

## Eliminativist Undercurrents in the New Wave Model of Psychoneural Reduction

Cory Wright

*University of California, San Diego*

“New wave” reductionism aims at advancing a kind of reduction that is stronger than unilateral dependency of the mental on the physical. It revolves around the idea that reduction between theoretical levels is a matter of degree, and can be laid out on a continuum between a “smooth” pole (theoretical identity) and a “bumpy” pole (extremely revisionary). It also entails that both higher and lower levels of the reductive relationship sustain *some* degree of explanatory autonomy. The new wave predicts that reductions of folk psychology to neuroscience will be located in the middle of this continuum; as neuroscientific evidence about mental states checks in, theoretical folk psychology will therefore be moderately revised. However, the model has conceptual problems which preclude its success in reviving reductionism, and its commitment to a syntactic approach wrecks its attempt to rescue folk psychology. Moreover, the architecture of the continuum operates on a category mistake that sneaks in an eliminativist conclusion. I argue that new wave reductionism therefore tends to be eliminativism in disguise.

Psychoneural reductionism has recently been resuscitated. The revived version, dubbed the “new wave,” aims at advancing a unique kind of reduction that is stronger than unilateral dependency of the mental on the physical. It predicts that psychoneural reduction in general, and folk psychology in particular, will fall somewhere toward the middle of the intertheoretic reductive spectrum. The pivot of this position, as articulated by Bickle (1998), is that reduction comes in degrees. However, the conclusions drawn from the new wave are hurried and premature, and I will argue that it actually ends up being eliminativist in disguise. Ultimately, the ideological profile and potential of the new wave seems geared toward supplanting our

---

The author wishes to thank Michael Lynch, John Howard, Ron Endicott, John Bickle, Kenneth Sufka, for their inspiration and helpful comments. Requests for reprints should be sent to Cory Wright, Department of Philosophy, 0119, University of California, San Diego, 9500 Gilman Drive, La Jolla, California 92093–0119. Email: sarahbellum@mad.scientist.com

limited commonsense psychology with a perfected and more articulate neuroscience.

The new wave program is heir to the vintage models of microreduction and the structural spectrums of classical reduction. These classical models generally viewed reduction as deduction of the higher level theory to the lower level theory. Such a process required a set of cross-theoretic connecting principles to bridge the disparity of terms between the two levels of explanation. Primarily then, classical models focused on the derivability of laws of the reduced theory from the reducing theory, and the biconditional form that these connecting principles took. Unfortunately, the instability and logical status of these bridge laws, in conjunction with the familiar problems of multiple realizability and mental anomalism, were more than enough to sink the classical models of reduction (Bickle, 1995, pp. 49–54; Fodor, 1974, pp. 77–115; Kim, 1998, pp. 90–97).

The new wave of psychoneural reduction attempts to resurrect the efficacy of reductionism by doing something different. It utilizes axiomatized set theory predicates and employs a corrected analogue of the reduced theory to avoid these and other potent objections against classical reductionism. Subsequently, it attempts to provide a viable alternative grounded in the same spirit as classical reductionism, maintaining the same endpoint: to show that the causal powers of macrophenomenon are explainable in terms of the dynamics and causal powers of microproperties while sustaining some degree of autonomy. The new wave is thus a resuscitated attempt to maneuver between anti-reductionism and eliminativism.

This essay highlights the conceptual and architectural problems with the model itself, and then examines the model's predictions and applications, specifically its consequences for folk psychology. After briefly describing the new wave reductive program in the first section, I build on Endicott's (1998) initial criticisms against it, which reveal it to be untenable based on problems with its anticipation of mutual co-evolutionary feedback between theoretical levels. The next section explains how the new wave sneaks in an eliminativist conclusion based on a category mistake. These conceptual problems with the model suggest that it subsequently leads to embracing either anti-reductionism or eliminativism. In the penultimate section, I discuss the new wave's unsuccessful attempt, based on the approximation to actual cognitive dynamics, to save folk psychology from elimination. The effect is that new wave reduction ends up being more of a "new wave eliminativism," which raises the further question as to whether new wave eliminativism is a plausible position. The last section is a brief consideration of objections to the possibility that the new wave is eliminativist in nature.

### New Wave Reductionism

The new wave formally construes theories as sets of models, with reduction and replacement defined in terms of empirical base sets, membership and set inclusion, and other set-theoretic relations supplemented with homogenous or heterogenous ontological reductive links between members. It minimally involves three separate types of operative theories: the original, higher level theory  $T_R$  that is being reduced, the basic, lower level reducing theory  $T_B$ , and the corrected analogue  $T_R^*$  of the reducing theory. This last component,  $T_R^*$ , is a constructed representation specified within the framework of the reducing theory, and is designed to mimic the structure of  $T_R$ . In other words, it is stipulated that the lower level (neurobiological) theories supply the conceptual resources for this analogue. The purpose of  $T_R^*$  is to bypass the bridge laws that plagued the earlier, more antique versions of reduction. In particular, it substantiates the logical consistency required by *modus tollens*, which is to say, to eliminate the possibility of deriving the falsity of  $T_R$  from true premises about  $T_B$ . The integrity and success of each reduction therefore turns on the strength of this analogical relationship between the reduced  $T_R$  and the corrected  $T_R^*$ .

The architecture of the new wave is constituted by a spectrum of intertheoretic reduction, specified according to degrees of commensurability for paired theories. Ontological conclusions are secondary to, and dependent on, the nature of the relationship obtaining between theoretic levels. So, the reductions are typically characterized as corrected  $T_R^*$  theories flecked all along the continuum according to the degree to which they approximate the reduced  $T_R$ .  $T_R^*$  is deduced from  $T_B$ , allowing for intertheoretic mapping to occur between  $T_R^*$  and  $T_R$  such that a reductive assertion about the relationship between empirical base sets can be formulated. The location of each case on the intertheoretic reductive spectrum thus depends on how successful the translation from higher to lower level theories is, or the degree to which the obtaining reduction is smooth or bumpy. Churchland (1998, p. 26) explains one misconception of the reductionist strategy, in that it is "dubbed as seeking a direct explanatory bridge between highest level and lowest levels. This idea of 'explanation in a single bound' does stretch credulity, but neuroscientists are not remotely tempted by it."

If the analogue  $T_R^*$  is a perfectly equipotent isomorphic image, it operates as an exactly similar version of the original  $T_R$  targeted for reduction, and the two are, for all intensive purposes, indistinguishable. In this case the intratheoretic deduction of  $T_R^*$  from  $T_B$  is perfectly mapped onto the properties of  $T_R$ ; the analogical relationship constitutes an ideally smooth case where the ontology of the reduced  $T_R$  is wholly preserved. The reductive pairs are exactly similar, and the reduction is perfectly retentive,

requiring no correction whatsoever to either the theory or the ontology. Similarly, if the relationship is strongly analogous, then it requires minimal correction and ends up falling toward the retentive end according to the degree of correction required. Reductions of this sort — both ideally smooth and strongly analogous — demonstrate that the higher and lower level theories have accurately characterized the exact same entities or properties, although in different ways. On the other hand, if the relationship is poorly analogous, then the one is no version of the other (the structure and laws of  $T_R$  are negligibly mimicked by  $T_R^*$ ). At this end of the continuum, the corrective reduction is construed as rough, justifying the higher level theory's cessation and even possibly justifying the elimination of  $T_R$ 's ontology. A major overhaul of  $T_R$  substantiates its possible replacement in favor of the corrective counterpart. Notice that the tendency for abandonment, in even the bumpiest of reductions, does not necessarily disqualify the abandoned entities from having some minimal ontological status, since the nature of reduction is constituted by the fact that both higher and lower level theories have explanatory power in degrees, and ontological status is dependent on the intertheoretic reductions according to the new wave. Although elements of the higher level theory tend to be abandoned because of a lack of explanatory power in both bumpy reductions and eliminations, the action and radical incommensurability at this end of the continuum is unclear; the new wave has difficulty distinguishing bumpy reductions from outright replacements. As I will later show, the vagueness and ambiguity between the mechanisms underlying reduction and elimination at this end is an architectural flaw that substantiates an eliminativist conclusion about folk psychology.

The new wave model definitively predicts that all of psychology will ultimately reduce. Its overarching aim is for reduction *par excellence*, where the higher level, coarse-grained, theoretical explanations of phenomena are reconceptualized and refined in terms of a more powerful lower level theory. In particular, the new wave case for reduction is a broadly empirical prediction targeting higher level folk psychology — the collection of common homilies about the causes of human behavior — for revision by the lower level cognitive and computational neurosciences. Folk psychology, according to standard usage and following the reductive program, is here treated as a theory insofar as it is conjectural and proffers explanations about human behavior and cognition. The new wave predicts that the magnitude and frequency of the psychoneural reduction will fall somewhere in the middle of the intertheoretic reductive spectrum, in the same vein as classical equilibrium thermodynamics and statistical mechanics/microphysics. Bickle (1999) further advertises it as being ideally committed to cross-theoretic, interlevel property identity at the retentive end of the continuum — that is, smooth intertheo-

retic reduction where the ontology of the original  $T_R$  is retained. However, Bickle (1998) explicitly states that the bulk of reductions will not be so facile:

The potential psychology-to-neuroscience theory reductions looming on the current horizon will not be sufficiently smooth to warrant contingent property identities. The ontological consequences will instead be revisionary: neither cross-theoretic property identity nor straightforward elimination of the caloric fluid and phlogiston variety . . . nor are the propositional attitudes of cognitive psychological theories that are the current candidates neuroscientific reduction contingently identical to any neuroscientific counterpart. (p. 163)

Ideally then, the vast majority of successful and undisputed intertheoretic psychoneural reductions should be located near the middle of the continuum, enjoying both high versatility and variability. Even considering that new wave reduction optimally functions on a case-by-case basis, all successful new wave revisions ought therefore to benefit from such a protean existence. For any case of psychoneural reduction less than ideal, it will be oriented toward the bumpy end of the continuum (a foreboding conclusion, since folk psychological accounts do not produce much cutting-edge theorizing relative to their neurobiological counterparts).

While Bickle may at times fluctuate where he thinks psychoneural reductions fall on the intertheoretic reductive spectrum, what seems right to say is that he anticipates a utopian neuroscience that corrects everything psychologically important, so that he can locate all cases on the intertheoretic reductive spectrum. The model itself is silent on how particular cases fall, or, if indeed, it can cover all cases. In other words, an anti-reductionist could accept the new wave model as an accurate account of reduction and replacement, where, in fact, reduction and replacement are called for; but the same anti-reductionist can resist the physicalist urge to apply the model everywhere, not believing that all higher level phenomena will eventually be reduced or replaced. Consequently, theoretical refinements to folk psychology by the relevant neurosciences, biochemistry, and physics do not imply the onset of any final materialist account of the mind/brain.

The new wave conclusion about folk psychology is reached in virtue of three components: the approximation of folk psychology to the actual cognitive dynamics; the fragmentation of folk psychology into distinct concepts within its neuroscientific successors; and the mutual co-evolutionary feedback between folk psychology and neuroscience. Before evaluating these three components, we ought to look at the framework and motivation in which this conclusion is reached. An understanding of the model becomes much more clear once it is applied to actual cases where it can be followed up with ontological discriminations. Reductionists typically parade some very

well-worn prototypical examples from the history of science (though far too few from the actual cognitive sciences) like water, temperature, and phlogiston to demonstrate how reductions ought to work.

First, it helps to distinguish between the theory — some explanatory representation — and the entities that are being explained and represented linguistically. This distinction begets the continuum's ontological consequences, where smooth reductions at one end allow the higher level theory and the objects of that theory to coexist. Smooth reductions typically allow for the explanatory representation to be kept around for practical purposes, and the ontology of the thing represented is retained — water is still around and usefully expressive, though the word “water” could be eliminated (say, if we all started talking German, or all talked in the vernacular of chemistry . . . “H<sub>2</sub>O talk”). Notice that it is possible for bifurcation between theory and ontology to occur even in smooth reductions, where the nominal character of the theory can undergo change while the referents and roles remain fixed (Endicott, 1998, p. 58). This being the case, smooth reductions allow for the possibility of ontic propositional attitudes whose signifiers, representations, and theories are disposable. In discussing mental states qua their underlying neurophysiological phenomena, Searle (1998b, p. 51) also attests to the fact that our theories and vague linguistic terms can ultimately be disposed of, leaving us with the brute facts about the processes of the brain and the structure of the mind itself. While Searle's comment lies outside of the context of new wave reductionism, it is telling of the possible bifurcation of explanatory representation and ontology at this end. Consequently, the possibility of change in the nominal character of the theory while the referents and roles remain fixed seems contrary in spirit to the new wave assertion that ontological conclusions are always secondary to, and dependent on, theoretical conclusions across the board. The model's subjugation of ontological conclusions may lead to a potential queerness for a scientific realism, although this is beyond the current scope of this essay. But it is important to note that, conversely, where there is significant ontological change there is typically theory replacement rather than revision (Endicott, 1998, p. 63).

With a bumpy reduction, there is evacuation not only from the theoretical axioms of  $T_R$ , but also from its ontological posits. Reductions at this end point to the fact that the things represented in our conceptual schemes tend to be abandoned, due, in part, to the competitive element between theories. However, demonstrating that a radically inferior higher level theory can be succeeded by a more competent successor is insufficient to demonstrate that the entities of the reduced theory do not exist. A more appropriate and sensitive conclusion is that  $T_B$  gives a more lucid, fine-grained picture of the very same entities posited in lieu of the relatively flawed  $T_R$ . This is because

reduction is a matter of refinement, which is to say, a matter of the degree of correction entailed to  $T_R$  in terms of set inclusion, (set) identity, and ontological reductive links which relate empirical base sets between formalized set theoretical models. Reductions ought to be, then, in some minimal manner, ontologically conservative, since reduction entails that the ontology of the higher level reduced theory is in some sense derivative of the countenanced ontological posits of the lower level reducing theory. This fact helps to support the new wave axiom that reductions are a matter of degree. In the case of elimination, on the other hand, the ontology of the objects represented drops out of the picture and is abandoned altogether, without reification — there's simply no such thing as phlogiston, crystalline spheres, caloric fluid, et cetera hanging around. Their theories are then indeed replaced by a radically different successor, since there is really nothing for the lower level theory to refine.

New wave reductionists often rely on the following analogy of temperature to illustrate their position concerning the moderate folk psychology-to-future-neuroscience reduction. Henceforth, is there really such a thing as temperature in the classical thermodynamic sense? No. The ideal gas law (relating pressure, volume, and temperature) holds nowhere in the actual physical universe — it holds only in the non-empirical “limit” — since thermodynamic temperature is only uniquely realized in ideal gases. So, is temperature eliminated from scientific ontology? Well, yes, in one sense: average kinetic energy of constituent molecules is what is actually going on. But no, in a lesser sense: the concept was not completely replaced with a totally incommensurable successor (as with phlogiston, caloric fluid, or witches). Temperature construed in classical thermodynamics is an approximation to mean molecular kinetic energy as construed in microphysics and statistical mechanics, and would be located toward the middle of the intertheoretic reductive spectrum for the revisionary physicalist. This and other historical examples are meant to be the beacon of light by which psychoneural reductions can be located on the continuum.

### Collapse of the New Wave

Unfortunately, the new wave is not immune from serious problems. Endicott (1998), its cardinal critic, has poignantly outlined its collapse into classical reductionism and its failure to capsize anti-reductionist claims. The new wave initially collapses because of bridge law problems at the smooth end of the intertheoretic reductive spectrum, and because of its constructive constraint on mutual co-evolution. Theories smoothly reduced at the retentive end of the new wave continuum are still subject to biconditional bridge laws, since cross-theoretic property identities exist between reduced and reducing

theories. This guarantees nomic coextension, where  $T_R^*$  is indistinguishable from  $T_R$ , and reduction therefore remains deduction of  $T_R$  from  $T_B$ . In other words, in a perfectly retentive smooth reduction, cross-theoretic property identity holds between interlevel theories, in which case the constructed analogue  $T_R^*$  can be deduced from either the higher or lower level theory, since it is a subset of both  $T_R$  and  $T_B$ . For all cases apart from perfect retention, where term-by-term property identities for all predicates do not exist and  $T_R^*$  must be deduced solely from  $T_B$ , reduction becomes a matter of displacement of the higher level theory. The new wave relapses into previous models of classical reductionism at this end of the continuum, and is again subject to the familiar problems issued forth by multiple realizability, and to the problem of specifying biconditional connecting principles for type reduction. Endicott (1998, p. 70) concludes that the collapse of the retentive end of the new wave continuum alone leads one either to an anti-reductionist or eliminativist conclusion.<sup>1</sup> I will try to show why the latter is the case, where the intertheoretic reductive spectrum is unidirectional as higher level reduced theories are funneled toward bumpy reduction followed by elimination.

Endicott also substantiates his conclusion by explaining that there are four main elements to the new wave, only one of which is actually new and which must be rejected anyway. This is the constraint on theory construction, which holds that the conceptual resources for the corrected analogue  $T_R^*$  are supplied by the structure and laws of the basic reducing theory  $T_B$ , rather than those of the reduced theory  $T_R$  which it is trying to mimic. This novel element of theory construction amounts to the third component of the new wave's conclusion — mutual co-evolutionary feedback — which is one of the main characteristics of the revisionary physicalist account that distinguishes reductions from replacements. The position of intertheoretic co-evolution is an ideal position for reductionists, since selective pressures can foster dynamic, effective adjustments between and within theories — in both directions on the continuum — in an effort to increase the overall coherence of explanatory schemes. So, the new wave asserts that higher level, course-grained folk psychology, once corrected, can have new life breathed into it by the developments of its lower level, fine-grained neurobiological theory; the analogue  $T_R^*$  can impress its properties back into the reduced  $T_R$ . Bickle (1998) states,

---

<sup>1</sup>Kim (1998, pp. 118–120) independently arrives at the same conclusion, “Either you retain supervenient and yet irreducible (that is, *nonfunctionalizable* [my emphasis]) mental properties, say qualia, but accept their causal impotence, or you embrace mental eliminativism and deny the reality of these irreducible properties.” He further explains that if we are taking physicalism seriously, as the new wave is certainly committed to, we are left with the irreality of the mental. If, on the new wave account, the only saving grace of folk psychology is the gross functional profile of intentionality, then the eliminativist elements of such a doctrine will have to be owned up to. See also Quine (1985, pp. 5–8).



close approximation also makes both feasible and fruitful injection of some *structure* [emphasis mine] that the reducing theory uncovers back into the reduced theory . . . . We should expect folk psychology to spawn more precise, although revised, explanatory posits because of these neurobiological developments. There is no barrier to mutual evolutionary feedback here. That initial and final states approximate their neurophysiological counterparts provides the toehold for such enrichment. (pp. 202–205)

In other words, the model for the intertheoretical relation of reductive pairs is reflexive; it speculates that fine-grained lower level theories correct the pronouncements of macrolevel accounts, but because the coarse-grained, higher level theory still provides a useful and efficient approximation of the reducing theory, it is only displaced to the degree that it incurs corrective revision. Noting that co-evolved terms on both theoretical levels are constrained in tandem, Endicott (1998) decisively frustrates this one novel new wave element:

In a word, they are theoretical hybrids, mirror images of the intertheoretic correspondence rules within classical reduction, differing from them only by the cover of a single term. The moral is that, because of the natural ebb and flow between levels of scientific language and scheme, the basic reducing theory becomes permeated with high-level concepts and concerns. Now the problem is straightforward. The new-wave constraint on theory construction stipulates that the basic  $T_B$  and not the original  $T_R$  must supply the conceptual resources for constructing the corrected image  $T_R^*$ . Yet this seems flatly contradicted by the fact that, once co-evolution has run its natural course,  $T_R^*$  has become a mutual product of  $T_B$  and  $T_R$ . How, then, is  $T_R^*$  specified “within the idiom of  $T_B$ ” in any meaningful sense that excludes  $T_R$ ? (p. 65)

If Endicott is correct, adjudication between co-evolutionary development and new wave architectural construction is implausible for new wave reductionists, because the model stipulates that the lower level, fine-grained reducing theory must supply the analogue  $T_R^*$  with all of the requisite conceptual resources. The new wave’s emphasis on co-evolution dissolves in light of its focus on  $T_B$  as the starting point to construction — a bottom-up approach. Endicott continues his anti-reductionist criticism: new wave reductionism is self-defeating where co-evolution is concerned, or else it is methodologically restrictive and historically myopic. For proponents of the new wave to accept the less deflationary of the two charges would be to orient the new wave along the lines similar to Churchland’s (1984) strong methodological materialism.

The new wave helps itself to explanatory co-evolution, where each theory informs and corrects the other; simultaneously, it espouses a bottom-up flow of information and influence, since lower level theories are the sole source of conceptual authority. Lower level theories offer more sophisticated and refined pictures of the etiology of human behavior and cognition in some cases, and outright corrective replacement in others. But this position is

simply incoherent, because there cannot be bidirectional bottom-up flow of information. As stipulated by the new wave construction,  $T_B$  drives the direction of fit for  $T_R/T_R^*$ , and the bottom-up approach is therefore justified as the measure of corrective reduction or elimination. Lower level neuroscientific and scientific psychological theories are given epistemic privilege over commonsense propositional attitudes, since they provide the data sets. As such, a higher level theory needs to provide an accurate behavioral or cognitive account buttressed by neurophysiological data, which can thereby distance itself from competitors in terms of explanatory power. In terms of psychoneural reduction, the new wave can therefore consistently claim that the neurosciences proffer a more complete, systematic, and polished picture of mental phenomena; abstracting away from the inner processes themselves is only advised where necessary. While smooth reductions can fare no better than an equipotent isomorphic image — subject to problematic cross-theoretic property identities as Endicott showed — the new wave model situates all other reductions on a chute toward the bumpy end, whereby their ontological reductive links and empirical base sets become increasingly heterogeneous, eventually ceasing to be reductions altogether.

Though mutual co-evolutionary feedback is typically an excellent approach to theories and models (the fundamental insight for a discipline like cognitive science), it is in this particular case of psychoneural reduction quite difficult to see how folk psychology makes the neurosciences more precise and fruitful. The concerns of folk psychology — intentionality and propositional attitudes — are more or less a fixed approach to understanding cognition. Compared to the neurosciences, the cognitive operations posited by folk psychology generate far too few insights about dynamic mental operations and the causal links between them. If anything, this creates an increasing heterogeneity of properties and empirical base sets between the reduced and reducing theories. Consequently, the ebb and flow of reductive situations produce a series of transitions where the magnitude of the ancestral theory, though perhaps a smooth reduction at first, weakens until the point of disappearance. Even if we stipulate that the new wave is correct about folk psychology being moderately revised, the likely outcome over time is an ever-increasing gap where a mature neuroscience ends up being quite different from naive folk psychology. As Churchland (1986, p. 312) explains, where this is the case, future cognitive scientists will come to see folk psychology as having been displaced rather than smoothly or moderately reduced to neurobiology. This outcome comports with methodological considerations as well, since reduced theories that are eliminated or fall out far toward the bumpy end of the spectrum are inept and offer little practical value for any serious scientific enterprise. It would be certainly possible that, while intertheoretic psychoneural reduction can consistently occupy a

midway position in the meantime, as Bickle believes it will, theories and their ontological posits are funneled toward the bumpy end of the continuum.

### New Wave and the Eliminativist Conclusion

Given the flotsam and jetsam of new wave reductionism, I can begin to demonstrate how the new wave sneaks in an eliminativist conclusion about folk psychology, and allude to the question of whether or not new wave elimination is a plausible position. This brings us to a crucial step in support for the conclusion that the new wave is eliminativist in reductionist guise. Revisionary physicalists generally seem to regard reductions in practical terms for the purposes of classification, depending on how much correction is entailed to  $T_R$  or how commensurable the paired theories are. The intertheoretic reductive spectrum allows for three possible outcomes for psychoneural reductions (retention, revision, or replacement), outcomes which tend to merge accordingly along the continuum all under the umbrella term of "reduction." So, reductions and their ontological consequences converge on the endpoints with which they are most closely approximated. However, when it comes to applicability, confusion abounds without precise distinctions; indeed, the vagueness and ambiguity that encompass the concept of "radical incommensurability" at the bumpy end of the continuum illustrate precisely this category problem.

To reiterate, reductionism in principle is a position quite distinct from eliminativism. Reductionism encompasses the less radical view that the concepts of higher level theories can be mapped and reflected in a lower level theoretical framework to the degree that their intertheoretic relations are commensurable. That is, macro cognitive and folk psychological theories are merely avatars of their lower level counterparts, similarly describing human behavior and molar phenomena but with less explanatory power. The latter is the position that higher level folk psychology is ultimately bankrupt in terms of explanatory power, coherence with adjacent scientific domains, and performance in general, and further that any such inadequate or defective candidate ought to be targeted for elimination in favor of more powerful, lower level neurobiological theories. Churchland (1986) summarizes,

By "eliminative materialism" I mean the view that holds:

- 1) that folk psychology is a theory;
- 2) that it is a theory whose inadequacies entail that it must eventually be substantially revised or replaced outright (hence "eliminativism"); and
- 3) that what will ultimately replace folk psychology will be the conceptual framework of a matured neuroscience (hence "materialism"). [p. 396]

An astute new waver will immediately object that I have foisted her position by using this particular definition, because, by claiming outright revision *and* replacement as eliminativist, it conflates or misconstrues the meaning of the two and collapses the distinction between revisionary and bumpy reductions versus pure elimination. A true new waver would not want to be assimilated into the eliminativist camp so easily. The reductionist therefore makes a prediction about reductions stronger than unilateral dependency of the mental on the physical, based on the potential revisionary nature of theories located on the dipolar intertheoretic reductive spectrum, not on the potential of theoretical replaceability.

The new wave continuum that Bickle proposes, however, is cast as much more than just reduction proper. Rather, it tries to bind corrective theory replacement and outright elimination to the bumpy end of the intertheoretic reductive spectrum, thereby failing to distinguish what is entailed by radical incommensurability between set theoretic models. As Endicott (1998) remarks,

Bickle describes nonborderline, nonretentive cases as “bumpy reductions.” By standard usage, however, calling outright replacement a “bumpy reduction” is slightly perverse — like calling one’s divorced status a “bumpy marriage.” (p. 57, fn13)

In other words, the new wave model holds that these messy cases are not genuine reductions, but rather cases of elimination; calling them “bumpy” is therefore a misnomer. Whereas Endicott uses this objection to advance his argument that new wave reduction is little more than repackaged classical reduction of  $T_R$  to  $T_B$ , I think this semantic confusion between kinds stands on its own, and perhaps can even be pushed a little harder. The foregoing exercise shows precisely the crux of the problem: eliminativism and reduction are two distinct kinds of action and outcome, in which case intertheoretic relations are strictly either bumpy reductions or replacements, but not both.

This being the case, the new wave model seems to have a formidable problem with its architectural design. According to convention, psychoneural reductions ought to fall anywhere between extremely corrective and extremely retentive poles. Crudely put, reductions at the farthest reach of the bumpy end are very messy, since the mapping of properties and set predicates between higher and lower levels are never numerically identical. At the opposite end lies the possibility of retention, of smooth mapping and translation of terms and identity conditions between  $T_R^*$  and  $T_B$ . Therefore, the smooth to bumpy range of reduction proper is coherent only if the polar opposite ends of the intertheoretic reductive spectrum are of the same categorical kind. Churchland (1989, pp. 212, 237) further illustrates that reduction augments scientific knowledge and is a matter of “conceptual

redeployment," neither generating new conceptual schemes nor destroying old ones. Reduction is therefore a matter of theoretical *refinement*, and is a mutually exclusive kind with regard to elimination. In other words, the intratheoretic deduction of  $T_R^*$  from the empirical base sets of  $T_B$  occurs at all points on the smooth to bumpy continuum of reductions, even in the most minimal sense of the latter. Furthermore, new wave reductionists must insist that this identification of smooth or rough reduction is not merely a binary relationship; otherwise, the architecture of the continuum patterned after strong and weak grades of reduction would be undermined. The reason for the new wave to utilize a continuum in the first place was to consistently hold that reduction comes in degrees. With elimination, this is simply not the case. Likewise, the existential import of reductionism is such that the entity or phenomena in question exists, whereas with elimination it does not. For the new wave, the estrangement and radical asymmetry between  $T_B$  and  $T_R^*/T_R$  at the bumpy end of the continuum are supposed to grant the reducing theory the ability to replace the higher level theory with impunity. So, intertheoretic reduction can become theory replacement — a position that lies much closer to the heart of eliminative materialism.

This is not merely a new wave mishap. For instance, Searle (1998a) seems to make the same confabulatory mistake. He writes,

It seems to me that there are two sorts of reductions — those that eliminate the phenomenon being reduced by showing that there is really nothing there in addition to the features of the reducing phenomena, and those that do not eliminate the phenomenon but simply give a causal explanation of it. (p. 34)

Searle claims that the difference between reduction and eliminativism is trivially just a matter of terminology, and that the facts are the same in both cases. But the facts in traditional parlance correspond to a sharp ontological difference. Perhaps part of our general aversion to reductionism stems from the fact that it is when reductionism becomes a loaded term, fed as an undifferentiated bolus, that we find reductionism preemptively objectionable.

How is this category problem instantiated? An example of a smooth reduction might be the explanation of the nature of light. The lower level theory of electromagnetic radiation reduced the explanation of a higher level theory of optics. Visible light turned out to be electromagnetic radiation, along with radio waves, ultraviolet rays, x-rays, et cetera. The higher level theory mapped precisely onto its lower level counterpart with little mess or conceptual change, and therefore little need for refinement. Conversely, modern genetics recognizes very few of the attributes proposed by Mendel, for genes involve distinct segments of DNA rather than single units of DNA. The concept of a gene has gone through numerous evolutions because of the imprecise mapping and set inclusion from higher to lower level theories. In

both of these historical examples the reduction constitutes a theoretical refinement, smooth or bumpy. On the other hand, the new wave employs corrective theory revision and replacement within the same category, and does not preserve the precedent distinction between reduction per se and outright elimination. While the smooth end of the intertheoretic reductive spectrum comprises retentive, one-to-one identity reductions, the bumpy end involves not just highly corrective reductions and revisions, but also full replacement and elimination — matters altogether distinct. Thus, unlike explanations of the nature of light or of DNA, the new wave explanation of psychoneural reduction sneaks in the possibility of an eliminativist conclusion, all the while collapsing the distinction under the umbrella term of intertheoretic reduction. Because of this problem with the heterogeneity of outcomes on the new wave model, rather than a true continuum of same-species reductions, new wave reductions end up on a slippery slope which are then funneled out toward the bumpy end, culminating in elimination.

### **New Wave Failure to Save Folk Psychology from Elimination**

Even without the consolation of mutual co-evolutionary feedback, and despite the aforementioned category mistake, the new wave still maintains its overarching conclusion in virtue of approximation. It is this concept of approximation that is a necessary mainstay for the new wave account of revisionary physicalism about our commonsense mentalistic ontology. The new wave employs the structural and functional aspects of folk psychology for approximation to neuroscience; yet, this approximation of folk psychology to actual cognitive dynamic is also suspicious. Without this element new wave reduction becomes eliminativist about folk psychology.

Folk psychology is widely said to bear the mark of a “degenerating research program,” since it has alternative competitors, is relatively stagnant, has little-to-no remedial resources, and makes wrong predictions about behavior (e.g., we do not shiver because we believe ourselves to be cold and desire to become warm; narcoleptics do not fall asleep because they believe they are tired and desire rest, et cetera). Blackburn (1993, p. 232) writes that folk psychological platitudes are not under pressure to evolve, nor is stagnation a negative symptom. However, incompatibilities accrue over time in evolutionary contexts (McCauley, 1996, p. 30), and reductionism, functionalism, and eliminativism are indeed all interested in, and informed by, the evolutionary context of scientific explanation. Insofar as the aim is to explain the mental states of cognizers — a common explanandum — there is theoretical competition for explanatory sovereignty, or at least a vested interest in “having one’s flower bloom” among others. Furthermore, if stagnation were not a negative symptom of broad explanatory failure, then alchemy, phrenol-

ogy, phlogistification, and astrology would not be represented as scientific failures; stagnation in scientific discourse is indeed part of what opens the floodgates to evolutionary pressures and theoretical replacement.

As it stands, folk psychology is generally understood to be mistaken about the tacit structure of cognitive content, and as such, defers to the more technical cognitive sciences for analyses about the facts of computation, structure, function, and even some phenomenal properties (Bickle, 1998, pp. 203–205; Kim 1998, pp. 35–37; Sufka and Lynch, in press). If the mind is understood as a syntactic (neurophysiological) engine, rather than a semantic one, as the new wave in fact does, then it is connectionist-type models that will be *moderately reduced* to neurobiology, not folk psychology. Bickle (1993b, p. 85) remains suspicious of the prospect of smooth reduction between connectionist models and brain science, since the former are comparatively abstract — “little more than a novel application of the mathematics of quasi-linear dynamical systems” — hence the moderate revision on the intertheoretic reductive spectrum. Nevertheless, simple cognitive tasks can be performed by neural networks that do not seem to refer to any structures corresponding to propositional attitudes, leading Bickle (1998, pp. 360–361) to the predictive conclusion that, “in an important sense, there are no propositional attitudes doing any causal work in our best accounts of cognition.”

The sentential account of folk psychology does not really have even the loose identities that are necessary for refinement. It maintains that an intentional attitude has a discrete causal role in behavior that allows for a semantic interpretation and evaluation of its content. Accordingly, its basic unit of cognitive computation is the inference relation from sentential state to some further sentential state; however, these states posited by folk psychology are largely attributory rather than causal. Folk psychological predictions about actual cognitive dynamics and subsequent behavior are therefore largely ignored by neuroscientific theorizing, which seems poised to offer powerful, competent, and fine-grained explanations of the same mental states and other cognitive activity. At issue, then, are not the pedestrian accomplishments of folk psychological predictions, but whether or not the theory of folk psychology about the inner processes of cognition bears any resemblance to reality. Neuroscientists instead recognize the basic unit of cognition to be the activation vector, the basic unit of computation to be vector-to-vector transformation, and the basic unit of memory to be the synaptic weight configuration. This interpretation of synaptic activity in biological neural networks reveals that a neuron computes activation output states according to its total input (the sum of its signal strength times its weight) and current activation state. Vectorial interpretations are unfamiliar to common sense, and do not really resemble at all the semantic computations and propositional representations of folk psychology; but so much the worse for folk psychology. Such

an interpretation of learning, memory, perception, decision-making, and cognition generally gives the key to dynamical systems to computational neuroscientists. If activation vectors, as the central kind of representation, and vector-to-vector transformations, as the central kind of computation, offer disproportionately more robust, coherent accounts of brain kinematics and supervenient mental content and the causes of behavior with little-to-no remainder, then the cross-theoretic gap is on par with phlogiston-style elimination.

This structural aspect of folk psychology — one of its most central claims and deep commitments — falls short of the complexity needed to accurately describe many of our subtle mental states and their causal relation to behavior, unlike some neurocomputational or connectionist theories. Certainly, this leaves out the possibility of retention and smooth mapping and translation of terms and identity conditions between  $T_R^*$  and  $T_R$ , or of moderate revision in light of connectionist models. The new wave purports that the theoretical reduction of folk psychology will be retained to the degree that its falsity necessitates modification, and as a centrally sentential account of mental content it appears radically false, both in theory and ontology. If commonsense discourse about the sentential account of propositional attitudes turns out to be defective, then the ontology and the theoretical constructs of folk psychology stand to be displaced by a more lucid and powerful scientific machinery. As Bickle (1998, p. 204) himself says, to eschew the sentential model — as cognitive neuroscience does — is consistent with a strong brand of phlogiston/aether type of eliminativism.

As such, the propositional attitudes of folk psychology do not make very good candidates for cross-theoretic identity relations with correlated neurophysiological states. Thus, the new wave seems clearly committed to moving away from the sentential model to connectionist ones, provided that the neurosciences continue on their present trajectory toward elucidation of the nature of the mind. The aggregate of propositional attitudes is again, for all intensive purposes, stagnant insofar as it does not evolve or produce any novel understanding about mental states and behavior. To that extent, the representational account of synaptic strengths does not refine the representational states of folk psychology so much as replace or eclipse them with an advanced successor.

And yet, the new wave maintains that folk psychology will be revised according to the second element of approximation, and will therefore have instrumental value, because of some residual homogenous or mixed ontological reductive links for interlevel property identities and empirical base sets. In other words, folk psychology presumably misconstrues the structural account of mental content but accurately describes the functional profile. So, as long as the mental states posited by folk psychology closely approximate



the explanatory function of their neurobiological counterparts, independently of the mistaken nature of the sentential profile, then this functional profile warrants a loose identity. On the new wave model, it is this loose identity which prevents folk psychology from being eliminated altogether — for without this last crutch it becomes defunct. Superficially then, the predictions of the new wave and the eliminativist seem distinct, since the new wave allows folk psychology to survive based on its functional account of mental states.

However, it is not at all clear how commonsense folk psychology is supposed to have a congruent explanatory role to the neurosciences, for the two are radically different in the way they explain the mechanisms and transactions of brain states and the flow of mental content. More and more, the neurosciences seem to be an efficacious and illuminating source for explaining how and why the mind/brain operates as it does, by piecing together small bits of the total puzzle, and increasing the amount of heterogeneous ontological reductive links and empirical base sets. The causal role that folk psychology gives to propositional attitudes is conspicuously absent in the neuroscientific theories about the operations of neurocortical structures and their dynamics. Folk psychology has no similar robust structural and functional translation about the causes of behavior, without oversimplifying the nature of the mind or leaving out explanation of the brain's structural intricacies. Any transition from one neurophysiological state to another is effected by the intrinsic, neurophysiological properties of those various states; the abstract relational states that constitute the functional profile of folk psychology do not figure into this causal equation. Folk psychology's inference relation from some sentential state to some further sentential state does not do much work, since the semantic content of a belief cannot be a strict causal explanation of behavior. This leaves the new wave ultimately appealing to some of the function-to-structure reductions similar to those employed by the classical models.

Additional inspection of the functional profile of propositional attitudes reveals it to be unsatisfying and unimpervious to objections, and hence, it is dubitable whether or not folk psychology is truly shorthand for the posits of the psychoneural vanguard, much less a close approximation to the actual cognitive dynamics. Here the new wave model of intertheoretic reduction proves helpful in an analogous discussion of properties to theories on the spectrum. The functional states of propositional attitudes are states that human cognizers manifest in virtue of being in some neurophysiological state; thus, any causal influence that a desire or belief possesses is possessed by its realizer, a neurological state, since higher level properties are dependent on lower level properties for their conceptual and causal resources. To put it another way, in what sense could the functional property of believing

or desiring be anything over and above having the lower level physical state that realizes it? Strictly speaking, such epiphenomenalism of higher level properties of propositional attitudes can have no causal impact, in the same way that  $T_R^*$  has no causal impact, since each is realized by their lower level counterparts. Going back to Bickle's previous quote, it is clear that his recourse is ultimately to the nomological laws and structure of the reducing theory rather than to the functional profile of the reduced theory.

Furthermore, Bickle's account of the functional profile needed by folk psychology is only one of abstraction. He maintains that this functional profile does not imply that folk psychology is committed to a functionalist ontology of mind. That is, propositional attitudes are said to have roles in an abstract system of related sensory inputs and behavioral outputs without entailing any declaration that they are whatever they are theorized to be. In keeping propositional attitudes at a high level of theoretical abstraction, functionalists of this stripe typically remain ambivalent about ontology; but eventually they must own up to their ontological commitments. If folk psychology is unrealized or the set of specified entities it posits does not exist, then the theory is mistaken because its terms denote nothing. As Lewis (1972, p. 213) remarks, for the theory to be true, its theoretical terms that evaluate mental states must name something existent.

These remarks about the initial problematic of new wave reductionism — namely, the collapse of the retentive end of the intertheoretic reductive spectrum and the instability of mutual co-evolutionary feedback between theoretical levels — suggest that the new wave situates all reductions cascading toward the bumpy pole. The vagueness of action at the bumpy end between reduction proper and elimination generates the category mistake. The further unsuccessful attempt of new wave reductionism to sustain the approximation of folk psychology to actual cognitive dynamics, and thereby save folk psychology from possible elimination, shows that the new wave is not reductive as billed. The upshot is that new wave reductionism ends up being more of a “new wave eliminativism.” This raises the additional question as to whether new wave eliminativism is a plausible position.

### Potential Objections to New Wave Eliminativism

As such, new wave reductionism has been very concerned about distinguishing itself from eliminativism, for the two are often perceived as quite similar in spirit. Endicott raises the question about whether the ultimate aim of the new wave is the displacement of the original theory. Quoting Paul Churchland (1979),

The intertheoretic deduction (of  $T_R^*$  within  $T_B$ ), and the intertheoretic mapping (of  $T_R$  into  $T_R^*$ ), constitute a fell-swoop demonstration that the older theory can be displaced wholesale by the new, without significant explanatory or predictive loss. (p. 11)

If Churchland is accurate, then the new wave model wholly belies theory replacement rather than a continuum of pure reduction. As Endicott (1998) notes, the new and corrected  $T_R^*$  has the resources to mimic the explanatory role of the original  $T_R$  in an ideally smooth case, and to better the explanatory role of  $T_R$  in a rough and disanalogous case, either way demonstrating the old's replaceability by the new. However, he keys in to several hefty problems with this hypothesis. Some of these are considered in the brief riposte below, which ought to continually show how the new wave model indeed tends toward eliminativism.

First, Endicott notes that replacement at the smooth end is weak since the ontology of  $T_R$  can be retained. Second, in ideally smooth cases  $T_R^*$  is an equipotent isomorphic image of  $T_R$  — perfect retention rather than weak replacement. Yet, ideal cases in the offing, it is explicitly stated that the bulk of new wave psychoneural reductions will not be retentive, signifying that our commonsense propositional attitudes are unsound in the first place and in need of corrective revision. Folk psychology's commitment to a sentential account of mental content/deliberation and intentional posits are a central aspect of its thesis, but these structural and causal commitments to the states underlying behavior are naïve if not dubious, and to that extent folk psychology is, in some sense, a defective theory. Its principles and explanation of mechanisms can be displaced, since they will not constitute nomic coextension with the reducing theory, and since  $T_R^*$  will not be formulated as a perfectly equipotent isomorphic image. So, even though Bickle maintains that the new wave is committed to cross-theoretic property identity at the retentive end of the continuum, which collapses anyway, the status of folk psychology lies outside the parameters of smooth reduction. Again, it is connectionist models that will fall in the range of moderate reduction in virtue of their theoretical sophistication, with folk psychology situated toward the bumpy end. While Endicott's first two objections may certainly hold for a wider philosophy of science and general account of reduction, the theoretical constructs and ontologies of folk psychology are not purported to be situated anywhere near the smooth end of the continuum, but rather *minimally* expecting corrective revision.

Furthermore, cases of reduction which are perfectly smooth or retentive create an autonomous relationship for the higher level theory and its ontological consequences, in which sense  $T_R^*$  stands apart from  $T_B$ . In cases of reduction less than perfectly smooth or retentive, the analogical  $T_R^*$  ought to stand in a more strained relation of refinement with  $T_B$ . Since the neuro-

biological reducing theories themselves can be seen in the light of molecular and quantum physical systems, this relationship is subject to continual parsing, especially if any reductive or eliminative program wins at the end of the day. Since  $T_B$  is to supply the conceptual resources for  $T_R^*$ , the direction of fit for the reduction between folk psychology and more technical lower level accounts is one of an increasingly wild and disparate relation — a conclusion which is compatible with the eliminativist's claim. Even if folk psychology is intractably employed as the heuristically public language of science, though devoid of any significant truth value and causal effect because of a lack of referents, it would still have to continuously fight for survival against increasingly technical scientific terms — terms which become more precise and accurate designators of actual states and processes, especially given their stability and coherence within general scientific conceptual and explanatory schemes. The utility of propositional attitudes in our everyday discourse is not inconsistent with the new wave eliminativist conclusion, and we need not preserve our intuitions about erroneous commonsense theories when convinced that these intuitions reflect how cognition appears to work rather than how it actually works.

A third reason Endicott balks at Churchland's displacement suggestion follows McCauley's (1996) argument which concerns whether or not theories must compete for the same logical space and target the same explanandum. So, because folk psychology and neuroscience operate at different levels of analysis — interlevel rather than intralevel settings — it would be inappropriate to conclude that the two levels are incommensurable. That being the case,  $T_R$  could not be displaced by  $T_R^*$  since they are *interlevel* theories. Yet this contention — that higher and lower level theories must be in direct competition for the same logical space in order to be eliminated — does not distinguish between arguments of vacuity and arguments of irrelevance. The eliminativist conclusion is reached — not because folk psychology and neuroscientific theories are adjacent interlevel theories, dealing with a common explanandum on disjunctive planes, and therefore reaching conclusions irrelevant to each other — but rather because the integrity of the precepts of folk psychology is vacant. An edifying example would be the concept of seeing a ghost: the concept is unintelligible because it presupposes that ghosts are nonphysical entities reflecting photoelectric light, and hence, unable to be seen in the first place. The conclusion to reach is not that our physical apparatus renders the concept irrelevant, but the more extreme claim that the concept of a ghost is a vacuous one. Furthermore, if the new wave is not committed to any functionalist ontology, as Bickle (1998, p. 198) claims, then it will have a hard time even saying what folk psychological explananda are even being competed for; hence, keeping the posits of propositional attitudes at the level of functional abstracta actually impairs the initial new

wave reductionist account. If the new wave reductionist concedes that our commonsense intentional systems are false by virtue of their ontological lack, she has moved unilaterally toward the eliminativist camp.

The explanatory pluralist, following Wimstatt (1976), might produce a further objection that the incommensurability and lack of intertheoretic translation merely reveals the irreplaceability of the higher level theory. Quoting McCauley (1996, p. 32), "the theories at two levels possess different conceptual and explanatory resources, which underscore different features of their common explanandum. They provide multiple explanatory perspectives . . ." Moreover, the pluralist could also hold that the domains of intertheoretic levels can be independently analyzing a common explanandum regardless of the ontological status of that explanandum. But insofar as theories target the same mental phenomena, even with different interlevel explanations, then this objection is no barrier to the reductive pairing. The reducing theory is still able to explain all or more of the phenomena successfully explained by the reduced theory, and there is at least some minimal mapping or overlap of empirical base sets occurring, lest they be targeting altogether different explananda. Also, to the degree that the pluralist is promulgating a theory about some mental event or entity, it seems intuitively obvious that they are, in some minimal way, committed to believing that it does or not exist.

Fourth, it is argued that Churchland's wholesale replacement is flatly contradicted by the history of scientific reduction (Ptolemaic vs. Copernican astronomy, genes vs. sequences of polynucleotide bases) and therefore likewise operates as a matter of degree on the intertheoretic reductive spectrum. Since the pivot of the new wave thesis concerns grades of revision and enhancement, Bickle rejects the suggestion of across-the-board intertheoretic displacement. This objection is merely about precedent and does not impugn the prediction made by new wave eliminativism; moreover, even if "conceptual redeployment" is the norm for the history of scientific reduction, it does not follow that some theories may not retain any of the elements from previous conceptual schemes (the phrenology of Gall and Spurzheim, the four humors of temperament proposed by Hippocrates, and other similar naïve or dubious theories seem like decent examples of historical succession and intertheoretic replacement). This objection is not incompatible with the activity of new wave psychoneural reductions, even if they all are assailed without impunity by a common eliminativist fate. As noted earlier, theory-based propositional attitudes are comparatively stagnant, and furthermore, nothing about this objection entails that folk psychology in particular will not endure increasingly corrective and highly disfiguring change, or even elimination, as its neuroscientific underpinnings are elucidated and the empirical evidence checks in. Indeed, it seems dubious that the psychoneural reduction of  $T_R/T_R^*$  to  $T_B$  for propositional attitudes will be as temperate and revisionary as Bickle believes.

At the end of the day, the advocacy of dynamic activation vector space theory of cognitive representations helps to gauge the fate of folk psychology. Bickle (1995) says,

The activation vector space theory applied to real brains promises to be explanatorily fruitful: it promises explanations of capacities of real nervous systems that otherwise appear baffling. Viewing our brains in AVS terms, an answer emerges . . . the connectionist AVS theory is an applicable and illuminating account of cognitive activity in real brains. It is the theory of representation from connectionist cognitive science that appears intertheoretically reducible to brain science . . . (p. 35)

Clearly, Bickle is optimistic about the authoritative explanatory tools employed by the interdisciplinary cognitive and neurosciences, and their ability to ground our understanding about mental phenomena. This optimism about microcanonical neuroscientific evidence is indicative of the current attitudes concerning consciousness and the mind-body problem, and it seems poignantly obvious that neurocomputational theories and other such models hold the real promise in developing a science of the mind/brain, not folk psychology. If activation vector space, weight, and partition theory is able to be smoothly or moderately reduced to brain science in virtue of its sophistication, explanatory power, and competence, then how much less will folk psychology fare? By his own admission, Bickle (1998) also anticipates elimination and historical succession as a likely story of the fate of folk psychology:

It turns out that a semantic axiomatization of the accounts of the mental representation in folk psychology and connectionism, along with the principled distinction between retentive and eliminative theory changes, reveals a conditional eliminative hypothesis to be by and large correct: if connectionist models prove scientifically superior to folk psychological explanations, then in an important sense there are no propositional attitudes doing any causal work in our best scientific account of cognition. (pp. 360–361)

This quote is telling; the tentative preference for neural networks and connectionist models in our best current accounts of brain processes and mental states, in combination with the absence of folk psychology in these understandings, proffers even more reason to predict a fatalistic replacement of folk psychology on the new wave elimination model. As the cognitive and neuroscientific evidence becomes available, the new wave should be motivated to break toward one end or the other since indeterminacy about the nature of psychoneural reduction will then be evicted. Furthermore, the new wave's revisionary physicalist prediction of folk psychology being located in the middle of the spectrum is that of a "fence-sitter," which Bickle is not; he is firmly committed to coding vector analysis which is through-and-through a syntactic approach to mental states and content. Like it or not, this makes him an eliminativist about conscious mental processes, not a reductionist.

This is exhibited in the conditional statement about the promise of connectionist models made at the end of the quote. Though the three tenets of intertheoretic reduction postulated by the new wave seem to allow Bickle to "ride the fence" in the meantime, a closer look reveals the new wave to hold that folk psychology will endure radical conceptual change, rough approximation, and general overhaul in comparison to the neurosciences.

The aim of the new wave was to find a new kind of reduction stronger than unilateral dependence of the mental on the physical, and a new kind is exactly what has been found. One of the driving principles of the new wave is that reductions come in degrees; but eliminativism is based on an all or none principle, and it is misleading to collapse the distinction. Endicott (1998) rightly argues that the retentive end of the new wave spectrum collapses into classical reduction. By default, this collapse ushers in the eliminativist conclusion that I have sketched out, since the reversion to classical forms of reduction by the new wave cannot justifiably anticipate mutual co-evolutionary feedback, nor the approximation of the sentential and functional accounts of folk psychology to actual cognitive dynamics. Where selection pressures and analogue construction arise strictly from below, the resulting anticipation is a bumpy new wave reduction which expects the propositions and intentions of folk psychology to be vacuously conspicuous and funneled off the spectrum over time. The new wave reductionist is forced to conclude that folk psychology cannot be parsed down to neurobiology, subject to revision as Bickle initially claimed. Indeed, it is not reduction at all, but replacement. Once unpacked, the new wave position is much more allied with eliminative materialism than it first appeared to be.

### References

- Bickle, J. (1992). Revisionary physicalism. *Biology and Philosophy*, 7, 411–430.
- Bickle, J. (1993a). Connectionism, eliminativism, and the semantic view of theories. *Erkenntnis*, 39, 359–382.
- Bickle, J. (1993b). Philosophy neuralized: A critical notice of P.M. Churchland's *Neurocomputational Perspective*. *Behavior and Philosophy*, 20, 75–88.
- Bickle, J. (1995). Connectionism, reduction, and multiple realizability. *Behavior and Philosophy*, 23, 29–39.
- Bickle, J. (1998). *Psychoneural reduction: The new wave*. Cambridge, Massachusetts: MIT Press.
- Bickle, J. (1999, February 26–27). *Psychoneural reduction: The new wave*. Paper presented at the symposium on psychoneural reduction, University of Mississippi, Oxford, Mississippi.
- Blackburn, S. (1993). *Essays in quasi-realism*. New York: Oxford University Press.
- Churchland, P.M. (1979). *Scientific realism and the plasticity of the mind*. Cambridge, England: Cambridge University Press.
- Churchland, P.M. (1984). *Matter and consciousness*. Cambridge, Massachusetts: MIT Press.
- Churchland, P.M. (1989). *A neurocomputational perspective*. Cambridge, Massachusetts: MIT Press.
- Churchland, P.S. (1986). *Neurophilosophy: Toward a unified science of the mind–brain*. Cambridge, Massachusetts: MIT Press.

- Churchland, P.S. (1998). What should we expect from a theory of consciousness? *Advances in Neurology: Consciousness*, 77, 19–32.
- Endicott, R. (1993). Species-specific properties and more narrow reductive strategies. *Erkenntnis*, 38, 303–321.
- Endicott, R. (1998). Collapse of the new wave. *Journal of Philosophy*, 15, 53–72.
- Fodor, J. (1974). Special sciences. *Synthese*, 28, 77–115.
- Hannan, B. (1990). Non-scientific realism about propositional attitudes as a response to eliminativist arguments. *Behavior and Philosophy*, 18, 21–30.
- Kim, J. (1998). *Mind in a physical world*. Cambridge, Massachusetts: MIT Press.
- Kobes, B. (1991). On a model for psychoneural co-evolution. *Behavior and Philosophy*, 19, 1–16.
- Lewis, D. (1972). Psychophysical and theoretical identifications. *Australasian Journal of Philosophy*, 50, 343–377.
- McCauley, R. (1996). Explanatory pluralism and the co-evolution of theories in science. In R. McCauley (Ed.), *The Churchlands and their critics* (pp. 17–47). New York: Blackwell Publishers.
- Searle, J. (1998a). How to study consciousness scientifically. In J. Cornwell (Ed.), *Consciousness and human identity* (pp. 21–37). New York: Oxford University Press.
- Searle, J. (1998b). *Mind, language, and society*. New York: Basic Books.
- Sufka, K., and Lynch, M. (in press). Sensations and pain processes. *Philosophical Psychology*.
- Quine, W.V. (1985). States of mind. *The Journal of Philosophy*, 82, 5–8.
- Wimstatt, W.C. (1976). Reductionism, levels of organization, and the mind–body problem. In G. Globus, G. Maxwell, and I. Savodnik (Eds.), *Consciousness and the brain: A scientific and philosophical inquiry* (pp. 199–267). New York: Plenum Press.