structure won't sustain heat of that kind while frozen.

Hume himself did not make the error of conflating metaphysics with epistemology, but his followers have done so. They have therefore produced a theory that requires us to dispose of the lessons of chemistry and physics, biology and medicine, before we begin to do metaphysics. Here again we see the force of Aristotle's dictum with which we began: a true theory harmonizes with the facts, whereas a false theory quickly comes into conflict with them.

III. Nominalism and Emergence

There remains an important problem for a form and matter metaphysics, which is the problem of nominalism. The reason is that it attacks the notion of form: there cannot be anything like a form if everything is radically unique.[8]

The reason the position is a serious objection is that it is in some sense true. No two mountains or men are exactly alike. To what degree, then, does it make sense to speak of there being a form common to them?

I wish to propose that individuality is an emergent property. This is a radical departure from Aristotle's metaphysics, in which what made two men different was some accidental difference between two things with the same basic form, but only at higher levels of organization. Aristotle's method works reasonably well at the lowest levels. However, just as the capacity to dissolve salt emerges when

[8] Bird takes pains to reject nominalism: see Bird, 15-18. See also Fred Dretske's argument that "the cost of nominalism has just gone up," in "Laws of Nature," *Philosophy of Science*, Vol. 44, No. 2. (Jun., 1977): 266-8.

oxygen and hydrogen are ordered in the form of water, individuality also emerges at higher levels of organization.

At the level of matter, we observe no uniqueness that we know how to record. At a slightly higher level, the ubiquity of common particles seems to produce nearly-universal effects like gravity. At the level of things like electrons, there is still relatively little difference between particulars. Electron *A* may be a member of hydrogen atom *X*, while electron *B* is a member of oxygen atom *Y*. *A* and *B* are different particular electrons, but they appear to share the same form.

We can't say just the same thing about two different human beings. Even where the DNA is very close, as with identical twins, there is a clear and observable individuality present. We can talk about what it means to be organized 'as a human' or even 'as a man' – it seems that most of us are subject to something like actuarial tables, because the insurance companies stay in business year after year. The differences they predict in outcomes for men and women more or less play out most of the time. Yet we never observe two people who are exactly alike, no matter how close their genetics, or how similar their physical bodies.

Likewise, while the Greeks took it to be a point of debate as to whether the Delian ship was "really" Theseus' ship, it is clear that no other ship could be. You couldn't build a new ship, even one as alike in form as possible, and have it be the same ship. The parts arguably can be replaced without destroying the whole, as the parts of organisms are, but the form of "being Theseus' ship" cannot be transferred to a new ship.

I will make my radical departure here, then, by asserting that there must be a form of the individual in certain higher-level cases. This form may contain nested forms such as "human" or "man," but the ultimate form – the form that is you, the form that properly graphs your "worm" in spacetime if the 4Dists are correct – is unique to you.

Why should an individual form be imagined? It happens that this argument is relatively easy to express in the symbolic terms preferred by analytic philosophers today.

$P \rightarrow \Diamond P$

We can render that in two logically-equivalent ways, one of which nevertheless sounds much stronger in natural language. The first way is "If P, then possibly P." The second is "if P, then not-necessarily-not-P." What we are saying in either case is that there is something about the structure of reality that permits you to be organized as you are. What is possible "belongs" to our universe in a way that the impossible does not.

In *Physics* VIII, 255a30-255b10, Aristotle describes what it is to be a potential in a way that is very helpful here. To be a potential is to be a first-actuality. We might say that to be a potential is to be "an actual potential." The potential for the individual really exists, because you – the individual! – really exist. Reality had the structure to permit you to be, and now you have come to be fully actual. The individual is emergent, in the sense of emerging from hiding.

An example to demonstrate the point: Let us say that I were to have a second son. The potential for this is already real enough – an actual potential – that we can say many things about the counterfactual case in which I already do have a second son. If I had a second son, and he had eyes as children ordinarily do, they would be brown eyes. This is true because all the forms that exist as potential forms for a second son of mine are constrained by my own genetics, which do not (if we are correct in our understanding of the science here) have the potential to produce a child with a different color of eyes.

The actuality of these potential forms is therefore enough to sustain a great deal of what we call modal conversations: talk about what is possible or necessary. I don't need to appeal to other possible

worlds in which I do have second sons. The actuality their forms have here, now, is enough to serve as a truthmaker for the claims I might reasonably make about them.

This is a strong reason to believe both in the priority of form in a true metaphysics, and in the form of the individual as an ontologically real entity. There are actual potentials, and these things are forms of organization.

Conclusion:

We began and ended with claims from Aristotle, the first about the relationship between true theories and facts, and the second about the actuality of potentials. It may seem surprising that the solution to a contemporary problem in metaphysics begins and ends with an ancient Greek philosopher, but we must continue to carry on the work. We have to update our understanding of hylomorphism, the metaphysics of form and matter, in order to take into account our contemporary understandings of emergence, and to answer the valid criticisms of the nominalists.

Still, there is reason to be confident. It ought to be encouraging to find Avicenna's arguments leading us to similar conclusions as the ones presented here. Much remains to be done, and some of it is out of our current reach – as much of what we believe we know now was out of Avicenna's, or Aristotle's himself. Yet our ancestors are worthy of listening to, even now. If we take care of our legacy, perhaps our descendents will someday say the same thing of us.