

10 Against Functionalism: Consciousness as an Information-Bearing Medium

Bruce Mangan

GENUS AND SPECIES

In general, the scientific analysis of a biological information-bearing medium (e.g., DNA, neurons, the fluid in the cochlea) aims to answer two related but different questions: (1) What information does the medium bear? (2) In what specific *way* does the medium bear its information? The "information" in the first question can be realized without loss in a great many other information-bearing media, whether the media are natural or man-made. But this freedom of instantiation is quite beside the point for the second question, which asks about the *specific* characteristics of a given medium that allow it to bear information in a particular way.

To extend biological usage slightly, the answer to the first question tells us that something belongs to the genus known as information-bearing media; the answer to the second question tells us how to characterize a given information-bearing medium as a distinct species. Full scientific understanding of cognitive activity in our organism normally demands that we explore both questions.

It strikes me as odd that something like this kind of straightforward, biologically informed distinction has not been applied to consciousness, but as far as I know, it has not. Is consciousness simply one more species of information-bearing medium at work in our organism? There are various reasons to think so, some of them more or less conceptual, some quite empirical. For now, I want to concentrate on the conceptual issues, particularly the issues that contrast with the contemporary functionalist analysis of consciousness, especially that by Dennett.

Functionalism is an excellent foil for developing an information-bearing account of consciousness, in part because the medium formulation looks so powerful by comparison—it seems able to handle a whole range of scientific possibilities that functionalism cannot address in principle.

Both approaches can deal equally well with the general properties of the genus (information-bearing media), but functionalism cannot treat consciousness as a distinct species belonging to this genus because the defining assertion of functionalism is that consciousness necessarily instantiates in *any*

medium when that medium is able to bear information that has a certain kind of abstract structure. As Dennett (1993) says,

the hallmark of functionalism [is] its commitment, at some level, to multiple realizability.

But an information-bearing medium is clearly not the sort of thing that can be fully realized by a different medium. Media instantiate information, not other media; media that bear the same information do not transmogrify into one another. Thus, if consciousness is a species of information-bearing media, it looks like a very poor candidate for multiple realizability.

Any argument that supports the consciousness-as-medium hypothesis is, at the same time, an argument against the functionalist theory of consciousness. Currently, the functionalist–antifunctionalist debate is quite abstract, generally argued at the level of thought experiments. But because the medium hypothesis is supported in part by experimental evidence (discussed below), the medium hypothesis is able to mount a direct challenge to functionalism solely on scientific grounds.

In any case, the medium hypothesis gives us a new, more precise way to state the crux of the dispute between functionalism and some of its opponents; even Dennett agrees that the hypothesis brings new clarity to the issue. But beyond this, the hypothesis lets us frame a basic, common-sense objection to functionalism in terms that do not go beyond the most conservative scientific notions already used to analyze cognition. The medium hypothesis does not need to make any appeal to so-called first-person experience or to qualia (though it is certainly compatible with and strengthened by such appeals).

Functionalism often tries to advertise itself as the only true scientific option for dealing with consciousness. Dennett's rhetoric, in particular, suggests that his opponents are simply unable to give up their vague, prescientific, common-sense intuitions. I do not think there is anything unscientific about appeals to direct experience. But the medium hypothesis can avoid the complications raised by qualia and still bring out a very serious problem with functionalism.

MEDIUM-SPECIFIC AND MEDIUM-INDEPENDENT RESEARCH

Consider a relatively unproblematic distinction between scientific concerns that are medium specific, and those that are medium independent. Medium-specific research works to understand a given information-bearing medium. Medium-independent research looks for findings that can be fully realized in various media. Medium-independent research can also be directed toward a specific medium but is only concerned with findings that can be *completely* reproduced in other media.

An entity is medium independent if all its properties can be understood without necessary reference to any given instantiating medium. Science

studies many medium-independent entities—an air-foil, for example. The air-foil in a bird's wing is instantiated by bone and feathers; in an airplane wing, it is instantiated by metal, canvas, or plastic. "Vision," as used in cognitive science, is arguably a medium-independent concept because it can apply to any process that performs the visual function of converting photons into useful information about an environment. The paradigm case of a medium-independent entity is a computer program.

Obviously, science does more than investigate medium-independent entities or look for medium-independent features in specific media. How do the rods in the human eye detect photons? This question does *not* ask about vision in the functional sense. It is *not* a question about the common structural features found in all systems that can (or in theory could) "see" in black and white. The question asks about the *particular* makeup and activity of the rods in our eyes. In answering this particular question, part of medium-specific research is the finding that the rods are photosensitive because they contain rhodopsin. Rhodopsin is the specific medium that (first) bears the information that electromagnetic radiation has struck the rods of a human eye. To answer by naming any other chemical functionally equivalent to, but distinct from, rhodopsin would not only be misleading, it would be false. *No complete functional substitution or instantiation or realization is possible for the answer to a medium-specific question.*

Of course, medium-specific and medium-independent concerns usually work together for full scientific understanding. For example, consider the ear when someone shouts "FIRE!" Medium-independent information flows through a series of distinct information-bearing media, each of which instantiates the information in its own unique way: first the ear drum, then the middle ear, cochlea, basilar membrane, cilia, cells on which the cilia attach, and, finally, the auditory nerve.

The medium-independent question—What information does the auditory system bear?—has an inherently abstract answer, one that could apply to all functionally equivalent systems, however wildly different their makeup. But the medium-specific question—How does the human ear bear information?—always stays absolutely particular: a taut membrane of skin bears information at the ear drum; tiny jointed bones bear information in the middle ear; minute wisps of hair bear information in the inner ear.

Or consider genetics. In theory, a computer can store all the genetic information now stored by our genes (and if the Genome Project succeeds, it will store this information). This information is medium independent because it can be instantiated without loss by many different media (e.g., by DNA, RNA, a computer, a very thick book, a very long abacus). But science must also give us a precise account of the specific reality of genetic media; for example, that DNA and RNA differ in both their structure and evolutionary history or that they transmit information through complementary pairing, and so forth.

CONSCIOUSNESS AND MEDIUM-SPECIFIC RESEARCH

We can now state the gist of the functionalist–antifunctionalist dispute in terms that are neutral, scientifically grounded, and make no necessary reference to qualia. Functionalists tacitly assume that consciousness is a medium-independent entity. Many antifunctionalists tacitly assume that consciousness is a specific medium.

To establish this point, we need look no further than to Dan Dennett. I first proposed the idea that consciousness is an information-bearing medium in a critical review (Mangan 1993a) of Dennett's 1991 book, *Consciousness Explained*. To establish at least one point of agreement, I tried to rework the common-sense intuition about consciousness by putting it in straightforward, cognitive terms.

In response, Dennett (1993) agreed that my version indeed captured the point at issue:

What a fine expression of Cartesian materialism! I wish I had thought of it myself. . . . Now we can see why Mangan, Searle, and others are so exercised by the zombie question: they think of consciousness as a "distinct medium," not a distinct system of content that could be realized in many different media.

Dennett continued:

Is consciousness—could conscious be—a distinct medium? Notice that although *light* is a distinct medium, *vision* is not; it is a distinct content system (a distinct information system) that could in principle be realized in different media.

Dennett continues in this vein, arguing the point (not at issue) that distinct information systems such as vision or audition can be multiply instantiated. But he says nothing further about the logic of instantiation for a distinct medium such as light; he certainly seems to grant that light, as a distinct medium, cannot itself be fully realized in some other, nonluminous, medium. (The reader is encouraged to look at the full discussion.)

Thus we already have some significant agreement about the core intuition at issue, and on how we can make it explicit in scientific terms. But for some reason Dennett never directly set out clear reasons against the consciousness-as-medium thesis. He asked the central question "Is consciousness—could consciousness be—a distinct medium?" but what may look like his answer really just restates the uncontested fact that distinct information systems can be multiply realized. Dennett did not explain *why* consciousness is supposed to be like vision, not like light.

The same shift occurs as Dennett proceeds:

But someone might want to object that this leaves out something crucial: there is not any vision or audition at all—not any *conscious* vision or audition—until the information that moves through the fungible [multiply realizable] peripheral media eventually gets put into the "distinct medium" of consciousness. This is the essence of Cartesianism: Cartesian materialism if

you think that there is something special about a particular part of the brain (so special that it is not fungible, not even in principle), and Cartesian dualism if you think the medium is not one more physical medium. The alternative hypothesis, which looks pretty good, I think, once these implications are brought out, is that, first appearances to the contrary, consciousness *itself* is a content system, and *not* a medium

It is not possible here to go over Dennett's arguments against the so-called Cartesian Theater (see [Mangan, 1993a](#)). But the above passage shows why Dennett's arguments against the Cartesian Theater are misdrawn if they are intended to work against the medium hypothesis. Dennett's argument pivots on the assumption that the medium hypothesis treats consciousness as something "special." But it is the "special" status of consciousness that the medium hypothesis denies. Dennett is absolutely right that we should be able to derive a medium-independent (functional) analysis for *all* the particular media that happen to make up our cognitive apparatus (including, I believe, consciousness). We can instantiate medium-independent findings in any medium able to bear information.

But Dennett forgets that the reverse is also true. *All* functionally equivalent systems are open to media-distinct analysis if they use distinct media. In other words, *all information bearing media are fungible from the standpoint of medium-independent research; no information-bearing medium is fungible from the standpoint of medium-specific research.* Just because we can ask medium-independent questions about consciousness, it hardly follows that consciousness is a medium-independent entity.

Functionalism must deny that consciousness is a distinct information-bearing medium or else functionalism fails. But, so far as I can see, no argument has been put forward to show why a medium-specific analysis of consciousness is a mistake (except that it would contradict functionalism). At the least, the consciousness-as-medium hypothesis is a logically possible alternative and is one that also gives us a new way to frame the functionalist–antifunctionalist debate.

CONSCIOUSNESS AS AN INFORMATION-BEARING MEDIUM

The medium hypothesis can appeal to much more than logical possibility. There are three reasons to think the medium hypothesis is, *prima facie*, scientifically plausible, not just logically possible. For a much more extensive discussion of these and related points, see Mangan (forthcoming).

1. Many people already suspect that something is wrong with functionalism. Probably the most serious problem is the account it must give of subjective experience. People not committed to functionalism find it hard to swallow the very wide range of entities (from thermostats to robots) that this or that functionalists insist are "conscious." For many of the uncommitted, the alternative looks unsavory because it seems to require a move away from scientific thinking, perhaps toward spiritual intuitions.

The medium hypothesis is able to explain, on purely scientific grounds, why so many people would feel uneasy about functionalism—functionalism ignores the entire domain of medium-specific research. Once we understand this, we can naturally extend the medium-specific stance and treat consciousness as just one more information-bearing medium along with neurons, rhodopsin, and the cochlea. The study of consciousness on the basis of this assumption is at least as scientifically plausible as is functionalism and does not have to pay functionalism's high, counterintuitive taxes in the bargain.

2. One of the most solid findings in consciousness research is that consciousness is extremely "narrow." Psychologists of various stripes (e.g., James, Freud, Miller, Neisser) have looked at this feature of consciousness and have often equated it with the limits on attention. Baars (1988) has an excellent treatment of the limits on consciousness from a cognitive perspective.

One way to discuss this limitation is in terms of bandwidth. Bandwidth can be treated as a purely objective concept, as can the limited capacity of attention. All else equal, any physical or biological medium has its own characteristic bandwidth.

The study of attention can be carried out without any direct reference to subjective experience or qualia. Even a conservative behaviorist can study attention (see Berlyne 1971) and not fall from grace. It is clear that attention operates on a very narrow bandwidth; it is equally clear that neural structures of the brain enjoy a remarkably wide bandwidth (Baars 1988). Although difficult to quantify precisely, the difference between the bandwidth capacity of even relatively limited parts of the brain, on the one hand, and of attention on the other, is something like the difference in capacity between a good fiberoptic cable and the string on a tin-can telephone.

So we can point to a strong, *objective* correlation between a certain subset of cognitive functions and a peculiarly narrow bandwidth. These functions have been discussed by many people and cluster around behaviorally specifiable notions such as access, reporting, monitoring, novelty evaluation, and executive function.

One plausible scientific explanation for the observed correlation of a certain subset of cognitive functions with a narrow bandwidth is that these functions all load heavily *on a narrow bandwidth medium that is quite distinct from the neural medium's very wide bandwidth.* (Great bandwidth disparity between two operations is one indication they are carried out by two distinct media.) We have, then, some purely objective empirical evidence supporting the possibility that cognition involves an information-bearing medium distinct from the observed character of neurons.

This argument makes no direct appeal to qualia to justify the possibility that some "higher" cognitive activity in our organism is based on a medium distinct from neurons. This view is useful because it lets us frame an *empirical argument* against functionalism without having to complicate matters further with the vexed question of qualia.

3. Nevertheless, the medium hypothesis is certainly able to offer an account of qualia, an account that links qualia quite naturally with the genus–species distinction as applied to information-bearing media.

We have converging evidence that a peculiar medium (distinct from neurons as currently understood) is associated with both the limited bandwidth character of attention *and* with the remarkably narrow phenomenology of experience (Mangan, 1993b). This suggests (but does not prove) that the objectively observed narrow bandwidth medium of attention reflects the subjectively experienced fact of conscious experience or qualia. The subjective–objective limitation correspondence is further reason to think consciousness is a distinct medium and that the objective bandwidth findings do not simply reflect an unrelated neural bottleneck. Otherwise, we would have to assume that pure coincidence accounts for two different but correlated bandwidth anomalies.

It is possible to have good evidence that a medium of some sort is at work in our organism and yet have no specific idea about the particular constitution of that medium. For instance, people realized that some kind of medium bore genetic information long before they knew anything about DNA.

The medium hypothesis lets us place consciousness within a purely biological perspective. The answer to the genus question—What is consciousness?—is that consciousness is a distinct, information-bearing medium. But what about the species question—How does consciousness bear information? The natural answer is that *consciousness bears its information as experience*. The fact of experience distinguishes consciousness from all other media.

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