
How Does Mind Matter?

Solving the Content Causation Problem

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The primary purpose of this paper is to develop a solution to one version of the problem of mental causation. The version under examination is the content causation problem: that of explaining how the specifically representational properties of mental phenomena can be causally efficacious of behaviour. I contend that the apparent insolubility of the content causation problem is a legacy of the dyadic conception of representation, which has conditioned philosophical intuitions, but provides little guidance about the relational character of mental content. I argue that a triadic conception of representation yields a more illuminating account of mental content and, in so doing, reveals a candidate solution to the content causation problem. This solution requires the rehabilitation of an approach to mental content determination that is unpopular in contemporary philosophy. But this approach, I conclude, seems mandatory if we are to explain why mental content matters.

Keywords

Content determination | Mental causation | Mental representation | Resemblance

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1 Introduction: The content causation problem

Philosophy delights in those aspects of the world that initially seem obvious and natural, but which on reflection turn out to be deeply mysterious. The mental causation of behaviour is one such phenomenon. Nothing could be more obvious than that our minds matter—that our beliefs and desires, and our perceptions and thoughts ultimately have a causal impact on our behaviour. And yet it has proved notoriously difficult to explain just how this could be the case.

The problem of mental causation has morphed and fragmented over the years. In its

original guise, it was the problem of how a non-physical mental substance or property could causally interact with the physical brain. The obvious solution to this version of the problem was to adopt a thorough-going materialism of some kind, with the consequence that mental phenomena are identified with properties of the brain from which they inherit their causal efficacy.

With the advent of functionalism in the later years of the last century, this “obvious” solution ran into difficulties. If mental phenomena are multiply-realizable, as the orthodox

construal of this metaphysical position seems to imply, then mental properties can't be identified with properties of the brain after all; and since the latter do all the causal work insofar as behaviour is concerned, the problem of mental causation re-asserts itself in a different form (Kim 1992; Crane 1995). This version of the problem of mental causation, which seems to generalise beyond the realm of the mental to all multiply-realizable phenomena, is still keenly debated in philosophy (Kim 2000, 2005; Hohwy 2008).

There is yet another rendering of the problem, however, that revolves around the causal efficacy of the specifically *representational* properties of mental phenomena. This third version typically arises in the philosophy of mind from the conjunction of three widely accepted theses about mental phenomena and their physical realization in the brain:

The content causation problem

1. Mental phenomena are causally efficacious of behaviour in virtue of their representational contents.
2. The representational contents of mental phenomena are not determined by the intrinsic properties of the brain.
3. The brain is causally efficacious of behaviour in virtue of its intrinsic properties.

The first of these theses is a fundamental tenet of both folk psychology and the computational theory of mind that has been constructed on its foundations. It is simply common sense that our perceptions and thoughts are about various aspects of the world in which we are embedded. It is also commonsense that mental phenomena causally interact with other mental phenomena and bodily behaviour in a fashion determined by their *content*—i.e., how they represent the world as being. Fodor refers to this as the “parallelism between content and causal relations” (1987).

The second thesis is widely accepted because most contemporary philosophers think that the representational properties of mental phenomena are determined at least in part by

factors beyond the brain. This is the conclusion drawn from a number of famous thought experiments implicating twin-earth, arthritis, and various species of tree (Putnam 1975; Burge 1979, 1986). But, even more importantly, the second thesis seems to be an entailment of the most popular approach among philosophers for explaining how the representational properties of mental phenomena are determined. This is the conjecture that mental phenomena are contentful in virtue of their causal relations with those aspects of the world they are about (Adams & Aizawa 2010).

The final thesis is consistent with all we know about the brain basis of behavioural causation. While the brain enters into complex causal relations with aspects of the environment via multifarious sensory channels, our best neuroscience informs us that the changes to musculature that constitute our behavioural responses are wholly determined by the intrinsic properties of the brain to which they are causally connected.

In conjunction, these three widely accepted theses form an inconsistent triad. This generates a distinct and narrower version of the problem of mental causation: How can mental phenomena be causally efficacious of behaviour in virtue of their representational contents if these contents are not determined by intrinsic properties of the brain? In what follows, I shall refer to this as the *content causation problem*. This is the version of the problem of mental causation with which I shall be concerned in this paper (see e.g., Kim 2006, pp. 200–202).

There are some philosophers who seek to resolve the content causation problem by rejecting either the first¹ or the third² of the theses composing the inconsistent triad. However, the most popular response has been to reject or at

1 This, for example, is one way of construing Dennett's instrumentalism (1978, 1987).

2 There has been a some discussion in the literature about whether the *relational* properties of brain states are implicated in the causation of behaviour. The standard way of defending this claim is by individuating behaviour *broadly*, so as to incorporate factors beyond bodily movements (Burge 1986; Wilson 1994). But many philosophers think this form of individuation does great violence to scientific practice in general and to neuroscience in particular, and hence this way of resolving the problem of content causation is thought to seem very unpromising (Fodor 1987).

least modify the second thesis. This leads to the the *narrow content program*:

The project of developing an account of mental phenomena according to which (at least the causally relevant component of) their representational properties are determined by intrinsic properties of the brain.

There are a number of different proposals about narrow content in the literature. Two of these have been particularly prominent. One is Fodor's suggestion that narrow contents can be unpacked as "functions from contexts to truth conditions" (1987, Ch. 2). The other is that narrow content is determined by "short-armed functional roles" (Block 1986; Loar 1981, 1982). But these (and other) proposals have been roundly criticised for failing to capture the *relational* character of mental content:

The main charge has been that narrow content, as construed in these accounts, is not real content. When one thinks of an apple, what one thinks about is not a role or a function, but a fruit. Real content must put the subject in cognitive contact with the external world. [...] A water concept, for example, must involve a relation between the thought wherein the concept is deployed and some worldly property or kind, presumably having to do with water. The problem with narrow content, construed as short-armed functional role or as a function from contexts to wide contents, is that it is not clear how it could involve any such relation. (Kriegel 2008, p. 308)

At this point, however, we seem to butt up against a classic paradox. On the one hand, those theories that appear to capture the relational character of mental content (i.e., causal theories) hold that content is not wholly determined by the intrinsic properties of the brain and, hence, imply that it isn't causally efficacious of behaviour. On the other hand, theories with the potential to account for the causal ef-

ficacy of mental content (i.e., narrow content theories), fail to capture its relational character. A solution to the content causation problem thus requires something that prima facie appears impossible: an explanation of the *relational* character of mental content that invokes only the *intrinsic* properties of the brain. Little wonder then that many philosophers despair of ever finding a solution to this puzzle.³

It is reasonable to hazard, however, that one of the main barriers standing in the way of a more productive treatment of the content causation problem is the radically underdeveloped understanding of mental content with which contemporary philosophy operates. In the foregoing quotation, for example, Kriegel characterises the relational character of content in terms of a subject's "cognitive contact" with the external world; yet he readily admits elsewhere that this notion is "not altogether transparent" (Kriegel 2008, p. 305). This is typical of the literature on this topic, which has become accustomed to describing content using the notoriously vague language of *aboutness*. While this language might capture our commonsense intuitions about mental phenomena, its imprecision may prevent us from discerning the lineaments of candidate solutions to the content causation problem.

This last point, at least, gives us the motivation for intruding yet another discussion into this already crowded philosophical space. The foundational conjecture upon which this paper is based is that the apparent insolubility of the content causation problem issues from an impoverished and unenlightening account of the relational character of mental content. Furthermore, this impoverishment is largely a con-

³ Perhaps the best we can do, according to some of these, is to accept that the representational properties of mental phenomena are causally inert, but to argue that there is enough room between explanation and causation for representational properties to be *explanatorily relevant*—despite their inertness (Baker 1993; Block 1989; Fodor 1986, 1989; Heil & Mele 1991; Jackson & Pettit 1990a, 1990b; LePore & Loewer 1989). A more radical response is to opt out of representation-based explanation altogether, as advocated originally by eliminativists (Churchland 1981; Stich 1983), and more recently by anti-representationalists (Brooks 1991). Finally, note that another radical position currently fashionable in philosophy—the extended-mind hypothesis (Menary 2010)—doesn't represent a solution to the content causation problem, since it signally fails to align mental phenomena with the brain-based causation of behaviour.

sequence of the *dyadic* conception of mental representation that has hitherto conditioned most philosophical thinking in this area. By contrast, a minority of philosophers has argued that mental representation is more properly analysed as a *triadic* relation. Triadicity, I will argue, yields a richer and ultimately more illuminating account of the relational character of mental content. Armed with this alternative treatment, we are in a position to assess the content causation problem anew. On the one hand, this novel viewpoint confirms the worry philosophers have expressed that causal theories of mental content are impossible to reconcile with the brain-based causation of behaviour. On the other hand, and much more positively, the triadic conception reveals a path that, from the perspective of content causation at least, looks more promising. The proposal that we travel down this path will undoubtedly face resistance, since it requires us to rehabilitate an approach to mental content that is unpopular in contemporary philosophy. But this approach, I shall conclude, seems unavoidable if we are to explain how mind matters.

2 The triadicity of representation

The bulk of philosophical writing on representation in general and mental representation in particular assumes, either explicitly or implicitly, that representation is a dyadic relation between something that does the *representing* and something that is *represented*. The task for a theory of representation, from this perspective, is to explain the necessary and sufficient conditions under which this dyadic relation obtains (see e.g., Stich 1992). But such a dyadic conception provides very little guidance about the relational character of representational content. All we have to work with is a mysterious action-at-a-distance phenomenon, whereby one part of the world, in virtue of the obtaining of a certain relation, is about another part.

To fill this gap, philosophers have almost invariably modelled their understanding of content on the semantic properties of the elements that compose our natural languages. Given the towering influence of Tarskian truth-conditional

semantics in this field, it is inevitable that the relational character of representational content is usually characterised in terms of *reference* (Kriegel 2008, p. 305). But such an approach, while perhaps appropriate for linguaform representation, sits awkwardly with all manner of the non-linguistic forms of representation with which we are familiar (Haugeland 1991; Fodor 2007; Cummins & Roth 2012). Moreover, it is not obvious we are more enlightened by replacing talk of aboutness with that of reference.

In this context, it is worth observing that over the years a minority of philosophers has expressed dissatisfaction with the dyadic conception of representation. The most salient complaint is that such an approach fails to take into consideration the role that “users” of representation play. The general thought here is that some parts of the world don’t represent other parts solely in virtue of some relationship between them; that the former represent the latter only when they are employed by some system to perform this representational function. According to Dennett, for example, physical entities “are by themselves quite inert as information bearers. [...] They become information-bearers only when given roles in larger systems” (1982, p. 217). Likewise, Millikan has long observed that a biological approach to representation forces one to consider not just the “production” of representations, but also their “consumption” (1984). And, in a similar vein, Bechtel argues that that since whether something acts as a representation is ultimately determined by its function for some user, it follows that there are “three interrelated components in a representation story: what is represented, the representation, and the user of the representation” (1998, p. 299).

This *triadic* conception of representation is not new, of course, since it forms the basis of Charles Sanders Peirce’s theory of semiotics, which was developed in the latter part of the 19th century (Hardwick 1977). Indeed, Peirce’s (sometimes obscure) writings embody one of the most comprehensive analyses of representation in all of philosophical literature. Peirce approached this issue principally by investigating those public forms of representation with which

we are all familiar—words, sentences, paintings, photographs, sculptures, maps, and so forth—but he also sought to apply his triadic analysis to the special case of mental representation. This suggests that Peirce’s writings might be an appropriate point of departure for exploring what the triadic conception entails about the relational character of representational content.

This strategy is very effectively adopted by von Eckardt when, following Peirce’s lead, she analyses representation as a triadic relation involving a “representing vehicle, a represented object, and an interpretation” (von Eckardt 1993, pp. 145-149).⁴ As with dyadic stories, the representing vehicle is the physical object (e.g., a spoken or written word, painting, map, sculpture, etc.) that is about something, and the represented object is the object, property, event, relation, or state of affairs that the vehicle is about. It is the addition of the interpretative relatum that sets the triadic account apart:

A sign [i.e., a representing vehicle] [...] is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which is created I call the *interpretant* of the first sign. (von Eckardt 1993, p. 145)

Interpretation is thus understood as a cognitive effect in the subject for whom the vehicle operates as a representation. But as von Eckardt observes, not any kind of effect will do. This cognitive effect, presumably implicating the production of *mental* representing vehicles, must bring the subject into some appropriate relationship to the original vehicle’s represented object (von Eckardt 1993, p. 157). Given this constraint, it is natural to interpret this third relatum in terms of the subject’s *thinking* about the object in question. So (non-mental) representation, on the triadic story, is a *functional* kind: it is a process whereby a representing

vehicle triggers a thought (or thoughts) in a subject about a represented object.

There are a couple of significant consequences of the triadicity of representation. The first is that, contrary to a dyadic story, representing vehicles aren’t about anything independent of interpretations. Words, sentences, paintings, photographs, sculptures, maps, and so forth, considered in isolation from the cognitive impact they have on us, don’t represent. This, of course, does some violence to the way that we talk about public representing vehicles—but it is far from catastrophic. The relevant revision is to think of these physical entities as possessing the *capacity* to trigger the necessary cognitive effects in us. The second (and, for our purposes, more important) consequence is that, unlike dyadic accounts in which content is unpacked solely in terms of relations between vehicles and represented objects, the triadic story entails that content is also conditioned by the interpretative relatum. This imposes an additional explanatory requirement on theories of content determination. It is not enough to merely explain how relations between vehicles and objects make it the case that the former are about the latter. These theories must also explain how it is in virtue of these relations that representing vehicles are capable of triggering thoughts in subjects about represented objects.

Once it has been suitably modified for the special, and presumably foundational, case of *mental* representation, the additional explanatory requirement that triadicity imposes on theories of content determination can form the basis of a richer account of the relational character of mental content. Such modification is necessary, of course, because treating the interpretation of mental vehicles solely in terms of a subject thinking about a represented object violates the *naturalism constraint*. This is the requirement that we explain mental representation without recourse to the antecedently representational (see e.g., Cummins 1989, pp. 127–129; Cummins 1996, pp. 3–4; Dretske 1981, p. xi; Fodor 1987, pp. 97–98; Millikan 1984, p. 87; von Eckardt 1993, pp. 234–239).

The relevant modification is fairly obvious, however, and represents a well-trodden path in

⁴ Von Eckardt actually uses the terms “representation bearer”, “representational object”, and “interpretant” to describe the three relata implicated in representation. I prefer the terminology I have used here because it is more consistent with the philosophical literature on mental representation.

philosophy. From the perspective of Peirce's triadic analysis, the role of interpretation is to forge a psychologically efficacious connection between the user of a representing vehicle and the vehicle's object. With public forms of representation it is perfectly acceptable to unpack this in terms of the (non-mental) vehicle activating thoughts directed at the object. But if we allow this story to run a little further it will point us in the right direction for the interpretation of mental vehicles too. Thoughts directed at objects modify our behavioural dispositions towards these same objects. This is why public forms of representation are so useful—they enable us to regulate our behaviour towards selective aspects of the world. But this story can be transported into the brain in order to account for the interpretation of mental representing vehicles. Instead of external vehicles triggering thoughts, and these in turn modifying behavioural dispositions, we simply suppose that mental vehicles have the same cognitive and ultimately behavioural effects. This acts to block the threatened regress since, presumably, it is possible to unpack behavioural dispositions without invoking further mental representation.

We are now in a position to deliver on one of the aims enumerated in the introductory section: that of fashioning a more illuminating account of the relational character of mental content. We saw earlier that Kriegel describes this character in terms of the “cognitive contact” between mental phenomena and the worldly aspects they represent, but admits that this notion isn't particularly transparent. Happily, the triadic analysis of mental representation affords a means of explicating what this cognitive contact consists in. Rather than simply employing the vague language of aboutness, the triadic analysis encourages us to understand the relational character of mental content in terms of the capacity of mental phenomena to regulate the behaviour of subjects towards specific aspects of the world. Cognitive contact is thus a relatively straightforward causal capacity. It is the capacity of cognitive creatures, bestowed by their internal states, to respond selectively to elements of the environment in which they are embedded.

This is where things currently stand. A solution to the content causation problem requires something that *prima facie* appears impossible—namely, an explanation of the relational character of mental content that invokes only the intrinsic properties of the brain. But the paradoxical appearance of content causation, I have suggested, might be a legacy of the dyadic conception of representation that has conditioned philosophical intuitions about content determination, but which provides little guidance about the relational character of mental content. The triadic analysis of representation, I have argued, generates a more enlightening account of this relational character—one pitched in terms of the causal capacities of cognitive creatures to regulate their behaviour towards specific aspects of their environments. From the perspective of this analysis, therefore, a solution to the content causation problem requires a theory of content determination to explain how relations between mental vehicles and their represented objects can endow subjects with the capacity to respond selectively to those very features of the world.

Philosophers seeking to fashion theories of mental content determination over the centuries have famously focused on just two kinds of relations between mental vehicles and their represented objects: “causal” relations and “resemblance” relations (Fodor 1984, pp. 232–233). In the following section I shall engage in an all-too-brief appraisal of the prospects of these two world-mind relations to deliver a solution to the content causation problem.

3 World-mind relations and the content causation problem

Causal theories of mental content determination have dominated philosophy for nearly half a century. They hold that representing vehicles are contentful in virtue of being (actually, nomologically, or historically) caused by their represented objects (Devitt & Sterelny 1987; Fodor 1984, 1987, 1990; Stampe 1977, 1986). Perhaps the most well-known causal theory in all of the literature has been developed, through a number of iterations, by Dretske (1981, 1988, 1995).

What makes Dretske's account particularly apposite in the current context is that it has been fashioned, at least in its later iterations, to address explicitly the account of content intruded by the triadic analysis of mental representation (though Dretske doesn't use this terminology). At one point in his discussion, for example, Dretske states that he approves of [Armstrong's \(1973\)](#) description of beliefs as "maps by which we steer", and goes on to observe that "beliefs are representational structures that acquire their meaning, their maplike quality, by actually *using* the information it is their function to carry in steering the system of which they are part" ([Dretske 1988](#), p. 81). This, for [Dretske](#), motivates the very desideratum we extracted from the triadic analysis in the last section:

It will not be enough merely to have a C [inner state of some cognitive system] that indicates F [i.e., causally covaries with some external condition] cause M [some observable behaviour]. What needs to be done [...] is to show how the existence of one relationship, the relationship underlying C's semantic character, can explain the existence of another relationship, the causal relationship (between C and M) comprising the behaviour in question. ([1988](#), p. 84)

Dretske's response to this problem, famously, is to appeal to teleology. It is only when an inner state, which causally covaries with some bit of the external environment, is "recruited" by the cognitive system (either by an evolutionary design process or through individual development) to cause appropriate behaviour, that the state acquires the *function* of indicating that part of the environment, and thereby comes to *represent* it ([Dretske 1988](#), pp. 84–89).

On the face of it, Dretske's theory seems to represent a promising solution to the content causation problem. From the perspective of the triadic analysis, a solution to this problem requires an explanation of how certain relations between mental vehicles and their objects can dispose cognitive subjects to behave selectively towards those represented objects. Dretske's el-

egant proposal is that reliable causal relations between inner states and environmental conditions (i.e., when the latter reliably cause the former to be tokened) can endow cognitive systems with these dispositions when the former states are conscripted by design processes to cause behaviour that is in some way relevant to the latter conditions. When this happens, the inner states are elevated to the status of representing vehicles, and their subsequent activity in bringing about behaviour directed towards their represented objects are examples of content causation.

Unfortunately, a closer inspection of Dretske's suggestion reveals a fundamental flaw. Contrary to what he contends, the relations at the core of his proposal are powerless to explain the required behavioural dispositions. Rather than describing this problem in the abstract, let me illustrate it using one of Dretske's favourite examples of a very simple representation-using system:

A drop in room temperature causes a bi-metallic strip in [a thermostat] to bend. Depending on the position of an adjustable contact, the bending strip eventually closes an electrical circuit. Current flows to the furnace and ignition occurs. The thermostat's behaviour, its turning the furnace on, is the bringing about of furnace ignition by events occurring in the thermostat—in this case [...] the closure of a switch by the movement of a temperature-sensitive strip [...].

The bi-metallic string is given a job to do, made part of an electrical switch for the furnace, because of what it indicates about room temperature. Since this is so, it thereby acquires the function of indicating what the temperature is [...]. We can speak of [...] representation here. ([Dretske 1988](#), pp. 86–87)

There is a subtle sleight of hand at work here, however. It is Dretske's contention that the bi-metallic strip is recruited (by the manufacturer) to play a causal role in the thermostat because

of what it indicates about ambient temperature. But that's not the full story. Bi-metallic strips have an *additional* property that appeals to the manufacturers of thermostats: their degree of curvature corresponds in an orderly fashion with ambient air temperature, such that it can be configured to complete a circuit when the temperature drops to a pre-set level.

In Dretske's thermostat example, therefore, there are two distinct relations between representing vehicles and represented objects: a systematic correspondence relation (wherein variations in ambient air temperature are mirrored by orderly variations in the bi-metallic strip's shape) and an indication relation (wherein variations in ambient air temperature *cause* variations in the bi-metallic strip).⁵ These two relations are not independent of one another, of course, as the former is mediated by the latter. But we can still consider which of these relations is doing the work, insofar as the capacity for the thermostat to control the behaviour of the furnace is concerned. And here the answer is clear: it is the fact that the curvature of the bi-metallic strip systematically mirrors the temperature, and not the causal covariation per se, that explains its capacity to operate the furnace in an appropriate manner. Consider the counterfactuals: curvature correspondence without causal covariation (e.g., where a mere correlation exists) would still generate the appropriate behaviour, but causal covariation without curvature correspondence (e.g., where the bi-metallic strip heats up but maintains its shape) wouldn't. The important point is that while the causal relation plays an important role in mediating the correspondence relation, it is the latter, not the former, that explains

5 Dretske scholars will cry foul at this point, of course. This is because Dretske claims that while indication is mostly founded on causal relations, it need not be. Indeed, he goes as far as to suggest that indication obtains whenever there is a non-coincidental covariation between vehicle and object (Dretske 1988, pp. 56–57). But this characterisation of indication transforms Dretske's proposal into something close to a resemblance theory (the approach to be examined in the next section), since it privileges systematic correspondence relations over causal relations. Consequently, insofar as Dretske's position is to be understood as a causal theory of content determination (as is widely assumed in the literature), it is essential that indication is interpreted as a relation of causal covariation. I adopt this interpretation in what follows.

the thermostat's capacity to bring about the desired behaviour.⁶

So Dretske's own example fails to satisfy the desideratum that he set for himself: the obtaining of a reliable causal connection between ambient air temperature and the bi-metallic strip doesn't explain the thermostat's capacity to control the behaviour of the furnace. Moreover, this example illustrates a fundamental problem with *all* causal theories of mental content determination: there is a fatal disconnect between world-mind causal relations, on the one hand, and the mind's behavioural dispositions on the other. This disconnect exists because any (actual, nomological, or historical) causal relations that might exist between external conditions and inner vehicles do not explain, in their own right, how a cognitive system inherits the capacity of behaving sensitively to the former. Whether cognitive systems have this capacity is determined by the properties of their inner vehicles in concert with their organizational, architectural, and motoric properties. And while external conditions can cause tokenings of and alterations to inner vehicles, the mere obtaining of such causal relations can't explain how the tokened or altered vehicles are capable of interacting with these multifarious systemic properties such that they bestow the appropriate behavioural dispositions.⁷ This is why manufacturers are very choosy about the materials from which they construct thermo-

6 One would expect to find causal relations mediating systematic correspondence relations between the representing vehicles of biological systems and aspects of the world. But, as Dretske is well aware, this is not always the case. Nature will make do with what works, and some kind of systematic correspondence in the absence of causal commerce will do just as well. This can be illustrated by another of Dretske's favourite examples: the evolutionary recruitment of magnetosomes in anaerobic bacteria to steer them towards deoxygenated water (1986). According to Dretske, evolutionary forces operating on these bacteria have selected magnetosomes because they are indicators of anaerobic water capable of influencing the direction in which the bacteria swim. But as Millikan has pointed out, the connection between the orientation of magnetosomes and anaerobic water is merely correlational, not causal (2004, Ch. 3). Magnetosomes indicate and steer northern hemisphere anaerobic bacteria in the direction of magnetic north, which results in these bacteria swimming into deeper (and hence deoxygenated) water. But there is no causal connection between magnetic north and deoxygenated water. In this case, therefore, magnetosomes have been selected because their alignment systematically corresponds with the direction of anaerobic water, not in virtue of any causal covariation between them.

7 Cummins reaches a similar conclusion, though via a somewhat different route (1996, p. 74).

stats. Engineering a causal covariation relation between ambient air temperature and the innards of a thermostat is easy; engineering these innards such that they possess the requisite causal capacities is a great deal harder.

Ultimately, therefore, Dretske's ingenious attempt to solve the content causation problem doesn't succeed. Dretske holds that the internal states of cognitive systems are elevated to representing roles when they are recruited by design processes to regulate behaviour towards the external conditions they indicate. He takes this to be a case of genuine content causation because he thinks that the causal relations between represented objects and representing vehicles can explain the causal activity in which the vehicles subsequently engage. But Dretske has over-estimated the explanatory power of world–mind causal relations. And he has done so because he has illicitly smuggled into his story a quite distinct form of content determination—one that exploits systematic correspondence relations between representing vehicles and their represented objects. Such systematic correspondences are, of course, a species of resemblance relation. The failure of Dretske's proposal is thus instructive, since it suggests that this alternative world–mind relation offers some prospect of a solution to the content causation problem.

Resemblance theories of content determination hold that representing vehicles are contentful in virtue of resembling their represented objects. The most obvious and straightforward application of this idea can be found in many public forms of representation, from photographs and paintings to sculptures and maps. But what is most significant about this approach for our purposes is that when vehicles resemble their objects, the former actually *replicate* the latter in some way, either by reproducing their properties or their relational organisation (more about which in the next section). And this affords a relatively straightforward way of explaining how a physical device, in virtue of incorporating vehicles that bear resemblance relations to the world, acquires a capacity to behave selectively towards particular elements of the environment. The thermostat's bi-

metallic strip reproduces—in the variations in its degree of curvature—the diachronic pattern of magnitude relations between ambient air temperature. Once this bi-metallic strip is incorporated into the thermostat, therefore, this device has a set of internal vehicles that dynamically replicates the external temperature. It is then simply a matter of rigging the innards of the thermostat so that its operation of the furnace is regulated by these internalised surrogates (Swoyer 1991).

Dretske is correct to judge this an example of content causation. It is a case in which the exploitation of a relation between environmental conditions and inner vehicles explains how the latter are capable of modifying a device's behavioural dispositions towards particular aspects of the world. But what is seldom acknowledged about this much-used example is that it demonstrates the causal efficacy of content fixed by resemblance. Despite this virtue, resemblance theories of mental content determination are unfashionable in contemporary philosophy, largely because they are widely thought to suffer from a number of fatal flaws. Before we end, therefore, it would be wise to engage in a degree of resemblance rehabilitation. This turns out to be easier than one might expect, however, once we adopt the perspective of the triadic conception of representation.

4 Rehabilitating resemblance

Despite the widespread assumption that they are fatally flawed, it's hard to find a sustained discussion of the problems associated with resemblance theories of content determination. Instead, one finds scattered somewhat haphazardly across the literature brief allusions to the same five objections. The canonical rendering of three of these can be found in the opening paragraphs of Nelson Goodman's *Languages of Art*:

The most naive view of representation might perhaps be put somewhat like this: "A represents B if and only if A appreciably resembles B", or "A represents B to the extent that A resembles B". Vestiges of this view, with assorted refinements, per-

sist in most writing on representation. Yet more error could hardly be compressed into so short a formula.

Some of the faults are obvious enough. An object resembles itself to the maximum degree but rarely represents itself; resemblance, unlike representation, is reflexive. Again, unlike representation, resemblance is symmetric: B is as much like A as A is like B, but while a painting may represent the Duke of Wellington, the Duke doesn't represent the painting. Furthermore, in many cases neither one of a pair of very like objects represents the other; none of the automobiles off an assembly line is a picture of any of the rest; and a man is not normally a representation of another man, even his twin brother. Plainly, resemblance in any degree is no sufficient condition for representation. (1969, pp. 3–4)

In short, representation can't be based on resemblance, since the latter is *reflexive* (where the former isn't), *symmetric* (where the former isn't), and *insufficient* (all manner of objects resemble others without representing them). But however influential these three objections might be when applied to a dyadic analysis of representation, they lose all force in the context of a triadic conception. This conception agrees with Goodman that relations between vehicles and their represented objects are insufficient to confer representational status. A representing vehicle must also undergo interpretation, either by triggering thoughts in a cognitive subject or by modifying the subject's behavioural dispositions. And it is this process of interpretation, according to a resemblance theory, that also enforces the non-reflexivity and asymmetry of representation.

A fourth objection is that resemblance theories of mental content are incompatible with our commitment to physicalism:

If mental representations are physical things, and if representation is grounded in [resemblance], then there must be phys-

ical things in the brain that are similar to (i.e., share properties with) the things they represent. This problem could be kept at bay only so long as mind-stuff was conceived as nonphysical. The idea that we could get redness and sphericity in the mind loses its plausibility if this means we have to get it in the brain. (Cummins 1989, p. 31)

But this objection is easily deflected once a proper understanding of the different forms of resemblance is in place. The most straightforward kind of resemblance—the kind that Cummins in the above quotation has in mind, for example—involves the sharing of one or more properties. This relationship can be termed *first-order resemblance*.⁸ It is this kind of resemblance that grounds the content of many public forms of representation, such as paintings, sculptures, and scale models. As Cummins points out, however, first-order resemblance is clearly unsuitable as a ground of mental content, since it is incompatible with what we know about the brain.

There is, nonetheless, a more abstract species of resemblance available. The requirement that representing vehicles share properties with their represented objects can be relaxed in favour of one in which the *relations* among a system of vehicles mirror the *relations* among their objects. This relation-preserving mapping between two systems can be called *second-order resemblance*.⁹ And while it is extremely unlikely

⁸ I am here adapting terminology used by Shepard & Chipman (1970).

⁹ To be more precise, suppose $S_V = (V, \nu)$ is a system comprising a set V of objects, and a set ν of relations defined on the members of V . The objects in V may be conceptual or concrete; the relations in ν may be spatial, causal, structural, or inferential, and so on. For example, V might be a set of features on a map, with various geometric and part-whole relations defined on them. Or V might be set of well formed formulae in first-order logic falling under relations such as identity and consistency. There is a *second-order resemblance* between two systems $S_V = (V, \nu)$ and $S_O = (O, \omicron)$ if, for at least *some* objects in V and *some* relations in ν , there is a one-to-one mapping from V to O and a one-to-one mapping from ν to \omicron such that when a relation in ν holds of objects in V , the corresponding relation in \omicron holds of the corresponding objects in O . In other words, the two systems resemble each other with regard to their abstract relational organisation. As already stressed, resemblance of this kind is independent of first-order resemblance, in the sense that two systems can resemble each other at second-order without sharing properties. Second-order resemblance comes in weaker and stronger forms. As defined it is relatively weak, but if we insist on a mapping that takes

that first-order resemblance is the general ground of mental content (given what we know about the brain), the same does not apply to second-order resemblance. Two systems can share a pattern of relations *without* sharing the physical properties upon which those relations depend. Second-order resemblance is actually a very abstract relationship: essentially nothing about the physical form of a system of representing vehicles is implied by the fact that it resembles a set of represented objects at second-order. Contrary to the fourth objection, therefore, a theory of mental content determination that exploits second-order resemblance is compatible with physicalism.¹⁰

However, this emphasis on second-order resemblance, at least in the eyes of many theorists, takes this approach to content determination out of the frying pan and into the fire. This is because the highly abstract nature of second-order resemblance invites the charge that it entails a massive and intractable indeterminacy of mental content. And it is this fifth objection, perhaps more than any other, that accounts for the current unpopularity of resemblance theories (Sprevak 2011).

The problem here can be illustrated by returning to Dretske's thermostat. The world-mind relation that does all the heavy lifting here constitutes a second-order resemblance: the relations among the representing vehicles (the set of bi-metallic strip curvatures) systematically mirror the relations among the representing objects (the set of ambient air temperatures).¹¹ The worry embodied in the fifth objection, how-

every element of V onto some element of O , and, in addition, preserves *all* the relations defined on V , then we get a strong form of resemblance known as a *homomorphism*. Stronger still is an *isomorphism*, which is a one-to-one relation-preserving mapping such that every element of V corresponds to some element of O , and every element of O corresponds to some element of V . When two systems are isomorphic their relational organisation is identical. In the literature on second-order resemblance the focus is often placed on isomorphism (see e.g., Cummins 1996, pp. 85–111), but where representation is concerned, the kind of correspondence between systems that is likely to be relevant will generally be weaker than isomorphism. For a much fuller discussion of second-order resemblance, see O'Brien & Opie (2004).

¹⁰ Two early theorists who sought to apply second-order resemblance to mental representation are Palmer (1978) and Shepard (Shepard & Chipman 1970; Shepard & Metzler 1971). More recently, Blachowicz (1997), Cummins (1996), Gardenfors (1996), O'Brien & O'Brien (1999), O'Brien & Opie (2004), and Swoyer (1991), have all defended second-order resemblance theories.

ever, is that this same set of representing vehicles will second-order resemble not just the temperature surrounding the thermostat but any set of objects, regardless of their nature and location, that shares its relational organisation. This fact is entailed by the abstract nature of second-order resemblance. And this is a problem, of course, because it suggests that second-order resemblance is incapable of delivering determinate content. The most we can say about the thermostat's bi-metallic strip is that its curvature represents that potentially large and motley collection of objects with which it systematically corresponds. And this would seem to be a long way from saying it represents the temperature of the ambient air.

Fortunately, the triadic analysis again offers a way to surmount this difficulty. On this account, representations aren't manufactured solely from relations between vehicles and the objects they represent. Rather, the process of interpretation must also be thrown into the mix. We've seen that interpretation is discharged ultimately in terms of modifications to a system's behavioural dispositions. But not any old modifications will do—representing vehicles must modify the system's dispositions towards their represented objects. Consequently, interpretation plays an important content-limiting role. Specifically, a system's behavioural dispositions will anchor its representing vehicles to particular represented domains. Once a domain is secured in this way, second-order resemblance relations determine the content of the individual vehicles. In the case of the thermostat, for example, the behavioural dispositions of the system restrict the represented domain to ambient air temperature, and the second-order resemblance relations determine what temperature each vehicle represents.

¹¹ Notice that in this case, the second-order resemblance is sustained *structural* relations among the set of representing vehicles (i.e., the set of bi-metallic strip curvatures). This is an example of what Palmer (1978) calls *natural isomorphism*, since the second-order resemblance relations are sustained by constraints *inherent* in the vehicles, rather than being imposed *extrinsically*. Elsewhere I have used the term *structural resemblance* to describe this kind of second-order relationship and to distinguish it from *functional resemblance*, where the second-order resemblance relations are sustained by *causal* relations among the vehicles—see O'Brien & Opie (2004).

5 Conclusion: How mind matters

It is time to take stock. We began with three commonplace theses about mental phenomena and their physical realization in the brain that together generate a profound puzzle about mental causation. This is the content causation problem: that of explaining how the specifically representational properties of mental phenomena can be causally efficacious of behaviour. This problem has an air of insolubility about it because it appears to require something impossible: an explanation of the relational character of mental content that invokes only the intrinsic properties of the brain. It has been the foundational conjecture of this discussion, however, that this despair issues from the impoverished understanding of content that attends the dyadic analysis of mental representation, and that once we adopt the perspective of the triadic conception our view of the content causation problem is transformed.

The insight offered by triadicity is that the relational character of mental content is to be discharged ultimately in terms of our behavioural dispositions towards features of the world. This offers a way forward with the content causation problem because it suggests that, rather than seeking to explain some kind of mysterious action-at-a-distance, the task for a theory of content determination is to explain how the obtaining of world-mind relations can dispose cognitive systems to respond selectively to certain elements of their embedding environments.

According to most naturalistically-inclined philosophers, there are just two candidate mind–world relations available: causal relations and resemblance relations. Causal theories of content determination dominate the contemporary landscape, but our analysis confirms what many have suspected—namely, that causal theories offer no prospect of a solution to the content causation problem. The reason for this, however, is not because such theories appeal to relations that incorporate factors beyond the brain. All theories of mental representation, in their efforts to explain the relational character of mental content, are forced to invoke world–

mind relations of some kind. The problem with causal theories, at least from the triadic perspective, is the disconnect between world–mind causal relations and a system’s behavioural dispositions. The obtaining of causal relations between external conditions and inner vehicles cannot explain how the latter endow systems with the capacity to respond in a discriminating fashion towards the former.

This leaves us with resemblance relations. The problem here is that resemblance theories of content determination have for many years been deeply unpopular in philosophy. But this is another point where the triadic conception of representation pays rich dividends. Most of the problems associated with resemblance theories don’t look so severe when viewed from the triadic perspective. This is encouraging, because resemblance does offer some prospect of a solution to the content causation problem. The key here is that the mere obtaining of the resemblance relation entails that representing vehicles replicate their represented objects. This ensures that the former have properties that can be exploited to shape the behavioural dispositions of cognitive systems towards the latter.

Consequently, if the line of argument presented here is on the right track, then resemblance theories of mental content determination must be rehabilitated and subjected to scrutiny and development. It goes without saying that there are a great number of significant hurdles yet to be overcome. I have focused, for instance, on just one very simple example of a representation-using system. There remains, accordingly, a large question mark over whether the resemblance solution to the problem of content causation scales up to more sophisticated cognitive creatures, let alone to the immense complexities of our own mental phenomena. But we have to start somewhere. And as things currently stand, resemblance theories appear to be obligatory, since they alone offer some prospect for explaining how mind matters.

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