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The Mind in Nature

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The Road to Pythagoreanism and Back

6.1 DISPOSITIONALITY MORE BASIC
THAN CAUSALITY

Dispositionality is ubiquitous. It is a mistake to try to explain dispositionality in general in terms of structural states. This is so, as we have seen, partly because it is just explaining more complex dispositional states (solubility) in terms of simpler sets of dispositional states (molecular structures) and partly because some entities (elementary particles) that do not have structural states have dispositional states.

Properties of elementary particles or spatiotemporal segments of fields are not structural states, yet such properties are not in pure act: they are not manifesting at each moment or temporal stage *all* of which they are capable. The particles have dispositions, not *all* of which they are *always* manifesting, and, in the nature of the case, *qua* elementary particles, their dispositionality is not explained in terms of the properties of their constituents.

You should not ask, 'Is there causality at the *quanta* level?', but you should ask the ontologically more basic question, 'Are the dispositionalities of properties of *quanta* in pure act (no potency) always manifesting everything of which they are *capable*, or are these capable of far more than on any particular occasion they actually manifest?' The answer to the second question is clearly 'The latter disjunct.' In this way, we have placed what *can* be and *can't* be manifested and how that can *change*, all of what anyone could want from causality, in the dispositionality of the *quanta*. Only the properties of mathematical entities are in pure act and, of course, the entities of physics (*contra* Quine) are not numbers.

Much of this chapter appeared as Martin (1997).

Putting the cart firmly *behind* the horse, one can see how misleading it is to try to explain dispositionality in terms of 'structural states.' First, because structural states themselves are loaded with dispositionality. Second, because properties of elementary particles or spatiotemporal segments of fields are not structural states. These properties are not in pure act, that is, manifesting at each moment or temporal stage *all* of which they are capable. They have dispositions and, in the *nature* of the case, their dispositionality is not explained in terms of their constituents.

Dispositions spend most of their time waiting, 'ready to go' for mutual manifestations with reciprocal disposition partners that are never present or may not even exist. The best image of 'waiting' dispositions is that of a lock with its 'fit' there *ready* for being turned by what might never exist or of a key with its 'fit' *ready* to turn what might never exist.

The dispositionalities of the 'finer interstices' even at the particle level are like locks with *or* without keys and keys with *or* without locks. It becomes obvious that dispositionalities are prior to and more basic and far more numerous than their mutual manifestations, which is cause and effect. Disposition and manifestation are the basic categories by means of which cause and effect are to be explained. A manifestation of a dispositional state should be seen in *depth* as the tip of a disposition iceberg at the *time*, rather than looking to a temporal spread of apparent manifestations perhaps for epistemic purposes.

Care must be taken in describing even an ordinary case of the manifestation of a causal disposition. The dissolution of salt in water might fail to be a manifestation of the salt's solubility in water *even* if the salt is soluble in water and the salt comes to be in dissolution in the water, because something could have brought about the dissolution before the water had its chance to team up with the salt to *do* the job.

In giving an account of something in terms of a disposition for a specific manifestation, care must also be taken not to obfuscate for the sake of a gestural tidiness the need for a rich (and difficult to adumbrate) variety of alternative mutual manifestations with alternative reciprocal disposition partners of the disposition. Quine's brusque account of believing 'The disposition to assent' only prompts the question, 'Assent *sincerely*?' To express this, one needs the central concept of the correlativity of disposition and manifestation.

A dispositional state or, what I shall call a *disposition base array*, derives its character from the pattern and complex variety of *alternative*

manifestations (under a complex range of kinds of manifesting condition, kinds of *reciprocal disposition partner*) to or for which it is directed. Manifestations themselves are such only as *from* the depths of the relevant disposition-bases.

It is best to replace cause and effect by the more basic and useful concepts of reciprocal disposition partners for mutual manifestations.

6.2 DISPOSITIONAL DEPTH AND BREADTH

(1) *Dispositional depth.* An infatuated lover thinks he hears his lover say, 'I believe she will come,' and he instantly leaps to agree, saying, 'Oh yes, I think she will come.' The lover coolly replies, 'I said I *didn't* think she would come,' and the infatuated lover sputters (*all* of this, of course, with sincerity), 'Oh yes, yes, I mean, I meant she *won't* come.' We could say that the manifestation does not come from a deep enough, strong enough disposition base.

(2) *Dispositional breadth.* A child is being taught the 10-times table and is told that $10 \times 2 = 20$. The child is bright and of a strong, determined nature and instantly learns at least to say, ' $10 \times 2 = 20$ ' under many conditions. The child has the *saying* of it from a deep disposition base. But it lacks breadth. The child does not know *any* arithmetic. The child resembles another child who, when asked what $2 + 2$ makes, replies, 'I don't even know what 2 makes.' With the first child, we could say the disposition base has *depth* but lacks *breadth*.

It will help to consider a nonmental case. How are we to think best about the *soundness*, in the sense of being made to last, of the bridge's standing up when a truck crosses it? Is it *just* that the bridge bears the stress, without deformation, of the truck's crossing it? Or is it instead that what is needed are many different kinds of event interrelated to the one in question in which the bridge, over time, in many ways bears stress without deformation? That cannot be so. We know that the *one* occasion of bearing the stress is not enough simply in itself, and yet we also know that it does not *need* those other stress-resistant events actually to occur for the bearing the stress on the one occasion to be that of doing so *soundly* in the sense required. It should be *something about* the bridge on the occasion, and that should not be the Rylean disposition halo of the counter-to-the-facts fact about the bridge.

We are able to think of the bridge's standing up soundly on that occasion as a manifestation of the soundness of the bridge as embodied in the stability of its substructures (with nothing built in for untimely deterioration or breakage, etc.) *rather* than divine interference or the purely accidental proppings up of a happenchance wind-carried piece of gravel, or the like. The soundness of the bridge can, then, in terms of its actual disposition base, quite understandably be there in *full* for a fraction of a second if a hydrogen bomb vaporizes the bridge. More might be needed *epistemically*, but that is irrelevant.

Michael Dummett (1979) advances an ill-chosen example of a capacity, 'good at learning foreign languages.' This is a poor case because it is tied to performance. The case should be 'capable of learning foreign languages easily,' which could be said of those who never, in fact, get around to learning a foreign language but whose facility with their first and only language suggests, rightly or wrongly, the further capacity for acquiring foreign languages.

If attention is focused *only* on the manifestation (whether the case is mental or nonmental) or even on a number of manifestations, to provide the richness of directedness and selectiveness that has occurred, then attention is focused in the wrong place, where we *know* we cannot find what we are looking for.

This is reinforced by the unfortunate disjunction, 'dispositional or occurrent,' applied to propositional attitudes: believing, having a thought, desiring, intending. The disjunction suggests that in the *occurrence* of the sounding of a word, making an inscription, visualizing, having the 'Aha!' experience, or saying in one's head, 'Oh, dear me, yes' (fill in the occurrence any way you like), *somehow* the whole relevant aboutingness is *there*. Whatever *occurs*, however, is consistent with a different aboutingness or 'expressive potential' being possible, or even none at all.

'Everybody knows that!' Yes, but its implications must be faced and an explanation given. If it is not and cannot be *there*, then one should not make a problem or a mystery of not *finding* it there! Then where is it? On the particular occasion what else is there? It has been shown to be in the depth and breadth of the actual disposition base from which the manifestation comes, whether the case is nonmental or mental, and in the correlativity of manifestation *from* and disposition *for*. The richness consists in the actual disposition being *for* an indefinite number of (but not just *any*) alternative manifestations with alternative

reciprocal disposition partners, and its specificity consists in what the disposition is *not* for or could even prohibit.

6.3 NON-EXISTENT AND PROHIBITIVE DISPOSITIONS

Any disposition or readiness potential, mental or nonmental, simple or complex, is *for* an infinity, within limits, of *alternative* manifestations with an infinity, within limits, of *alternative* reciprocal disposition partners actual and *nonactual*, present and absent, and even never-existing. The limits of directedness are set by the still greater infinity of manifestations the disposition is *not for* as well as the manifestations it *prohibits*. This is the ontology of the specificity of dispositionality.

A difference must be drawn between

- (A) *not* having a disposition for manifesting *x*, and
- (B) *having* a disposition for *prohibiting* *x*.

The distinction is essential to understanding the constraints and limits of infinities. This difference is one between

- (A') a state's or entity's simply not having a disposition for a particular kind of manifestation, although there is nothing about the state or entity that would require alteration for its addition, and
- (B') a state's having a disposition that is prohibitive against a particular kind of manifestation such that it would require *alteration* for the addition of the disposition that is prohibited. An example would be a square peg disposed to prohibit fitting into a round hole as a round peg would.

Seeing the richness of correlativity between manifestation and disposition, we can understand how a thought could be an indivisible unity though only partially expressed. The manifestation fragment gets its fullness of import by being of a deep enough, broad enough, relevant disposition base array that is for an infinity of alternative manifestations with alternative disposition partners—an infinity within limits.

It can be seen just how the 'occurent or dispositional belief' is a clumsy and superficial disjunction. What is occurent is some manifestation fragment that can have the specificity and richness of its import only by being *from* the richnesses of the disposition base array of which it is the manifestation.

6.4 NONMENTAL DISPOSITIONS

Causal dispositions are directive and selective—that is, they are dispositions *for* and *to* some kinds of manifestation rather than others—and so they are, whether physical or mental, in their very *nature* directive, projective, discriminatory readinesses *for* and *to* what is external to themselves.

The disposition can be *for* what may never exist—the fit of a particular lock for a non-existent key, or a substance soluble in a solvent that does not exist in nature and whose manufacture is simply too expensive and so never gets made. And finally, there may be some fundamental particles irreducibly different in kind from one another that are disposed for reactions to one another but eternally fail to manifest such reactions because of cosmic space-time separateness.

A nonmental dispositional state needs, just as much as a mental state, to be characterized in terms of that to which the state is directed, which may or may not be present or even exist.

Just as a belief needs *content*, namely, what would follow the 'that' in 'belief that . . .', so a disposition needs a *what-for*, namely, what would follow the 'for' in 'disposition for . . .', for instance, 'disposition *for* dissolving in H₂O (and not *acqua regia* or XYZZ).'

A nonmental (as well as mental) dispositional state can be directive in a way that is indeterminate in reference to a particular individual or in a way that is determinate (to a *particular* individual) in reference.

A particular hen has or does not have a set of dispositions and capacities for laying an egg (not any *particular* egg), and furthermore, the hen might have a set of dispositions and capacities for laying a *particular* egg provided by the causal context (e.g. the *one* egg that has actually begun to form). 'Externalism' (and 'broad content') unarguably could enter where the directedness is to a *particular* entity, uniquely provided in the physical context, rather than to just *anything* that happens to be of a particular kind.

Holding a belief or having *understanding* (or kindness, for that matter) can be 'holistically' and 'fully', at a particular time, in the head, without magic, as *soundness* can be in the bridge at a particular time, namely as an actual disposition state array that might or might not have actual manifestations at the time, or ever.

The correlativeness of a disposition-manifestation is such that for something to be a particular kind of manifestation, it must come *from* a relevant deep enough, broad enough disposition base, and for something to be a disposition base it must be *for* alternative typifying manifestations. Nature comes in package deals. One should see that the dispositionality *for* a range of manifestations will also *not* be *for* or even be *prohibitive* against manifesting an infinite number of other manifestations. This is the basic ontology for setting the limits of the infinities of directiveness and selectiveness, whether the entities or states are psychological or nonpsychological, and even whether they are systemic or, as in the case of elementary particles, nonsystemic.

Dispositions or readiness potentials exist embodying programs for, *not* for, and even prohibitive *against* an infinity of manifestations under a limited scope as described above. This account of the dispositional as directive, selective, readiness with the correlativeness of disposition and manifestation is such that the manifestation 'carries' the richness of the disposition base it is *from* or *of*. It is natural that so little can carry so much. In this way, every disposition is a holistic web.

Through the concepts of 'reciprocal disposition partner' and 'mutual manifestation,' a way can be seen to bridge the 'narrow-content'/'broad-content' gap. The physical environment and the individual human mind should be considered to be *reciprocal* disposition partners for the *mutual* manifestation of perception. The reaching out comes from *both* sides of the partnership in their mutual manifestation.

The externalist and the internalist both miss the point. Readiness for the mutual manifestation of perception is found in *each* disposition partner, whether state of a perceiver *or* state of the environment, even if the other does not exist! Both are needed for the actualization of the perception that is their *mutual* manifestation.

It is clear that forms of readinesses with their directedness and selectiveness are gifts of nonpsychological nature and should *not* be asked for all over again at the psychological level. It is, of course, another matter to say what more is needed to make the directedness and selectiveness *mental*.

Given a realist view of dispositions as fully actual even without the actuality of their manifestations or their reciprocal disposition partners, a purely dispositional account of properties has a degree of plausibility. This plausibility is enhanced by the impossibility of characterizing any property as purely qualitative, that is, as existing without any

implications of dispositionality. I shall argue, however, that, in the end, it is equally implausible to characterize any property as *purely* dispositional.

6.5 PROPERTIES AS PURELY DISPOSITIONAL

Sydney Shoemaker (1980), James Fetzer (1981), and Hugh Mellor (1974, 1991) have been recent proponents of the claim that a property is identical with its causal powers. Take the following passage from Shoemaker, for instance:

Suppose, however, that all of their causal powers and potentialities, all of their dispositions to influence other things or be influenced by other things, were exactly the same. Then, I suggest, they would share all of their properties in the narrow sense, all of the 'intrinsic' properties. Likewise, when I say that the loss by my pencil of the property of being fifty miles south of a burning barn, or the property of being such that Gerald Ford is President, is not a real change, the cash value of this is that the acquisition or loss of these so-called properties does not in itself make any difference to the causal powers of a thing. This suggests a view about what intrinsic properties, properties in the narrow sense, are. According to this view, what constitutes the identity of such a property, what makes it the particular property it is, is its potential for contributing to the causal powers of the things that have it. . . . If we could indicate all of the ways in which the having of this property could contribute to the causal powers of things, we would have said all there is to say about the intrinsic nature of this property. (Shoemaker 1980: 332)

My initial response to any such account is to state it fairly but baldly and let its absurdity show through.

The image of a property as *only* a capacity for the production of other capacities for the production. . . . etc., is absurd, even if—indeed, *especially* if—you are a realist about capacities. Whether you take this response as just question-begging or as revealing a *reductio ad absurdum*, my opponent cannot plead misrepresentation.

A more measured response to Shoemaker's purely dispositional account of properties, requires us to reflect on a more general point. A lack of candor has characterized the formulation of some of the great reductive ontologies: phenomenism, behaviorism, and operationalism, for instance. The vocabulary used in presenting these theories discouraged a clear view of their ontological commitments. I am not trying to push defenders of these views into giving translation

or logical entailment accounts. I am perfectly happy if they scrub up their vocabulary, then add 'etc.' When that is done, the doctrines will at least be ready for consideration.

(a) *Phenomenalism* got away with:

For 'There is an *F* in the next room': 'It would tend to look *F*-ish to me if my *sensory capacities* were in good working order and I were to go into the next room and look in the direction of *F*, etc.'

The italicized part of the sentence is not expressed in terms of the basic terms of the ontology. When the candid attempt is made to do so, to scrub the vocabulary clean, its anti-intuitiveness becomes apparent.

(b) *Behaviorism* got away with:

For 'I am having mental imagery of *Greensleeves* as played by Glenn Gould': 'I would behave as if *hearing* Glenn Gould play *Greensleeves*, or by saying *sincerely*, if I *thought* the occasion called for it, that it was as if Glenn Gould were playing *Greensleeves*, etc.'

Again, the italicized part of the sentence is not expressed according to the ontology. 'Hearing,' 'sincerely,' and 'thought' are not behaviourist terms. When the attempt is made to scrub the vocabulary clean, the anti-intuitiveness of this view likewise becomes apparent.

The very same holds true of the Shoemaker-Mellor-Fetzer view that all that is intrinsic to properties is exhausted in their dispositionalities.

(c) *Pure Dispositionalism* gets away with:

For '*x* and *y* are equal in length': '*x* and *y* are disposed to *fit* or *not fit* into the same *containers* in the same way, ignoring their *width* and *weight*, etc.'

The story is no different than it is for phenomenalism and behaviourism. The need is to couch all of the vocabulary in terms of dispositionalities and only dispositionalities.

Let us demand maximum candor here. If properties are treated only as capacities—dispositions, let us have that clear from the outset. Explicitness is necessary in all ontological domains, but particularly in the domain of the mental because of the ambiguity of terms such as 'behaviour,' in which *sensory* (therefore, sentient) feedback might be implicit. When stated explicitly, the Shoemaker-Mellor-Fetzer view is revealed to have the anti-intuitiveness of a reduction of all the properties of whatever the dispositions are for (namely, the

manifestations) to just further dispositions themselves. What, on this view, is introspected as the very quality of the *feel* of the feeling of a kind of pain? Indeed, what, on this view, is the account of the (non-number) quality of the length as directional spread seen or felt of a form of extension?

Your knowledge of the existence of physical *x* or mental *y* has to involve the causal dispositions of *x* and *y* to affect your belief that *x* or that *y*. Those dispositions are specifically operative on that occasion for that belief. This, however, does not establish (*contra* Shoemaker) that the content of what you know or believe is nothing more than the collection of causal dispositions or functions that make you or would make you believe *x* or *y*.

Dispositionalists believe that all that appears to be qualitatively intrinsic to things reduces to capacities—dispositions for the formation of other capacities—dispositions for the formation of other capacities—dispositions for the formation of... And, of course, the manifestations of any disposition can only be further dispositions for... This image appears absurd even if one is a realist about capacities—dispositions. It is a promissory note that may be actual enough, but if it is for only *another* promissory note that is..., it is entirely *too* promissory.

6.6 DISPOSITIONALITY AND QUALITATIVITY

When we try to state or to think through what justifies, warrants, or makes true a counterfactual or causal dispositional statement, it seems absurd to attempt to find it in something purely dispositional and nonqualitative, and *equally* absurd to find it in something purely qualitative and nondispositional. The purely qualitative is as much a 'logical fiction,' in Hume's phrase, as is the purely dispositional. The truth is obvious: in this matter, *nothing* is pure.

The only way to express this Limit View of real properties that does not amount to treating real properties as compounds of purely qualitative and purely dispositional properties is to show how the attempt to abstract these as distinct elements is unrealizable in reality and only approachable as *limits* for different ways of being of the *same* unitary property such that they may be necessarily or contingently covariant. This will hold for *all* real properties, encompassing even the most ultimate properties of elementary particles or fields.

We have seen that it is useful to replace talk of cause and effect with talk of disposition and manifestation (under triggering and manifestation conditions). Whatever resistance there may be to speaking of a causality at the quantum level, it should be obvious that *quanta are not potency-free, in pure act, or at all times manifesting all of which they are capable* under every sort of manifestation-condition. The dream of either a purely qualitative, nondispositional account or a purely dispositional account of properties is philosophical fantasy. On the one hand, no property is in 'pure act,' free of all unfulfilled potency unless it is a property of God or, perhaps, the number 2. On the other hand, no property is *only* its capacity for the production of further capacities for . . . This ontological fact is more evident than is any hypothesized lawlike regularity that seems not to occur at the level of quanta, nor, for that matter, at the macroscopic level.

My suggestion is that properties of entities constitutive of any state of affairs must be qualitative as well as dispositional, dispositional as well as qualitative. Dispositional and qualitativity are correlative (Locke), complementary, inseparable, and covariant when they are displayed in their intrinsic and irreducible form at the level of the finer interstices of nature. I contend that they have a surprising identity. In this regard, properties resemble duck-rabbit pictures, in which the duck picture and the rabbit picture are surprisingly identical.

What I have called (perhaps misleadingly) the Limit View (Martin, 1993: 519; see also my contribution to Armstrong *et al* 1996) treats any intrinsic property not as a two-part compound of the purely qualitative and nondispositional and of the purely nonqualitative and dispositional, but as a two-sided dispositional-qualitative coin. These cannot be abstracted as fully distinct and separable elements, but must be considered unrealizable limits for different ways of being the selfsame unitary property. Supervenience is not to the point. The dispositional and the qualitative are equally basic and irreducible; there is no direction for one being basic in a property and the other being 'supervenient.' The dream of a purely nondispositional categorical property is as much a philosophical fantasy as the purely noncategorical dispositional property.

The Limit View has maximum flexibility in expressing both necessary (if any) and contingent (if any) relations between categoricity and dispositionality of properties. This is an important and largely unexplored area of ontology. If an idea is expressed only in terms of

quantities, then the system of relations of quantities is natural material for the necessities accruing to the mathematicization of nature.

This was the place, namely, among 'the finer interstices of nature' and 'the insensible corpuscles,' at which Locke suggested that the real necessities between the primary quantities resided, although he thought we would be largely ignorant of them. Locke believed the molecular theory of heat provided an approximation to such hidden necessities. Necessities will have to be earned, but so will contingencies. The Limit View is specially suited for the statement of either or a judicious *mixture*. For antimodalists, it can suit nonmodal talk as well.

The preliminary characterization above in terms of 'different ways of being,' however, is still too suggestive a mixture. It is even more than necessary covariance (as exhibited by equiangular and equilateral). For any intrinsic and irreducible property, what is qualitative and what is dispositional are one and the same property considered as what that property exhibits of its nature and what that property is directive and selective for as its manifestations. These cannot be prised apart into the purely qualitative and the purely dispositional. What is exhibited in the qualitative informs and determines what is the for-ness of the dispositional, and the for-ness of the dispositional informs and determines what is exhibited in the qualitative. There is no direction of priority or dependence. There is no reduction of one to the other.

The only way this can be expressed is by affirming that the qualitative and dispositional are identical with one another and with the unitary intrinsic property itself. This is perhaps a surprising identity, but frequently it happens that different representations turn out (to one's surprise) to be of the selfsame entity.

This claimed identity might be easier to see once you understand clearly that it is not a matter of one aspect being nonrelational (the qualitative) and the other aspect being relational (the dispositional). Dispositionality is *not* a relation between what is dispositional and what is its manifestation. A disposition can fully exist and be 'ready to go' with the total nonexistence of the manifestation and reciprocal disposition partners needed for the manifestation. Their absence or nonexistence does not affect the readiness of the dispositional state. The state would not have to alter to yield the manifestation.

What is qualitative and what is dispositional for any property is less like a two-sided coin or a Janus-faced figure than it is like an ambiguous drawing. A particular drawing, remaining unitary and

unchanged, can be seen or considered one way as a drawing of a goblet and, differently considered, as a drawing of two faces staring at one another. The goblet and the faces are not distinguishable parts, components, or even aspects of the drawing, although you could easily consider the one without considering, or even knowing of, the other. The goblet drawing is surprisingly identical with the two-faces drawing. The duck drawing and the rabbit drawing are likewise surprisingly identical.

It might be thought, however, that something could exist in a qualitative state but in no dispositional state. You might be able to imagine something that is totally inert and unchanging. That is different from being without any dispositionality, however. A thing or property that is intrinsically incapable of affecting or being affected by anything else, actual or possible, is not merely a case of inertness—it amounts to a *no-thing*.

Getting clear about the nature of properties, determines the scope of the empirical question of what properties in particular there are or might be, including their qualitativity as well as their dispositionality, in either the physical domain (which includes 'theoretical entities') or the psychological domain.

According to a realist theory of dispositions, the notion of a distinct, purely dispositional property existing on its own is an important and powerful notion, however anti-intuitive it might appear at first. Correct or incorrect, the notion has an honorable lineage and ought to be discussed in terms of some of its past and current forms.

Historically, the supposition of the purely dispositional can arise from operationalism cum functionalism that can, in turn, arise from a verificationism that makes an infinitude of possible forms of neural and bodily activity (verification-operations)—that need not be actualized—basic.

Weak verificationism is the view that no statements of any finite set of verifications/falsifications or confirmings/disconfirmings entail the truth or falsity of what is confirmed/disconfirmed. *Strong verificationism* is the view that some finite set of verifications/confirmings entails the truth or falsity of what is confirmed/disconfirmed. Strong verificationism is evidently *too* strong.

It is ironic that *weak* verificationism is *itself* verification-transcendent. Any possible set of statements about confirming-happenings is consistent with the *falsity* of a statement about the existence of what is

being confirmed. Whatever verification is effected, it is transcendently projective beyond any finite amount of verification-exemplifications.

This incompleteness is underscored by the fact that, typically, the performance of a set of one kind of verification *excludes* the possibility of the performance of some other kinds of verification. Recourse to falsification or disconfirmation changes nothing.

Gestures to the 'Ideal Observer' are of no help here. Verification of the ideality of an 'Ideal Observer' must be incomplete as well. Weak verificationism has the seeds of a verification-transcendent projectivism within it!

Reductivist ontologies that tend to emanate from weak verificationism—operationalism, phenomenalism, behaviorism—inheritor the same verification-transcendent project to the limitless and numerically indefinite would-have-been-ifs that take precedence over and against any possible finite set of *actual* confirmings in the form of operations, observings, or behaviors.

A focus on the incompleteness of verification or falsification and the recourse to the rough linguistic gesture toward an indefinite number of dispositionals and counterfactuals is a focus toward the purely dispositional (*mostly* unmanifested) and away from the purely categorical.

6.7 SURPRISING IDENTITIES

You might initially balk at the suggestion that the dispositional and the qualitative are in fact identical. If $x = y$, it might be supposed that we ought to know it immediately. But this supposition is a mistake. Examples of *surprising* identities abound (especially in discussions of identity and reference) from the Morning Star/Evening Star and the man with the martini to Simon Blackburn's 'the bleeding foot is mine.' The example I want to explore here is the well-known duck/rabbit (Fig. 6.1). We can recognize a number of parallels between this perceptually ambiguous identity case and a conceptually ambiguous identity case, as well as between the foibles of perceptual eyes and conceptual 'eyes.'

The parallels to be established are between the perceptual surprising identity in the duck/rabbit picture and the conceptual surprising identity in the quality/disposition case. In each case, duality lies only in the eyes of the perceiver or the 'eyes' of the conceiver, for the

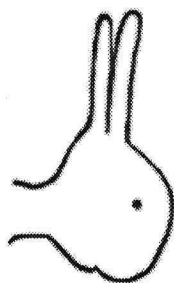


FIG. 6.1. Duck/Rabbit

seeing one rather than the other as a duck and then as a rabbit is, of course, not identical.

- (1) Some can only see the duck.
- (1') Some can only 'see' the quality in its pure act, with no potency—e.g. D. M. Armstrong. (St Thomas would apply pure act only to God.)
- (2) Some can only see the rabbit.
- (2') Some can only 'see' the dispositionality—e.g. Hugh Mellor.
- (3) Some can see nothing about the picture.
- (3') Some can 'see' nothing about properties—e.g. Quine's linguisticism.
- (4) Some can alternatively see the duck or the rabbit in the picture.
- (4') Some can alternatively 'see' the quality or the dispositionality of the property.
- (5) Some can see both the duck and the rabbit *at once*, each filling the picture. (Try seeing the eye as looking directly at you to help with this effect.)
- (5') Some can 'see' both the quality and the dispositionality at once, each filling the property. (Try reading pertinent passages in this book several times to help with this effect.)
- (6) It is false to suppose that we see part of the picture as purely and solely rabbit and a different part as purely and solely duck, because the parts are not exclusive of one another—they fully overlap.
- (6') It is false to suppose that we 'see' an aspect of the property as a purely and solely nondispositional quality (the Thomistic pure act holding only of qualities of God) and another aspect of the property as purely and solely nonqualitative dispositionality, because the aspects are not exclusive of one another—they fully overlap.

- (7) The duck drawing and the rabbit drawing are the selfsame unitary drawing. That explains, as nothing else can, the fact that they 'fully overlap.'
- (7') The quality property and the dispositional property are the identical unitary property. That explains, as nothing else can, the fact that they 'fully overlap.'

It becomes obvious that the epistemic and the ontological conditions (as in the case of everything) are very different for identity and nonidentity. Examples abound in mathematics and logic for mistaking one for the other. Descartes knew this rather well; Locke knew it better.¹

An argument that identity (of quality and disposition, for instance) is the best explanation for necessary covariance appears to be threatened by cases of distinct properties—being equiangular and being equilateral, for instance—having such covariance.

Three straight lines or edges at their three points of connection form a three-sided plane figure with three angles. Consider an equiangular, equilateral triangle. Disproportional increases or decreases of the lengths of the sides are matched by increases or decreases of the amounts of the degrees of the angles. *Proportional* increases or decreases of the lengths of the sides are not matched by proportional increases or decreases of the amounts of the degrees of the angles, however. There is consequently a *lack* of covariance between the sizes of the sides and the sizes of the angles of equiangular, equilateral triangles.

6.8 DISPOSITIONS AND QUANTUM THEORY

Instead of measuring operations or observations, we can speak of measures. Quantum theory has commonly been interpreted as encoding measurement predictions and the irreducible indeterminacy of quantum 'states of affairs' understood as irreducible probabilities (less than unity) stated in measurement predictions. This interpretation imposes an essential mind-dependence of quantum events described in the theory. The choice is whether to interpret the wave function as a physical continuum at all.

Arthur Fine has shown a fascinating vacillation in Schrödinger's interpretation of measurement predictions between referring to and

¹ And perhaps Spinoza knew it best of all; see Chapter 10.

not referring to the wave function as a real continuant. Fine describes Schrödinger's laconic letter of July 13, 1935, to Einstein:

Schrödinger then proceeds to set out briefly what he thinks is going on; namely, that the classical physical model has in fact been abandoned but that instead of replacing it with another, one has simply declared all of its determinables to be exactly measurable in principle and in addition prescribed with wise, philosophical expressions that these *measurements* are the only real things, which is, of course, metaphysics. Then in fact it does not trouble us at all that our claims about the *model* are monstrous. (Fine 1986: 76)

In such a mood (very different from the mood in which he attempted interpretations in terms of wavelike models), Schrödinger rejects all attempts to provide a model. He even dismissively describes the model of sparse and intermittent measurement events as the only 'real' posits as 'metaphysical.' This vacillation provides few crumbs for ontologically hungry philosophers, whether realist, antirealist, or something in between.

The introduction of the term 'measurement' is disturbingly ambiguous. Any measurement procedure will involve certain physical movements. Surely, if precisely similar physical movements were brought about by something that was not an intelligent agent, or if the experimenter performed the 'measurement' but no measurement was recorded, perhaps due to a lapse of attention, then, in one sense, no measurement would have been made. The physical outcome of the physical experimental procedure would have occurred, however, although it remained unknown.

The alternative to this interpretation is an interpretation that would include mental dependence through the observer-dependent notion of measurement from the very beginning so that it should be no surprise that mental dependence would be excluded in a final account. It would be no more than clumsy question-begging to use (perhaps without notice) such a mind-dependent interpretation of quantum physics as an authority against forms of realism. Looked at quite literally, if the *physical* result of measurement requires the knowing attentiveness of an observer, that would be a mind-over-matter factor not even specified in the theory, but only evoked in some interpretation of the theory. This ought to remind us of Einstein's reference to the quantum theorists' 'epistemology-soaked orgy.'

The drive to Pythagoreanism and the tendency to deprive properties of their nature can take the form of limiting basic physical

descriptions to statistical or probabilistic claims concerning purported states. Einstein stated this doctrine clearly, though with the strongest disapproval:

They [Born, Pauli, Heitler, Bohr, and Margenau] are all firmly convinced that the riddle of the double nature of all corpuscles (corpuscular and undulatory character) has in essence found its final solution in the statistical quantum theory. On the strength of the successes of this theory they consider it proved that a theoretically complete description of a system can, in essence, involve only statistical assertions concerning the measurable quantities of this system. (Einstein 1949: 666)

If what is claimed is taken seriously, and if this is not to be a Pythagoreanism of pure numbers, it is an ontology of pure 'probabilifyings'—probability facts or probability bundles somehow embedded in space-time.

The ontology of such probabilifyings, if it is not Pythagorean, could be expressed as equivalent to primitive dispositionality, propensities, or potentials. A probabilifyings is more like a propensity than it is like a specific manifestation-directed disposition. Propensities can admit of degree, so there might be a propensity of a certain degree for both outcome *A* and (incompatible) outcome *B*.

Consider interpretations that take Schrödinger's wave function as a state that grounds, or is the truthmaker for, measurement predictions and probability statements concerning measurement outcomes, such that its 'theoretically complete description . . . involve[s] only statistical assertions.'

Such an interpretation of quantum theory represents quantum states of affairs as probability-less-than-unity states that ground measurement predictions. In such an interpretation, the full characterization of a state of affairs is just in terms of irreducible probabilities; it excludes any further complement that could not itself be expressed in terms of probabilities. A parallel interpretation in terms of tendencies is that of a full characterization of a state of affairs just in terms of irreducible tendencies or readiness potentials. Perhaps the most difficult feature to mathematize of reciprocal disposition partners would be their respective degrees of availability.

Speaking of probability facts, or even probability bundles or states, is merely an alternative way of speaking of pure, but unspecified and perhaps unknown, tendencies. This becomes most apparent when it is claimed of their ontological status that they are not reducible to and

need not have or be based on a ratio of actual relevant occurrences. What other than tendencies could be the ontological ground for such cases of probabilities with non-occurrent frequencies? Opportunities for mathematicization undoubtedly afford this metaphysics an added measure of respectability.

The ontology of this is the positing of non-categorical pure probabilities or probabilifyingnesses or pure dispositions, propensities or 'potentials.' A probabilifyingness is more like a propensity than it is like a specific manifestation-directed disposition. Propensities can admit of degree and so there can be a propensity of a certain degree (probability) for outcome *A* and also a propensity of a certain degree (probability) for outcome *B*.

Characterizing states of affairs only in terms of irreducible probabilities, then, if it has a non-Pythagorean ontological status, is just equivalent to a characterization in terms of irreducible tendency or propensity properties. The probability (less than 1) or the tendency can be satisfied or actualized for a particular state of affairs in the absence of the outcome the probability is *for* or the propensity is *to*.

6.9 INDETERMINACY AND DISPOSITION FLUTTERS

The irreducible disjunctivity in higher-order accounts of irreducible probability rests in the probabilifying 'linking' or 'connecting' as a primitive relation between universals (Armstrong 1983) above pure 'happening' in a way that is far from clear. Disjunctive 'linking,' even if we allow it, does no work for the production of the particular disjunct that actually results. Even a view that admits primitive tendencies or propensities has the similar problem of being irresolubly disjunctive and not taking us up to the very production of the specific result itself.

This is not a naïve complaint about indeterminacy—I am pointing out a metaphysical gap. The gap resembles a nomination procedure for a disjunction of candidates that does not decide among them. Were it to elect one disjunct or candidate, it would decide for one rather than another, and be determinate between them. If there is not such a selection or production of one disjunct rather than another between the candidates, there is no election nor a production of a disjunct at all. The explanation of the success of a candidate or production of a disjunct, short of magic, would be incomplete, and the links in

this disjunctive linkage would not take us to the result, but only to a pre-result determination of disjunctivities.

We need an account of disjunctivity that could take us all the way to the result. This is no more than a graphic presentation of what is anti-intuitive in current models of the collapse of the wave function. Perhaps an account in terms of a primitive *disposition flutter* would help.

The disposition flutter is an ontologically primitive oscillator built into the basic and irreducible properties of the elementary particle itself rather than something fixed by hidden conditions outside the particle and its properties. Each flut of the flutter (oscillation) of the dispositions intrinsic to the properties of the particle, however unpredictable, would be an irreducible ontic ground for the manifestation of a determinate result.

Thus conceived, the disposition flutter is intrinsic to irreducible properties of an elementary particle. There would be no need to look to hidden factors extrinsic to the basic properties of the particle itself, just as the rate of 'decay' has sometimes been represented as intrinsic to the nature of an atom and not to be explained by extrinsic and hidden causes or variables.

The intrinsic disposition flutter *itself* is not a mutual manifestation of reciprocal disposition partners, though the particular flut of a disposition flutter could, with its reciprocal partners, *have* a mutual manifestation.

A disposition flutter might occur too quickly to measure, thus appearing to be random or nondeterminate, or the disposition flutter might be intrinsically irregular, giving the impression of nondeterminateness.

If a disposition flutter is intrinsic, it is like other irreducible intrinsic factors for elementary and basic particles or aspects of spatiotemporal segments (if one exchanges particle theory for field theory): their presence and nature is not to be explained in terms of anything else. An account of this kind provides maximum determinacy.

6.10 PYTHAGOREANISM

The progression to Pythagoreanism (all is number) goes from the measure of the observably measurable to the quantity of that observed measure as it is used for further quantity assessments of what is

unobserved. The dispositional and qualitative of any intrinsic property might be analogous to the way shape and size are of extension. In each case, the one cannot exist without the other, although it appears that one could *vary* independently of the other. *Contra* Hume, they are distinct but not separable. And *contra* Hume, there are cases of distinctness that lack separability but which *must* co-vary, for instance, the old example of equiangular and equilateral.

We must logically exclude separability and affirm the necessity of both dispositional and qualitative for any property, but then we are free to decide on any given case whether their co-variance is necessary or contingent. The properties that are constitutive of any state of affairs must be qualitative *as well as* dispositional and dispositional *as well as* qualitative. They are correlative (Locke) and inseparable.

It also appears that causal relations between properties involved in causal situations could be necessary or contingent. An example of necessary causal relations between distinct properties is how a square peg does not fit into a round hole in quite the way a round peg does. An apparent example of contingent relations between distinct properties in a causal situation is that obtaining between the freezing and expansion of water.

Examples of contingency of causal situations, following Locke's suggestion, might be only 'seeming' examples. When we get, if we ever do, to what constitutes macroscopic entities, we get down to a specificity of how the work gets done. As we move among the fittings within the 'finer interstices' of the 'insensible corpuscles,' the appearance of contingency could fade. It is there that the measures of quantities are suited to the mathematicizations of nature itself with its accruing necessities. Relations within the most intimate parts of nature also get their expression (and, it is tempting to think, their *full* expression) in terms of algorithms and mathematical formulae.

Let there be a warning: 'This way lies Pythagoreanism.' We must see that physics has tended to be, in Locke's phrase, a 'partial consideration' *qua* the measures of quantities and not let it become a denial and an expungement of the properties for and of which the quantities have a measure. Richard Feynman puts it this way:

If we look at a glass of wine closely enough we will see the entire universe. There are the things of physics: the twisting liquid which evaporates depending on the wind and weather, the reflections in the glass, and our imagination adds the atoms. The glass is a distillation of the earth's rocks,

and in its composition we see the secrets of the universe's age, and the evolution of stars. . . . There are the ferments, the enzymes, the substrates, and the products. There in wine is found the great generalizations: all life is fermentation. . . . How vivid is the claret, pressing its existence into the consciousness that watches it! If our small minds, for some convenience, divide this glass of wine, this universe, into parts—physics, biology, geology, astronomy, psychology, and so on—remember that nature does not know it! So let us put it all back together, not forgetting ultimately what it is for. Let it give us one more final pleasure: drink it and forget it all! (Feynman *et al.* 1963: lec. 3, 10)

Physicists' partial consideration of qualities *qua* only their measures works well enough until perhaps the end of the road of the *reductio ad absurdum* of Pythagoreanism. Then the task must be to state the indispensable qualities for which we have considered only their measures. We must 'put it all back together,' and that will take *more*, much more, as Feynman himself sometimes realized, than to 'drink it and forget it all!'

Properties of things at the macroscopic and molecular levels are complexes of the simpler properties of their constituents in all of their interrelatednesses and interreactivenesses. The tendency toward Pythagoreanism increases as the posited constituents and their changes are further and further removed from direct observation. At the level of the entities of particle physics, the quantities assessed for changes and change potentials are projected from the observable changes of objects and measuring devices and by the direction derived from available mathematical models. These quantities do service for what is required for mathematicizations in terms of which the theory is to be ultimately expressed.

Properties that the quantities of changes and change potentials are of might not be explicitly denied, but they are considered exclusively in terms of their numerical nature. From a Pythagorean point of view, quantities of projected change and change potentials are nested or grouped uniquely as intrinsic to, and typifying of, the numerical nature of some theoretical entity, rather like number-packets of algorithms and mathematical formulae in space-time. What changes and change potentials represent over and above pure quantity can be disregarded in the partial consideration *qua* numbers formed by the mathematicization of projected quantities of changes and change potentials. This non-regard of the properties in terms of which changes occur and change potentials stand can, if it turns into a denial, become

Pythagoreanism or, perhaps, the propertyless there-nesses of the simple atoms of extreme atomism.

We have been led by Quine and by others to think that necessity and contingency are one, that there is no distinction in reality between them. This brings to mind a comic strip in which one character says to the other, 'Marriage is where two people become one.' In the next panel, the second character clearly is considering the statement. In the final panel, the second character asks, 'Which one?'

Quine's answer seemed to be, 'All is contingent.' But then, in 'Whither material objects?' (1976), he took the step from the need of the existence of numbers for physics (the measure of quantities), with an invocation of the Principle of the Identity of Empirically Isomorphic Theories (a fancy term for the verificationism Quine never rejected), to Pythagoreanism—all is number, that is, numbers and their relations—the mathematicization of space and time:

Carnap was propounding such a *Koordinatensprache* already in 1934 [*Logische Syntax der Sprache*, II, 40], and not because of constraints on the notion of physical object from the side of physics; for the scheme has also a certain intrinsic appeal. Numbers and other mathematical objects are wanted in physics anyway, so one may as well enjoy their convenience as coordinates for physical objects; and then, having come thus far, one can economize a little by dispensing with the physical objects. . . . As physicalists we have welcomed bodies with open arms. . . . On the other hand the mathematical objects attained the ontological scene only begrudgedly for services rendered. . . . It is ironical, then, that we at length find ourselves constrained to this anti-physical sort of reduction from the side of physics itself. It is this I have wanted to bring out. (Quine 1976: 502)

and

Physical objects, next, evaporated into space-time regions; but this was the outcome of physics itself. Finally the regions went over into pure sets; still, the set theory itself was there for no other reason than the need for mathematics as an adjunct to physical theory. (Quine 1976: 502-3)

After that, the Quinean answer to the question, 'Which one?' might better be, 'All is necessary.'

6.11 BACK FROM THE BRINK

The unfettered deontologizing that results in a world of pure number seems as clear a *reductio* as any in philosophy. There are two

hoary alternative detours on the road back from the unworldly abstraction of Pythagoreanism. Reversing direction to move back from the Quantities to the Measures and Measure Potentials is just old-fashioned Operationalism all over again. Moving further back to the measurer's possible measure-observations is just Idealism—Phenomenalism—Subjectivism all over again.

Once we recognize that the properties of nature require the qualitative as well as the dispositional, there seems no alternative remaining for the road back from Pythagoreanism but to ask, 'What are the *physical qualia* (that is, qualities)?'

This is not to ask for anything inconsistent with the conservation of energy or the laws of thermodynamics. The question is meant only to indicate that mathematicizations in physical theory are partial characterizations of what is changing and at work. To make explicit the need for qualities is not to add more work by something not measured or measurable. Properties (including both qualitative and dispositional aspects) of elementary particles or segments of fields, whatever these properties might, in the end, turn out to be, are what change and have typical change potentials whose measures are ascribed and given quantities. These properties have been tacitly there all along, as they needed to be.

We must see physics as a partial consideration *qua* projected quantities of changes and change potentials, not as the expungement of properties including their qualities and dispositions for which there are those quantities and change potentials. What the simpler properties among the 'insensible corpuscles' that constitute the macroscopic properties really are (whether sentient or nonsentient) might be a real surprise.

Qualities of shape and size are intrinsic and provide the form and extent of the 'shell' of the entities that have them. These qualities are space-fillings noted by Berkeley, Hume, and Blackburn (1990) in that they are needed as intrinsic to what has size and shape and are the extension limits of these specific properties. They are needed for *what* is changing or different by virtue of which all of the quantities of such changes and differences of ultimate constituents (whether particles, aspects of fields, or superstrings) are assessed.

These needed qualities should not be ontologically questionable secondary qualities that, for many, have come to be thought of in terms of primary qualities, leaving aside the status of the questions of their powers to affect observers.

6.12 NEUROLOGICAL PYTHAGOREANISM

When we consider the need for physical *qualia* (that is, qualities), even in the finest interstices of nature, largely unregarded and unknown, among them should belong the *qualia* (qualities) required for the sensing and feeling parts of physical nature. But first things first—let us appreciate the need for physical *qualia* (qualities) in nonsentient nature and make sure we do not leave out any that are needed.

An account of neuronal qualities in terms of a purely directional vector function with its dispositionalism for potential alternative trajectories would embody a pure dispositionalism, something like the on-the-go American Sunday driver. Every arrival point is seen only as a point for departure, and the qualitative nature of what is present at any point in the driver's progress is of no interest. The qualitative nature of what occupies the place is spelled out in terms only of its actual and potential trajectories from and to other places. This vectorial approach mathematizes nicely, but one needs a model explicitly incorporating vectors (for directional connectivities) and single cell groups (for the properties of *what* are connecting) with the different research emphases of each made necessary to the other.

It is almost inevitable for functionalist-driven researchers and theorists to place exclusive emphasis on the neuronal interconnections within the neural network. This is the road to Pythagoreanism of the brain. Against this is a useful corrective by P. A. Getting:

Although knowledge of connectivity is essential, network operation depends upon the 'cooperative interaction' (Selverston *et al.* 1983) among multiple network, synaptic, and cellular properties, many of which are inherently nonlinear. No longer can neural networks be viewed as the interconnection of many like elements by simple excitatory or inhibitory synapses. Neurons not only sum synaptic inputs but are endowed with a diverse set of intrinsic properties that allow them to generate complex activity patterns. Likewise, synapses are not just excitatory or inhibitory but possess an equally diverse set of properties. The operation of a neural network must be considered as the parallel action of neurons or classes of neurons, each with potentially different input/output relationships and intrinsic capabilities interconnected by synapses with a host of complex properties' (Getting 1989: 187).

The task is to discover those quality-disposition properties, in both psychological and nonpsychological domains, for which changes and

change potentials have been given quantities. At the most basic level of elementary particles, this task needs not only the discipline of physics and what Bertrand Russell called 'a nose for reality,' but also a great deal of luck.

Let me repeat: this is no threat to the laws of thermodynamics. I am not suggesting the addition of 'an excess of work from nowhere,' but instead noting that our task is to make what is intrinsic to the properties by virtue of which the work is done salient and evident to the mind. It is simply taking note of what is needed to make natural properties *whole*. This will not be expressed *only* in terms of further algorithms and other mathematical formulae, however essential these may be for the depiction of the intrinsic character of Locke's 'finer interstices of nature.'

There is, then, a *physical* qualia-qualities problem, leaving aside what problem, if any, arises for *mental* qualia-qualities.

One objective of this and the two previous chapters has been to outline a gradualist account of reality that will emerge more fully in subsequent chapters. One element of that account is the thesis that the world includes properties that are at once dispositional and qualitative. I have begun to fill in what an ontological model that recognized this point would look like. If we accept this general ontological model, certain features thought to typify (and mystify) the mental can, with a little effort, be seen to be present already in the nonmental and even the nonsystemic cases that have been considered.