

# Informationalism

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## Introduction

After reading Dennett's *Consciousness Explained*, I was left with an unsatisfied feeling. Dennett does not seem to capture our experience in any meaningful way, and so I was relieved when Chalmers addressed this concern in his book, *The Conscious Mind*. Being rather cautious and skeptical, I read chapters 1 and 2. I began to have some doubts, but then upon reading chapter 3 I had a startling revelation; Chalmers is right! It was one of those rare moments of realization, where a multitude of ideas come together and just *click*. Here, in this paper, I will relate those ideas.

If one thing supervenes on another, then it should be (in principle) possible to offer a reductive explanation for it in terms of the other. There are known problems with reductive explanations of many phenomena, but Chalmers notes that these can be thought of as "reductively explainable modulo conscious experience" (1996, 72). A true theory of consciousness holds this promise, that everything can be reductively explained, or at least understood in full.

I do not intend to argue that there are conscious experiences above and beyond a functionalist account; I will just take it for granted there are, and that we all have them. As Chalmers notes, "the very obviousness of what we are describing works in our favor, and helps shift the burden of proof further onto the other side" (1996, 97). The real problem is that we want, even need, explanations, and materialism seems to be our best bet so far. In our desperate search for the truth, we cling to materialism, and hold it

sacred. This is almost an irrational sort of faith, where the obvious is ignored in favor of a general consensus. In this materialistic view we find a false sense of comfort.

Chalmers favors what he calls *naturalistic dualism*, where consciousness and physicality coexist in a fundamental way, but he also says:

I should also note that although I call the view a variety of dualism, it is possible that it could turn out to be a kind of monism. Perhaps the physical and the phenomenal will turn out to be two different aspects of a single encompassing kind, in something like the way that matter and energy turn out to be two aspects of a single kind. Nothing that I have said rules this out, and in fact I have some sympathy with the idea. But it remains the case that if a variety of monism is true, it cannot be a *materialist* monism. It must be something broader. (1996, 129)

I shall argue for just this sort of monism, which I tentatively refer to as *Informationalism*.

To make this sort of monism clear, I offer the following simple distinction:

**Materialism:** The phenomenal supervenes on the physical.

**Idealism:** The physical supervenes on the phenomenal.

**Informationalism:** The physical and the phenomenal both supervene on the *informational*.

This view bears a semblance to Spinoza's, in that mind and matter are just two modes of the same substance.

The main thesis of this paper is that the informational exhausts the physical *and* the phenomenal. In part I, I will argue against materialism, and in so doing show that the physical is reducible to the informational. In part II I will show that emergent properties, especially conscious experience, are also reducible to the informational. Finally, in part III, I shall discuss the ontological status of such a view.

## **Part I: The Case Against Materialism**

Indeed, a current trend, initiated by John A. Wheeler of Princeton University, is to regard the physical world as made of information, with energy and matter as incidentals. (Bekenstein, *Scientific American*, 2003, 59)

In philosophy of consciousness, attacks against materialism are generally directed at showing that consciousness cannot supervene on the physical. This will not suffice for my purpose; I must show that materialism is false altogether. While this task may at first seem more difficult, or even impossible, I believe it to be, in fact, easier.

Physicists have been remarkably successful at describing the physical universe in mathematical terms. If something cannot be described mathematically, it just is not physical. But then, why go to metaphysically extravagant lengths to posit "substance" to mere mathematical descriptions? This may seem necessary to the materialist, but as we shall see in parts II and III, this just is not so. Physical objects need not consist of actual substance, only mathematical descriptions. Indeed, I hardly find it necessary to argue against materialism at all; physicists have done all the hard work for me. There is still the matter of why there *seems* to be real concrete physical stuff, consisting of what philosophers call substance, but as we shall soon see, appearances can be deceiving.

When I refer to substance, I mean that which causes the concurrence of various properties. This substance is what physicists call matter. The primary quality of substance is extension, or what physicists call mass. Note the circular definition of these two terms:

**Matter 1b** that which has mass and occupies space.

**Mass 5** *Physics* quantity of matter a body contains.

(The Oxford American Desk Dictionary, 1998)

It seems that extension (i.e. mass) is the defining characteristic of substance (i.e. matter), but this just cannot be. That is, upon close examination, the very notion of extension collapses altogether.

For an entire physical system, consisting of figures in geometric relation to one another, it is sufficient that the size of each and the distances between them can be described by ratios. Everything could be twice as large, or half as small, and these relations would remain. Subjectively, these ratios constitute the only means of measuring size and distance within such a system. We can compare various different lengths to each other, and conclude that one is smaller or larger than the other, or equal to two of 'those' or one-half of 'these', but these are just relativistic methods of measurement, consisting in *pure numerical quantity*. Therefore, there is no objective measure of extension; there is no "universal yardstick".

Another related primary quality that must also be considered is motion. When a given number of objects are in motion, there is no objective *geometric* means for determining a frame of reference regarding this motion. The only way to construct a frame of reference is to understand the *causes* of such motion, and how these causes and the objects stand in relation to one another. Perhaps the best example is our own solar system. The Geocentric Model describes the motion of the celestial bodies in relation to the Earth, while the Heliocentric Model uses the Sun for a frame of reference. The preference for one over the other comes from an understanding of the laws of gravity and the simplicity of the Heliocentric Model. But in any case, one could construct a model that uses any given point in space for a frame of reference. Since motion is

relative *between* bodies, there cannot be an independent background against which they move; that is, there is no objective measure of movement.

Einstein's theory of Special Relativity shows that time is relative between bodies in motion. There is another consideration, however: the way in which time is measured. Mechanical/digital devices measure time through repeated uniform operations (i.e. causes and effects). There is no possibility of measuring time without causes and effects. Visualize a static universe in which nothing happens; no movement, no radiation, no light, etc... Would any "time" elapse? The answer to this dilemma, and that of attributing motion to individual bodies, hinges on the concept of cause and effect. Our subjective view of time is entirely due to our witnessing causes and effects (i.e. events), whether external to us, or the inner working of our own minds.

Ever since Hume, the very notion of cause and effect has been quite uncertain. One point that philosophers have grossly overlooked, however, is that physics describes cause and effect in pure mathematical terms. In Stephen Wolfram's book, *A New Kind of Science*, he shows that even the most complex processes can be understood as the result of simple algorithms. Objects have mathematical descriptions, and their interactions can be described as algorithmic processes. We can consider these descriptions to be information, and the algorithmic processes of their interactions to be informational processes (hereafter referred to as *iprocesses*). An "event" can then be seen as the interaction of iprocesses. To propose the existence of anything above and beyond these two concepts is entirely unnecessary.

Since extension is a quantitative relation *between* bodies, it cannot be attributed to individual bodies. Likewise, since motion is relative *between* bodies, it cannot be

attributed to individual bodies outside of an understanding of cause and effect. Time is seen as the transpiring of causes and effects, from which we fix our own subjective order of events. Everything in the universe is described entirely by information, and all interaction is governed by iprocesses. In the face of such arguments, it is difficult to see how anyone could possibly remain a materialist (and no, the broad net of physicalism won't save you). Of course, the burden falls upon me to explain why there *seems* to be real concrete "physical stuff", so we now must turn to perception.

## **Part II: The Reduction of the Phenomenal**

Suppose that there be a machine, the structure of which produces thinking, feeling, and perceiving; imagine this machine enlarged but preserving the same proportions, so that you could enter it as if it were a mill. This being supposed, you might visit its inside; but what would you observe there? Nothing but parts which push and move each other, and never anything that could explain perception.  
(Leibniz, *Monadology*; quoted from Baird, 2003, 285)

A great mystery is the way in which we consciously perceive the external world. For perception to occur, it is necessary for one thing to interact with another. To make this evident, imagine yourself in a world where there was no light, so that you could not see anything. Imagine also that there was no atmosphere in which sound waves could travel, so that you could not hear anything. Then imagine that there was no movement, so that you could not touch, smell, or taste anything. In this world, every physical object is completely cut-off from every other. Even though you would be well equipped for perception, there could be none. Physical interaction is an absolute requirement for perceptions of any type. Various frequencies of light waves must be reflected/absorbed for sight, objects must vibrate within an atmosphere for sound, and our bodies must come into physical contact with various substances for touch, taste, and smell. We can

then trace this train of interactions through our sense organs and along various paths in our neural network. We can follow this train of changes for as long as we like, and never come to understand *conscious* perception. What is happening is that, when one thing interacts with another physically, information is transmitted between the two. But how can physical substance perceive information? The answer is that it cannot, but then again, physical substance is *itself* informational.

Qualia have generally been a thorn in the side of materialism. It is agreed that our perceptions carry informational content, but they also seem to have an intrinsic, ineffable nature that cannot be easily explained. What is it about green that is so...*green*, and why are we unable to describe it? Why does it *look* this way to us? The ineffable nature is due, no doubt, to a loss of information in our perceptual systems, and I propose that the intrinsic nature is due to our peculiar point of view. To properly appreciate this point of view, we must first engage the notion of emergent properties.

Emergent properties are among the most amazing phenomena of our universe. How is it that physical objects can be organized in such a way that the whole is seemingly greater than the sum of the parts? Well, of course the whole *physical* aspect is not greater than the sum of the physical parts, but the informational content appears to be. For example, imagine a pile of bricks. Now, imagine that a crew of masons constructs of building out of those bricks. There is certainly a difference that would lead us to conclude that the whole is greater than the sum of the parts, but nobody is suggesting that there are more bricks than in the original pile. It seems, therefore, that the answer is to be found in the *informational* content of the structure.

Objects have structures that reflect their informational content. This structure in turn affects the way in which they process information. For example, visualize a circuit board in an electronic device. A team of electronic engineers, using the known laws of electricity, designed the board to perform certain tasks. The board then contains information. Since the laws of electricity are purely mathematical, the structure of the circuits can be described mathematically. As for the physical stuff of which the board is made (silicon, silver, etc...), it is described mathematically as well. This structure results in complex iprocesses, which process information that the board is given as input. In this way, the iprocesses direct, parse, focus, amplify, and recombine the input into output. Other objects (e.g. rocks) lack this focused aspect, because they lack the appropriate *informational structure* (hereafter known as *istructure*). Without the appropriate *istructure*, we would have all the complexity and processing power of rocks.

I have briefly discussed the notions of iprocesses and *istructure*, but it is time to put everything together. Iprocesses are, in their simplest form, the basic unit of algorithms. They are entirely abstract, having no "substance". The fundamental iprocesses can be combined together into an *istructure*, thereby forming a larger, more complex algorithm. To clarify this concept, examine the following basic algorithmic equations:

$$x = x + 1; x = x / 2; x = x + 5$$

These can be combined into a single, larger, algorithmic equation:

$$x = ( x + 1 ) / 2 + 5$$

Iprocesses can be combined in much the same way, with the possibility of multiple "entry points" (i.e. multiple variables), which in turn can connect to other iprocesses.

This structure is what I have referred to as the *istructure*. The potential computational power of such processes is theoretically without limit. I wish that I could give an exact account of the nature of these *iprocesses*, and how they work, but it is currently beyond my understanding, and in any event, beyond the scope of this paper.

Now that we have an intuitive understanding of *iprocesses*, the obvious question is, "Is there anything it would be like to *be* an *iprocess*?" In our minds, various different systems perform different functions. Their individual outputs then become available to certain other processing systems. These systems form an aggregate state, a complex central *iprocess*, which takes input from various systems, and produces output. Some of this output feeds into external *iprocesses*, but some of it is fed back as input (e.g. as when we "hear ourselves think"). The key to understanding the cohesiveness of this central *iprocess* is the way in which individual *iprocesses* combine to form a single *iprocess*, and the notion of timelessness discussed in part I. Time is just a function of varying, logically sequential states of the *iprocesses*. Time is only something we perceive, not something that could cause a discontinuity in our cognitive states. Some events may appear to occur in an illogical order (e.g. the color-phi phenomenon), but that is of little consequence. As for our apparent self-awareness, that is a result of feedback, which, as input, is interpreted as being about us. As for the intrinsic nature of qualia, it is just the way in which the information comes to us. It is a matter for empirical investigation, although it may have to wait for a better understanding of *iprocesses* (mathematics) and *istructure* (neurology). In any case, it is not possible to imagine all this taking place without experience, because experience is exactly what is being described.

At this point there is one immediate consideration. As Chalmers puts it, "Simulated heat is not real heat" (1996, 328), but he is missing the point. Simulated heat *would* be real heat to a simulated entity. Now, I am not saying that we are simulated entities, I am just pointing out the obvious fact that the ubiquitous nature of iprocesses means that everything in the universe is just as real as anything else. This, of course, raises a multitude of ontological considerations, which I will now address.

### **Part III: Toward an Ontological Basis**

I find modal realism intriguing because it arrives at its conclusions -- and solutions to paradoxes -- through simplicity, even deconstruction. It is essentially the rejection of giving ontological privilege to certain possible events, times, places, and things. It may be a "grand theory," but you don't have to get it from "grand metaphysical theory building." (Miller, *online posting*, 2004)

The best conclusions are derived from the simplest of assumptions, and thus far, it may seem as though I have been assuming too much. This is because I have been working from the top down; now it is time to change gears, start from the bottom, and work our way back up. To accomplish this, I will begin with but one simple assumption: the notion of *logical possibility*. Something is logically possible if and only if it contains no inherent contradiction. This applies not only to simple things, but to complex ones as well. A simple notion cannot be self-contradictory, and in a complex construct, none of the constituent simple notions can contradict one another. Such informational constructs have an abstract sort of existence; they exist as possibilities. To visualize this, take the following equation:  $2 + 2 = 4$ . There is no need for someone to "work the problem"; it already has an answer, and it exists as a logical possibility. We can then imagine all possible combinations of simple notions, each of them corresponding to a possible world. Now, ask yourself this question; "Is it possible that these worlds do not exist in

reality?" Reality means that which exists, and so drops out of consideration. We are now left with a simpler question: "Is it possible that these worlds do not exist?" But wait; we have already said that it *is* possible that they exist! If something is logically possible, then it exists *necessarily*.

Modal realism is most often regarded as untenable, but my friend Sam Miller was not referring to *Lewisian* modal realism in the above quote. It may be noted that my view of modal realism differs markedly from David Lewis'. Lewis was a materialist, and he also thought of each possible world as independently existing, forever cut-off from all the others. In my view, this just cannot be. As Gregory Bateson put it, "Information is a difference that makes a difference" (quoted from Chalmers, 1996, 281). Where there is no difference, there simply is no differentiation between worlds. Again, I am still working with just one notion: that of logical possibility. The nice thing about my view is that the consequences fit with the observations of quantum physicists. With this modal realism, the Hugh Everett interpretation of quantum formalism falls out as a consequence. We do in fact observe some of the effects of this "no-difference" phenomenon, as in the dual-slit experiment. As for all the common objections to modal realism, they are of no consequence to this view. I wish that I could go over them here, but a full account and defense of my modal realism is far outside the scope of this paper.

There is, however, one objection that I must answer here. If we are just logical possibilities, then why does everything seem to be so real? That is, mere logical possibility couldn't be real in the sense that our world is real, could it? Recall the simulated heat example I gave in Part II. This world is real to *us* because we are part of *it*. How could it be that the world would appear any less real to us than we do to

ourselves? This leads to a redefinition of what is "real", but it is a *better* definition. Note the standard definitions of the following terms:

**Reality 1** what is real or existent...

**Real 1** actually existing or occurring.

**Exist 1** have a place in objective reality.

(The Oxford American Desk Dictionary, 1998)

Here again we have a circular definition, but one that can be redefined in terms of logical possibility, in reference to the one using the word:

**Reality:** that which is part of the same logical space as the observer.

### **Conclusion**

In the Introduction I stated that my view bears a semblance to Spinoza's, and it does; Informationalism has *dual-aspect realizability*. The operations of complex iprocesses correspond to the phenomenal, and the way in which they interact and perceive information gives the appearance of concrete physical substance. As for the veracity of the account I have given, I must admit that all this is highly speculative and quite counterintuitive. But in my defense, I also point out the simplicity of this view: that everything can be derived from the notion of logical possibility, without having to deny that which is obviously true.

## References

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