Real Patterns

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REAL PATTERNS*

ARE there really beliefs? Or are we learning (from neuro-science and psychology, presumably) that, strictly speaking, beliefs are figments of our imagination, items in a super-seded ontology? Philosophers generally regard such ontological questions as admitting just two possible answers: either beliefs exist or they do not. There is no such state as quasi existence; there are no stable doctrines of semirealism. Beliefs must either be vindicated along with the viruses or banished along with the banshees. A bracing conviction prevails, then, to the effect that when it comes to beliefs (and other mental items) one must be either a realist or an elimina-tive materialist.

I. REALISM ABOUT BELIEFS

This conviction prevails in spite of my best efforts over the years to undermine it with various analogies: are *voices* in your ontology?[1] Are *centers of gravity* in your ontology?[2]

It is amusing to note that my analogizing beliefs to centers of gravity has been attacked from both sides of the ontological dichot-omy, by philosophers who think it is simply obvious that centers of gravity are useful fictions, and by philosophers who think it is simply obvious that centers of gravity are perfectly real:

> The trouble with these supposed parallels . . . is that they are all strictly speaking *false,* although they are no doubt useful simplifications for many purposes. It is false, for example, that the gravitational attraction between the Earth and the Moon involves two point masses; but it is a good enough first approximation for many calculations. However, this is not at all what Dennett really wants to say about intentional states. For he insists that to adopt the intentional stance and interpret an agent as acting on certain beliefs and desires is to discern a pattern in his actions which is genuinely there (a pattern which is missed if we instead adopt a scientific stance): Dennett certainly does not hold that the role of inten-tional ascriptions is merely to give us a useful approximation to a truth that can be more accurately expressed in non-intentional terms.[3]

[1] *Content and Consciousness* (Boston: Routledge & Kegan Paul, 1969), ch. 1.

[2] "Three Kinds of Intentional Psychology," in R. Healey, ed., *Reduction, Time and Reality* (New York: Cambridge, 1981); and *The Intentional Stance* (Cam-bridge: MIT, 1987).

[3] Peter Smith, "Wit and Chutzpah," review of *The Intentional Stance* and Jerry A. Fodor's *Psychosemantics, Times Higher Education Supplement* (August 7, 1988), p. 22.

Compare this with Fred Dretske's[4] equally confident assertion of realism:

> I am a realist about centers of gravity . . . . The earth obviously exerts a gravitational attraction on *all* parts of the moon—not just its center of gravity. The *resultant* force, a vector sum, acts through a point, but this is something quite different. One should be very clear about what centers of gravity are *before* deciding whether to be literal about them, *before* deciding whether or not to be a center-of-gravity realist (*ibid.,* p. 511).

Dretske's advice is well-taken. What are centers of gravity? They are mathematical points—abstract objects or what Hans Reichenbach called *abstracta*—definable in terms of physical forces and other properties. The question of whether abstract objects are real —the question of whether or not "one should be a realist about them"—can take two different paths, which we might call the metaphysical and the scientific. The metaphysical path simply concerns the reality or existence of abstract objects generally, and does not distinguish them in terms of their scientific utility. Consider, for instance, the *center of population* of the United States. I define this as the mathematical point at the intersection of the two lines such that there are as many inhabitants north as south of the latitude, and as many inhabitants east as west of the longitude. This point is (or can be) just as precisely defined as the center of gravity or center of mass of an object. (Since these median strips might turn out to be wide, take the midline of each strip as the line; count as inhabitants all those within the territorial waters and up to twenty miles in altitude —orbiting astronauts do not count—and take each inhabitant's navel to be the determining point, etc.) I do not know the center of population's current geographic location, but I am quite sure it is west of where it was ten years ago. It jiggles around constantly, as people move about, taking rides on planes, trains, and automobiles, etc. I doubt that this abstract object is of any value at all in any scientific theory, but just in case it is, here is an even more trivial abstract object: Dennett's lost sock center: the point defined as the center of the smallest sphere that can be inscribed around all the socks I have ever lost in my life.

These abstract objects have the same metaphysical status as centers of gravity. Is Dretske a realist about them all? Should we be? I do not intend to pursue this question, for I suspect that Dretske is—and we should be—more interested in the scientific path to realism: centers

of gravity are real because they are (somehow) *good* abstract objects. They deserve to be taken seriously, learned about, used. If we go so far as to distinguish them as *real* (contrasting them, perhaps, with those abstract objects which are *bogus*), that is because we think they serve in perspicuous representations of real forces, "natural" properties, and the like. This path brings us closer, in any case, to the issues running in the debates about the reality of beliefs.

I have claimed that beliefs are best considered to be abstract objects rather like centers of gravity. Smith considers centers of gravity to be useful fictions while Dretske considers them to be useful (and hence?) real abstractions, and each takes his view to constitute a criticism of my position. The optimistic assessment of these opposite criticisms is that they cancel each other out; my analogy must have hit the nail on the head. The pessimistic assessment is that more needs to be said to convince philosophers that a mild and intermediate sort of realism is a positively attractive position, and not just the desperate dodge of ontological responsibility it has sometimes been taken to be. I have just such a case to present, a generalization and extension of my earlier attempts, via the concept of a *pattern*. My aim on this occasion is not so much to prove that my intermediate doctrine about the reality of psychological states is right, but just that it is quite possibly right, because a parallel doctrine is demonstrably right about some simpler cases.

We use folk psychology—interpretation of each other as believers, wanters, intenders, and the like—to predict what people will do next. Prediction is not the only thing we care about, of course. Folk psychology helps us understand and empathize with others, organize our memories, interpret our emotions, and flavor our vision in a thousand ways, but at the heart of all these is the enormous predictive leverage of folk psychology. Without its predictive power, we could have no interpersonal projects or relations at all; human activity would be just so much Brownian motion; we would be baffling ciphers to each other and to ourselves—we could not even conceptualize our own flailings. In what follows, I shall concentrate always on folk-psychological prediction, not because I make the mistake of ignoring all the other interests we have in people aside from making bets on what they will do next, but because I claim that our power to *interpret* the actions of others depends on our power—seldom explicitly exercised—to predict them.[5]

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[5] R. A. Sharpe, in "Dennett's Journey Towards Panpsychism," *Inquiry*, XXXII (1989): 233–240, takes me to task on this point, using examples from Proust to drive home the point that "Proust draws our attention to possible lives and these

Where utter patternlessness or randomness prevails, nothing is predictable. The success of folk-psychological prediction, like the success of any prediction, depends on there being some order or pattern in the world to exploit. Exactly where in the world does this pattern exist? What is the pattern a pattern *of*?[6] Some have thought, with Fodor, that the pattern of belief must in the end be a pattern of structures in the brain, formulae written in the language of thought. Where else could it be? Gibsonians might say the pattern is "in the light"—and Quinians (such as Donald Davidson and I) could almost agree: the pattern is discernible in agents' (observable) behavior when we subject it to "radical interpretation" (Davidson) "from the intentional stance" (Dennett).

When are the elements of a pattern real and not merely apparent? Answering this question will help us resolve the misconceptions that have led to the proliferation of "ontological positions" about beliefs, the different grades or kinds of realism. I shall concentrate on five salient exemplars arrayed in the space of possibilities: Fodor's industrial-strength Realism (he writes it with a capital 'R'); Davidson's regular strength realism; my mild realism; Richard Rorty's milder-than-mild irrealism, according to which the pattern is *only* in the eyes of the beholders, and Paul Churchland's eliminative materialism, which denies the reality of beliefs altogether.

In what follows, I shall assume that these disagreements all take place within an arena of common acceptance of what Arthur Fine[7] calls NOA, the natural ontological attitude. That is, I take the interest in these disagreements to lie not in differences of opinion about the ultimate metaphysical status of physical things or abstract things (e.g., electrons or centers of gravity), but in differences of opinion about whether beliefs and other mental states are, shall we say, *as real as* electrons or centers of gravity. I want to show that mild realism is the doctrine that makes the most sense when what we are

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possible lives are various. But in none of them is prediction of paramount importance" (240). I agree. I also agree that what makes people interesting (in novels and in real life) is precisely their unpredictability. But that unpredictability is only interesting against the backdrop of routine predictability on which all interpretation depends. As I note in *The Intentional Stance* (p. 79) in response to a similar objection of Fodor's, the same is true of chess: the game is interesting only because of the unpredictability of one's opponent, but that is to say: the intentional stance can usually eliminate *only* ninety percent of the legal moves.

[6] Norton Nelkin, "Patterns," forthcoming.

[7] *The Shaky Game: Einstein Realism and the Quantum Theory* (Chicago: University Press, 1986); see esp. p. 153n, and his comments there on Rorty, which I take to be consonant with mine here.
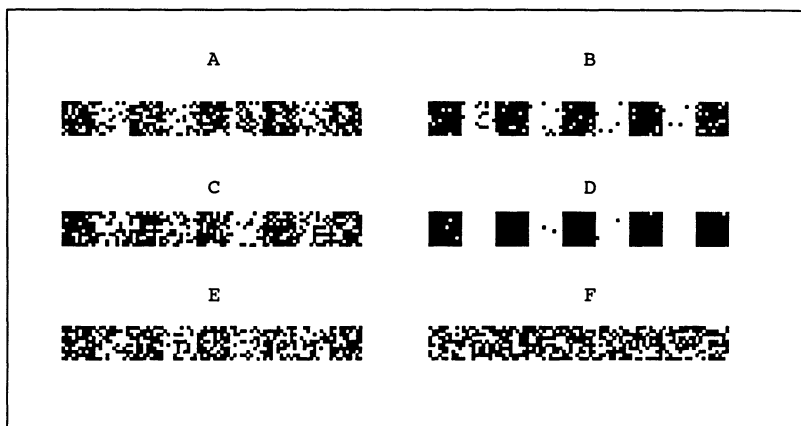
Figure 1

talking about is real patterns, such as the real patterns discernible from the intentional stance.[8]

In order to make clear the attractions and difficulties of these different positions about patterns, I shall apply them first to a much simpler, more readily visualized, and uncontroversial sort of pattern.

II. THE REALITY OF PATTERNS

Consider the six objects in Figure 1 (which I shall call *frames*):

We can understand a frame to be a finite subset of data, a window on an indefinitely larger world of further data. In one sense $A-F$ all display different patterns; if you look closely you will see that no two frames are exactly alike ("atom-for-atom replicas," if you like). In another sense, $A-F$ all display the same pattern; they were all made by the same basic process, a printing of ten rows of ninety dots, ten black dots followed by ten white dots, etc. The overall effect is to create five equally spaced black squares or bars in the window. I take it that this pattern, which I shall dub *bar code*, is a real pattern if anything is. But some random (actually pseudo-random) "noise" has been allowed to interfere with the actual printing. The noise ratio is as follows:

A: 25% B: 10%

C: 25% D: 1%

E: 33% F: 50%

[8] See *The Intentional Stance,* pp. 38–42, "Real patterns, deeper facts, and empty questions."

It is impossible to see that F is not purely (pseudo-) random noise; you will just have to take my word for it that it was actually generated by the same program that generated the other five patterns; all I changed was the noise ratio.

Now, what does it mean to say that a pattern in one of these frames is real, or that it is really there? Given our privileged information about how these frames were generated, we may be tempted to say that there is a single pattern in all six cases—even in F, where it is "indiscernible." But I propose that the self-contradictory air of "indiscernible pattern" should be taken seriously. We may be able to make some extended, or metaphorical, sense of the idea of indiscernible patterns (or invisible pictures or silent symphonies), but in the root case a pattern is "by definition" a candidate for pattern *recognition*. (It is this loose but unbreakable link to observers or perspectives, of course, that makes "pattern" an attractive term to someone perched between instrumentalism and industrial-strength realism.)

Fortunately, there is a standard way of making these intuitions about the discernibility-in-principle of patterns precise. Consider the task of transmitting information about one of the frames from one place to another. How many bits of information will it take to transmit each frame? The least efficient method is simply to send the "bit map," which identifies each dot *seriatim* ("dot one is black, dot two is white, dot three is white, . . ."). For a black-and-white frame of 900 dots (or pixels, as they are called), the transmission requires 900 bits. Sending the bit map is in effect verbatim quotation, accurate but inefficient. Its most important virtue is that it is equally capable of transmitting any pattern or any particular instance of utter patternlessness.

Gregory Chaitin's[9] valuable definition of mathematical randomness invokes this idea. A series (of dots or numbers or whatever) is random if and only if the information required to describe (transmit) the series accurately is *incompressible:* nothing shorter than the verbatim bit map will preserve the series. Then a series is not random —has a pattern—if and only if there is some more efficient way of describing it.[10] Frame D, for instance, can be described as "ten rows

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[9] "Randomness and Mathematical Proof," *Scientific American,* CCXXXII (1975): 47–52.

[10] More precisely: "A series of numbers is random if the smallest algorithm capable of specifying it to a computer has about the same number of bits of information as the series itself" (Chaitin, p. 48). This is what explains the fact that the "random number generator" built into most computers is not really properly named, since it is some function describable in a few bits (a little subroutine that is called for some output whenever a program requires a "random" number or series). If I send you the description of the pseudo-random number generator on

of ninety: ten black followed by ten white, etc., *with the following exceptions:* dots 57, 88, ..." This expression, suitably encoded, is much shorter than 900 bits long. The comparable expressions for the other frames will be proportionally longer, since they will have to mention, verbatim, more exceptions, and the degeneracy of the "pattern" in F is revealed by the fact that its description in this system will be no improvement over the bit map—in fact, it will tend on average to be trivially longer, since it takes some bits to describe the pattern that is then obliterated by all the exceptions.

Of course, there are bound to be other ways of describing the evident patterns in these frames, and some will be more efficient than others—in the precise sense of being systematically specifiable in fewer bits.[11] Any such description, if an improvement over the bit map, is the description of a real pattern in the data.[12]

Consider bar code, the particular pattern seen in $A-E$, and almost perfectly instantiated in D. *That* pattern is quite readily discernible to the naked human eye in these presentations of the data, because of the particular pattern-recognition machinery hard-wired in our visual systems—edge detectors, luminance detectors, and the like. But the very same data (the very same streams of bits) presented in some other format might well yield no hint of pattern to us, especially in the cases where bar code is contaminated by salt and pepper, as in frames A through C. For instance, if we broke the 900-bit series of frame B into 4-bit chunks, and then translated each of these into hexadecimal notation, one would be hard pressed indeed to tell the resulting series of hexadecimal digits from a random series, since the hexadecimal chunking would be seriously out of phase with the deci-

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my computer, you can use it to generate exactly the same infinite series of random-seeming digits.

[11] Such schemes for efficient description, called compression algorithms, are widely used in computer graphics for saving storage space. They break the screen into uniformly colored regions, for instance, and specify region boundaries (rather like the "paint by numbers" line drawings sold in craft shops). The more compli-cated the picture on the screen, the longer the compressed description will be; in the worst case (a picture of confetti randomly sprinkled over the screen) the com-pression algorithm will be stumped, and can do no better than a verbatim bit map.

[12] What about the "system" of pattern description that simply baptizes frames with proper names (A through F, in this case) and tells the receiver which frame is up by simply sending 'F'? This looks much shorter than the bit map until we consider that such a description must be part of an entirely general system. How many proper names will we need to name all possible 900-dot frames? Trivially, the 900-bit binary number, 11111111 . . . . To send the "worst-case" proper name will take exactly as many bits as sending the bit map. This confirms our intuition that proper names are maximally inefficient ways of couching generalizations ("Alf is tall and Bill is tall and . . .").

mal pattern—and hence the "noise" would not "stand out" as noise. There are myriad ways of displaying any 900-bit series of data points, and not many of them would inspire us to concoct an efficient description of the series. Other creatures with different sense organs, or different interests, might readily perceive patterns that were imperceptible to us. The patterns would be *there* all along, but just invisible to *us*.

The idiosyncracy of perceivers' capacities to discern patterns is striking. Visual patterns with axes of vertical symmetry stick out like sore thumbs for us, but if one simply rotates the frame a few degrees, the symmetry is often utterly beyond noticing. And the "perspectives" from which patterns are "perceptible" are not restricted to variations on presentation to the sense modalities. Differences in knowledge yield striking differences in the capacity to pick up patterns. Expert chess players can instantly perceive (and subsequently recall with high accuracy) the total board position in a real game, but are much worse at recall if the same chess pieces are randomly placed on the board, even though to a novice both boards are equally hard to recall.[13] This should not surprise anyone who considers that an expert speaker of English would have much less difficulty perceiving and recalling

The frightened cat struggled to get loose.

than

Te ser.ioghehnde t srugfcalde go tgtt ohle

which contains the same pieces, now somewhat disordered. Expert chess players, unlike novices, not only know how to *play* chess; they know how to *read* chess—how to see the patterns at a glance.

A pattern exists in some data—is real—if *there is* a description of the data that is more efficient than the bit map, whether or not anyone can concoct it. Compression algorithms, as general-purpose pattern describers, are efficient ways of transmitting exact copies of frames, such as $A–F$, from one place to another, but our interests often favor a somewhat different goal: transmitting *inexact* copies that nevertheless preserve "the" pattern that is important to us. For some purposes, we need not list the exceptions to bar code, but only transmit the information that the pattern is bar code with $n\%$ noise. Following this strategy, frames A and C, though discernibly different under careful inspection, count as *the same pattern*, since what mat-

[13] A. D. de Groot, *Thought and Choice in Chess* (The Hague: Mouton, 1965).

ters to us is that the pattern is bar code with 25% noise, and we do not care which particular noise occurs, only that it occurs.

Sometimes we are interested in not just ignoring the noise, but eliminating it, improving the pattern in transmission. Copy-editing is a good example. Consider the likely effect thes santince wull hive hod on tha cupy adutor whu preparis thas monescrupt fur prunteng. *My* interest in this particular instance is that the "noise" be transmitted, not removed, though I actually do not care exactly *which* noise is there.

Here then are three different attitudes we take at various times toward patterns. Sometimes we care about exact description or reproduction of detail, at whatever cost. From this perspective, a real pattern in frame A is *bar code with the following exceptions: 7, 8, 11, ...* At other times we care about the noise, but not where in particular it occurs. From this perspective, a real pattern in frame A is *bar code with 25% noise.* And sometimes, we simply tolerate or ignore the noise. From this perspective, a real pattern in frame A is simply: *bar code.* But is bar code really there in frame A? I am tempted to respond: Look! You can see it with your own eyes. But there is something more constructive to say as well.

When two individuals confront the same data, they may perceive different patterns in them, but since we can have varied interests and perspectives, these differences do not all count as disagreements. Or in any event they should not. If Jones sees pattern α (with $n\%$ noise) and Brown sees pattern β (with $m\%$ noise) there may be no ground for determining that one of them is right and the other wrong. Suppose they are both using their patterns to bet on the next datum in the series. Jones bets according to the "pure" pattern α, but budgets for $n\%$ errors when he looks for odds. Brown does likewise, using pattern β. If both patterns are real, they will both get rich. That is to say, so long as they use their expectation of deviations from the "ideal" to temper their odds policy, they will do better than chance —perhaps very much better.

Now suppose they compare notes. Suppose that α is a simple, easy-to-calculate pattern, but with a high noise rate—for instance, suppose α is bar code as it appears in frame E. And suppose that Brown has found some periodicity or progression in the "random" noise that Jones just tolerates, so that β is a much more complicated description of pattern-superimposed-on-pattern. This permits Brown to do better than chance, we may suppose, at predicting when the "noise" will come. As a result, Brown budgets for a lower error rate—say only 5%. "What you call noise, Jones, is actually pattern," Brown might say. "Of course there is still *some* noise in my pattern,

but my pattern is better—more real—than yours! Yours is actually just a mere appearance." Jones might well reply that it is all a matter of taste; he notes how hard Brown has to work to calculate predictions, and points to the fact that he is getting just as rich (or maybe richer) by using a simpler, sloppier system and making more bets at good odds than Brown can muster. "My pattern is perfectly real— look how rich I'm getting. If it were an illusion, I'd be broke."

This crass way of putting things—in terms of betting and getting rich—is simply a vivid way of drawing attention to a real, and far from crass, trade-off that is ubiquitous in nature, and hence in folk psychology. Would we prefer an extremely compact pattern description with a high noise ratio or a less compact pattern description with a lower noise ratio? Our decision may depend on how swiftly and reliably we can discern the simple pattern, how dangerous errors are, how much of our resources we can afford to allocate to detection and calculation. These "design decisions" are typically not left to us to make by individual and deliberate choices; they are incorporated into the design of our sense organs by genetic evolution, and into our culture by cultural evolution. The product of this design evolution process is what Wilfrid Sellars[14] calls our *manifest image,* and it is composed of folk physics, folk psychology, and the other pattern-making perspectives we have on the buzzing blooming confusion that bombards us with data. The ontology generated by the manifest image has thus a deeply pragmatic source.[15]

Do these same pragmatic considerations apply to the scientific image, widely regarded as the final arbiter of ontology? Science is supposed to carve nature at the joints—at its *real* joints, of course. Is it permissible in science to adopt a carving system so simple that it makes sense to tolerate occasional misdivisions and consequent mispredictions? It happens all the time. The ubiquitous practice of using idealized models is exactly a matter of trading off reliability and accuracy of prediction against computational tractability. A particularly elegant and handy oversimplification may under some circumstances be irresistible. The use of Newtonian rather than Einsteinian mechanics in most mundane scientific and engineering calculations is an obvious example. A tractable oversimplification may be attrac-

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[14] *Science, Perception and Reality* (Boston: Routledge & Kegan Paul, 1963).

[15] In "Randomness and Perceived Randomness in Evolutionary Biology," *Synthese,* XLIII (1980): 287–329, William Wimsatt offers a nice example (296): while the insectivorous bird tracks individual insects, the anteater just averages over the ant-infested area; one might say that, while the bird's manifest image quantifies over insects, 'ant' is a mass term for anteaters. See the discussion of this and related examples in my *Elbow Room* (Cambridge: MIT, 1984), pp. 108–110.

tive even in the face of a high error rate; considering inherited traits to be carried by single genes "for" those traits is an example; considering agents in the marketplace to be perfectly rational self-aggrandizers with perfect information is another.

III. PATTERNS IN LIFE

The time has come to export these observations about patterns and reality to the controversial arena of belief attribution. The largish leap we must make is nicely expedited by pausing at a stepping-stone example midway between the world of the dot frames and the world of folk psychology: John Horton Conway's Game of Life. In my opinion, every philosophy student should be held responsible for an intimate acquaintance with the Game of Life. It should be considered an essential tool in every thought-experimenter's kit, a prodigiously versatile generator of philosophically important examples and thought experiments of admirable clarity and vividness. In *The Intentional Stance,* I briefly exploited it to make a point about the costs and benefits of risky prediction from the intentional stance,[16] but I have since learned that I presumed too much familiarity with the underlying ideas. Here, then, is a somewhat expanded basic introduction to Life.[17]

Life is played on a two-dimensional grid, such as a checkerboard or a computer screen; it is not a game one plays to win; if it is a game at all, it is solitaire. The grid divides space into square cells, and each cell is either ON or OFF at each moment. Each cell has eight neighbors: the four adjacent cells north, south, east, and west, and the four diagonals: northeast, southeast, southwest, and northwest. Time in the Life world is also discrete, not continuous; it advances in ticks, and the state of the world changes between each tick according to the following rule:

> Each cell, in order to determine what to do in the next instant, counts how many of its eight neighbors is ON at the present instant. If the answer is exactly two, the cell stays in its present state (ON or OFF) in the next instant. If the answer is exactly three, the cell is ON in the next instant whatever its current state. Under all other conditions the cell is OFF.

The entire physics of the Life world is captured in that single, unexceptioned law. [While this is the fundamental law of the "phys-

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[16] *The Intentional Stance,* pp. 37–9.

[17] Martin Gardner introduced the Game of Life to a wide audience in two columns in *Scientific American* in October, 1970, and February, 1971. William Poundstone, *The Recursive Universe: Cosmic Complexity and the Limits of Scientific Knowledge* (New York: Morrow, 1985), is an excellent exploration of the game and its philosophical implications. Two figures from Poundstone's book are reproduced, with kind permission from the author and publisher, on pp. 39 & 40.

ics" of the Life world, it helps at first to conceive this curious physics in biological terms: think of cells going ON as births, cells going OFF as deaths, and succeeding instants as generations. Either overcrowding (more than three inhabited neighbors) or isolation (less than two inhabited neighbors) leads to death.] By the scrupulous application of this single law, one can predict with perfect accuracy the next instant of any configuration of ON and OFF cells, and the instant after that, and so forth. In other words, the Life world is a toy world that perfectly instantiates Laplace's vision of determinism: given the state description of this world at an instant, we finite observers can perfectly predict the future instants by the simple application of our one law of physics. Or, in my terms, when we adopt the physical stance toward a configuration in the Life world, our powers of prediction are perfect: there is no noise, no uncertainty, no probability less than one. Moreover, it follows from the two-dimensionality of the Life world that nothing is hidden from view. There is no backstage; there are no hidden variables; the unfolding of the physics of objects in the Life world is directly and completely visible.

There are computer simulations of the Life world in which one can set up configurations on the screen and then watch them evolve according to the single rule. In the best simulations, one can change the scale of both time and space, alternating between close-up and bird's-eye view. A nice touch added to some color versions is that ON cells (often just called pixels) are color-coded by their age; they are born blue, let us say, and then change color each generation, moving through green to yellow to orange to red to brown to black and then staying black unless they die. This permits one to see at a glance how old certain patterns are, which cells are co-generational, where the birth action is, and so forth.[18]

One soon discovers that some simple configurations are more interesting than others. In addition to those configurations which never change—the "still lifes" such as four pixels in a square—and those which evaporate entirely—such as any long diagonal line segment, whose two tail pixels die of isolation each instant until the line disappears entirely—there are configurations with all manner of periodicity. Three pixels in a line make a simple flasher, which becomes three pixels in a column in the next instant, and reverts to three in a line in the next, ad infinitum, unless some other configuration encroaches. Encroachment is what makes Life interesting:

[18] Poundstone, *op. cit.,* provides simple BASIC and IBM-PC assembly language simulations you can copy for your own home computer, and describes some of the interesting variations.
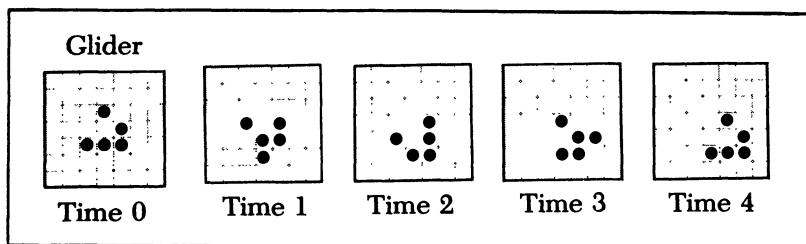
Figure 2: (from Poundstone, *op. cit.*).

among the periodic configurations are some that swim, amoeba-like, across the plane. The simplest is the *glider,* the five-pixel configuration shown taking a single stroke to the southeast in figure 2. Then there are the eaters, the puffer trains, and space rakes, and a host of other aptly named denizens of the Life world that emerge in the ontology of a new level, analogous to what I have called the design level. This level has its own language, a transparent foreshortening of the tedious descriptions one could give at the physical level. For instance:

> An eater can eat a glider in four generations. Whatever is being consumed, the basic process is the same. A bridge forms between the eater and its prey. In the next generation, the bridge region dies from over-population, taking a bite out of both eater and prey. The eater then repairs itself. The prey usually cannot. If the remainder of the prey dies out as with the glider, the prey is consumed (*ibid.*, p. 38).

Note that there has been a distinct ontological shift as we move between levels; whereas at the physical level there is no motion, and the only individuals, cells, are defined by their fixed spatial location, at this design level we have the motion of persisting objects; it is one and the same glider that has moved southeast in figure 2, changing shape as it moves, and there is one less glider in the world after the eater has eaten it in figure 3. (Here is a warming-up exercise for what is to follow: should we say that there is *real* motion in the Life world, or only *apparent* motion? The flashing pixels on the computer screen are a paradigm case, after all, of what a psychologist would call apparent motion. Are there *really* gliders that move, or are there just patterns of cell state that move? And if we opt for the latter, should we say at least that these moving patterns are real?)

Notice, too, that at this level one proposes generalizations that require 'usually' or 'provided nothing encroaches' clauses. Stray bits of debris from earlier events can "break" or "kill" one of the objects
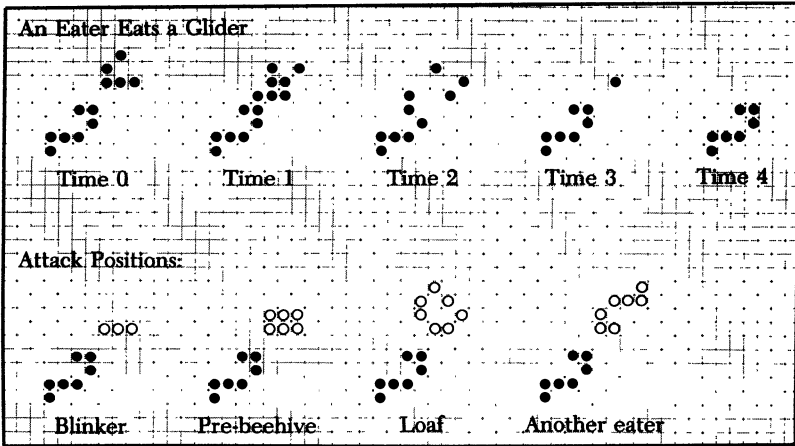
Figure 3: (from Poundstone, *op. cit.*).

in the ontology at this level; their *salience as real things* is considerable, but not guaranteed. To say that their salience is considerable is to say that one can, with some small risk, ascend to this design level, adopt its ontology, and proceed to predict—sketchily and riskily— the behavior of larger configurations or systems of configurations, without bothering to compute the physical level. For instance, one can set oneself the task of designing some interesting supersystem out of the "parts" that the design level makes available. Surely the most impressive triumph of this design activity in the Life world is the proof that a working model of a universal Turing machine can in principle be constructed in the Life plane! Von Neumann had already shown that in principle a two-dimensional universal Turing machine could be constructed out of cellular automata, so it was "just" a matter of "engineering" to show how, in principle, it could be constructed out of the simpler cellular automata defined in the Life world. Glider streams can provide the tape, for instance, and the tape reader can be some huge assembly of eaters, gliders, and other bits and pieces. What does this huge Turing machine look like? Poundstone calculates that the whole construction, a self-reproducing machine incorporating a universal Turing machine, would be on the order of 10^{13} pixels.

> Displaying a 10^{13}-pixel pattern would require a video screen about 3 million pixels across at least. Assume the pixels are 1 millimeter square (which is very high resolution by the standards of home computers). Then the screen would have to be 3 kilometers (about two miles) across. It would have an area about six times that of Monaco.

Perspective would shrink the pixels of a self-reproducing pattern to invisibility. If you got far enough away from the screen so that the entire pattern was comfortably in view, the pixels (and even the gliders, eaters and guns) would be too tiny to make out. A self-reproducing pattern would be a hazy glow, like a galaxy (*ibid.*, pp. 227–8).

Now, since the universal Turing machine can compute any computable function, it can play chess—simply by mimicking the program of any chess-playing computer you like. Suppose, then, that such an entity occupies the Life plane, playing chess against itself. Looking at the configuration of dots that accomplishes this marvel would almost certainly be unilluminating to anyone who had no clue that a configuration with such powers could exist. But from the perspective of one who had the hypothesis that this huge array of black dots was a chess-playing computer, enormously efficient ways of predicting the future of that configuration are made available. As a first step one can shift from an ontology of gliders and eaters to an ontology of symbols and machine states, and, adopting this higher design stance toward the configuration, predict its future *as* a Turing machine. As a second and still more efficient step, one can shift to an ontology of chess-board positions, possible chess moves, and the grounds for evaluating them; then, adopting the intentional stance toward the configuration, one can predict its future *as* a chess player performing intentional actions—making chess moves and trying to achieve checkmate. Once one has fixed on an interpretation scheme, permitting one to say which configurations of pixels count as which symbols (either, at the Turing machine level, the symbols '0' or '1', say, or at the intentional level, '*QxBch*' and the other symbols for chess moves), one can use the interpretation scheme to predict, for instance, that the next configuration to emerge from the galaxy will be such-and-such a glider stream (the symbols for '*RxQ*', say). There is risk involved in either case, because the chess program being run on the Turing machine may be far from perfectly rational, and, at a different level, debris may wander onto the scene and "break" the Turing machine configuration before it finishes the game.

In other words, real but (potentially) noisy patterns abound in such a configuration of the Life world, there for the picking up if only we are lucky or clever enough to hit on the right perspective. They are not *visual* patterns but, one might say, *intellectual* patterns. Squinting or twisting the page is not apt to help, while posing fanciful interpretations (or what W. V. Quine would call "analytical hypotheses") may uncover a goldmine. The opportunity confronting the observer of such a Life world is analogous to the opportunity confronting the cryptographer staring at a new patch of cipher text,

or the opportunity confronting the Martian, peering through a tele-scope at the Superbowl Game. If the Martian hits on the intentional stance—or folk psychology—as the right level to look for pattern, shapes will readily emerge through the noise.

IV. THE REALITY OF INTENTIONAL PATTERNS

The scale of compression when one adopts the intentional stance toward the two-dimensional chess-playing computer galaxy is stu-pendous: it is the difference between figuring out in your head what white's most likely (best) move is versus calculating the state of a few trillion pixels through a few hundred thousand generations. But the scale of the savings is really no greater in the Life world than in our own. Predicting that someone will duck if you throw a brick at him is easy from the folk-psychological stance; it is and will always be in-tractable if you have to trace the photons from brick to eyeball, the neurotransmitters from optic nerve to motor nerve, and so forth.

For such vast computational leverage one might be prepared to pay quite a steep price in errors, but in fact one belief that is shared by all of the representatives on the spectrum I am discussing is that "folk psychology" provides a description system that permits highly reliable prediction of human (and much nonhuman) behavior.[19] They differ in the explanations they offer of this predictive prowess, and the implications they see in it about "realism."

For Fodor, an industrial-strength Realist, beliefs and their kin would not be real unless the pattern dimly discernible from the perspective of folk psychology could also be discerned (more clearly, with less noise) as a pattern of structures in the brain. The pattern would have to be discernible from the different perspective provided by a properly tuned *syntactoscope* aimed at the purely formal (non-semantic) features of Mentalese terms written in the brain. For Fodor, the pattern seen through the noise by everyday folk psycholo-gists would tell us nothing about reality, unless it, and the noise, had the following sort of explanation: what we discern from the perspec-tive of folk psychology is the net effect of two processes: an ulterior, hidden process wherein the pattern exists quite pure, overlaid, and partially obscured by various intervening sources of noise: perfor-mance errors, observation errors, and other more or less random

[19] To see that the opposite poles share this view, see Fodor, *Psychosemantics* (Cambridge: MIT, 1987), ch. 1, "Introduction: the Persistence of the Attitudes"; and Paul Churchland, *Scientific Realism and the Plasticity of Mind* (New York: Cambridge, 1979), esp. p. 100: "For the P-theory [folk psychology] is in fact a marvelous intellectual achievement. It gives its possessor an explicit and systematic insight into the behaviour, verbal and otherwise, of some of the most complex agents in the environment, and its overall prowess in that respect remains unsur-passed by anything else our considerable theoretical efforts have produced."

obstructions. He might add that the interior belief-producing process was in this respect *just* like the process responsible for the creation of frames *A–F*. If you were permitted to peer behind the scenes at the program I devised to create the frames, you would see, clear as a bell, the perfect bar-code periodicity, with the noise thrown on afterward like so much salt and pepper.

This is often the explanation for the look of a data set in science, and Fodor may think that it is either the only explanation that can ever be given, or at any rate the only one that makes any sense of the success of folk psychology. But the rest of us disagree. As G. E. M. Anscombe[20] put it in her pioneering exploration of intentional explanation, "if Aristotle's account [of reasoning using the practical syllogism] were supposed to describe actual mental processes, it would in general be quite absurd. The interest of the account is that it describes an order which is there whenever actions are done with intentions . . ." (*ibid.*, p. 80).

But how *could* the order be there, so visible amidst the noise, if it were not the direct outline of a concrete orderly process in the background? Well, it *could* be there thanks to the statistical effect of very many concrete minutiae producing, as if by a hidden hand, an approximation of the "ideal" order. Philosophers have tended to ignore a variety of regularity intermediate between the regularities of planets and other objects "obeying" the laws of physics and the regularities of rule-following (that is, rule-*consulting*) systems.[21] These intermediate regularities are those which are preserved under selection pressure: the regularities dictated by principles of good design and hence homed in on by self-designing systems. That is, a "rule of thought" may be much more than a mere regularity; it may be a *wise* rule, a rule one would design a system by if one were a system designer, and hence a rule one would expect self-designing systems to "discover" in the course of settling into their patterns of activity. Such rules no more need be explicitly represented than do the principles of aerodynamics that are honored in the design of birds' wings.[22]

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[20] *Intention* (New York: Blackwell, 1957).

[21] A notable early exception is Sellars, who discussed the importance of just this sort of regularity in "Some Reflections on Language Games," *Philosophy of Science*, XXI (1954): 204–228. See especially the subsection of this classic paper, entitled "Pattern Governed and Rule Obeying Behavior," reprinted in Sellars's *Science, Perception and Reality*, pp. 324–7.

[22] Several interpreters of a draft of this article have supposed that the conclusion I am urging here is that beliefs (or their contents) are *epiphenomena* having no causal powers, but this is a misinterpretation traceable to a simplistic notion of causation. If one finds a predictive pattern of the sort just described one has *ipso facto* discovered a causal power—a difference in the world that makes a subsequent

The contrast between these different sorts of pattern-generation processes can be illustrated. The frames in figure 1 were created by a hard-edged process (ten black, ten white, ten black, . . .) obscured by noise, while the frames in figure 4 were created by a process almost the reverse of that: the top frame shows a pattern created by a normal distribution of black dots around means at $x = 10, 30, 50, 70$, and 90 (rather like Mach bands or interference fringes); the middle and bottom frames were created by successive applications of a very simple contrast enhancer applied to the top frame: a vertical slit "window" three pixels high is thrown randomly onto the frame; the pixels in the window vote, and majority rules. This gradually removes the salt from the pepper and the pepper from the salt, creating "artifact" edges such as those discernible in the bottom frame. The effect would be more striking at a finer pixel scale, where the black merges imperceptibly through grays to white but I chose to keep the scale at the ten-pixel period of bar code. I do not mean to suggest that it is impossible to tell the patterns in figure 4 from the patterns in figure 1. Of course it is possible; for one thing, the process that produced the frames in figure 1 will almost always show edges at exactly 10, 20, 30, . . . and almost never at 9, 11, 19, 21, . . . while there is a higher probability of these "displaced" edges being created by the process of figure 4 (as a close inspection of figure 4 reveals). Fine tuning could of course reduce these probabilities, but that is not my point. My point is that *even if* the evidence is substantial that the discernible pattern is produced by one process rather than another, it can be rational to ignore those differences and use the simplest pattern description (e.g., *bar code*) as one's way of organizing the data.

Fodor and others have claimed that an interior language of thought is the best explanation of the hard edges visible in "propositional attitude psychology." Churchland and I have offered an alternative explanation of these edges, an explanation for which the

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difference testable by standard empirical methods of variable manipulation. Consider the crowd-drawing power of a sign reading "Free Lunch" placed in the window of a restaurant, and compare its power in a restaurant in New York to its power in a restaurant in Tokyo. The intentional level is obviously the right level at which to predict and explain such causal powers; the sign more reliably produces a particular belief in one population of perceivers than in the other, and variations in the color of typography of the sign are not as predictive of variations in crowd-drawing power as are variations in (perceivable) meaning. The fact that the regularities on which these successful predictions are based are efficiently capturable (only) in intentional terms and are not derived from "covering laws" does not show that the regularities are not "causal"; it just shows that philosophers have often relied on pinched notions of causality derived from exclusive attention to a few examples drawn from physics and chemistry. Smith has pointed out to me that here I am echoing Aristotle's claim that his predecessors had ignored final causes.
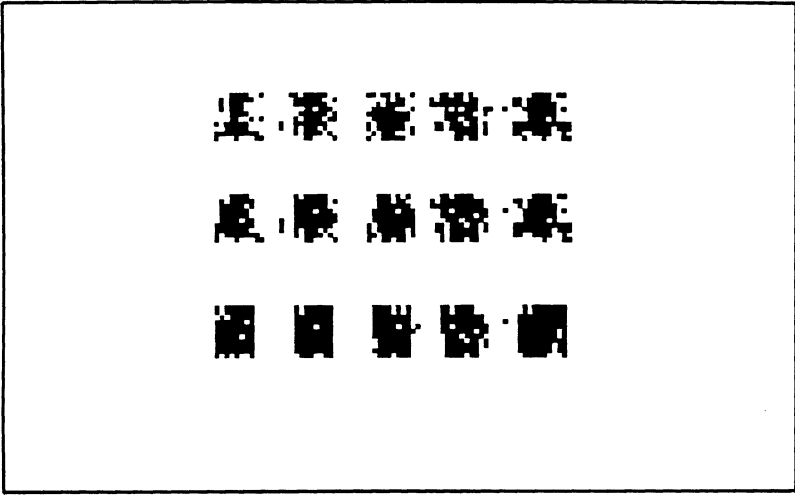
Figure 4

process that produced the frames in figure 4 is a fine visual meta-
phor. The process that produces the data of folk psychology, we
claim, is one in which the multidimensional complexities of the un-
derlying processes are projected *through linguistic behavior,* which
creates an appearance of definiteness and precision, thanks to the
discreteness of words.[23] As Churchland[24] puts it, a person's declara-
tive utterance is a "one-dimensional *projection*—through the com-
pound lens of Wernicke's and Broca's areas onto the idiosyncratic
surface of the speaker's language—a one-dimensional projection of
a four- or five-dimensional 'solid' that is an element in his true
kinematic state" (*ibid.,* p. 85).

Fodor's industrial-strength Realism takes beliefs to be things in the
head—just like cells and blood vessels and viruses. Davidson and I
both like Churchland's alternative idea of propositional-attitude
statements as indirect "measurements" of a reality diffused in the
behavioral dispositions of the brain (and body).[25] We think beliefs are

[23] See my discussion of the distinction between beliefs and (linguistically infected)
opinions; in *Brainstorms* (Montgomery, VT: Bradford, 1978), ch. 16, and in "The
Illusions of Realism," in *The Intentional Stance,* pp. 110–6.
    [24] "Eliminative Materialism and the Propositional Attitudes," this JOURNAL,
LXXVIII, 2 (February 1981): 67–90, esp. p. 85.
    [25] Churchland introduces the idea in *Scientific Realism and the Plasticity of
Mind,* pp. 100–7. My adoption of the idea was in "Beyond Belief," in A. Woodfield,
ed., *Thought and Object* (New York: Oxford, 1982), repr. as ch. 5 of *The Inten-
tional Stance.* Davidson's guarded approval is expressed in "What is Present to the
Mind?" read at the Sociedad Filosófica Ibero Americana meeting in Buenos Aires,
1989.

quite real enough to call real just so long as belief talk measures these complex behavior-disposing organs as predictively as it does. What do we disagree about? As John Haugeland[26] has pointed out, Davidson is more of a realist than I am, and I have recently tracked down the source of this disagreement to a difference of opinion we have about the status of Quine's principle of indeterminacy of translation, which we both accept.

For Davidson, the principle is not the shocker it is often taken to be; in fact, it is well-nigh trivial—the two different translation manuals between which no fact of the matter decides are like two different scales for measuring temperature.

> We know there is no contradiction between the temperature of the air being 32° fahrenheit and 0° celsius; there is nothing in this 'relativism' to show that the properties being measured are not 'real'. Curiously, though, this conclusion has repeatedly been drawn. . . . Yet in the light of the considerations put forward here, this comes to no more than the recognition that more than one set of one person's utterances might be equally successful in capturing the contents of someone else's thoughts or speech. Just as numbers can capture all the empirically significant relations among weights or temperatures in infinitely many ways, so one person's utterances can capture all the significant features of another person's thoughts and speech in different ways. This fact does not challenge the 'reality' of the attitudes or meanings thus reported.[27]

On Davidson's view, no substantive disagreements emerge from a comparison of the two description schemes, and so they can quite properly be viewed as competing descriptions of the same reality.

I think this is a flawed analogy. A better one is provided by the example of "rival" descriptions of patterns-with-noise. Consider two rival intentional interpretations of a single individual; they agree on the general shape of this individual's collection of beliefs (and desires, etc), but because of their different idealizations of the pattern, they do not agree point-for-point. Recalling a famous analogy of Quine's[28] and extending it beyond radical translation to radical interpretation (as Davidson and I both wish to do), we get the image in Figure 5.

To the left we see Brown's intentional interpretation of Ella; to the right, Jones's interpretation. Since these are intentional interpreta-

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[26] See the discussion of Haugeland's views in the last chapter of *The Intentional Stance*, "Mid-Term Examination: Compare and Contrast," pp. 348–9.

[27] Davidson, "What is Present to the Mind?" (ms.), p. 10.

[28] "Different persons growing up in the same language are like different bushes trimmed and trained to take the shape of identical elephants. The anatomical details of twigs and branches will fulfill the elephantine form differently from bush to bush, but the overall outward results are the same." *Word and Object* (Cambridge: MIT, 1960), p. 8.
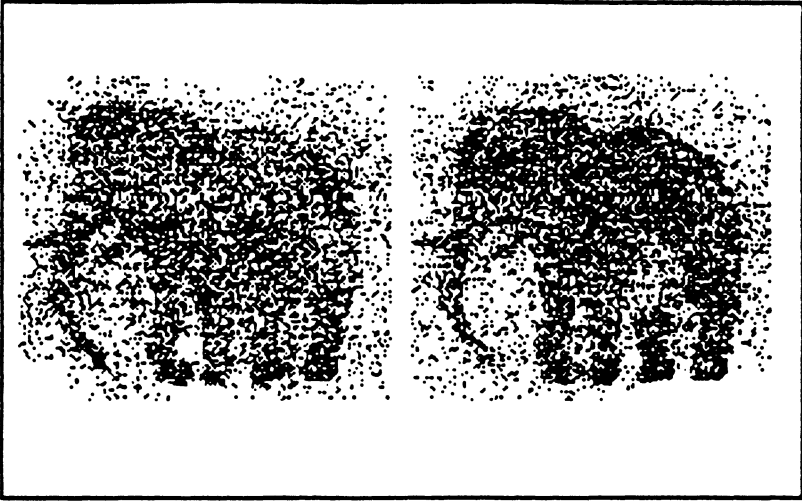
Figure 5

tions, the pixels or data points represent beliefs and so forth, not (for instance) bits of bodily motion or organs or cells or atoms, and since these are rival intentional interpretations of a single individual, the patterns discerned are not statistical averages (e.g., "Democrats tend to favor welfare programs") but personal cognitive idiosyncracies (e.g., "She thinks she should get her queen out early"). Some of the patterns may indeed be simple observed periodicities (e.g., "Ella wants to talk about football on Mondays") but we are to understand the pattern to be what Anscombe called the "order which is there" in the rational coherence of a person's set of beliefs, desires, and intentions.

Notice that here the disagreements can be substantial—at least before the fact: when Brown and Jones make a series of predictive bets, they will not always make the same bet. They may *often* disagree on what, according to their chosen pattern, will happen next. To take a dramatic case, Brown may predict that Ella will decide to kill herself; Jones may disagree. This is not a trivial disagreement of prediction, and in principle this momentous difference may emerge in spite of the overall consonance of the two interpretations.

Suppose, then, that Brown and Jones make a series of predictions of Ella's behavior, based on their rival interpretations. Consider the different categories that compose their track records. First, there are the occasions where they agree and are right. Both systems look good from the vantage point of these successes. Second, there are the occasions where they agree and are wrong. Both chalk it up to noise,

take their budgeted loss and move on to the next case. But there will also be the occasions where they disagree, where their systems make different predictions, and in these cases sometimes (but not always) one will win and the other lose. (In the real world, predictions are not always from among binary alternatives, so in many cases they will disagree and both be wrong.) When one wins and the other loses, it will look to the myopic observer as if one "theory" has scored a serious point against the other, but when one recognizes the possibility that both may chalk up such victories, and that there may be no pattern in the victories which permits either one to improve his theory by making adjustments, one sees that local triumphs may be insufficient to provide any ground in reality for declaring one account a closer approximation of the truth.

Now, some might think this situation is *always* unstable; eventually one interpretation is bound to ramify better to new cases, or be deducible from some larger scheme covering other data, etc. That might be true in many cases, but—and this, I think, is the central point of Quine's indeterminacy thesis—it need not be true in all. *If* the strategy of intentional-stance description is, as Quine says, a "dramatic idiom" in which there is ineliminable use of idealization, and if Fodor's industrial-strength Realism is thus not the correct explanation of the reliable "visibility" of the pattern, such radical indeterminacy is a genuine and stable possibility.

This indeterminacy will be most striking in such cases as the imagined disagreement over Ella's suicidal mindset. If Ella does kill herself, is Brown shown to have clearly had the better intentional interpretation? Not necessarily. When Jones chalks up his scheme's failure in this instance to a bit of noise, this is no more ad hoc or unprincipled than the occasions when Brown was wrong about whether Ella would order the steak not the lobster, and chalked those misses up to noise. This is not at all to say that an interpretation can never be shown to be just wrong; there is plenty of leverage within the principles of intentional interpretation to refute particular hypotheses—for instance, by forcing their defense down the path of Pickwickian explosion ("You see, she didn't believe the gun was loaded because she thought that those bullet-shaped things were chocolates wrapped in foil, which was just a fantasy that occurred to her because . . . ."). It *is* to say that there could be two interpretation schemes that were reliable and compact predictors over the long run, but that nevertheless disagreed on crucial cases.

It might seem that in a case as momentous as Ella's intention to kill herself, a closer examination of the details just prior to the fatal moment (if not at an earlier stage) would have to provide additional support for Brown's interpretation at the expense of Jones's inter-

pretation. After all, there would be at least a few seconds—or a few hundred milliseconds—during which Ella's decision to pull the trigger got implemented, and during that brief period, at least, the evidence would swing sharply in favor of Brown's interpretation. That is no doubt true, and it is *perhaps* true that had one gone into enough detail earlier, all this last-second detail could have been predicted—but to have gone into *those* details earlier would have been to drop down from the intentional stance to the design or physical stances. From the intentional stance, these determining considerations would have been invisible to both Brown and Jones, who were both prepared to smear over such details as noise in the interests of more practical prediction. Both interpreters concede that they will make false predictions, and moreover, that when they make false predictions there are apt to be harbingers of misprediction in the moments during which the *dénouement* unfolds. Such a brief swing does not constitute refutation of the interpretation, any more than the upcoming misprediction of behavior does.

How, then, does this make me less of a realist than Davidson? I see that there could be two different systems of belief attribution to an individual which differed *substantially* in what they attributed— even in yielding substantially different predictions of the individual's future behavior—and yet where no deeper fact of the matter could establish that one was a description of the individual's *real* beliefs and the other not. In other words, there could be two different, but equally real, patterns discernible in the noisy world. The rival theorists would not even agree on which parts of the world were pattern and which were noise, and yet nothing deeper would settle the issue.[29] The choice of a pattern would indeed be up to the observer, a matter to be decided on idiosyncratic pragmatic grounds. I myself do not see any feature of Davidson's position that would be a serious obstacle to his shifting analogies and agreeing with me. But then he would want to grant that indeterminacy is not such a trivial matter after all.[30]

What then is Rorty's view on these issues? Rorty wants to deny that any brand of "realism" could *explain* the (apparent?) success of the

[29] Cf. "The Abilities of Men and Machines," in *Brainstorms,* where I discuss two people who agree exactly on the future behavior of some artifact, but impose different Turing-machine interpretations of it. On both interpretations, the machine occasionally "makes errors" but the two interpreters disagree about which cases are the errors. (They disagree about which features of the object's behavior count as signal and which as noise.) Which Turing machine is it really? This question has no answer.

[30] Andrej Zabludowski seems to me to have overlooked this version of indeterminacy in "On Quine's Indeterminacy Doctrine," *Philosophical Review,* XCVIII (1989): 35–64.

intentional stance. But since we have already joined Fine and set aside the "metaphysical" problem of realism, Rorty's reminding us of this only postpones the issue. Even someone who has transcended the scheme/content distinction and has seen the futility of corre-spondence theories of truth must accept the fact that *within* the natural ontological attitude we sometimes explain success by corre-spondence: one does better navigating off the coast of Maine when one uses an up-to-date nautical chart than one does when one uses a road map of Kansas. Why? Because the former accurately represents the hazards, markers, depths, and coastlines of the Maine coast, and the latter does not. Now why does one do better navigating the shoals of interpersonal relations using folk psychology than using astro-logy? Rorty might hold that the predictive "success" we folk-psychol-ogy players relish is itself an artifact, a mutual agreement engen-dered by the egging-on or consensual support we who play this game provide each other. He would grant that the game has no rivals in popularity, due—in the opinion of the players—to the power it gives them to understand and anticipate the animate world. But he would refuse to endorse this opinion. How, then, would he distinguish this popularity from the popularity among a smaller coterie of astro-logy?[31] It is undeniable that astrology provides its adherents with a highly articulated system of patterns that they *think* they see in the events of the world. The difference, however, is that no one has ever been able to get rich by betting on the patterns, but only by selling the patterns to others.

Rorty would have to claim that this is not a significant difference; the rest of us, however, find abundant evidence that our allegiance to folk psychology as a predictive tool can be defended in coldly objec-tive terms. We agree that there is a real pattern being described by the terms of folk psychology. What divides the rest of us is the nature of the pattern, and the ontological implications of that nature.

Let us finally consider Churchland's eliminative materialism from this vantage point. As already pointed out, he is second to none in his appreciation of the power, to date, of the intentional stance as a strategy of prediction. Why does he think that it is nevertheless doomed to the trash heap? Because he anticipates that neuroscience will eventually—perhaps even soon—discover a pattern that is so clearly superior to the noisy pattern of folk psychology that everyone will readily abandon the former for the latter (except, perhaps, in the rough-and-tumble of daily life). This might happen, I suppose. But

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[31] Cf. my comparison of "the astrological stance" to the intentional stance, *The Intentional Stance,* p. 16.

Churchland here is only playing a hunch, a hunch that should not be seen to gain plausibility from reflections on the irresistible forward march of science. For it is not enough for Churchland to suppose that in principle, neuroscientific levels of description will explain more of the variance, predict more of the "noise" that bedevils higher levels. This is, of course, bound to be true in the limit—if we descend all the way to the neurophysiological "bit map." But as we have seen, the trade-off between ease of use and immunity from error for such a cumbersome system may make it profoundly unattractive.[32] If the "pattern" is scarcely an improvement over the bit map, talk of eliminative materialism will fall on deaf ears—just as it does when radical eliminativists urge us to abandon our ontological commitments to tables and chairs. A truly general-purpose, robust system of pattern description more valuable than the intentional stance is not an impossibility, but anyone who wants to bet on it might care to talk to me about the odds they will take.

What does all this show? Not that Fodor's industrial-strength Realism must be false, and not that Churchland's eliminative materialism must be false, but just that both views are gratuitously strong forms of materialism—presumptive theses way out in front of the empirical support they require. Rorty's view errs in the opposite direction, ignoring the impressive empirical track record that distinguishes the intentional stance from the astrological stance. Davidson's intermediate position, like mine, ties reality to the brute existence of pattern, but Davidson has overlooked the possibility of two or more *conflicting* patterns being superimposed on the same data—a more radical indeterminacy of translation than he had supposed possible. Now, once again, is the view I am defending here a sort of instrumentalism or a sort of realism? I think that the view itself is clearer than either of the labels, so I shall leave that question to anyone who stills find illumination in them.

<div align="right">DANIEL C. DENNETT</div>

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[32] As I have put it, physical-stance predictions trump design-stance predictions, which trump intentional-stance predictions—but one pays for the power with a loss of portability and a (usually unbearable) computational cost.

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[30] **On Quine's Indeterminacy Doctrine**
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The Philosophical Review, Vol. 98, No. 1. (Jan., 1989), pp. 35-63.
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