BIOLOGY, BEHAVIOR, BETTERMENT: STIMULATING THE PLASTIC BRAIN

by

John McClain Watson

A thesis submitted in partial fulfillment of the requirements
for the Doctor of Philosophy degree in Communication Studies
in the Graduate College of The University of Iowa

July 2004

Thesis Supervisor: Professor David J. Depew

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CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

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To Samara and Annika

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This dissertation is dedicated to my daughters, Samara and Annika, whose bright smiles and big hearts mean more to me than I ever could have imagined. I only hope I turn out to be half the father they deserve.

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An Abstract

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ABSTRACT

This dissertation illustrates how scientific terms and techniques related to human brain research have been dispersed throughout a wide range of discourses and practices concerning childhood, parenting, and pedagogy, and child welfare. Whereas it was once believed that the human brain was a relatively stable organ which matured along a genetically-predetermined course, the past decade of neuroscientific research has introduced the radically different view that the human brain is in fact a dynamic system whose development is greatly influenced by the experiences, environments, and sensory stimulation of each individual. This shift from static to plastic brain has had an expansive impact on several of the most well-established topics in American culture: what it means to be a kid, how to parent, how to educate, and how to manage a home. I assess this impact through the rhetorical analysis of many kinds of texts – from tabloid to policy paper, news magazine to public relations brochure – in order to show how the textual emergence of the plastic brain has both enabled and required significant and often controversial movement across a wide array of discourses.

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CHAPTER I

INTRODUCTION

This project examines ways that the terms and techniques of contemporary brain research achieve dispersed effectivity by being articulated to and through a wide variety of public texts and practices concerning child development, parenting, education, and mental health. Dispersed effectivity refers to the manner in which these terms and techniques attain value across a wide range of topics and become available as rhetorical and practical resources within the discursive and social fields relevant to those topics.[1] This 'becoming available' is not some mystical unveiling but rather a practical, even mundane, result of actually-existing texts which manage to articulate, or stitch together, previously unrelated or 'unavailable' domains. One example of this kind of articulation that has proliferated in recent years concerns human brain research which is said to show that, contrary to the traditional belief that it ceased developing before the age of ten, the human brain remains extraordinarily plastic throughout a person's life. Whereas the it was previously said to have developed along a genetically-determined, acorn-to-oak sequence of development, recent technical advances in the ability to correlate synapse growth with environment and behavior in the lab have been said to reveal the brain as an essentially reactive organ that is not provided by ones genes, but rather **produced** by ones behavior, sensations, and environments. I argue that this newly-appreciated plasticity, and the anxiety subsequently produced, has both enabled and required the human brain to be articulated to and through an extensive array of discourse practices concerning topics of parenting, childhood, child development, and education.

The purpose of the introductory chapter is to introduce in a rather straightforward way some of the reading practices that will be utilized throughout the project. Because

[1] Although I present reasons for the uniqueness of the case of the plastic brain, given favorable conditions, any set of terms could, in theory, achieve dispersed effectivity.

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the value of these practices can't really be judged in the absence of textual particulars, most of what follows in this chapter should be read as a statement of assumptions rather than a text-tested analysis.

Examinations of the relationship between scientific research and journalism often presume static relations between the scientist (who "discovers" facts) and the journalist (who "reports" facts).[2] While this approach may be useful for making arguments about differences between so-called 'popular' and 'scientific' genres, critics who make such a priori categorizations obscure the centrality and the dynamism of actual, material texts as productive of the value of "science" within specific moments of reading.[3] That is, the meaning of a term like "scientist" or "knowledge" is an effect of the textual presentation of those terms within texts, regardless of whether it is an article in *People* magazine or the journal *Science*. Likewise, the value of a term in one text will be totally different from the value of that same term in another setting, in another publication, or in relation to another exigency. Critics who treat terms as if they have static meanings that operate across multiple texts overlook (empirically) the textual "material" from which those meanings are continually (re)produced, and (conceptually) the primacy of actual texts as productive of attitudes and actions within macro social and cultural formations. Attending to texts as the primary site from which larger cultural and political discourses are produced allows one to make arguments about the materiality of rhetoric by privileging the concrete-particular space in which meaning is achieved.

The texts that this project engages are typically called "popular" or "journalistic texts" and it is through the study of these texts that the meaning-as-product-of-single-

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[2] Deborah M. Urycki and Stanley T. Wearden, "Science Communication Skills of Journalism Students," *Newspaper Research Journal* 19 (1998): 64-78; Fred Molitor, "Accuracy in Science News Reporting by Newspapers: The Case of Aspirin for the Prevention of Heart Attacks," *Health Communication* 5 (1993): 209-224; David A. Stone, "*Omni* Meets Feynman: The Interaction Between Popular and Scientific Cultures," in *The Literature of Science: Perspectives on Popular Scientific Writing*, ed. M.W. McRae. (Athens, GA: University of Georgia Press, 1993), 291-310.

[3] Greg Myers, *Writing Biology* (Madison: University of Wisconsin Press, 1990), 141-193.

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texts approach can be especially productive. Consider for example the way one is likely to read a story in the *Iowa City Press-Citizen* or *Time* magazine. Probably, one takes the story on its own terms and typically will not think to question the validity of the terms, metaphors, or sources through which the importance of the issue/event is characterized. In fact, readers are more than likely to read this text not as a transparent mirror of nature but rather *as a story* whose truth value and essential constructedness are left relatively unquestioned.[4] Still, texts like these articulate fragments from many different and (apparently) unrelated discourses and serve to instruct readers on how best to understand and act on a wide range of issues. Simply stated, news media provide the primary materials through which people are exposed/expose themselves to current issues/topics/debates/etc. To be sure, this is meant to be a strictly empirical, value-neutral claim. I do not mean to suggest that this is a good or a bad state of affairs, or that exposure necessarily translates into knowledge or understanding. I only mean to point out that, regardless of what 'kind' they are, texts serve as the primary articulating technology of our world. They provide the discursive "stuff" through which we come to configure our individual and collective assumptions about what exists, what is good and bad, and what is possible.

All this is to say that one of the central assumptions undergirding the reading practices in this project is that all texts are constitutive of the event/issue/object that they are allegedly "about." Journalistic texts, for example, do not "report"; they create.[5] This

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[4] Describing his reaction upon reading a newspaper story about the ozone layer gives Bruno Latour a nice opportunity to illustrate how journalistic texts serve as sites for the articulation of apparently-unrelated topics. He writes, "The same article mixes together chemical reactions and political reactions. A single thread links the most esoteric sciences and the most sordid politics, the most distant sky and some factory in the Lyon suburbs, dangers on a global scale and the impending local elections or the next board meeting. The horizons, the stakes, the time frames, the actors – none of these is commensurable, yet there they are, caught up in the same story." in *We Have Never Been Modern.* (Cambridge: Harvard UP, 1993), 1.

[5] Thomas F. Gieryn and Anne E. Figert, "Ingredients for a Theory of Science in Society: O-Rings, Ice Water, C-Clamp, Richard Feynman, and the Press," in *Theories of Science in Society,* ed. Susan E. Cozzens and Thomas F. Gieryn (Bloomington: Indiana UP, 1990), 67-97.

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creation occurs in each and every text. Reading practices which treat texts as construction sites for "facts" and "knowledge" do not tend to raise eyebrows as long as the empirical basis of the topic under consideration is difficult to grasp, as in "democracy" or "agency." Yet when this mode of inquiry is directed towards objects that are generally considered to be immune to the ebb and flow of discourse – the human brain, for example – the critical burden is doubly weighted because one must push back against deeply-entrenched ways of knowing predicated upon a rigorous distinction between words and things. It is one thing, this argument goes, to say that two news accounts of a political protest march offer Rashomon-style perspectives on an essentially elusive object, but it is entirely another to say the same of two neuroscientific research papers. And yet, I want to show how, just as so-called everyday texts are assumed to be productive of agency, history, and possibility, so are they productive of what is typically called "scientific knowledge." In order to do this, I must resist the historically-conditioned temptation to read texts as if they activated pre-textual, static concepts like "environment" or "science." To give in to this temptation would be to restrict the rhetorical critic's role to that of evaluating texts based on how well they represented or achieved transparency in relation to the objects or "facts" being reported. This kind of normative evaluation may be important for some situations, but not this one. Instead, I want to approach each text as if it constitutes definitions, facts, and linkages that mean <u>whatever they appear to mean</u> within the self-validating orbit of any given text. Put simply, I treat these texts in their own terms, deferring judgement as to their reflective "accuracy" vis-à-vis the state of scientific research in order to assess their capacity to ground arguments and other inducements for contemporary modes of rhetorical engagement.

Exigency

Materialist Approaches to Rhetorical Criticism

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The approach I take is related to what is called the 'materialist turn' in rhetorical theory. Indeed, questions of materiality have become increasingly central to rhetorical inquiry. [6] The issue centers on the capacity of any given piece of rhetorical criticism to speak productively about relationships between texts, attitudes, and actions without having to suck all the life out of those elements in the process. While it is, of course, still possible to speak about "texts", "audience", and "meaning" as if the significance of these terms is self-evident and have a self-fulfilling use value to the critic, scholars pushing for a broader incorporation of materiality into rhetorical criticism struggle to theorize rhetoric in a way which foregrounds the highly-contingent, by-no-means certain ways that rhetorical performances manage to achieve effectivity across a radically overdetermined set of discursive practices and historical moments. Meanings become provisionally secured within and through particular texts by virtue of their articulation with fragments from other discourses and/or moments. These fragments (which could be words, arguments, examples, names, images, gestures, etc.) achieve meaning only by virtue of their articulation with other fragments; and, although "elements preexist articulation as floating signifiers, the act of linking in a particular discourse modifies their character such that they can be understood as being spoken anew."[7] Concepts of "meaning", "identity", and "subjectivity" are <u>not</u> made useless by this mode of criticism. Rather, their status as "up for grabs" and contingent on concrete engagement of texts reinvigorates their potential to shape new forms of meaning and novel practices of rhetorical intervention.

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[6] For more on the emergence of materiality as a key term in rhetorical studies, see (in addition to those cited below), Ronald Walter Greene, "Another Materialist Rhetoric," *Critical Studies in Mass Communication*, 15 (1998): 21-41; Dana Cloud, "The Materiality of Discourse as Oxymoron: A Challenge to Critical Rhetoric," *Western Journal of Communication*, 58 (1994): 141-163; Michael Calvin Mcgee, "Text, Context and the Fragmentation of Contemporary Culture," *Western Journal of Communication*, 54 (1990): 274-289; Barbara Biesecker, "Rethinking the Rhetorical Situation From Within the Thematic of *difference*," *Philosophy and Rhetoric*, 22 (1993): 110-130.

[7] Kevin DeLuca, "Articulation Theory: A Discursive Grounding for Rhetorical Studies," *Philosophy and Rhetoric*, 32 (1999): 335.

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Since I am fundamentally concerned with how discourses concerning brain science and child development get articulated in and through so-called "popular" texts, reading practices founded on logics of articulation are crucial for my project. I want to use the topics of brain research, child development, and journalism as means of showing that/how texts and rhetoric achieve materiality, or what Michael McGee called "pragmatic presence" for everyday understanding.[8] Of course, there is no single materialist program or "method" for engaging texts. Instead, a materialist perspective on rhetorical theory and criticism entails certain assumptions about texts and that/how they achieve particular kinds of effectivity across a number of dispersed and seemingly unrelated discourse practices. These assumptions amount to what might best be conceptualized as a particular "attitude" about texts which is difficult to quantify outside of a specific and unique set of critical concerns. In keeping with this loose federation of critical affiliations, I will briefly discuss in what sense I am using the term "materialist" and how I mean it to characterize the reading practices employed in this project.

By treating meaning as an effect-of rather than a cause-for communication, materialist theories embrace a constitutive model of rhetorical effectivity. As Ronald Walter Greene puts it, a constitutive model holds that rhetoric is best viewed as a "practice of world-disclosure, not an instrument of symbolic influence."[9] The role of the critic is to "analyze the effectivity of rhetorical practices in terms of the situation created and not the success or failure of the message to influence behavior."[10] Indeed, notions of "influence" become problematic in a materialist frame since the critic is no longer able to presume which fragments might be intelligible to readers or how those fragments might

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[8] Michael Calvin McGee, "A Materialist's Conception of Rhetoric," in *Explorations in Rhetoric: Studies in Honor of Douglas Ehninger*, ed. Ray E. McKerrow (Glenview, Il.: Scott, Foresman, and Co., 1982), 29.

[9] Ronald Walter Greene, "The Aesthetic Turn and the Rhetorical Perspective on Argumentation," *Argumentation and Advocacy*, 35 (1998): 22.

[10] Ibid.

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or should be stitched together by any one person in any given moment. When it is coupled with the assumption that meaning is an effect achieved by readers rather than self-evident dictum compelled by some absolute source, attention to how situated moments of reading create rather than reflect terrains of human judgment and behavior serves to restore a sense of vitality, possibility – indeed, the high stakes – of every instance of exposure to texts and their rhetorics. The term "materiality," then, is used in this project to emphasize the primacy of the quotidian: those moments when we are skimming the morning paper, glancing through magazines in the waiting room, following the instructions for a child's toy. The close proximity of these moments to what is sometimes called "daily life" is typically treated as evidence of an essential gap separating the scientific from the non-scientific. And yet, when one recognizes or even hypothesizes that words on a page *come before* and are constituitive of "scientific" and "non-scientific", the practical domain of science expands to a potentially infinite number of moments and across a potentially infinite number texts. The critical and practical implication of this notion of materiality is that journalistic and so-called popular texts are treated on a par with texts, like those in the following section, that are more typically presumed to document – in the most NON-contingent way – scientific fact.

Recent Research on the Human Brain

As sketched in the opening paragraphs, the past decade has been framed as an exciting one for those who are interested in understanding the human brain. This 'excitement' is registered in one of the first research papers which reported the "discovery" of neurogenesis in the adult human brain. In their paper, "Neurogenesis in the Adult Human Hippocampus," Eriksson et al. counter one hundred years of scientific convention when they declare, "Our study demonstrates that cell genesis occurs in human

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brains and that the human brain retains the potential for self-renewal throughout life."[11] Evidence for neurogenesis in adult rats had existed for several decades, and there was even some evidence for human neurogenesis in lower-order brain systems but neither the techniques nor the inclination to investigate more closely existed prior to 1995.[12] It was then that researchers at Rockefeller University published results showing that not only did adult chickadees produce upwards of 4000 neurons a day, but that this number rises during seasons in which birds have to remember more dispersed food storage sites. "Nottebohm's dramatic results led to a reawakening of interest in neurogenesis in adult mammals and of course caused investigators to wonder once more whether the mature human brain had any regenerative potential."[13] Currently, the only answer to this question is "yes," but little is yet said to be known about the function or potential of new neurons in the human brain.[14]

Neurogenesis is important, but it is only one species of a broader concept which has come to be most associated with the past twenty years of developmental neuroscience. This concept, this term, this physiological phenomenon, is **plasticity**. Whereas neurogenesis refers to the the growth of new neurons in the brain, plasticity is an umbrella term which postulates the brain's capacity to respond to its environment and "develop" as new connections are forged between neurons in the wake of that stimulation. Plasticity is said to be a *reactive capacity* of the brain. That is, it does not occur "on its own" or as part of a genetically-predetermined sequence of development. Rather, it is taken as a physiological **response** to environmental cum physiological

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[11] Peter H. Erikkson, Ekaterina Perfilieva, Thomas Bjork-Erikkson, Ann-Marie Alborn, Claes Nordborg, Daniel A. Peterson, and Fred H. Gage, "Neurogenesis in the Adult Hippocampus," *Nature Medicine*, 4 (Nov 1998): 1315.

[12] Gerd Kempermann and Fred H. Gage. "New Nerve Cells for the Adult Brain," *Scientific American*, (May 1999): 48-53.

[13] Ibid. 49.

[14] Jennifer Fisher Wilson, "Group demonstrates that adult human brains grow new cells after all," *The Scientist*, 14 (Dec 2000): 23.

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stimuli. This is important since the texts I will engage in this project do not for the most part discuss plasticity in a vacuum but rather concern how specific sorts of environmental stimulation are said to provoke desired or undesired trajectories of brain development. Because these trajectories are said to materially constitute a person's brain, and therefore allegedly determine ones' personality, capacity for success, and quality of life, a rhetorical inquiry into the the case of the plastic brain illumines the role texts play in the intermediation of social and biological life.

For example, rats that are placed in a "more complex" environment with lots of stimuli have been shown to have more richly-interwoven synapses than rats who are put in standard cages with no such amenities.[15] These "enriched" rats also completed mazes and other experimental tasks more efficiently than rats raised in "sterile" cages. "Enriched environment" here means cages where the lucky rats "luxuriated in very large cages and shared the company of many other rodents. They could also explore their surrounding (which were continually changed by the caretakers), take spins in running wheels and play with a variety of toys."[16] Although I address this particular example more fully in Chapter Four, as an example of the kind of articulation and materiality achieved via the texts at issue in this project, consider how the imputed and "scientific" correlation between enriched environments and enhanced intelligence achieves a distinctly different value once it is articulated to/through an article about the proper way to organize and furnish your 4-year old's bedroom.[17]

Because the (textually-constructed) "implications" of this research can so easily be articulated to/through issues of public concern, developmental neuroscience has achieved such a level of publicity that one can hardly look through any news magazine or

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[15] Gerd Kempermann, HG Kuhn and Fred Gage. "More hippocampal neurons in adult mice living in an enriched environment," *Nature*, 386 (Apr 1997): 493-495.

[16] Kempermann and Gage, "New Nerve Cells," 51.

[17] David L. Marcus, "'Tis the season for smart toys, and they don't even need a silicon chip," *U.S. News and World Report*, 127 (6 Dec 1999): 99.

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walk down a toy aisle at Target without seeing references to brain development and the brain's amazing responsiveness to its environment. Journalists in particular often reference the "old dogma" about brain development (which I call "the static brain") and assert that this dogma is rapidly being undone by "today's cutting-edge scientific research". I argue that one of the reasons this research and generalized talk about plasticity achieves such traction is that it enables new ways of thinking about topics like parenting, education, and childhood at a time when the frequency and social costs of existing understandings of development, adolescence, and parenting have become difficult to ignore. News stories often position this research against an often compelling backdrop of overworked parents, willful adolescents, dilapidated schools, and economic anxiety, and this textual backdrop provides an endless supply of warrants for the significance and use value of brain research. In fact, as we will see, the emergence of the plastic brain and the increasing prominence of its logic both require and hasten the demise of existing conceptions of what it means to be a parent, to educate, or to be a kid.

Importantly, I treat the underlying exigency and "implications" of the plastic brain as textual effects rather than extra-discursive absolutes that exist prior to or function as "context" for the texts under examination. That is, both context (i.e. latch key kids) and "content" (i.e. implications of brain research on need for good day care) are mutually constituted in texts and neither can be said to pre-exist the other. This perspective allows for a greater illustration of how journalistic and other everyday texts are not only productive of "scientific knowledge" per se, but rather call into being specific sites of application and warrants for importance through which that "science" is understood to be "real". In this way, the "discovery" of the plasticity of the brain can be understood to occur at exactly the right time and in service of an important social need. This need, its perceived importance, and its "solution" are produced by and through texts which are either "about" or position "brain research" as a way to understand and intervene in a social issue.

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Abandoning the Spectrum

It may seem strange for me to suggest that everyday, non-technical texts can be highly-productive sites from which to engage rhetorics of "scientific knowledge." Many would argue that the *last place* you would want to look for knowledge about science would be a newspaper or toy instruction manual. This tends to be the attitude of those who approach the relationship between "scientific" and "non-scientific" texts from a "popularization" perspective, in which the critic charts the transmission of scientific knowledge to different audiences, and often criticizes public representations of science for the varying degrees of fidelity they have to the "actual science" of the lab. It should be clear from what has come above that I do not endorse a popularization approach. Nevertheless, I argue that the reason some think it is strange to examine "scientific knowledge" using journalistic and other non-technical texts – which is also the reason that studies of so-called "popular texts" are in general afforded less intellectual significance in most circles – is that we tend to think in terms of what I want to call a "spectrum of rhetoricity". This conceptual spectrum ranges from the most didactic science on one end to the most salacious tabloid on the other:

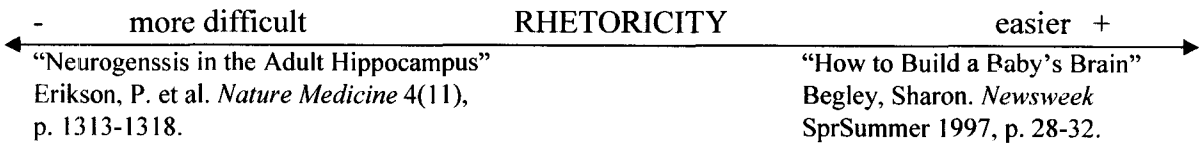

Figure 1. Sample Spectrum of Rhetoricity

This spectrum reinscribes a presumption that the rhetorical dimensions of scientific and philosophical texts are harder to find and have to be painstakingly demonstrated and continually justified, while the rhetoric of the weekly news magazine or advertisement is self-evident and can simply be taken for granted. As a consequence, the presumption of a

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spectrum of rhetoricity often forces scholars to treat some texts as "more rhetorical" than others, that the "less rhetorical" texts are more difficult to critique, and that the critic who engages "less rhetorical" texts is doing more difficult and worthwhile work.. We have all encountered or made this kind of judgement at some point of the other. In fact, it may be this essentially conservative position vis-a-vis the relative degree of rhetoric in everyday life that turns out, ironically, to be a condition of possibility for the more liberating visions of the "rhetorical turn" that some say we are currently undergoing.[18] I want to suggest both that this kind of rhetorical turn is enabling for those interested in doing rhetoric of science, but also that there is a great danger in not taking the turn far enough and thereby finding ourselves in the awkward position of having to maintain both the rhetoricity and the non-rhetoricity of texts.

In rhetorical criticism of science the primary imposition of a "spectrum of rhetoricity" is that it puts the critic into the position that scientific texts possess varying degrees of rhetoric and that their task is to ferret out what is rhetoric from what is not. These studies typically conclude by arguing that, since the technical text under examination is in some way "rhetorical," we should for that reason be less willing to grant cultural supremacy to science at all since **all** science is in some way rhetorical (and NOT, therefore, scientific). In this way, projects that presume a spectrum of rhetoricity often conclude by shoring up the very bifurcation between rhetoric and science that they presumably set out to dissolve. Instead of concerning myself with categorizing what is rhetoric and what is science, I take up a position which treats the meaning and practical effectivity of terms like "science", "development", and "interaction" as textual effects of reading, rather than the activation of extra-textual objects of some primordial Understanding or the introduction of tropes for purposes of 'science communication.' In

[18] An essential component of any 'turn' or change is some 'original direction' that is being turned away from. This 'original direction', however, is a fiction that gets produced after-the-fact and in order to dramatize the novelty of the 'turn.' This is why, although it may be ironic that a tendency to reify language in science appears to be followed by a 'turn' in the opposite direction, it is also rhetorically necessary. See Chapter Three for a fuller discussion of how this plays out in the context of the plastic brain.

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the context of this project, this means that instead of looking at texts in order to distill their alleged essence, I look at texts in order to pursue their metaphors, terminologies, historical allusions, and dispositions in order to place them within larger conversations to which they make no explicit reference but within which they can and must nevertheless be implicated.

Although I will be making this argument many times throughout this project, I do not want to limit myself to the by-now common conclusion that readers come to understand texts as "scientific" because of how those texts are written and read. Instead, if rhetorical scholars agree on the ultimately textual and embodied basis of what we call "science", then there is no reason to engage in the tail-chasing circularity induced by the spectrum of rhetoricity, and those who are interested in pursuing rhetorics of science should feel free to incorporate and investigate a wide variety of texts using a wide variety of reading practices. Put simply, if science is utterly (but not singularly) rhetorical, the study of so-called "scientific texts" can not and should not continue to be monopolized by attention to so-called "canonical" or "authoritative" texts.

In order to make some small opening gesture along these lines, I will attend to the texts in this project *not* as "scientific texts", but as "texts-which-come-to-be-understood-as-scientific" by virtue of their capacity to (re)define certain everyday behaviors and spaces as "scientific." My hope is that this choice I am making as a critic will help to open up what is meant by 'rhetoric of science', reinvigorate wider examination of how scientific texta and knowledges achieve dispersed effectivity, and offer a way to get a handle on the heretofore underexamined role that everyday texts play in this process.

Chapter Outline

In this section I outline core questions and give some indication of the kind of texts I will be engaging in each chapter of the dissertation. Originally, I considered organizing chapters chronologically according to the age/developmental groups that are

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at issue in particular texts concerning and constructing the plastic brain. I would have begun with the pre-natal, then gone on to discuss babies, toddlers, elementary school children, middle-schoolers, and I would have finished with teenagers in high school. This would have enabled me to make distinctions and draw comparisions between the different texts and knowledges that are brought to bear on, for example, pre-natal as opposed to pre-teen brains. Despite this advantage, however, such an approach if carried out mechanistically would have required me to make some potentially problematic distinctions, since the texts under consideration here are much more likely to vaguely reference "children," "toddlers," or "teens" than to specify particular ages or school grades. This chronological organization would also have forced me to confine particular texts to one chapter when many will be useful when discussing a range of ages and topics. For these reasons, I have decided to organize chapters topically, according to the concrete spatial and temporal domains to which particular iterations of the plastic brain are said to apply. That is, the primary texts discussed in each chapter coalesce around particular spaces of development which are said to potentially benefit from a realignment given the special needs of the plastic brain. While each chapter might appear to map on to a discreet age set, this is not intended to imply that I see any such demarcations in the texts under examination.

Chapter Descriptions

After two chapters which introduce and frame the conceptual terrain of the dissertation, Chapter Three, "Baby Brains," engages a wide variety of texts in order to show the anxiety generated when the plastic brain is articulated to and through both longstanding theories of child development and practical advice for parenting. These texts focus primarily on the first years of life, when a baby's brain is said to undergo tremendous synaptic growth precisely while they are first exposed to innumerable unique stimuli and experience. Interaction between baby brain and its experience-environment

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creates what amounts to a physiological index of all the environments, interactions, smells, sounds, etc. to which a newborn has been exposed. The texts in this chapter encourage parents to become attuned to the needs of their child's brain and offer practical behaviors which are said to evoke more advantageous trajectories of development. Everything from time spent holding a newborn, to artistic play, to nutrition, to the color scheme of a child's room becomes a critical opportunity to help their brain develop in a socially and economically productive way. As a result, the entire domain of a child's sensory experience attains developmental value. I argue that this opening (re)defines parenting less as "personal relationship" than as biological intervention.

Chapter Four, "Environparent," expands the level of analysis from the level of the single child to the level of the home as it becomes a critical player in each family's drama of development when articulated to/through the plastic brain in journalistic, organizational, and commercial texts. As primary constructors of the experience-environments which are said to be so crucial for "proper" brain development, parents get bombarded with all manner of toys and technologies, which are alleged to enhance the ability of the parent to do right by their child('s brain). Whereas earlier chapters have addressed the notion of experience in stimulating "normal" or "appropriate" brain development, this chapter engages **the home** as it functions as the primary brain effective environment and those texts which advocate the use of particular kinds of domestic architecture, toys, and artistic resources within the domestic space of the home. A large industry marketing brain-related consumer goods has come into being in order to respond to a market of parents and teachers eager both to promote beneficial brain development and to assuage their fears that they might not be doing everything they can for their charges. To be sure, these are longstanding fears which parents and teachers have experienced since the beginning of time. And yet, since the net effect of the plastic brain is to make the long-term potential of the brain/child a material consequence of the most

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quotodian of behaviors, the relative degree of parental/pedagogical responsibility for each child's future forces parental anxiety to increase accordingly.

Chapter Five, "Schooling the Plastic Brain," expands yet again from the single home to the public school and the notion of a proper pedagogical environment. Organizations and voices constituting the professional educational establishment have been perhaps the most active agents in the circulation of the plastic brain. This chapter examines how teachers and teacher organizations are framing and mobilizing the plastic brain to enhance their efficacy as teachers, to reinforce their significant public and developmental role, and to advocate for increased professional and institutional support.

Chapter Six engages the growing discourse of the 'teen brain' as it is articulated to one of the primary topics to have been recently associated with high school-age youth: school shootings. School shootings present what are in many ways the most compelling reasons for attending to the complicated relationships between brain, environment, and behavior. It makes sense, then, that journalists, educators, and others concerned with youth welfare would position these traumatic events as exigencies/justifications for discussing the science of violence. Even so, I argue that it can be misleading to assume that journalists and others are simply "using" school shootings in order to legitimate the newsworthiness of their article or the importance of their policy initiative. Instead, by examining how texts script "school shootings" and "brain science" into a productive relationship with one another, rhetorical criticism can illustrate how these texts serve to produce provisional lines of demarcation between science and society. Furthermore, the texts examined in this chapter are unique in that they situate the responsibility for adolescent mental health not only with educators or parents, but with teens themselves. What results is the novel notion of 'brain-strapping' in which teenage boys are encouraged to consider their own brains as resources to be appropriately developed. In this context, teen violence operates as an object lesson in 'brain training gone wrong' and functions rhetorically as a warrant for 'self control' of a distinctly unique sort.

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The final chapter of the dissertation pulls together several conceptual threads developed in previous chapters. Based on the evidence and arguments put forth throughout the project, I conclude by offering integrative comments not only about rhetoric, science, and texts, but also about how the case of the plastic brain illuminates how the discursive and practical intersections of these three domains have served to condition new and by no means uncontroversial futures for child and parenthood in the 21st century.

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CHAPTER II

STIMULATION

> With the right brain stimulation between birth and 3 years old, your child will be smarter. Of course, genetics play a role in a child's brain growth, but the ability that parents have to influence that growth is little short of awesome. Nothing you do or don't do will change how your child's heart chambers develop, or how many eggs her ovaries hold, or how her kidneys function. But proper stimulation, meaning a rich and diverse environment, will make her brain grow denser, her thought processes quicker, her perception keener -- and ultimately make her a more competent and happier person.[19]

The above epigram cuts to the heart of both the promise and the problems entailed in the notion that experience and environment play a vital role in determining how a child's brain develops. On one hand, since the limits on influence which are imposed by genes and vital organ development allegedly do not apply to the brain, parents, educators, and environments suddenly become primary agents in the development of their child or charge. "Proper stimulation," or, "a rich and diverse environment," becomes – in a material, physiological way – the most fundamental means by which a parent makes a difference in their child's life. Never before has the connection between biology and betterment been so clearly defined. On the other hand, what exactly does it mean to have a "rich and diverse environment"? Should a parent worry that, since they typically don't have time to wash dishes more than twice a week, the kitchen sink full of dirty pots and pans might be having a deleterious effect on their child's ability to score well on the end-of-course tests? Does a diverse environment mean that teachers should keep their classrooms well-organized, or will rooms and chairs that are arranged haphazardly facilitate more stimulation and therefore "a more competent and happier person"?

These questions get "answered" in a de facto sense - and the very idea of a plastic brain achieves a certain kind of relevance - when journalistic texts articulate the

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[19]"Stimulating baby helps makes her smarter," dist. by the Associated Press, March 9, 1998.

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outcomes of scientific research to and through more general discussions of parenting, child care, and children. Detailing how this is achieved textually, and arguing that these articulations effect a reconfiguration of what it means to be a parent and what it means to be a kid, are two primary objectives of this project. The more modest objectives of this single chapter are, first, to give an impression of the theory of brain development that has so captivated the attention of journalists, parents, and educators since it began to be articulated in the early 1990's. To manage this in a manner consistent with the reading practices I described in the previous chapter, I employ fragments from multiple publications and discourses – from *Newsweek* to *Nature Reviews Neuroscience*, from a non-governmental organization brochure to a piece of state legislation. Although each of these texts operates in/from a particular discourse, and in later chapters I attend to how these differences are crucial for the larger picture to develop, in this section I am more concerned with offering a sketch of the theory of the plastic brain.

Second, I discuss what I consider to be the primary characteristic that unites these texts, namely, their status as texts which make the human brain visible by articulating it to and through a particular social field. That is, I do not read news stories as simply "applying" an already-existing topic/knowledge of brain research to the field of parenting in order to derive practices which might help people to better handle their children. Instead, I want to treat these texts as constituitive of the very distinctions - between science, society, and the home - which ostensibly provide the novelty and "gee wiz"-ness of these news stories in the first place. What is occurring in these stories is not simply the production of "scientific knowledge" or the "public utility" of that knowledge, but also a reconfiguration of the social field upon or within which those knowledges and utilities are to be put to use. I am not only interested in analyzing the particular form of "scientific knowledge" as it is constituted in journalistic and other texts, but also in identifying how the social and discursive fields of parenting, education, and childhood get re-vised in order to optimize the impact of this new awareness. What is important is

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to see the triumph of the plastic brain NOT as the inevitable result of an ever-increasing enlightenment among scientists, but as a textual effect made possible by and through texts which narrate the story as such. It is equally important that one understand the fanfare of the plastic brain NOT as the intentional result of sensationalizing journalists or opportunistic scientists, but as an effect of those texts which constitute and frame the implications as such.

Third, I offer some important some brief conceptual comments about how the mobilization of a plastic brain raises key questions about the concepts of "experience" and "environment" which are central to the formation I am examining in this project. Whereas the discursive dominance of a static brain meant that experience and environment were treated as either present or absent in a child's life, the introduction of the plastic brain shifts the central question from "Does the child have Experiences?" to "What *kinds* of experiences does the child have?" I discuss this shift and suggest that it serves to radically alter the landscape of parent-child relations.

Fourth and finally, I illustrate an example of the discursively reciprocal relationship between innovation and tradition by examining the fanfare which accompanied the "discovery" of the plastic brain. Whereas primary tropes for previous understandings of brain development – which I call the static brain – privileged notions of **maturation** and **maintenance**, the plastic brain, since it is based on the idea that experience and environment actively determine the physiology and therefore behavior of the brain, compels a **dynamic** and **interventionist** terminology against which the static brain is made to seem not only unscientific, but conservative and old-fashioned to boot. According, the period prior to the early-1990's, when the entire scientific establishment was steadfastly committed to a maturation (acorn-to-oak) model of brain development, is now said to have been a kind of Dark Ages in which researchers were beholden to the "dogma" of the static (i.e. boring) brain. Unlike most narratives of scientific "advancement," in which there is typically a period of skepticism and/or reluctance to

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commit to an entirely new set of research and theoretical assumptions, defenders of the static brain are said to be few and far between, easy converts to the possibilities offered and challenges posed by the plastic brain. In this final section I want both to document the liberatory tone heralding the "discovery" of the plastic brain and to argue that the very notions of "discovery" and "dogma" are textual effects, made possible less by the cognitive dissonance brought about by competing models in the minds of practicing scientists than by the fact that journalistic texts are framed and scripted in such a way that when reading them one can't help but become both excited about the present and embarrassed by the past.

But first, what is it that has got everyone so excited in the first place?

The (Incessantly) Developing Brain

Every second of every day neurons in the brain (all 100,000,000,000 of them) are forming either brief or extended connections with other neurons. These connections are achieved through the part of the neuron called the axon, which sends impulses away from the soma (or cell body of the neuron), and the dendrite, which transmits impulses from the synapse to the cell body of the neuron. There is simply no facet of a human's life which is not motivated by or productive of impulses being sent from, through, and to neurons, axons, and dendrites. Since each neuron may have anywhere from 1000 to 10,000 synapses, the total number of synapses can be as extraordinarily high as 10^{15} or 1,000,000,000,000,000. This is equal to about 500 million synapses per square millimeter of brain mass. Each time a synaptic connection gets used it becomes more robust just as a trail becomes more clear the more people use it.

Of course, as anyone who has hiked more than a few trails will tell you, it is not uncommon when hiking to come upon a fork in a trail or to see other, older trails which have become overgrown as a consequence of underuse. Walking down *this* trail means that you are not walking down *that* trail and over time *that* trail begins to look less like a

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trail and more like wilderness. Similarly, whereas when two (or three or five) neurons repeatedly release neurotransmitters (or "fire") in a similar way over time the synaptic connection becomes strong, those synapses which are not employed become less and less likely to be trod in the future.

The first clear statement of this physiological process was made in 1949 by McGill psychologist Donald Hebb. Now typically referred to as "Hebbian Learning" or the "Hebbian Synapse," the basic idea is that "[W]hen an axon of cell A is near enough to excite a cell B and repeatedly and persistently takes part in firing it, some growth or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased."[20] Another way of putting it, as has been done so many times, is that neurons which "fire together, wire together." Hebb's hypothesis that neurons and synapses could, with time and repeated use, form what he called "cell assemblies" has been empirically validated over the past twenty years, as imaging technologies have become better at providing noninvasive methods for assessing both the structure and function of the human brain.

A question may be asked at this point: if the above sketch applies to all humans, what is it about baby and children's brains that makes the "discovery" of the plastic brain more interesting in their case than in the case of adults? The answer is evident once one understands that the brain grows more rapidly in the first several years of life than it does after a person reaches adolescence. Neurons can grow at a rate of 250,000 a minute at some points, causing a corresponding proliferation in synaptic density. At its peak, the synaptic density of a child's brain can be anywhere from 50% to 100% higher than an adult's brain.[21] So where do all those billions of synapses go? The answer to this question, so crucial because it puts into motion what one could call the "developmental

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[20] D.O. Hebb, *The Organization of Behavior*. (New York: John Wiley & Sons), 1949.

[21] Gal Chechik, Isaac Meilijson and Eytan Ruppin, "Synaptic Pruning in Development: A Computational Approach," *Neural Computation* 10 (1998): 1759.

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dramatics" of the plastic brain, is that **they die**. Through a process called "synaptic pruning," the brain selects which synapses to maintain and which to ignore based on the amount of use that each synapse requires. After all, the implicit correlary to Hebbian Learning is that neurons which DO NOT fire together DO NOT wire together. The brain, like most biological systems, has the ability to selectively destroy those parts of it which take more from the overall system than they provide. As will be seen, the most common encapsulation of this core principle of the plastic brain is "use it or lose it."

Binding the Brain

As discussed in Chapter One, journalistic and other everyday texts articulate both practical and conceptual relations between science and society. The important thing to point out here is that the potentially infinite scope of those relations gets whittled down in each journalistic text such that "this" becomes related to "that" in a relatively concrete way. Even though "brain research" can potentially be articulated to/through any number of historical, social, economic, or domestic domains, the practical and textual forces operating on **single texts** have a *subtractive* not an additive effect on the scope of each text. This subtraction – or whittling – occurs by virtue of the metaphors, source selection, organization, images, and all other elements that appear in the journalistic text.

Consider as an example this excerpt from "Fertile Minds", a piece written by J. Madeline Nash and published in *Time*:

> Emotional deprivation early in life has a similar effect. For six years University of Washington psychologist Geraldine Dawson and her colleagues have monitored the brain-wave patterns of children born to mothers who were diagnosed as suffering from depression. As infants, these children showed markedly reduced activity in the left frontal lobe, an area of the brain that serves as a center for joy and other lighthearted emotions. Even more telling, the patterns of brain activity displayed by these children closely tracked the ups and downs of their mother's depression. At the age of three, children whose mothers were more severely depressed or whose depression lasted longer continued to show abnormally low readings.
>
> Strikingly, not all the children born to depressed mothers develop these aberrant brain-wave patterns, Dawson has found. What accounts for the difference appears

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> to be the emotional tone of the exchanges between mother and child. By scrutinizing hours of videotape that show depressed mothers interacting with their babies, Dawson has attempted to identify the links between maternal behavior and children's brains. She found that mothers who were disengaged, irritable or impatient had babies with sad brains. But depressed mothers who managed to rise above their melancholy, lavishing their babies with attention and indulging in playful games, had children with brain activity of a considerably more cheerful cast.
>
> When is it too late to repair the damage wrought by physical and emotional abuse or neglect? For a time, at least, a child's brain is extremely forgiving. If a mother snaps out of her depression before her child is a year old, Dawson has found, brain activity in the left frontal lobe quickly picks up. However, the ability to rebound declines markedly as a child grows older. Many scientists believe that in the first few years of childhood there are a number of critical or sensitive periods, or "windows," when the brain demands certain types of input in order to create or stabilize certain long-lasting structures.[22]

Clearly, there are several things going on in this excerpt but my reason for presenting it is to point out that those several things – depression, children, EKG, left frontal lobes, "sad brains", the idea of "snapping out" of mental illness, the conflation of depression and "emotional abuse" – are scripted in such a way as to bind the plastic brain to a particular social field, in this case the practice of neurally-appropriate mother-child interaction. The elements in this excerpt cast a mother's mental illness – itself presumably a brain-based condition – in light of "what scientists believe" about the developing brain of her child. As if mental illness wasn't already a source of great anxiety for most people, "scientists now believe" that developing brains are adversly affected by an environment surrounding a depressed mother. This is an example of how journalistic texts practice a kind of adjudication through which existing practices and ways of thinking are put into conversation with "new" statements and found to be lacking.

Importantly, I am not trying to argue that this hypothesis about depression and brain development is not "scientifically valid" or "true" in some way or other. What matters most is that the statement was made, the configuration was introduced, and a particular world was disclosed in which the truth effect of "the plastic brain" was situated

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[22] Madeline J. Nash, "Fertile Minds," *Time*, (Feb 3, 1997): 48-57.

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within and used to overhaul a picture of the everyday domestic world of mother-child interaction. Terminologies and reading practices common to rhetorical criticism are in a unique position to productively examine and describe/argue both practical and conceptual implications of these practices of situation. This kind of investigation will yield important insights into the mutually-constitutive formation of a both a "social science" and a "scientific society".

A Note about Experience and Environment

> Have you ever noticed what happens when you walk through deep snow or through tall grass over and over, along the same route? You make a path. Something like this happens as the brain develops. Each time your baby uses one of her senses— seeing tasting, touching, hearing, and smelling—a connection or path is made. When your child has different kinds of experiences, and these experiences are repeated over and over again, the connections in the brain become stronger. These connections shape the way your child thinks, feels, behaves, and learns.[23]

Just as trails which are not traveled by hikers eventually get subsumed by wilderness, synapses which are no longer used by the brain get terminated. In economics, the term "opportunity cost" refers to the advantage foregone as the result of making a choice between two or more possible paths of action. The emergence of the plastic brain allows us to speak of *neural opportunity cost* as that possibility, that thought, that emotion, that behavior, which is made impossible by virtue of wiring our brain in this way instead of that. Whether or not such an opportunity cost is scientifically valid or a perversion of the data is irrelevant for our purposes in this project. Instead, what interests us is the production of the "reality" of a neural opportunity cost, how that "reality" circulates throughout a wide range of discourses, and how that circulation effects wide-ranging implications for how one imagines child development, raises a child, conducts oneself, educates, and designs social policy.

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[23] Diana Trister Dodge and Cate Heroman. *Building Your Baby's Brain* (Washington, D.C.: Teaching Strategies, 1999), 3.

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As Dodge and Heroman suggest, the variable that helps the brain to select which synapses to keep and which to destroy is something called "experience." The term "experience" must certainly be one of the most vexed terms in the human sciences, and the emergence of the plastic brain has done little to straighten things out. After all, what is the **opposite** of "experience"? What has been said of "behavior" and "communication," is also true for experience: it is impossible for a person to NOT "experience". After all, even if a child is raised in a sound and light-proof chamber, is that not still an "environment"? If a child sits on the floor in an entirely-empty room, would not that child still be "experiencing"? To be clear, this terminological promiscuity should not be viewed as a problem. In fact, it is only because "experience" accomodates such a wide field of reference that the idea of the plastic brain can achieve uptake within so many discourses and put into the service of so many different causes. I discuss these issues in detail in later chapters, but for present purposes it is important to remember that the brain is always part of a body, that bodies interact to form groups of bodies, and that bodies and groups of bodies interact within spaces and places which both are and are not of their own making. "Experience" and "environment" are reciprocal and mutually-constitutive terms. Katherine Long intimates this when she writes

> Scientists now know that learning begins much earlier than anyone ever suspected, and that an infant's earliest experiences lay down the circuits for future learning. They also know that most parents are providing critical "brain food" when they hold their babies, talk to them, sing to them, read to them and provide them with a loving, nurturing environment.[24]

Experience conditions environment, environment conditions experience.[25] Each is important because, as Long suggests, they determine the nutritional value of the "brain food" by which the child's health and potential are maintained.

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[24] Katherine Long, "Brain Food For Infants: Stimulation is Key to How Babies Learn." *Seattle Times* (22 April 1997): A8.

[25] For the remainder of this project I signify the inextricability of these terms by using the term "experience-environment."

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Despite the apparent obviousness of this relationship between environment and experience, what may only be dimly apparent between the lines is just how different this assumption is from the widespread and largely tacit beliefs about parenting and child development that are currently being displaced by the emerging plastic brain. From the beginning of the 20th century until recently, the general thread running through discussions of parenting and child development regardless of its intellectual or empirical justification was "Do No Harm." To parent meant to provide a stable environment wherein a child could make her way from one developmental stage to the next and emerge from adolescence as a well-rounded, self-aware adult. Experience mattered, but only in the limited sense that *any* experience would suffice to kick-start the innate sequence of cognitive maturation. Since the brain was thought to possess an entire lifetime's worth of neurons shortly after birth, the only reason to even consider the brain in relation to parenting was so that parents could help their child avoid activities which were said to reduce the total number of brain cells in their brain. While parents of the 1950's still had plenty of things to be anxious about, whether or not and how to ensure that their child's brain was going to develop in an "appropriate" manner was, apparently, not one of them.[26]

Contrast this earlier view with the contemporary assumptions of a plastic brain, and it becomes clear how such a radical alteration in the most basic assumptions about brain development can effect a tectonic shift in how parents think it best to relate to their child and manage their development. In fact, the very idea of "managing" a child's brain development would have seemed absurd within the earlier, maturation frame since it was believed that the brain managed <u>its</u> <u>own</u> development and didn't need its host or anyone

[26] I qualify this statement with "apparently" for reasons that are explained in the final section of this chapter. Briefly, although there may in fact have been articles published in the middle of the last century that argued the importance of the relation between a child and her brain, I am more concerned with the histories that get produced when contemporary writers place the old guard static brain model in opposition to the more dynamic picture of the plastic brain. I make this qualified statement because I have not come across any contemporary text that suggests the contrary.

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else intervening. Access to toys and music lessons, consistent discipline from parents and teachers, and a stable domestic setting were of course considered beneficial to a child's psychological well-being, but there was only a tenuous link between the variables of geography, class, and inclination and the physical structure of the child's brain. With the emergence of the plastic brain, heralds psychiatrist Thomas R. Verny, this link is no longer tenuous.

> The new studies reveal that every early experience, from conception on, materially affects the architecture of the brain. From the journey down the birth canal to afternoons in the park, a child will register every experience in the circuitry if his or her brain. Whenever a mother strokes her baby, whenever a father plays with his daughter or son, those physiological acts will be instantly converted into neurohormonal processes that transform the body and wire the brain of the child. Every time a child is traumatized or abused, the integrity of the circuitry is threatened; if the trauma is powerful enough, the architecture of the brain will be permanently damaged. Everything a pregnant mother feels and thinks is communicated through neurohormones to her unborn child, just as surely as are alcohol and nicotine.[27]

During the reign of the static brain, the notion of "experience" was quantitative in the sense that parents should provide – as opposed to NOT provide – "experience" for their child. In contrast, the ascendancy of the plastic brain means that it is no longer enough for parents to simply "provide experience" since it is the *quality* – not merely the fact – of "experience" that is at issue. In the end, the most significant element of a child's neural development is not the presence or absence of these categories, but rather the *kind* of experience, the *kind* of stimulation, and the *kind* of environment. Since it is the experiential and environmental particulars of **each** living moment which determine synaptic development, the singular quality, character, and implication structure of each interaction initiates a unique drama of development for each family.

Heralding and Historicizing the Plastic Brain

Until very recently, a central dogma of neuroscience has been that new neurons

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[27] Thomas R. Verny and Pamela Weintraub, *Tomorrow's Baby* (New York: Simon & Schuster, 2002): 10.

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> are not added to the adult mammalian brain. For more than 100 years it has been assumed that neurogenesis, or the production of new neurons, occurs only during development and stops before puberty. Indeed, there are few views of the brain that have persisted for so long with so little successful challenge.[28]

The standard mode of narrating the evolution of scientific topics is the historical survey, which proceeds more-or-less along the following lines: "First, scientists believed this, then they believed this, and now they know this." The stated shift from 'belief" to "knowledge" is an important one because it reassures the reader that the history of science is an archive of progressive enlightenment, and that the contemporary moment is one of maximum certainty vis-à-vis the object under investigation. Writers often moderate this picture somewhat, by retaining terms like "believe" or "think" when reporting on contemporary research. Nevertheless, even though the image of scientific research produced by these texts refrains from enacting a transition from belief to knowledge, the conceptual implications of the "history has already happened and you can see it out there" form continue to give these stories a distinctly maturational flavor.

Consider the above fragment, originally the first paragraph of Gross's article. What follows is a helpful survey of the methodological, professional, and conceptual moments in the history of the hypothesis that the adult brain can grow new neurons. Key periods are marked by such conventional phrases as "By the end of the nineteenth century" (p. 67), "Starting in the late 1960s" (p. 69), and "Beginning around the 1990s" (p. 69). To conclude the text, Gross suggests possible practical benefits of current research on neurogenesis: "Finally, adult neurogenesis may also be relevant, in the long run, to the development of therapeutic strategies for the treatment of brain damage and disease" (p. 72). To be sure, these signposts do a lot of important work for the reader and the text would have been much less helpful had been organized in some other way. Indeed, the authorial voice established by these and other textual conventions is comprehensive, confident, and obliging, all of which we expect from professors of

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[28] Charles G. Gross, "Neurogenesis in the adult brain: death of a dogma," *Nature Reviews Neuroscience* 1 (Oct 2000): 67.

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psychology at Princeton University. Who would quarrel with the history Gross has written?

Certainly not me. Rather than review the technical, factual, or historical details of his text, I am interested in how it manages to both report and produce the history it sets out to describe. That is, how does a description of the past also function as a prescription for the present? In an important but often overlooked sense, the "history" Gross is reporting/producing does not exist "out there" in the late 19th century; rather, it is *in there* - in the text - that history is presented and made intelligible through the richly-textured and manifestly presentist circumstance of the reader. When Gross writes, "By the end of the nineteenth century, the idea that the brain of the adult mammal remains structurally constant was already universally held by the main figures of the time, including Koelliker, His and Cajal" (p. 67), although he is in one register merely and neutrally documenting some past state of affairs, he is also in another register positioning that (now strategic) past as a background against which readers are told to understand the ostensibly primary concern of the article: neurogenesis in the adult brain. The first register tends to be the domain of historians, philosophers, and scientists, concerned as they tend to be with logical consistency, precision, or empirical veracity. The second, more provisional register is the domain of the rhetorical critic, concerned less with the determination of fact than with how strategies of determination prefigure the uses to which those facts may be put. Although much work in/on rhetoric of science has been concerned with assessing what if any relationship exists between these two registers, I am less concerned with tracing connections between the two levels than with attending to the ways that the second register comes to constitute and otherwise "speak for" the first.

Textual fanfare for the plastic brain offers clear illustration of how statements about what is new imply judgements about what is old. In addition to Burke's point regarding the give and take implicit in the nature of every statement (i.e. if A is, then B,C,

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and D, are not)[29], texts which document and herald the plastic brain very explicitly identify the reigning assumption of the static brain as a "dogma" which can now finally be cast off like last year's couture.[30] And yet, in order for "dogma" to become dogma, and before writers are able to illustrate the wide-ranging implications of the shift from static to plastic brain, they must first distinguish "what scientists used to think" with "what scientists know now." That this textual conversion occurs in a single text means that "history" can (only?) be produced either explicitly or through implication by contemporary texts.

This is the "history" of interest to me in this project, since it is made to become the scene against which readers contextualize commentary and statements regarding brain development and through which historically and scientifically "appropriate" behaviors can be made visible to an audience. I am less interested in doing a "history of ideas" documenting how the static brain gives way to the plastic brain since the very notion of "static" or "plastic" brains is in effect an outcome of those texts concerned with producing such an opposition in the first place. "Plastic brains" and ' static brains" only make sense in relation to one another and this relation gets (re)produced whenever this distinction or reworking gets made. In this way, we can understand the static model of brain development as an effect, or outcome, of the successful narration of a "useable past" and not as an extra-textual insertion of reality.

With regard to the emergence and circulation of the plastic brain, and as indicated in the article titles noted in the previous footnote, an important aspect of what I am calling the textual fanfare of the plastic brain often gets accomplished via the many tropes

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[29] This idea and Burke get more attention in the following chapter.

[30] As illustrated by Gross's subtitle, "Death of a Dogma," titles exert a powerful force on the reader and quickly establish both the breakthrough status of the plastic brain and the demystified pretensions of the static brain. See also W. Wayt Gibbs, "Dogma Overturned," *Scientific American*, Nov 1998; Alice Park, "Old Brains New Tricks," *Time*, Aug 7, 2000; Adam Rogers, "New Life in the Brain," *Newsweek*, Nov 9, 1998; A.J.S. Rayl, "Research Turns Another Fact Into Myth," *The Scientist*, Feb 15, 1999.

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of *normative replacement*: dethrone, overturn, overrule, correct, rectify, etc. These terms encourage readers to think of scientific model-making and model-breaking as an intentional and consensus-driven practice wherein, after a certain date, respectable scientists will have cleansed their labs and papers of all traces of the offending assumptions. On the contrary, the idea that until the mid-1990s neuroscientists went around referring to the "static brain" serves to gloss over the ways which writing - as an inherantly articulatory practice of identification – produces its own unique constraints on the ways that relations between past and present can be imagined and how labels such as "scientific" and "appropriate" can be articulated to particular statements and behaviors. Since this project attempts to identify the rhetorical substrate upon and through which these articulations are being achieved with respect to the plastic brain, the distinctly presentist histories which get produced by contemporary texts will be just as useful as the licensed histories of academic historians.

Bringing It All Back Home

These histories, which narrate both the conceptual and practical prospects for a new and improved relationship between scientific research and human behavior, get delivered daily to doorsteps and news stands everywhere. While they create a backdrop against which the emergence of the plastic brain is to be understood, these texts also parlay their up-to-the-minute news-you-can-use ethos into a license to evaluate and advocate both attitudes about and techniques for proper parenting, education, and social policy. This allegedly straightforward transition from laboratory to living room authenticates not only a text's status as neutral transmitter of certified "scientific knowledge" but the pragmatic utility of the examples and elaborations which are used to illustrate – precisely – how a scientifically-informed parent should interact with their child.

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At issue are the ways that the shift from static to plastic brain serves to implicate even a person's most prosaic everyday experiences in the ongoing physiological development of their brain. This move from a linear to a dynamic sense of development opens up the entire domain of human behavior what Foucault called a "field of intervention" upon or within which it becomes necessary for people concerned about issues and outcomes of development – parents, teachers, social service personnel, etc. – to act. Importantly, whereas existing practices of parenting, education, and domestic assistance are undergirded by a relatively unambiguous ethico-cognitive matrix of justification, the increasing publicity and circulation value of the plastic brain serves to cast doubt on the capacity for static brain policies and practices to be effective in/for a plastic brain world. Indeed, after describing various existing educational techniques, a 1998 policy brief by the Educational Commission of the States suggests that, "Recent research about early brain development...conflicts with many common education practices and beliefs, and opens possibilities for profoundly different approaches."[31] Even if the practices and attitudes which are said to be "appropriate" for plastic brains seem more or less identical to those which were appropriate under the old dogma of the static brain (high quality day care, increased teacher preparation, etc.), the "discovery" of the plastic brain raises the stakes by recasting such behaviors as *biological* over and against ethico-cognitive interventions. I discuss this in more detail in the following chapter but for now it is sufficient to suggest that, as parenting and teaching get continually rearticulated, recirculated, reproduced as techniques for stimulating or "building" a child's brain, nature and nurture fuse. Neuroscientist Joseph Ledoux puts it this way, "The first thing to say about this nature nurture issue is that, once you realize

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[31] Janelle Miller, "Brain Research Has Implications for Education," Denver: Educational Commission of the States (March 1998), available at <http://www.ecs.org/clearingl.ouse/14/67/1467.htm> (accessed 23 September 2003).

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these aren't different things but just two ways of doing the same thing, it gets much simpler. And what they're two ways of doing is wiring up your synapses.[32]

I have argued that the distinctions between static and plastic are produced by generic features of texts which situate the plastic brain within a "past then present" form. This distinction then takes on normative value as the plastic brain's textually-achieved status as an "advance" gets circulated throughout a wide range of publications and discourses which frame it as a "scientific breakthrough." It is in this way that the dispersed effectivity of the plastic brain comes to problematize a host of existing practices, techniques, and institutions – discourses for short – which have helped to administer the experiences of American childhood and parenthood for over a century. The following chapters engage key spaces around which these discourses tend to congregate: the newborn, the adolescent, the home, and the school.

[32] Joseph LeDoux, "Synaptic Self." Interview with Ira Flatow. *Science Friday* (March 29, 2002), available at http://www.sciencefriday.com/pages/2002/Mar/hour2_032902.html (accessed 30 April 2002).

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CHAPTER III

BABY BRAINS

> When you're holding a child and you talk to that child, millions of connections are being made in that child's brain. And they're different connections depending on how you hold the baby and how you talk to the baby. That is extraordinary.[33]

The past fifteen years have been witness to a number of important revisions in what is often called the "standard model" of development. But what was this standard model? How do we know what it is, who helped formulate it, its primary tenets, or the assumptions on which it is based? There are at least two ways of coming to answer these questions. In the previous chapter I discussed the first such way, namely, the textual fanfare that accompanies the circulation of novel research findings or the proposal of a "nonstandard" model. The example was from the field of developmental neuroscience, and it addressed how the standard model of the static brain was being reworked by a newer model of a plastic brain. I argued that the figure of the "standard model" typically only comes into view when writers re-iterate that model for their own purposes of critique, addition, contrast, or other iteration.

To be sure, it only makes good rhetorical sense for writers (whether professional scientists, professional journalists, or whomever) to distinguish "new knowledge" from "old assumption", but what often gets overlooked is how this relatively straightforward technique can be used to illustrate an important similarity between so-called "scientific" and so-called "popular" texts. The fact that all writers employ this presentist, always after the fact (re)construction of history, authorizes us to examine and, to some degree, willfully neglect prevailing assumptions about the differences between "popular" and "scientific" discourse. After all, since "the standard model" is always and only whatever it is currently said to be, the collation of ANY recent texts - not simply "scientific" ones - can provide an archive of fragments from which a "standard model" can emerge. Critics

[33] Rick Hulefeld qtd. in David Water, "A new learning curve – first years are key in brain science," *Memphis Commercial Appeal* (11 May 2003): A1.

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who embrace this line of inquiry can answer the question "what is the standard model of brain development?" through the lateral examination of contemporary texts.

In contrast, the second way of answering that question - the historical survey - entails a vertical examination of a much older and narrower set of texts. Here the purpose is to identify between-the-lines assumptions and/or categorical statements of fact in order to nail down what people really thought "back then." The central conceit of the historical survey is that, despite the fact that people disagree and tend not to hold similar beliefs for identical reasons, it remains possible and useful to lump everyone together into a "people" and attribute to them one general belief, way or life, or practice. In this way, and despite its many benefits, the historical survey is selective and simplistic.

For example, in order to identify the "standard model of brain development" the historical surveyor would look for statements like, "As no brain cells are ever formed after birth, the increasing myelination of the nerve fibers is the chief structural change in the brain that can be correlated with the educational process."[34] From this statement, along with others like it, one could glean that researchers in the 1920s and 1930s held that neurons did not grow after birth and that learning was primarily attributable to myelination, or the progressive maturation of sheathing around the neuron fibers, which served to speed up the transmission of nerve impulses. The only texts that deserve any consideration in the historical survey are those that meet strict (though typically unstated) criteria, criteria which are often put in place precisely to screen off the unauthorized texts that are central to the previously-described lateral mode of explanation. Those who practice the historical survey hold that the only way to answer the question "What is the standard model of brain development?" is to look back at what scientists wrote and parlay that (constructed) expertise into a legitimation for their proposed explanation.

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[34] H.B. Ferris, *The evolution of man; a series of lectures delivered before the Yale chapter of the Sigma Xi during the academic year 1921-1922.* (New Haven: Yale UP, 1922): 47-48. qtd. in Lovisa C. Wagoner, *The Development of Learning in Young Children* (New York: McGraw-Hill, 1933): 71.

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It should be noted that, despite its desire to break from the present, the contribution of the historical survey is always symbiotic with the novel or non-standard "discovery" that warranted the creation of a "standard model" in the first place. That is, in the above example it is only against the backdrop of a "new" model of brain development that the 1922 excerpt becomes germane. After all, since "standard" is always a relative term, how would one know how or where to find "the standard model" without some orienting connection to the present? This inescapability is particularly evident when reviewing past episodes in the discourse of child development, since, as we will soon see, those discourses tends to be based on an especially visceral rejection of past practices. With these methodological points in mind, the next section is meant to serve as a (selective and simplistic) survey of one particular model of development: maturation. It is also meant to showcase the value of the more self-consciously rhetorical, lateral examination of texts and show how, paradoxically, to declare maturation the "standard model" of development is simultaneously to declare its obsalescence.

Maturation, Gesell, and The Consolations of (Some) Theories of Development

The majority of the modifications to the "standard model" of brain development have targeted a central pillar of that model: that the brain, indeed the entire organism, is a closed system that develops progressively and more or less exclusively according to genetic instruction and bodily capacity. Physical structures - muscles, lungs, the brain, connective tissues, bones, etc. – take time to mature and so can only do certain things at each point along the path to maturity. Within this frame, the term "development" is used to describe the process whereby organisms reach maturity and is best studied by identifying the capabilities characteristic of those physical structures over time. As renowned embryologist G.E. Coghill put it in 1930, "The law or pattern of development

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consists in the expansion of a primarily integrated total pattern of action within which partial patterns arise by individuation within restriction of both the field of motor action and the field of *adequate stimulation*."[35] The emphasis is added to illustrate how the importance of the organism's environment in these standard theories of development was typically restricted to that of a mere kickstart for the internal processes which drove the organism to maturity. As long as an organism – lower vertebrates like salamanders were especially favored in this research – wasn't exposed to an extremely-deprived environment with no food, light, or muscular activity, it was presumed to receive "enough" or "adequate" stimulation to kindle morphological growth.

Through the mid-20th century, this *maturational* perspective on development would have its most renowned and steadfast advocate in the person of Yale child psychologist Arnold Gesell. As someone who received a Ph.D. in psychology at Clark University under G. Stanley Hall and an M.D at Yale, Gesell was uniquely suited to bring a maturational perspective to the scientific study of children. An admirer of Coghill, Gesell embraced the embryologists' attention to the temporal relations between structure and function, relations in which the behavior of organisms – in his case children – had to be observed longitudinally and in painstaking detail. As in all organisms, the physical components of a young human body matured along straightforward and internally-governed trajectories which had a wholly-determinitive effect on the behavior and mind of the child. Two prominent pieces of evidence for the maturational perspective were grasping, which cannot be achieved unless and until the connective tissues in the shoulder grow enough to enable such a movement, and the fact that the great majority of children begin using words at more or less the same age. It seemed clear that physical maturation, not the presence of a radio in the home or the telling of bedtime stories, was the engine of growth.

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[35] G.E. Coghill, "The Structural Basis of the Integration of Behavior," *Proceedings of the National Academy of Science of the United States of America* 16 (Oct 15, 1930): 638. emphasis added.

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Gesell and his frequent collaborator Frances Ilg illustrate this position on the role of the environment in their 1943 bestseller, *Infant and Child in the Culture of Today.* "Environmental factors support, inflect, and modify; they do not generate the progressions of development. The sequences, the progressions come from within the organism".[36] Of course, the child still benefitted from a "favorable environment" which would insure "a favorable realization of his [sic] growth potentialities" (p. 20), but, since environment could never be more than a handmaiden to the real (i.e. genetic and morphological) engine of development, there was no need – nor were there the technical means – to investigate the nature of that relationship in any detail. For Gesell, "Growth [which he equated with development] is a step-by-step process. Each step is made possible by the step that proceeded. The mind thus grows by natural stages. Maximum educatability is realized only when educational measures are attuned to the maturity status of the organism."[37]

In keeping with this general picture, the great majority of twentieth-century literature on child development is devoted to rendering normative descriptions of – and thereby buttressing the objective reality of - discreet stages of physical and mental growth. These descriptions were typically presented as exhaustive indexes of one child's behavioral and psychological existence. The following excerpt, from Gesell and Ilg's 1946 book, *The Child From Five to Ten*, typifies this form and was meant to give parents and teachers of ten year olds a sense for the kind of creature they could/should expect

> The distinctive characteristics of the ten-year level are best interpreted in terms of the maturity traits of the 9-year-old. Nine…is earnestly engaged in mastering skills; he works with channelized intentness and is not too easily diverted from one activity to another. He is in a more or less constant state of urgency, as though in a contest with Time. In comparison Ten is relaxed and casual, yet alert. He has himself and his skills in hand; he takes things in his stride; he works with

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[36] Arnold Gesell and Frances L. Ilg, *Child Development: An Introduction to the Study of Human Growth* (New York: Harper & Brothers Publishing,1949): 20.

[37] Arnold Gesell, "Growth Potentials of the Human Infant," *The Scientific Monthly* 68 (1949): 255.

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> executive speed and likes the challenge of mental arithmetic. He often shows a genuine capacity to budget his Time and his energy. His general behavior, his demeanors, his orientation to the household are more modulated....Having consolidated certain visual, manual, and laryngeal skills, he can attend to a visual task, and at the same time maintain conversation.[38]

These texts encouraged teachers and parents to cultivate an ability to identify appropriate behavioral manifestations for their child's age (encapsulated in catch phrases like "terrible twos" and "noisy nines") and, if necessary, to alter the child's environment in order to make it "more favorable" to the 'already-knows-what-it-wants' organism. Importantly, these environmental modifications would not (re)direct development, but only remove any roadblocks that might prohibit the organism from continuing on its course. In short, parents and teachers were to work around – not work *on* – the developing child. They would know whether the environment they had shaped was "favorable" based on whether or not the child began to behave in ways consistent with Gesell and Ilg's description.

In any event, Gesell's earlier comment regarding the need to attune "educational measures" to the "maturity status of the organism" illustrates the essentially *reactive* and *reassuring* tenor of parenting practices sanctioned by maturational theories of development. As child psychologist Laura Berk (2001) puts it, Gesell's and other similar maturational theories "aimed to reassure uneasy parents that children's problematic behaviors were merely a phase – part of a biologically based sequence requiring understanding, not correction" (p. 15). After all, if "the process of acculturation is fundamentally limited and pervasively patterned by the mechanisms of maturation inherent in the individual" (Gesell, 1949, p. 255), one had better not try to do too much with their child lest they impede Nature's course. On the other hand, as Beekman (1977) points out, "the tendency to match one's child against given norms cannot be denied;

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[38] Gesell and Ilg, *Child Development*, 213. It should be noted that Gesell and Ilg weren't simply making up these descriptions. Instead, they were culled from numerous multi-year observational studies conducted at Yale and later at the Gesell Institute of Human Development in New Haven.

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Gesell's charts can represent one more hindrance to parents dealing with the immediate and individual needs of each child" (p. 171). According to this view, and despite Gesell's repeated request that maturity traits "are *not* to be regarded as rigid norms or as models" (1949, p. 197), parents and teachers, desperate for some objective indication of their impact on the child, couldn't be expected to maintain a rigorous distinction between physiological and qualitative definitions of the term "maturity."

Description/Prescription

Gesell's is a relevant case for our purposes here because it illustrates how theories of biological development achieve practical value when they get articulated to/through functional regimes of parenting and instruction. Indeed, there is in general a peculiar ease with which *descriptive* **theories** of child development become *prescriptive* injunctions for parents and teachers to think/act in particular ways. I seek to show throughout this project that this collapse is encouraged and made even desirable by a wide variety of texts working for a wide variety of ends. When writers write about "brain development" they are also writing about "child development" and vice versa. It is precisely in this way, I argue, that *descriptive* accounts of brain development research achieve *prescriptive* value as they get circulated throughout multiple and overlapping fields of influence and interest.

Kenneth Burke offers a nice way to understand the immanence of this double movement in his discussion of the differences between scientistic and dramatistic approaches to the nature of language. A scientistic approach begins with "questions of *naming* or *definition*" and "builds the edifice of language with a primary stress upon a proposition such as 'It *is*, or It *is not*.' The 'dramatistic' approach puts the stress upon such hortatory expressions as 'thou *shalt*, or thou *shalt not*.'[39] Burke is clearly interested

[39] Kenneth Burke, *Language as Symbolic Action.* (Berkeley: UC Press, 1968): 44.

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in exploring the dramatistic approach through his rubric of *symbolic action*. And yet he is careful to explain that the scientistic and dramatistic approaches do not each have their separate empirical domain wherein it is only appropriate to use "is" when speaking of quarks and "thou shalt not" when addressing another human being. Rather, Burke's discussion of terministic screens is so extraordinarily insightful precisely because it helps us to see how both the propositional and the hortatory can and do flow from terms in – theoretically – equal measure.

In one of the more suggestive passages to be found in his immense body of work, Burke explains that

> The dramatistic view of language...is exercised about the necessarily *suasive* nature of even the most unemotional scientific nomenclatures. And we shall proceed along those lines; thus: Even if any given terminology is a *reflection* of reality, by its very nature as a terminology it must be a *selection* of reality; and to this extent it must also function as a *deflection* of reality.[40]

That language is primarily a technology of (typically benign) *mis*direction is almost always cast aside in favor of an strategic-intentional theory of rhetoric which presumes that speakers have ultimate and determinative control over what they say and what they mean. Rather than acknowledge how ALL terms and symbolic acts manage - once they are introduced into unstable and overdetermined networks of interpretation and iteration - to, in Burke's words, "direct the attention" towards some possibilities and away from others, critics often mis-characterize the vicissitudes of meaning as evidence of an overriding calculation or excess of cunning on the part of the writer under discussion. In other words, the internal flexibility of terms becomes an argumentative resource when critics read the descriptions of their opponents as prescriptions and vice versa.

For example, in a recent, insightful paper, developmental psychologists Esther Thelen and Karen E. Adolph make such a move when discussing what they call Gesell's

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[40] Ibid, 45.

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"paradox of nature and nurture." [41] Commenting on Gesell's legacy of age-specific developmental milestones, Thelen and Adolph criticize Gesell's "leap from description – what is – to prescription – what ought to be" and characterize it as rhetorical "sleight-of-hand." Despite his "laudable clinical goals," they said there was "a transformation from the typical into the desirable. Gesell elevated the typical child, who of course was no child, into a biological reality with profound consequences for both theory and practice."[42] The question to ask here is: did *Gesell* "elevate the typical child into a biological reality" OR were his *books and articles* circulated, positioned, iterated, or otherwise **used** in such a way as to "elevate the typical child into a biological reality"? The question may seem be trivial, but it is in fact central to any rhetorical analysis of the intersections of "scientific" and "nonscientific" discourse because it helps to ward off the tendency to conflate the mind of the author with Meaning and consider the text as a (mere) vehicle for Meaning. Indeed, looking again at Adolph and Thelen's characterization of Gesell's rhetoric, it is easy to see how the verbs they use - leap, transformation, elevate - attribute an intention to Gesell and as such illustrate how words are always far more than mere vehicles.

Thelen and Adolphs practice a criticism which passes judgment on the rightness or wrongness of the intentions of the writer and show how easy it is to overlook the fact that, again as Burke puts it, many of a writers' observations "*...are but implications of the particular terminology in terms of which the observations are made.*"[43] That is, the prescriptive is <u>built in</u> to the descriptive and vice versa. From this we can see how Gesell's frequent use of terms like "stage" to characterize different periods of development and "norms" when discussing age-appropriate behaviors, spins off

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[41] Esther Thelen and Karen E. Adolph, "Arnold L. Gesell: The Paradox of Nature and Nurture," *Developmental Psychology* 26 (1992): 368-380.

[42] Ibid, 374.

[43] Ibid, 46. emphasis in original.

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implications which may have – and in this case seem to have – far exceeded his own desires or intentions. Far from being determined by the intentions of the writer, whether or not a text gets understood as a description ("this is a chair"), a prescription ("you should/will call this a chair"), or more likely a hybrid of both, the primary reservoir from which the implications of reading flow is not the mind of the author but is rather produced at each moment of contact between text and reader.

Gesell himself was always concerned with that moment of interaction and cautious about the uses to which his work was being put.[44] He especially feared that parents and teachers would treat his observations as "rigid standards of expectancy"[45] and use them as norms with which to evaluate their kids. Almost every introduction to his discussions of developmental norms is headed up with a disclaimer warning against potential misuse:

> The reader is warned, in advance, however, that the age norms are not set up as standards and are designed only for orientation and interpretive purposes.[46]
>
> The lay person should not attempt to make a diagnosis on the basis of such norms…it is not intended that a single age profile should be used to determine whether a given child is bright or dull, good or bad. Individual deviations are almost as normal as they are numerous.[47]
>
> For convenience, each gradient consists of a series of levels arranged by weeks, months, or years. This does NOT mean that the itemized gradient levels should be regarded as statistical age norms. The parent who reads a gradient should never say "My child ought to be at this particular level of the gradient because he is old enough." The child may well be younger or older than the age assigned by the gradient…The gradients are intended to show the overall developmental

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[44] Louis Ames Bates, *Arnold Gesell: Themes of his Work*. New York: Human Sciences Press, 1989. Bates was Gesell's long-time collaborator and director of the Gesell Institute of Human Development in New Haven, Connecticut.

[45] Gesell and Ilg, *Child Development*, 223.

[46] Ibid, 2.

[47] Ibid, 70.

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> *sequences* of behavior rather than rigid standards of expectancy. Individual differences are too great to permit rigid standards rigidly applied.[48]

> With all these cautions and reservations we hope that the reader will look upon the growth gradients as convenient tabular summaries, which suggest how behavior characteristics may change with advancing stages or maturity. Common sense will protect the gradients from misinterpretation and misuse.[49]

Unfortunately for Gesell, his faith in (what he considered) common sense ended up being misplaced. Today, Gesell is known primarily as the father of the very "rigid standards" that the previous fragments, albeit when taken out of context, show he so clearly warned against.[50] All this is to indicate how Gesell tried mightily to establish a clear boundary between the *descriptive* observations of the children in his work and the *prescriptive* ends to which that work would be put. He encouraged parents and teachers and readers NOT to take his descriptions as prescriptions and yet, by all accounts, *they did.* Interestingly, what Gesell likely considered an unfortunate failure of the common sense of his readers, Thelen and Adolphs deem a deliberate choice on the part of the author to neglect his scientific duty to construct the (allegedly) essential wall between description and prescription. Burke's insight concerning the essential inextricability of this double movement helps explain both why Gesell's pleas seem so futile and why Thelen and Adolph's criticism seems so misplaced.

The real challenge is to thread Burke's needle. That is, we must struggle to understand how descriptions of brain development attain prescriptive value when they are articulated to/through discourses of child development, parenting, violence, and pedagogy, <u>as well as how</u> prescriptions regarding those topics attain descriptive status when they get articulated to/through discourses of brain development The goal, ultimately, is to show how longstanding presumptions about which texts do which (e.g.

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[48] Ibid, 223.

[49] Arnold Gesell, Frances L. and L.B. Ames. *Youth: The years from ten to sixteen.* (New York: Harper, 1956): 24.

[50] Neil Salkind, *Theories of Development*, 2nd ed. (New York: John Wiley & Sons, 1985): 54.

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toy manuals prescribe whereas research papers describe) obscure half the picture and, in so doing, impute ontological status to a distinction which is nothing more – and nothing less – than a rhetorical effect. Taking the descriptive force of journalistic, policy, advocacy, and instructional texts seriously (as both prescriptions and descriptions) rather than treating them as vulgarized "encodings" of scientific research (i.e merely prescriptive), enables one to trace the dispersed effectivity and discern contingencies of value that are obscured when scholars handicap the status of those texts from the outset.

Of Innocence and Experience

> How can the bird that is born for joy,
> Sit in a cage and sing.
> How can a child when fears annoy,
> But droop his tender wing,
> And forget his youthful spring.
>
> William Blake, "The Schoolboy" (1794)

Earlier it was suggested that texts which are ostensibly "about" brain development can profitably be read as also being "about" child development and vice versa. Another, perhaps more cautious, way of putting it is that I am interested in charting how "brain development" and "child development" get put into certain kinds of textual and practical relationships which legitimate unique forms of interaction among children, parents, teachers, and environments. In this section I offer support for this way of reading by engaging those texts which most directly illustrate/accomplish the formation of this relationship: texts that stipulate the importance of neurally-productive experience-environments during the first several years of a child's life. The argument in this section is that one of the reasons "child development" and "brain development" are able to become so closely articulated in and through these texts has to do with the fact that they

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are both grounded in a notion of *potential* that, while broad enough to accommodate both constructs, nevertheless effects a subtle shift of emphasis from child to brain.

As described previously, the first several years of brain development are crucial because it is in these first few years that the brain undergoes what is typically called a "proliferation" of synapse creation, where nerve cells in the brain branch out and form chemical and electrical connections with the branches of other nerve cells. Two fragments:

> At birth, a firestorm of synapse creation begins. By the time a child is two, her brain has twice as many synapses as her mother's or father's. The period when brain connections proliferate explosively coincides with the period when a child is discovering new things for the first time in virtually every waking moment. At the end of a child's first decade there is still a lush overgrowth of synapses, but by late adolescence, some neuroscientists estimate, half of all the synapses in the brain have been eliminated.[51]
>
> Both before and after birth, an initial "blooming" of brain connections occurs: Neurons create far more synapses with other neurons than will ever be retained in the mature brain. This proliferation of synapses creates great potential for the developing brain, but it also makes the young brain ineffecient and noisy with redundant and unnecessary neural connections. Consequently, this proliferation is soon followed by a stage of "pruning" when little-used synapses are gradually eliminated to reach the number required for the brain to operate efficiently.[52]

Although the elimination of synapses – as well as the death of as many as half of the child's neurons before adulthood – is believed to be dictated by genes and more or less consistent for all humans, the particular *value* of this elimination is unique to each child/brain since it is their unique experience-environments that over time select *which* synapses and neurons will survive and which will die.[53]

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[51] Ann B. Barnet and Richard J. Barnet, *The Youngest Minds: Parenting and Genes in the Development of Intellect and Emotion*, (New York: Simon & Schuster, 1998): 23.

[52] Ross A. Thompson, "Development in the First Years of Life," *The Future of Children* 11 (Spring/Summer 2001): 29.

[53] Dale Purves, E. Leonard White, and David R. Riddle, "Is neural development darwinian?" *Trends in Neurosciences* 19 (1996): 460-464.

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This intimate relation between nature and nurture is evident in the metaphors of the preceeding fragments. Synapse creation is a "firestorm" that coincides "explosively" with the child's first sensory experience. Synaptic density "blooms" to create a "lush overgrowth" which, though "noisy" and "redundant," both symbolizes and materially authorizes the "great potential" we typically associate with the beginnings of life. And yet, the physiological source of this potential is fated to end, at which point those pathways and connections which have become strengthened through use will survive while those which go unused only introduce noise and are pruned away so that the system achieve maximum efficiency.

Tropes which image the infant brain as an overgrown jungle bursting with potential appear alongside and are are interwoven with the more widely-recognized allusions to the potential of the infant child to realize its (or its parents) wildest dreams. After all, what parent hasn't looked into the crib of their infant and gotten overwhelmed when reckoning the seemingly infinite potential embodied in the little person staring back at them? Who hasn't smiled knowingly upon hearing the responses of children when asked "What do you want to be when you grow up?" Who hasn't heard – and believed – the perhaps uniquely American assertion that "Any child can become President of the United States"? These pleasing fictions illustrate how powerfully intertwined the figures of "child" and "brain" are able to become as the drama of development is rewritten to account for the new model of brain development.

Once institutional and psychological in nature (i.e. organizations and ability enable young girls to become astronauts, freedom of speech and desire enable almost anyone to run for president, etc.), the locus of a child's "potential" as it gets re-articulated to/through the discourse of the plastic brain is NOT essentially the parent, the teacher, the

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community, or even the child themself. The primary target or, as Foucault put it, *field of intervention*, is the brain itself.[54]

> "All of us are born with a relatively broad potential, but our experiences and their timing seem to play a big part in how much that potential will be expressed," says Bruce Perry, M.D., chief of psychiatry at Texas Children's Hospital, in Houston. "The foundation you lay down in infancy and early childhood really does make a difference for the rest of your child's life."[55]

One can easily imagine this fragment appearing in the pages of a 1940's-era *Parenting* magazine article detailing the importance of adequate socialization of the adolescent boy in order to channel his hormonal energies towards socially-appropriate ends. Within that frame, children act as they are taught to act and the labor necessary to create a strong foundation of, say, good table manners, makes it unlikely that in the future your child will embarrass themselves on their first unchaperoned date. And yet, again, the target of the above fragment is not the child per se, but the child's brain. This "foundation" is not social, ethical, or psychological but physiological. As for the child, the child is a property of the brain. The self is synaptic.[56]

To review: infant brains initially produce an overabundance of synapses. This excess both conceptually represents and materially instantiates the immense potential attributed to the child. And yet, this period of irrational exuberance cannot be sustained. "While this overproduction is certainly useful...it comes at the cost of lower overall efficiency."[57] During this period of pruning or "refinement," those connections which

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[54] Michel Foucault. "Governmentality," in *The Foucault Effect: Studies in Governmentality*, eds. Gordon Burchell, Colin Gordon, and Peter Miller (University of Chicago Press: Chicago, 1991): 102.

[55] Laura Muha, "Your Baby's Amazing Brain," *Parenting* 13 (Fall 1999): 40.

[56] Joseph Ledoux, "Connecting the self and the brain," *Australian Financial Review* (Jan. 1, 2003): A6.

[57] Lise Eliot, *What's Going On In There? How the Brain and Mind Develop in the First Five Years of Life* (New York: Bantam, 1999): 402.

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have been strengthened through use are "magically preserved" while those which remain unused are "ruthlessly destroyed."[58] Potential – now defined as strength of synapse and complexity of neuronal interrelation – can be sustained through experience-environments which provide the widest possible range of stimulation (or synapse use) since it is only through use that a connection will become strong enough to survive. This section has shown how the concept of potential serves as a node of articulation in/through which statements concerning the plastic brain attain value by bearing legitimate, even necessary, implications for the many fields of human relations that are concerned with maximizing that potential as it exists (or can be constructed) in children.

Implications and Applications

> 'For parents willing to really invest time and attention in the early years', says Dr. Perry, 'the dividends will be tremendous.[59]

Dr. Perry suggests that maximizing the potential of the plastic brain requires a sizeable investment in time and attention. The dividends – by which he presumably means the brain/child, since that is what physiologically reflects the extent of the investment in its production – will be tremendous. But what exactly is meant by an "investment of time and attention"? And what are the "dividends" that so reliably accrue from this investment? These questions mark a transition from the fairly conceptual discussion of "potential" in the previous section to the more practical domain of parent-child interaction, where the implications and applications of the plastic brain can/must be realized. While in the following chapter I examine how the dispersed effectivity of the plastic brain re-defines the domestic space of the home as a space for biological

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[58] Nash, 55.

[59] Muha, 41.

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intervention, the object in this section is to identify and trace the circulation of "implications" of the plastic brain as they get attached to specific behaviors and forms of relation by/between two people.

Part of the reason that the plastic brain is able to be articulated to/through such a variety of discourses and institutions has to do with the fact that the "implications" of brain development are, so to speak, so close to the surface. After all, if the brain is essentially an index of the experience-environments to which it has been exposed, and if certain experience-environments make for a more robust and versatile index than others, then it becomes fairly clear where parents and educators should be focusing their "time and attention." The immediacy of the plastic brain contrasts rather nicely with the many discourses regarding human genetics since, apart from genetic screening, cloning, or the future prospects for genetic therapy, there is – for better or worse – not much anyone can do about their DNA. This barrier to intervention helps explain why public discussion of genetics has to this point been limited mostly to the more abstract topics of ethics and privacy, while brain research achieves uptake inside and is said to help inform more day-to-day topics of parenting, education, and child development.

Not surprisingly, then, it is these day-to-day activities and behaviors which are most often put into to contact with "the plastic brain" and get re-fashioned as they come out the other side.

> As science is now telling us, some of the most important preparation we can give our children takes place during the earliest years of life. New research has confirmed what many parents have known infants begin learning the minute they are born. They are acutely aware of their surroundings and their brains crave and absorb all sorts of stimulation. Although Bill and I didn't realize it at the time, the countless hours we spent cuddling with Chelsea and reading her favorite stories not only strengthened our relationship with her but literally helped her brain grow.[60]

[60] Hilary Rodham Clinton, "Doing the Best for Our Kids," *Newsweek* (Spring/Summer 1997): 94.

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Reading, singing, and holding babies – more or less the entire scope of interaction between a parent and their newborn – are crucial behaviors, but not for the reasons one is most likely to imagine. This is not your parent's parenting. Instead, whereas the importance of these simple interactions once derived from their alleged power to affect parent-child bonding or to enhance a child's emotional development, textually-secured contact between the authoritative "as science is now telling us…" and the most basic parenting practices imaginable brings about a (re)valuation of those practices as scientific interventions into/upon the developing brain itself rather than as "quality time" or any of the other euphemisms for preferred sorts of interaction. After all, it is suggested, beyond being simply a nice thing to do, what parents are REALLY doing when they read a story to their child is wiring their synapses.

This is illustrated well in the text from an advertisement for Enfamil LIPIL Baby Formula. This particular product offers a "unique blend of DHA and ARA – nutrients also found in breast milk that support brain and eye development." The ad is ubiquitous in magazines like *Parenting* and *Working Mother* and features an extreme close-up on a baby's face as it sucks from a bottle. Directly under the baby's left eye appears the text, "Right now, she's doing more than just warming your heart. She's also developing her mind." The "just" is key because it shows how the plastic brain can displace the previously-sufficient impact of a cute baby "warming your heart" and assert the fundamental primacy of brain development above all else. This re-valuation of parent-child interaction can even lasso in that most idyllic image of (grand)parent-child bonding: sitting on an adult's lap and listening to them read you a story.

> 'The thought in the past was that not much happened during the first three years,' says [Barbara]Bowman, who has 50 years of experience in child development… 'But now, we have a better idea about the brain, and we find that the capacity of the brain is shaped by the experiences children have when they're very, very young. That makes the 0-to-3 period so much more important than we've ever dreamed before.' Experts say that simple activities like talking to children, playing games with them, reading to them, cuddling and kissing them--tasks often

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> taken for granted--play major roles in determining whether a child will excel in life. And prominent figures, notably retired Gen. Colin Powell with his "Laptop" campaign of putting kids on your lap and reading to them, have started nationwide efforts extolling the importance of these activities to a child's intellectual and emotional development.[61]

Importantly, although the paragraph ends with a reference to "emotional and intellectual development," the organization of the article offers readers a chance to simplify their understanding of development (and practices of parenting – see Chapter 4) by embracing the brain as the primary locus of human capacity and treating "intellectual and emotional development" merely as a common sense way of describing what is **really** going on in the brain.

Descriptions of the intimate, even causal, connection between a particular behavioral interaction (reading, touching, singing, gazing, etc) and the consequent value of that interaction for synapse formation are a key feature of texts that produce and circulate "implications" of the plastic brain. In fact, the tone achieved in these texts is most often pedagogical in nature; similar to, 'Even if you don't do anything differently or even care about brain development, THIS is what is nevertheless going on when you read, sing or hold your child.'

> YOU HOLD YOUR NEWBORN SO HIS SKY- blue eyes are just inches from the brightly patterned wallpaper. ZZZt: a neuron from his retina makes an electrical connection with one in his brain's visual cortex. You gently touch his palm with a clothespin; he grasps it, drops it, and you return it to him with soft words and a smile. Crackle: neurons from his hand strengthen their connection to those in his sensory-motor cortex. He cries in the night; you feed him, holding his gaze because nature has seen to it that the distance from a parent's crooked elbow to his eyes exactly matches the distance at which a baby focuses. Zap: neurons in the brain's amygdala send pulses of electricity through the circuits that control emotion. You hold him on your lap and talk . . . and neurons from his ears start hard-wiring connections to the auditory cortex. And you thought you were just playing with your kid.[62]

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[61] "Making the Most of the First Years," *Ebony* (May 1999): 66.

[62] Sharon Begley and Mary Hager, "Your Child's Brain," *Newsweek* (Feburary 19, 1996): 54.

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> Connections that are reinforced by a baby's exposure to language, images, sounds, facial expressions and even lessons in cause and effect (Baby smiles, Mommy smiles back) become permanent.[63]

> Of course, we want no adversity for our children, no window of opportunity slammed shut. So we play nursery games, read simple books, make funny faces. The neurologist might say that with each round of peekaboo, a particular neural connection is reinforced. The cognitive-development theorist might counter that during the appropriate developmental stage, a baby moves to the next logical step. Both would agree that the net effect of peekaboo is the same: A baby comes to understand that among the known properties of his physical universe, his parents considered him worthy of their time, love, and attention.[64]

> [Then First Lady Hillary] Clinton said she often runs into parents who still don't know what babies are capable of doing and learning. She said that all those games we play with infants, from itsy-bitsy spider to peek-a-boo, now are clearly important to stimulating their development. In addition, she said, it's important to talk, read and sing to young children and to take them outdoors... Common sense has argued this for a long time, but now science is backing it up. We should start listening. It could be the best investment we've ever made in the future of our country.[65]

> An infant is staring at his mother's versatile face, not a trace of understanding in his still-focusing eyes. And yet behind that wide-eyed gaze and soft cap of bone, an electrical storm is taking place. Deep inside the 1-1/2 pound infant brain, millions of wispy circuits are zapping and firing, paving electrical roads and bridges that will carry the heavy traffic of learning, questioning and creating throughout life. The first five years of life is, arguably, the richest period for learning — a short but spectacular window of time when experiences such as a whisper, a hug and a bedtime lullaby literally change the architecture of the developing brain.[66]

If the primary implication drawn from maturational theories of development for parents was to treat their child as "a living, growing organism...to whom the culture must

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[63] Jennifer Lach, "Cultivating the Mind," *Newsweek* (Spring/Summer 1997): 38.

[64] Linda Henry, "Inside the Mind of a Baby," *Parenting* (May 1998): 86.

[65] Judy Mann, "Making the Most of the Early Years," *Washington Post* (April 16, 1997): E13.

[66] Tamara Koehler, "Nature lays the foundation of a baby's brain, then nurture adds the walls and roof," *Ventura County Star* (May 11, 2003): A1.

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attune itself if his potentialities are to be fully realized"[67], the plastic brain asks/requires parents to "make the most of" the "biological advantage that is given to us by Mother Nature all the way to 10 to 12 years of age."[68] I argue that part of what it means for a parent to capitalize on the "biological advantage" presented by the plastic brain is to reconfigure the relational dynamics of the parent-child relationship itself. To explain this will require venturing onto the very well-trod ground known as the nature/nurture debate.

Nature/Nurture: Reframing the Picture

From at least the 1930's to the present, the discursive contours of the parent-child relationship could be located along the spectrum – or, more accurately, within the topos – called Nature v Nurture.[69] No matter where one came down on this topic, the specific components entailed by the categories of "Nature" and "Nurture" were tacitly agreed to by all. "Nature" was comprised of heredity, genes, physical development, and, for most of the twentieth century, intelligence.[70] "Nurture" encompassed the sum total of a person's upbringing (especially the mother-child relationship), socialization, and education (broadly defined). Since the substance of "Nature" was presumed to be more or less fixed from the beginning, arguments regarding child development and child care were directed at "Nurture," since it was all anyone could do anything about. In fact, although it is typically called the "debate" between "Nature" and "Nurture," this so-

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[67] Arnold Gesell and Frances Ilg, *Infant and Child in the Culture of Today* (New York: Harper & Row, 1943): 4.

[68] Harry Chugani, "pioneer in child brain development from Children's Hospital in Detroit", quoted on NBC's *Today*, April 14, 1997.

[69] Elizabeth M.R. Lomax, *Science and Patterns of Child Care* (San Francisco: W.H. Freeman & Co., 1978).

[70] Peter N. Stearns, *Anxious Parents: A History of Modern Childrearing in America* (New York: New York University Press, 2003): 99-103.

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called debate really only concerns "Nurture," and whether and to what degree parenting/education/experience has or can have any impact on a person's life course. After all, it wasn't as if Gesell, considered the father of maturation, had nothing to say to or for parents, teachers, or cultural institutions. Instead, the heart of the "Nature-Nurture" divide has always concerned what kind of relationship was possible between "Nature" and "Nurture" and what kind of relationship was desireable.[71]

The reconfiguration of the relational dynamics that I argue has been made necessary by the textual production and circulation of the plastic brain stems from the disruptive effect that the plastic brain has on this well-established picture of "Nature" and "Nurture". There are two aspects of this disruption. The first concerns the fairly-wide degree of choice that has heretofore been assumed to exist between various schools of "Nurture." Behaviorists proclaimed that environmental manipulation was the only possible (and therefore the most desirable) form of "Nurture", while maturationists countered that the only possible and desirable form of "Nurture" was anticipatory adaptation to the child's physical maturation. Both perspectives were based on the assumption that "Nuture" could be intentionally dialed up or down – "more" (behaviorists) or "less" (maturationists) – depending on the situation, the child, commitments of the parents, or numerous other factors. In short, "Nurture" was comprised of a finite set of environmental and behavioral interactions, initiated primarily by parents, and considered, whether doled out in heaps or dribbles, an unmitigated good for the child.

The plastic brain upsets this see-saw back and forth from "less nurture" to "more nurture" by removing its argumentative fulcrum. "Nurture" is no longer the imposition of a sovereign (transcendent) force that either influences or does not influence that static object called the child, but rather an immenent and inextricable being-with from which

[71] This helps explain why the topic of "Nature v. Nurture" is, to my mind, most productively explored by those with a sensitivity to rhetoric.

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there is no escape. That is, nurture is not something one does at 10:30AM and then again at 6:00PM. On the contrary, it is happening every second of every day whether one wants it to or not. At issue is no longer whether or not to engage in "Nurture" but what kind of "Nurture" is going to make the most appropriate use of the potential offered by the (incessantly) developing brain. Obviously, the fact that there can no longer be such a thing as "more nurture" or "less nurture" does not in any way temper the normative element which has underwritten much of the Nature-Nurture "debate." While this normative tenor had earlier been supplied by longstanding conflicts between opposing theories of development and their preferred modes of parenting (e.g. behaviorist, Spock-ian, psychoanalytic, Piaget-ian, Montessori-ian, etc.), the plastic brain serves to dilute the central assumptions that once kept those schools discreet and disperse the resulting jumble of beliefs, practices, and justifications across the entire field of "Nurture". Whereas justifications for different modes of parenting once derived from a (typically-tacit) identification with a particular theory or school of development, the picture as revised by the plastic brain is greatly simplified since there is now only one arbiter, one Boss: the child's brain.[72]

With apologies to Martin Luther, the basic argument is similar to that which spurred the Protestant Reformation in that the plastic brain cuts out the middleman and puts the parent/teacher/other into intimate contact with the man/organ upstairs. In sum, when the plastic brain forces a shift from a transcendent to an immanent "Nurture", this in effect enables the plastic brain to dig deeper than, destabilize, and, in a sense, make irrelevent those practices of and attitudes about development in which the real-world impact on a particular child is always one step removed. It is important to point out that this one step remove was an important source of security for parents since it meant that they could look elsewhere for justification, assurance, or blame for their "choice" of

[72] Or, more accurately, "those sources and symbols that tell us about the brain."

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nurture.[73] The new form of "Nurture", though, means that parents no longer have this security, since direct access to the brain can only act as a mirror reflecting disappointment or joy back on the whomever seeks counsel or affirmation.

While the first aspect of disruption involves "Nurture", the second concerns a shift in the "Nature" of the mode of parent-child interaction itself. This shift can be illustrated very clearly by examining the verbs most often used to characterize the nature of development and the nature of parenting. Prior to the the emergence and articulation of the plastic brain to/through discourses of parenting and child development, the primary verbs used to illustrate in a global sense "what parents do" were: influence, nurture, manage, encourage, train, observe, facilitate, teach, and understand. These are all "acting on" verbs that signify a bi-directional relation between two discreet entities. The general idea is that the parent-child dyad is achieved through the inter-action of two distinct individuals who work out over time a mutually-satisfying and beneficial relationship. The point is that these verbs signify a relation located *between* the child and the parent. Contrast this with the primary set of verbs used to signify the parent-child relation from within the context of the plastic brain: build, reinforce, hard-wire, change, alter, generating, sculpting, and make. The difference is profound. Parent do not merely "influence" or "teach" their child. Rather, they "literally change the architecture of the developing brain."[74] This is an intervention, not an interaction; a result, not a relationship.

It is true that there have been earlier episodes in the history of discourses concerning developmental theory and parenting in which verbs like these were considered to reflect the true nature of the parent-child relationship. I am not suggesting

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[73] It is worth pointing out here that the use of the phrase "baby bible", which originally referred to Dr. Spock's *Baby and Child Care* but continues to be used for today's parenting gurus, can be seen as an indication of the nature of the investment that parents have in these third-party sources of justification.

[74] Koehler, A1.

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that this is the first time there has been a direct connection drawn between parenting practice and physiological change.[75] After all, even B.F. Skinner, who allegedly "black-boxed" the brain and considered a complete understanding of behavior to be a necessary precursor to the study of the nervous system, noted in his later years that the contribution of a future physiology would be "an important *advance* over behavior analysis."[76] In short, it has always been assumed that there was some basic connection between what a person smelled, how they behaved, their physical capacity, etc. and their physiology. And yet, what is unique about the moment marked by the emergence and dispersed circulation of the plastic brain is that, rather than "influence" or "guide" or channel the child's brain, the parent and the child via an experience-environment actually produce nerve tissue. This ongoing production is pre-cognitive, of course, so it comes before and, crucially, conditions/determines the character of the more traditional psychological constructs like self-image, personality, individuality, and ability. This temporal primacy is also developmental primacy, a point which, when presented alongside the inevitability of synaptic pruning, helps to explain just how much is said to be riding on the early experience-environments of a child.

Economies of Development

As a way of concluding, it may be productive to point out how the two approaches to development discussed earlier in this chapter have analogues in the history of economics. Maturational theories of development like Gesell's, in which development is an internally-governed, acorn-to-oak sequence of genetic unfolding, are like command economies. Decisions about the availability of resources are made according to a set schedule of development that is spread out over many years. The needs of the total

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[75] Daniel Beekman, *The Mechanical Baby* (Westport, Conn.: Lawrence Hill & Co., 1977): 16-27.

[76] B.F. Skinner, *About Behaviorism* (New York: Random House, 1974): 236. my emphasis.

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system are predetermined in advance and, as long as each unit follows its own unique part of the Master Plan, the organism will remain healthy. Outside events have little effect on the overall scheme of things; if one region suffers trauma or natural disaster, too bad. The objectives of the multi-year, Master Plan must be satisfied or the entire system will suffer as a result. This economy of development is relatively immune from preturbation and designed to achieve only those levels of production (development) that are necessary (normal) for ensuring completion (maturation) of the plan (organism).

In contrast, the theory of development registered in and by statements that promote the plastic brain can be likened to a mercantilist economy. In the early years, raw materials (i.e. the "lush overgrowth" of synapses) are plentiful beyond belief. There is no 10-Year Plan; no central committee to coordinate decisions. Alliances are formed between competitors and joint endeavors begun in order to maximize economic (developmental) potential. Those entities that make strategic connections become strong enough to combine and cooperate, which in turn makes them even more adept at controlling/anticipating the ever-changing environment. Unlike in the command economy, so-called "outside events" are absolutely essential to a mercantilist economy of development. The ability to tailor one's activities to local conditions and adapt to an infinite array of circumstances is the primary characteristic of successful entities. It follows that this is a highly-unstable and cut-throat milieu. Every day presents wholly-unique challenges and many more entities fail than succeed. Then, after this initial period of almost Edenic abundance, the amount of raw materials begins to decline. Panic sets in. Those entities that for whatever reason were unable to gain strength by making connections with those around them close up shop and are never heard from again. On the other hand, practices which were most-widely used have now become axioms and only those entities that managed to realize the most potential are able to survive within the new economy of scarcity.

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To be sure, this fanciful illustration is overstated for effect, but the general point should be clear: the pre-adolescent brain presents parents, teachers, counselors, and children themselves with a time-limited and diminishing resource. The stairsteps once used to illustrate maturational and stage theories of development have been flattened out, leaving an almost Sisyphusian incline against which organisms must continually struggle.

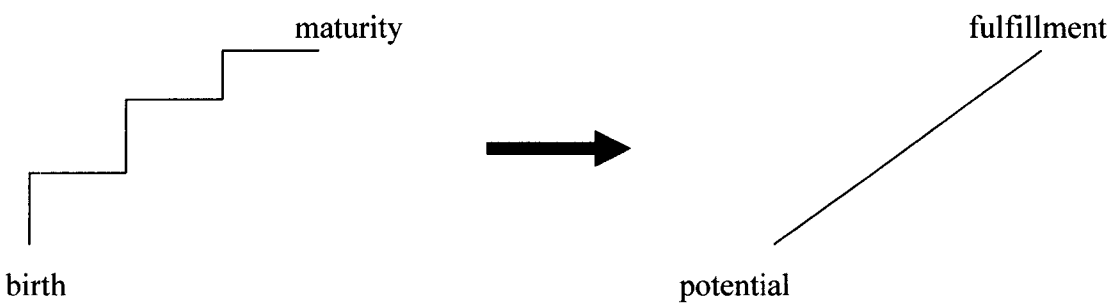

Figure 2. Slippery Slope of Plastic Potential

This struggle is endured NOT because we know that we need to help children get from point A to point B. After all, the plastic brain flattens the progressive chronology of maturation into a single point – NOW – and thereby produces a potentially infinite number of possible point A's and point B's. Rather, in the face of this uncertainty, the struggle for development must be endured because struggle is the only option available. The plastic brain offers no guarantees. No longer are parents entitled to look into the crib and wonder, "What will she be like in twenty years?", because the answer is clear: no more – and no less – than her brain allows.

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CHAPTER IV

ENVIRONPARENT

> Touch in the form of rocking and swinging also is beneficial to a baby's brain. My little Peter got lots of hugging and cuddling a few weeks ago when he was in the midst of his colic. I logged hundreds of miles of walking in my hallway while I tried to calm him in my arms. I was afraid I was spoiling him, since I jumped to his side every time he cried. But now researchers tell me I actually was helping to get his brain working. And after all, that's my job as a mom.[77]

In the previous chapter I attempted to show how a wide array of texts have both 1) provoked a shift from static to plastic conception of the brain and 2) helped explore the details and implications of that shift throughout discourses of early child development. In the present chapter I broaden the scope of inquiry in order examine how these textually-achieved implications have become legitimating warrants for particular attitudes about and practices of parenting the plastic brain. In other words, what are parents told that they must do differently – or for different reasons – in the wake of what, to paraphrase Wixon, "researchers tell us"? By this point in the project the reader should hopefully have an idea about *why* Wixon can now plausibly define her "job" as a mom as "helping to get his brain working." This chapter seeks to show **how** this new job description gets positioned as a backdrop against which to introduce significant conceptual and practical alterations into the mindset and behavior of parents. This story begins, appropriately enough, in the womb.

The Earliest Environment

> It is a child of God that you now have within you. What a consolation [for your pain]! It is a member of His mystical body which is now shaping in secret and curiously to be wrought. Sobriety must accompany this holiness. Indeed the unborn infant will be naturall and powerfully and profitably affected by the sobriety of a holy mother. The passions or the surfeits of the mother make a strange impression on the infant: yea, on the soul of it. Be temperate in all things.

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[77] Colleen Wixon, "For Mom, stirring Baby's brain is one of biggest jobs," *Vero Beach Press Journal*. (August 22, 2003), available at http://www.abqtrib.com/archives/news03/082203_news_mom.shtml. Retrieved January 31, 2004.

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> Keep your mind in all the undiluted serenity that is possible. In your meats, drinks, rest, use enough, but nothing too much. This temperance will dispose you to wait upon God in a due frame for His favors and your offspring will enjoy the good effects of it.[78]
>
> It is certain, however, that the future health and constitution of the offspring are greatly, though it may be to an indefinite extent, dependent upon the conduct of the mother. If she carefully adopt the right mode of managing herself, experience has proved that she takes the most likely steps to insure a healthy progeny. Should she, however, be careless and negligent upon this head, and fail in attention to the measures which her new condition demands perhaps indulging in a course which, under ordinary circumstances, would be directly opposed to the maintenance of healthier child will inevitably be variously and injuriously affected, these causes operating through her system upon that of the child.[79]

Despite their age, these fragments represent what has until recently been the conventional wisdom regarding the biological relationship between mother and fetus. As long as expectant mothers practiced temperance (emotional and gastronomic), got ample rest, and engaged in adequate self-management, proper fetal development could be more or less assured. Although the existence of maternal impressions[80] has been under dispute through the beginning of the twentieth-century, the primary focus of prenatal health has been for most of the century the increasing number of toxins and other dangers in the mother's environment.[81] On the subject of gross physical dangers in the mother's environment, one direct relationship between maternal injury and fetal development was taken up in the courts in 1920 with two separate cases alleging prenatal damages to a fetus. In one case, a family sued Borden's Milk Co. for $100,000 alleging that the mother's shock at being bitten by one of that company's cart horses had caused "physical

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[78] Cotton Mather, *Elizabeth in Her Holy Retirement* (1710), qtd. in Beekman, 77.

[79] Thomas Bull, *Hints to mothers, for the management of health during the period of pregnancy, and in the lying-in room: with an exposure of popular errors in connexion with those subjects* (New York: J. Wiley, 1877): 17.

[80] Namely, the hypothesis that birthmarks, deformities, or other affective disorders are caused by a mother's traumatic experience. For a discussion of how such beliefs affected one pregnant woman, see Naomi Wolf, *Misconceptions* (New York: Vintage, 2001): 109-112.

[81] Brian P. Pace, "Maternal Impressions," *Journal of the American Medical Association*. 27 (1896): 1031-1032.

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deformities and other abnormalities in the child," who was born a few months later.[82] In another case, a judge awarded $10,000 to an infant whose "permanent injuries" were caused prenatally when her pregnant mother fell into a coal hole on a Brooklyn sidewalk.[83] This judgment was upheld 3-2 on appeal, with the majority opinion holding that "the rights of humans do not necessarily originate at birth, but in many cases precede birth in their origin."[84] This trend reached perhaps its apogee when in April 2004 President George W. Bush said, before signing the Unborn Victims of Violence Act, that "The moral concern of humanity extends to those unborn children who are harmed or killed in crimes against their mothers."[85]

In addition to overt physical harm, expectant mothers have been instructed to be especially concerned about their exposure to any chemicals or other toxins that might compromise fetal development. And yet, from industrial air pollutants to lead paint in the home, from Thalidomide for sound sleep to Bendectin for morning sickness, the twentieth century proved to be one tragically extended lesson in the developmental dangers posed by synthetic chemicals. [86] In addition, the conventional wisdom regarding voluntary consumption of recreational chemicals has been less than consistent, most clearly on the question of whether it is developmentally "ok" for pregnant women to smoke cigarettes or drink alcohol. Not only that, the importance of good nutrition has been reinforced time and time again, but, because the definition of "good" has changed so often over the years, many pregnant women have become so anxious about eating the

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[82] "Girl of 4 Sues for Prenatal Accident," *New York Times* (March 5, 1920): 6.

[83] "Gives Child $10,000 on Prenatal Injury," *New York Times* (May 23, 1920): 5.

[84] "Child May Recover for Prenatal Injury," *New York Times* (January 15, 1921): 15.

[85] George W. Bush, "President Bush signs the Unborn Victims of Violence Act of 2004," (1 April 2004). Available at http://www.whitehouse.gov/news/releases/2004/04/20040401-3.html (accessed 13 May 2004).

[86] Incidentally, both these drugs have recently been re-introduced into the American market. See Charles Marwick, "Thalidomide back - under strict control," *Journal of the American Medical Association* 278 (Oct 8, 1997): 1135-1137.

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right foods that some actually do more harm than good.[87] As it stands now, inadequate nutrition during pregnancy has been said to have a hand in causing stress, obesity, diabetes, high cholesterol, cancer, allergies, and heart disease. Women who are or may be thinking about getting pregnant should seriously consider what kind of environment they are creating in their womb because "[T]he seeds of health are planted even before you draw your first breath, and the nine short months of life in the womb shape your health as long as you live."[88] It seems the womb can be a very dangerous place.

Importantly, each of the above concerns has been primarily *preventive* in nature. That is, it is presumed that the fetus develops normally as long as the mother clears away those environmental complications that may have a negative effect. Development proceeds according to a standard timetable and the job of the expectant mother is to ensure that that process progresses unimpeded. This should sound familiar because it is the position taken by Gesell as it was discussed in the previous chapter: "Intrinsic growth is a gift of nature. It can be guided, but it cannot be created; nor can it be transcended by any educational agency"[89] Of course, this notion of "intrinsic growth" is an essential component of the static theory of brain development and, as this theory is upended by theories of the plastic brain, we can expect to see important changes in the advice and directions given to women who are or are considering becoming pregnant. Indeed, whereas the static brain privileged a defensive frame of mind, one important effect of the plastic brain has been to replace this logic of prevention with a logic of **production** by substituting parental intervention for Gesell's "intrinsic growth." In the following subsections I engage two sites where these changes have been embraced and show how

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[87] Brody, Jane E., "Life in Womb May Affect Adult Heart Disease Risk," *New York Times* (Oct. 1, 1996): C1.

[88] Sharon Begley and William Underhill, "Shaped By Life in the Womb," *Newsweek* 134 (Sept. 27, 1999): 58.

[89] Gesell, "Growth Potentials of the Human Infant", 252.

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they adopt and adapt to a productive rather than preventive model of parenting and brain development.

Bonding before birth

> Considering all we know today about the realities of life before birth, we are obliged to set back the clock of parenthood. The new facts plead for parental involvement and participation in the matrix of intimate interactions in the womb. Parents are creators and creating starts very early, ideally before the conception itself, when "quality control" efforts can spare the baby from a lifetime of sickness or handicap. Creating is what early parenting is about--creating a physical body and brain, creating emotional foundations for living, and establishing a rich connection with the prenatal self.[90]

It is important to note that many of the specific maternal behaviors advocated from within the logic of prevention do not necessarily become irrelevant within a logic of production. The injunction to safeguard oneself from exposure to harmful chemicals or maintain adequate nutrition remains intact but the warrant motivating those behaviors has changed. This shift in the source of motivation for particular behaviors can be suggestive in analysis of scientific texts because it allows one to see how themes of scientific research can become internalized ways of seeing the world rather than simply external sources of legitimation or expertise. Whereas logics of prevention entail authoritative voices telling expecting mothers what they should and shouldn't do to clear the path for intrinsic growth, logics of production transcend GOOD and BAD by attributing physiological value to each and every minute-by-minute behavior of the pregnant woman. This is what Chamberlain means when he says that "we are obliged to set back the clock of parenthood." Parents are "creating" a baby, not merely "having" one, and this means that the prenate requires as much if not more attention and stimulation as a baby.

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[90] David Chamberlain, "What Is Early Parenting?" Association for Pre- & Perinatal Psychology and Health. Available at <http://www.birthpsychology.com/lifebefore/early.html> (accessed 10 February 2004).

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> Not long ago we did not think prenates could have any significant experiences. We didn't see how they could have a working mind. In retrospect, our false beliefs about the brain obscured the fact that babies in the uterine world were indeed having experiences, establishing patterns of interaction, listening to music and conversation (and as tests ultimately proved) were remembering them.[91]

It so happens that Chamberlain is the editor of a website and journal devoted to what is called Birth Psychology, or the study of the influence of prenatal and perinatal (less than six months) experiences on a person's emotional and spiritual well-being. There are quite a large number of publishers and organizations and therapists working in this area and each situates itself in varying degrees of opposition to mainstream psychiatry. Judging from its strongly-held beliefs in such things as intra-uterine communication, life before conception, and birth trauma, one might be tempted to dismiss this community as just another sort of New Age spiritualism which, despite its good intentions, illustrates more about the power of the placebo effect than about so-called hard science. And yet the Birth Psychology movement has embraced the plastic brain and utilized its logic of production as a source of proof of the significance of the womb as an environment which mothers can and must manage according to desired ends.

The most significant of these ends is said to be the strong emotional bond between mother and child. This bond is said to be achieved prenatally through a kind of 'communication' between mother and fetus via the environment of the womb. Thomas Verny, a founder of the Birth Psychology movement, laments how "despite the evidence, many resist the notion that communication between parents and unborn child lays the groundwork for their relationship after birth, and in all the years to come."[92] Arguing that Freud "missed the true significance" of the Oedipal myth, he locates the source of Oedipus' torment in the womb and immediately after his birth, when he was subjected to

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[91] Ibid. For a survey and discussion of obstetrical naming practices (fetus, baby, fetus-baby, prenate, etc.), see Nicole Isaacson, "The "Fetus-Infant": Changing Classifications of "In Utero" Development in Medical Texts," *Sociological Forum* 11 (Sept. 1996): 457-480.

[92] Verny, *Tomorrow's Baby*, 59.

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attempted murder by this father and betrayal and abandonment by his mother. It was the physiological imprint of these experiences on his brain that drove Oedipus', not some vague notion of metaphysical desire. While he maintains that Freud's interpretation remains valid, Verny biologizes it by pushing it back into the womb and making it evidence for an explicit causal connection between pre/perinatal experience and lifelong source of motivation.

Verny proceeds to outline the three "channels of communication" through which "maternal emotions and thoughts" are communicated to the unborn child. "Right from the moment of conception, the unborn child has a dialogue with the mother and, through her, the outside world. When all the channels are active the baby receives the full message; it's like stereophonic sound."[93] The three channels are:

1. molecular – stress hormones, neurohormones, and sex hormones that reach the child through the umbilical cord and placenta.
2. sensory – when pregnant mother "strokes her stomach, talks, sings, walks or runs, she is communicating with her baby through the baby's senses."
3. intuitive – "transmits the mother's thoughts, intentions, and much of her emotion to her baby. The mother receives messages by the same channel from her unborn child, often in the form of dreams."

Mothers are encouraged to recognize these channels of communication and, because they occur mainly without her conscious intention, to reconcile their behaviors and thoughts to the fact that, when it comes to fetal development, they cannot not communicate.

Perhaps a better way to put it is that expectant parents either do or do not communicate with their "unborn baby" but <u>both choices have developmental consequences</u>. In the previous chapter, I discussed how, rather than having AN environment or NO environment, the real question is what **kind** of stimulation is effected by a **particular** environment and what are the **particular** effects of that stimulation on

[93] Verny, 61.

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development. There is no developmentally or physiologically neutral environment. In the same way, even though some pregnant women may not *intend* to "communicate" with their fetus-baby, they nevertheless do, thanks to Verny's biological gloss of the term "communication". The question again is what **kind** of communication and to what end?

It is interesting to try to reconcile Verny's notion of 'communication' with the competing definitions of that term in the academic discipline of Communication Studies. Indeed, the tensions within Verny's 'communication' mirror two fundamental tensions in that field regarding the place of intention and the relation between communication and subjectivity. On one hand, there is a considerable investment in a transmission model of communication, wherein individuals have in their head what they want to say and 'communication' is simply the process of transmitting those intentions successfully to someone else. Another term for intention is 'message'. In this sense, Verny wants to teach parents about 'healthy messages' and tell them how they can best communicate those intentions to their 'unborn child'. And yet, on the other hand, Verny's embrace of the plastic brain requires him to back away from a transmission model because it is no longer the <u>intentions</u> of parents that directly impact their unborn child, but rather stimulation from the fetal environment. Parents may be able to have *some* effect on the fetal environment but the end result no longer resembles parent-child communication but rather an overdetermined and dynamic system comprised of parent, fetal environment, and child.

A second point of tension in Verny's theory of 'communication' can also be seen in the field of Communication Studies and this concerns the relation between communication and subjectivity. On one hand, because the starting and ending point of message transmission must always exist prior to the transmission itself, Verny's embrace of a transmission model commits him to an extra-discursive theory of subjectivity. That is, mother-to-be represents her (already-existing) self to the (already-existing) self of her unborn child (and vice versa) through communication. And yet, on the other hand, many

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of Verny's claims rest on the presupposition that the child-to-be is NOT a fully formed person but is rather, for good or ill, a work in progress. 'Communication' in this sense is constitutive in that subjects are formed as a result of symbolic action. The point of drawing out these tensions is not to use them to dismiss Verny's claim but rather to show how the introduction of the logic of plasticity can be seen to expose similar tensions in one of the key terms for those fields in which the notion of communication is central.

Verny and virtually all other birth therapists advocate some kind of musical experience as a particularly beneficial form of communication between pregnant mother and "unborn child". Indeed

> No one questions the fact that sound and motion reach the baby in the womb. Evidence that babies recognize their mothers voice – and even words or stories she repeats – has been accepted for years. Numerous studies now indicate that the most effective means of communication may be delivered through music. Although the research is fairly recent, the technique of as ancient as motherhood itself.[94]

Speaking to the "unborn child" and exposing it to music are said to ensure a strong bond between mother and soon-to-be-born child because, as physiological stimuli, it utilizes all three of Verny's channels of interuterine communication. In response to this new awareness/market, a number of manufacturers have begun to create devices meant to assist parents who wish to engage in this kind of communication with their "unborn child". These devices, essentially small Doppler or stethoscope instruments, allow parents to "stimulate" baby with music and speech and enable baby to stimulate parents by letting them hear heartbeats and movements in utero. As you may expect, the simulative value of this communication – for both parties – constitutes the primary basis of commercial appeal for these products and so has a prominent place in their marketing and instructional texts. One such product, the BeBe Sounds Deluxe Prenatal Gift Set, includes headphones, fetal stethoscopic monitor, instruction manual, a cord allowing one

[94] Verny, 62.

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to record sounds picked up by the monitor, fetal speakers, a Mozart CD, and fetal microphone. The instruction manual addresses both the mechanical operation of and physiological changes wrought by the device, making it a kind of primer in brain development, bonding, and prenatal stimulation. Its sections on "How Your Unborn Baby Develops," "How Your Unborn Baby's Brain Develops," and "Research Findings" skillfully intertwine the emotional/therapeutic benefits of sonic stimulation with cognitive advantages said to result once the baby is born. For example, the following items make up the list of advantages said to accrue to those who engage in prenatal stimulation of the kind enabled by the BeBe Sounds device:

- Be calmer and more alert
- Be happier and cry less
- Have a long attention span
- Be stronger and have better coordination
- Lift up his or her head and stand up earlier
- Walk earlier
- Talk earlier
- Have more self-confidence."[95]

Importantly, the existence of this direct connection between emotional bonding and intellect/achievement, previously only assumed, becomes a great deal more plausible in the wake of the plastic brain. In effect, the plastic brain becomes the translation mechanism by which a mother's touch, voice, and song attain physiological value within the fetus as a biological organism. This presents a tremendous rhetorical advantage to those wishing to advocate prenatal stimulation because they can now point to something more substantive than fuzzy notions of "attachment" or "mother love". Of course, it is doubtful that this newfound 'objectivity' could withstand "scientific" scrutiny, but that is beside the point. More important is to see how and understand why the figure of the plastic brain, because it reorients attention to the womb as an environment whose

[95] Instruction Manual. *BeBe Sounds Deluxe Prenatal Gift Set*, available at <http://www.bebesounds.com/products_prenatalgiftsets_downloadmanual.asp.> (accessed 25 February 2004).

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simulative character has material impact on brain/fetal development, manages to pull the entire range of maternal behavior and thought into the realm of biology and its preferred medium: science.

Clearly, the many notions of prenatal bonding and the double consciousness of the pregnant woman and her fetus-baby have been circulating for millennia and represent a significant source of vernacular knowledge about pregnancy and motherhood. And yet, the plastic brain allows writers and advocates of birth psychology to buttress their claims about the "reality" of the significance of intrauterine communication and maternal emotion on the life (i.e. brain) of the "unborn child". Even though the textual presence of scientific research is typically limited to "Studies prove…" or "Research shows…", the effectivity is more far-reaching because it suggests that, since the spiritual midwife and the neuroscientist are actually in agreement on this, it cannot be denied. Also, whereas this discourse has traditionally lauded ancient folk wisdom and presented itself in opposition to the medicalization of pregnancy, fulfilling the promise of the plastic brain requires parents to learn basic neuroscientific vocabulary and to employ a number of medical technologies in their preparation and practices of pregnancy. After all, even though bonding will almost certainly occur without the use of the BellyBeats Digital Doppler Monitor™, the only way to *really* know for certain is to seek confirmation and assurance through technology.

Prenatal Classroom

> Q: Why should we use BabyPlus?
> A: The real question is, "why wouldn't you use BabyPlus?" It is safe, it is scientifically sound, and the benefits are remarkable. In order to give your child every advantage, you take care of your health while your pregnant - eating right, taking prenatal vitamins, avoiding alcohol, etc. Why not start educating your child as early as possible?[96]

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[96] "Frequently Asked Questions," BabyPlus Inc, available at <http://www.babyplus.com/FAQs/>. (accessed 26 February 2004).

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> Order Your Own BABY BOOMERS (R) Today - Your Baby Will Thank You For It.[97]

While the plastic brain introduces the possibility of confirmation into the discourse of prenatal bonding, it has helped to generate an entirely new discourse-practice which falls under the rubric of prenatal education. After all, there is no reason that the root mechanism of synaptic plasticity cannot be employed for purposes other than bonding. Indeed, one consequence of the immanence of the plastic brain – and our subsequent obligation/desire to re-define behavior, thought, and environmental stimulation as (mere) modes of synapse formation – is to begin thinking of the womb as a public space of instruction as opposed to an private space of affect. Evident here is the same logic of production discussed earlier, since what 'instruction' and 'education' *really mean* in this context is synapse growth in response to a select class of environmental stimulation.

Interestingly, when looking at the practical directions given to parents, there is little difference between those that are recommended for bonding and those that are recommended for education. This in addition to the fact that many "prenatal learning" texts draw on metaphors of the classroom in order to call attention to the significance of both affect and instruction in the pursuit of an optimum educational outcome. The dual commitment held by many teachers to both personal and intellectual growth is a very productive analogue to the kind of relationship these texts want to make attractive to their readers. In his chapter, "The Womb as Classroom", Verny writes

> Where do we first experience the nascent emotions of love, rejection, anxiety, and joy? In the first school we ever attend – in our mother's womb. Naturally, the student brings into this situation certain genetic endowments: intelligence, talents, and preferences. However, the teacher's personality exerts a powerful influence on the result. Is she interested, patient, and knowledgeable? Does she spend time with the student? Does she like him, love him? Does she enjoy teaching? Is she happy, sad, distracted? Is the classroom quiet or noisy, too hot or too cold, a

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[97] "Prenatal Stimulation System Helps Produce Smarter, Happier, Healthier Babies," Kimes Products Inc., available at <http://www.kimesproducts.com> (accessed 26 February 2004).

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> place of calm and tranquility or a cauldron of stress?...All these things matter enormously, not so much by themselves but as part of the ongoing education of the unborn child.[98]

Not only what the teacher knows, but the way she *feels* about her students and the way those feelings influence how she arranges the classroom environment take on educational (i.e. synaptic) value. This entwining of terms of affection and terms of learning pervades the discourse of prenatal education and is especially evident in explicitly commercial texts. One explanation for this unification of love and learning is that it enables a product to appear "comprehensive" in a way that a text that was either more attachment or intellect-oriented wouldn't. For example

> **Make Way for Baby!** is a video program that will show you how to get a head start in realizing every parent's goal: a loving relationship with a healthy, intelligent and happy child. **Make Way for Baby!** is an innovative 55 min. in uterus stimulation video program that offers lots of information on pregnancy care, fetal development, prenatal calisthenics and the most important: prenatal stimulation techniques, that will help you developing a healthy, close relationship with your new child before birth while optimizing your baby's mental and motor development. New prenatal stimulation techniques are introduced as soon as the fetus develops the capacity to benefit from them, and new toning and strength exercises are added to the mother's routine as her pregnancy progresses. Just think, in the privacy of your own home you can watch, listen and learn to teach and stimulate your unborn child.
> Don't wait until after your baby is born to begin developing a healthy, close relationship with your new child. Let your first gift to your child be a loving head start.[99]

Or, the BabyPlus Prenatal Education System:

> BabyPlus is a series of 16 scientifically designed rhythmic sounds that resemble a mother's heartbeat. The rhythm of the sounds increases incrementally and sequentially as the pregnancy progresses. The BabyPlus sound pattern introduces your child to a sequential learning process, built upon the natural rhythms of their own environment.
> This "auditory exercise" strengthens brain connections during the developmental time period when the advantages will be most significant for a child. BabyPlus is

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[98] Verny, 53.

[99] "Pregnancy and pre-natal care video," Amphion Communications Inc., available at <http://www.2bparent.com/video.htm.> (accessed 1 March 2004).

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> the first educational tool designed for prenatal use that has been proven effective. BabyPlus children have an intellectual, developmental, creative, and emotional advantage from the time they are born.[100]

The tag lines of these fragments – Make Way for Baby! offers a "loving head start" and BabyPlus provides "an intellectual, developmental, creative, and emotional advantage" – emplot newborn babies into a competitive world wherein every advantage counts. They also extend the domain of parental achievement anxiety into the womb. "Set back the clock of parenting" indeed!

Over and against traditional concerns about adequate nutrition and physical safety, the plastic brain requires revisions in discourse-practice of pregnancy. Since the fetal brain is (said to be) a cumulative index of its stimulation by an environment and, since that environment is (said to be) affected by her attitude as much as her Iron intake, the plastic brain greatly expands the social and ethical obligations of pregnancy. This logic of production differs from earlier logics of prevention. Pregnant women can no longer simply 'do no harm'. Instead, they are 'tasked' with producing an abundance of synapses through simulative practices designed to maximize the neural potential of their "unborn child". Whereas in her 1924 book, *Getting Ready To Be a Mother*, nurse and infant blindness crusader Carolyn Conant Van Blarcom was giving good advice when she told pregnant women to "In general, try to forget that you are pregnant", this course of action would, in 2004, constitute a betrayal of what is now said to be a parents most fundamental responsibility.[101]

The preceding sections have shown how the plastic brain has been articulated to/through discourses of prenatal health. The plastic brain focuses attention away from the fetus itself and towards the womb as an environment which is the primary determinant of the emotional and intellectual "results" of fetal development. This shift

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[100] "What is Babyplus?" The BabyPlus Company Inc., available at <http://www.babyplus.com/what_is/> (accessed 1 March 2004).

[101] Carolyn Conant Van Blarcom, *Getting ready to be a mother: a little book of information and advice for the young woman who is looking forward to motherhood* (New York: Macmillan, 1924): 47.

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from a logic of prevention to a logic of production is warranted by the mechanics of plastic brain development since it is the aural, tactile, and chemical stimulation provided by the womb that evoke the physiological generation of synapses. Both the logic and mechanism of production also re-define the concept of "bonding" in important ways. Previously, the underlying assumption of bonding was that both pregnant woman and fetus were fully-formed entities, complete in themselves, and that by, say, singing out loud, a mother-to-be and unborn child could communicate and establish a relationship. The plastic brain and its logic of production changes that, however, because it highlights the fact that one party – the fetal brain – is *not* fully formed and so does not possess the self-unity required to bond with an other. According to this new logic, the fetal brain represents neural potential that is to be shaped, not a thing to be bonded with. Bonding-talk persists, of course, but, because the plastic brain purports to expose what is "really going on" when a mother sings to her unborn child, this is a strictly biological bonding. This biologization of prenatal interaction – or, as Verny would have it, "communication" – is a rhetorical condition of possibility for concepts such as "prenatal education" and "the womb as classroom". That is, in a manner similar to bonding, once the plastic brain manages to redefine "learning" as "synapse formation", any stimulation that causes synapse formation – i.e. **any** stimulation – is plausibly eligible to be designated "educational". This helps to explain why, despite the alleged fact that *any* stimulation will have "educational" effects, the advocacy and marketing of prenatal stimulation techniques and devices rely so heavily on logocentric metaphor ("brainy", "gifted", etc.) and a rhetoric of genius (Baby Einstein, Brainy Baby, etc.). More about this later.

The main point I want to make here is that, as it gets taken up into and circulated throughout discourses of prenatal health, the plastic brain becomes the common denominator that underlies and unites bonding and prenatal education. According to the logic of this new equation, bonding and education are no longer either qualitatively

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different or substantive in themselves, but are rather epiphenomena of "what is *really* going on": the formation of synapses in response to the environment of the fetus.

A Note Concerning the Status of Environment

As suggested earlier, while in utero the fetus is said to participate in a forty week dialogue with its mother. This "communication" is nonstop because it takes place through chemical, tactile, and aural channels which cannot be closed. Even if the mother is not intentionally wishing to "communicate" aurally with the fetus, aural "communication" is nevertheless occurring because the fetal environment is always "on" and the fetal brain is always reacting to the stimulation provided by that environment. To repeat once again the old saw whose implications underwrite much of this project: there is no such thing as a "non-environment," an environment cannot not stimulate, stimulation cannot not evoke some manner of physiological change in the brain. This fact troubles the notion of intentionality which lies beneath the definition of "communication" forwarded by people like Chamberlain and Verny. Although they base the veracity of their claims on the central tenet of the plastic brain, because their definition of "communication" presumes a transcendent subject who either acts or does not act from outside, their rhetoric remains stuck in the intentional, binary logic of the static brain. Their "communication" retains the possibility of "no communication", yet the plastic brain radically declares that there can be no "outside" of environment, stimulation, or communication.

This tension is by no means limited to partisans of prenatal stimulation. In fact, the vast majority of the primary texts taken up throughout this project try in one way or another to reconcile static notions of influence, responsibility and agency with the so-called reality of the plastic brain. Attempts to achieve this reconciliation through, say, a rhetoric of education, are bound to fail because they locate agency and responsibility in

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the individual. "Parents must do X," "Good teachers do Y," etc. These texts end up, ironically, treating the plastic brain as a call for the renewal of **static** modes of intervention. The central nub is this: the plastic brain enables/requires us to think in terms of *dispersed and emergent networks of environmental agency*, but our existing vocabularies for comprehending behavior are anchored in atomistic logics of influence wherein agency is the sole property of intentional subjects. Although the plastic brain distributes agency and effectivity throughout each living moment, we have not yet created a vocabulary for a non-linear, dynamic ecology of parenting or teaching or relating. This vocabulary is both logically and substantively necessary but it is not to be found in the texts of this or any chapter. Instead, these texts struggle to reassert the agency of individuals even as this undercuts the most dramatic implication of the plastic brain: that brain-child development is always only stimulated by Environment, not parents, teachers, or peers. Once considered a mere mediator of intentional agency, the plastic brain proclaims the primacy of Environment. The medium is the message.

This can be a disheartening prospect for parents. Figures Three and Four illustrate how the plastic brain redefines the parent-child relationship by placing parents at one remove from their child.

Figure 3. Relational Dynamic of the Static Brain

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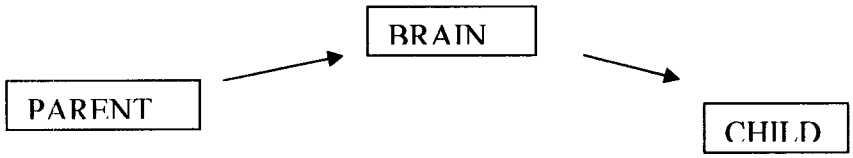

Figure 4. Relational Dynamic of the Plastic Brain

Figure Five illustrates a subsequent shift. Here, the transition in emphasis from a parent's intentional action to a highly-overdetermined matrix of environmental stimulation introduces an additional gap, since parents can only (partially) shape the environment, not the brain directly and much less the child herself.

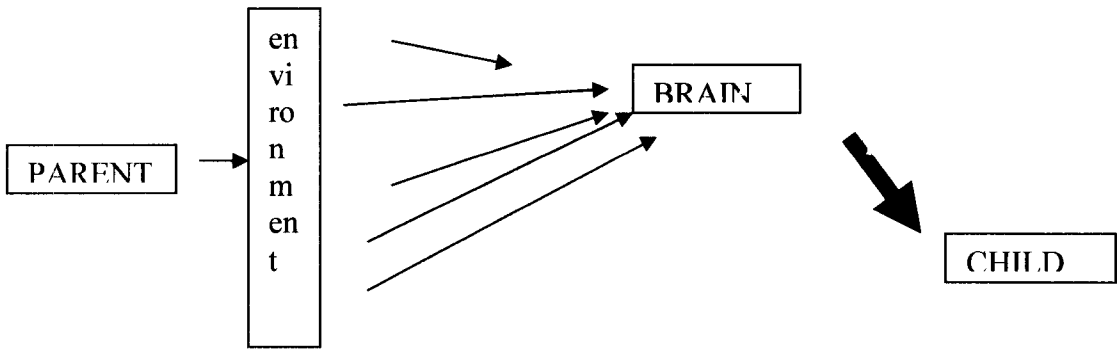

Figure 5. A Two-Fold Remove

Finally, on top of all this, the plastic brain trumpets the absolute primacy of sensory stimulation over and against "feelings", "expectations", or "love". While environmental changes in the womb can be caused by maternal emotion during pregnancy, this privileged period of affective efficacy comes to an end with birth. After that, subjective affect (i.e. a mother's hope, a father's pride, etc.) attains developmental and ethical value

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only as it manages to impact the sensory world of the child. No longer can a father assume that, despite losing his temper last night over a messy room, his son "knows how I feel about him." The plastic brain is deaf to everything but tactile, aural, olfactory, or visual stimulation dispersed throughout a singular environment. "Pride", "hope", "love", these become quaint folk terms used to clumsily represent what is really going on: the intimate synaptic implications of an environment for a brain. Such terms are driven out by a new term which, as we will see, though it is placed alongside terms like "love" and "affection", is of a distinctly different cast. This new god term is *stimulation.*

Stimulation occurs exclusively between environment and brain, but it can be initiated by others through technologies designed to translate one's intentions or desires into synaptically-relevant stimuli. Once introduced into an environment these technologies serve as stimuli which are alleged to "spark"[102] "encourage"[103] and "nurture"[104] desired trajectories of brain-child development. In the following section I engage the promotional materials of many of these technologies – traditionally called "toys" – and show how these texts help to redefine parent-child interaction as parent – via environment – brain intervention.

It May Look Like Play, But...

Before getting to the analysis of the rhetoric of these marketing materials and product catalogues, it is interesting to note a fairly far-reaching homology between those texts which purport to "discover" the plastic brain and those that purport to "report" and/or "make the plastic brain relevant" for ordinary people. This homology is brought about by a deep and potentially-telling overlap between so-called "scientific texts" and

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[102] *Baby University*. Product Catalog. © Fisher-Price, 2002.

[103] *Learning Patterns: System of Infant Development*. Brochure. © Fisher-Price, 2001. p. 3.

[104] "Strike Up The Band!" Product Instruction. © Gruner + Jahr Publishing, 2001.

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so-called "popular texts". I have previously discussed why I think it is important to resist assigning normative, epistemological, or temporal primacy to either of these crude designations. What follows is an illustration of how the fruits of this resistance can be interesting and productive for those concerned about the discursive interplay of science and society.

The terminological overlap (which both evinces and encourages a conceptual homology) has to do with descriptions of experimental procedure on one hand and prescriptions to parents on the other. Recall from Chapter One that the "discovery" of the extent of plasticity in the brain was achieved primarily by comparing both the number and density of synapses in the brains of rats who lived in so-called "enriched environments" to that of rats that lived in environments that were not "enriched." This latter kind of environment goes by many names, from "isolated" to "deprived" to "sterile", but the more neurally-productive one is always called "enriched".

> Housing Conditions
> Ten animals were placed in individual standard cages measuring 45 X 22 X 18 cm, while 12 other animals were placed in two special cages, six in each cage in the same room in the animal facility. The special cages measured 100 X 60 X 60 cm. These cages were equipped with climbing ladders, several platforms, paper, nesting material, and cardboard nests. New toys were introduced every 3–4 days. All animals received food and water ad libitum. In addition to the standard food, the animals kept in the enriched environment received popcorn and apples.[105]

> Mice assigned to standard-cage conditions following weaning were placed in groups of 3 same-sex mice per cage (0.48 X 0.27 X 0.15 m)... Mice assigned to enrichment were placed in groups of 6 samesex weanlings in customized, large dog kennels (1.22 X 0.81 X 0.89 m), each with a similar design consisting of two extra levels constructed of galvanized wire mesh and connected by ramps of the same material to create three interconnected levels. Bedding, a running wheel, a shelter (inverted baking pan or similar opaque, concave object), and various other objects (habitrail tubes, plastic toys, mesh structures for climbing) were placed in each kennel prior to introducing the mice. Throughout the 60-day experimental phase, the shelter and habitrails remained undisturbed in the kennel, but other

[105] Michael Nilsson, Ekaterina Perfilieva, Ulf Johansson, Owe Orwar, and Peter S. Eriksson, "Enriched Environment Increases Neurogenesis in the Adult Rate Dentate Gyrus and Improves Spatial Memory," *Journal of Neurobiology* 39 (June 1999): 570.

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> objects not used for nesting were removed and replaced with novel objects on a weekly basis.[106]
>
> For each study, male rats were separated at weaning into one of two groups. In the enriched condition, the rats lived in social groups of between 6 and 12 animals in large open-meshed cages supplied daily with a variety of "toys". In the isolated condition, the rats were confined to small, individual, solid-walled cages with mesh floors and ceilings.[107]

Each of these studies, and dozens more like them, find that the brains of rats that lived (albeit briefly) in so-called enriched environments showed more and more complex interconnections between neurons and tended to perform better at behavioral tasks like maze completion. Access to "toys", a diverse diet, and a large, clean living space makes for "better" brains. What other prerequisites for uptake into so-called popular texts could there possibly be? The more conceptual homology is produced by the tight coupling of two perspectives on the term "environment": the environment of the rat cage and the environment of the child's home. Consider as an example the following excerpt:

> Deprived of a stimulating environment, a child's brain suffers. Researchers at Baylor College of Medicine, for example, have found that children who don't play much or are rarely touched develop brains 20% to 30% smaller than normal for their age. Laboratory animals provide another provocative parallel. Not only do young rats reared in toy-strewn cages exhibit more complex behavior than rats confined to sterile, uninteresting boxes, researchers at the University of Illinois at Urbana-Champaign have found, but the brains of these rats contain as many as 25% more synapses per neuron. Rich experiences, in other words, really do produce rich brains.[108]

Environment here is a species-neutral term referring to the number of "toys" populating a given area. A "sterile, uninteresting box" is still, of course, an "environment" but,

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[106] Cortney R. Turner, Mark H. Lewis, and Michael A. King, "Environmental Enrichment: Effects on Stereotyped Behavior and Dendritic Morphology," *Developmental Psychobiology* 43 (July 2003): 21.

[107] R.A. Cummins, P.J. Livesey, J.G.M. Evans, and R. N. Walsh, "A Developmental Theory of Environmental Enrichment," *Science* 197 (August 1977): 693.

[108] Nash, 49.

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because it provides little hope for synaptic flourishing, it is said to "confine" young rats rather than provide a place for them to be productively "reared".

Formations such as this identify the laboratory with the living room and, in so doing, illustrate how so-called popular texts can serve as the material locus of discursive articulation wherein textually-produced "facts of science" can diagnose pathology within and derive their legitimacy from everyday, "non-scientific" experience. In other words, "scientific knowledge" does not possess any *a priori* dominion over other modes of expertise or understanding, but rather achieves discursive value by virtue of its textually-secured insight into the practical realm of human experience. This value is enhanced when the dispassionately-deployed objects of experimental synapse production are both physically and terminologically identical to the deeply-affective and heretofore non-essential objects that can be found strewn about the home of parents of young children. This movement would appear to "trickle down" from the rarified space of the lab to the masses, but it is obvious yet strangely necessary to point out that neither the term "toy" nor the notion that creatures become "enriched" by play with other creatures originated or attained widespread acceptance *anywhere near* the discourse or practice of scientific inquiry. Despite being a cliché, the scene in youth technology films where the spectacled scientist opens the door to his private lab, finds his meddling son, and has to remind him that "these are not toys, you know", goes a long way to indicate how important many scientists think it is for their work to be disassociated from what "normal people" would find fun.

And yet, consider the names of these products manufactured by Otto Environmental: Tunnel O' Fun, Coconut Cabana, Hide-N-See TV, Toob-A-Trail Jr., or the description of their ever popular Roley Poley, "A fun toy that shakes, rattles, and rolls!"[109] One would assume that these were children's toys but, in fact, Otto is one of

[109] Otto Environmental, available at <http://www.ottoenvironmental.com> (accessed 23 March 2004).

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the foremost suppliers of rodent enrichment toys used by researchers of brain plasticity. Theirs are the toys that populate the "enriched environments" which bring about high performance mice, but are there any real differences between these objects and, say, the Attach 'N Play Monkey™ from Fisher-Price?

> Attach this silly monkey wherever baby spends the day and watch the discoveries start! Sensory-stimulating activities include a mirror, spinner ball, teethers, and clacker rings. They combine with crinkly sounds and a variety of textures to feel, all encouraging baby to touch and explore. Press its nose for light-up fun with music![110]

or the Changing Sensations Mobile™?

> This mobile is perfect for gently stimulating baby's senses or soothing him off to sleep. An intriguing display of colors and patterns gradually changes as the motorized color wheel automatically rotates. The rhythmic movement of high-contrast colors and patterns dance overhead. Baby's sense of hearing is enhanced with four melodies that play for up to five minutes, including traditional lullabies and "The Lion Sleeps Tonight".[111]

or the Baby Einstein Discover and Play Jungle Teether™?

> The Discover & Play Jungle Teether is a highly sculpted, brightly colored flashcard teether with multiple tactile surfaces for baby to explore. The teethers are soft and easily removed from the ring. Each holder features a permanently affixed Baby Einstein character image on one side and words on the backside. The key ring easily attaches to strollers, car seats, etc.[112]

If the basic formulation of "increased stimulation = smarter animal" appears to travel from the lab to the living room, everything about the objects which achieve that stimulation would appear to move from living room to lab. After all, Otto could just as well have named their product "Log with Hole v. 3," but they chose to package and market it as the Coconut Cabana. This was obviously a marketing decision. Yet, by framing what is ultimately an instrument of physiological intervention as a "toy", Otto

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[110] *Baby University.*

[111] ibid.

[112] "Baby Einstein Toys and Teethers," available at <http://www.littlemindz.com/showtoy.cfm?id=73> (accessed 23 March 2004).

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and the researchers who use products like the Coconut Cabana help beg the question: to what extent does the plastic brain blur the line between scientific instrument and object of play, between space of science and space of the home, between scientist and parent? If it is appropriate for brain scientists to say they use "toys", is it then also appropriate for parents to say that they use instruments of science? If scientists observe the brain/behavioral effects of environmental enrichment by cleaning (or not), providing a diverse diet (or not), providing play partners (or not), and providing stimulating objects (or not), can parents then also claim field expertise in this scientific endeavor? Because these questions arise again in and are just as important for the next two chapters, a cumulative response will be held until the project's conclusion. The question for now is this: if the line between parent and scientist gets blurred by the plastic brain, how do the promotional and instructional texts that are associated with children's toys (or, if you wish, instruments of child-brain stimulation) negotiate and capitalize on this instability?

There are two ways this is accomplished, both of which have to do, not surprisingly, with terms and associations between terms. The first concerns these text's prominent use of verbs that have come over time to have distinctly scientific connotations. These verbs characterize children as triumphant Baconian scientists whose toys enable them to "discover", "explore", "observe", and otherwise "figure out" the sensory world around them. Consider for example the catalog caption for the Flip Flop Caterpillar™ from Fisher-Price.

> This friendly caterpillar is full of surprises, music, light and activities, and eager to help your child learn more about the world. Each flip of a flap offers a new *discovery* for baby (a mirror here, a squeaker there, grab rings and teethers…), encouraging *exploration* with hands, eyes, ears and mouth.

Or the Musical Clutch Elephant™

> From its musical cheek to activity-filled legs – with plenty of colorful patterns and textures in between – this adorable elephant pal encourages baby to *reach out*,

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> *clutch*, *grab*, and *feel*...as well as see and hear! Baby will love *exploring* its crinkly fabric, clackers and rattles.[113]

Bacon himself offers a helpful description of what is being encouraged in and through these fragments. In his well-known discussion of the Idols of the Tribe, Bacon eloquently argues that the "waxen wings of the senses" provide too weak a foundation for the New Science. Only through assiduously-designed experiments and objective instrumentation can one mitigate outside interference such that Nature can be more intimately known. Rather than trust the knowledge produced by direct sensory contact with Nature, Bacon considered empirical experiment a necessary and a corrective go-between.

> For the sense by itself is a thing infirm and erring; neither can instruments for enlarging or sharpening the senses do much; but all the truer kind of interpretation of nature is effected by instances and experiments fit and apposite; *wherein the sense decides touching the experiment only, and the experiment touching the point in nature and the thing itself.*[114]

If we transpose this equation into the discourse of children's toys, the place of Nature is taken by Environment, the child becomes the student of Environment, and the toy-object becomes the instrument through which Environment is experienced and becomes "known". This medium is necessary due to the vast and illusory character of Environment, a character which makes it very difficult for parents know where to begin productive engagement. This helps to produce no small amount of anxiety for parents, whose newfound recognition of the importance of Environment obliges them to value the practical arts of brain stimulation over and against purely cognitive notions of love or happiness. Against this backdrop, toys become the instruments by which parents can effect a productive sensory Environment by bringing a particularly desirable slice of it into contact with their child('s brain).

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[113] *Learning Pattern,* emphasis added.

[114] Francis Bacon, *Novum Organum* (1620), ed. and trans. Basil Montague. *The Works,* 3 vols. (Philadelphia: Parry & MacMillan, 1854): 3: 348, emphasis added.

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A second and more complicated way in which contemporary toy discourses capitalize on the blurring distinctions between scientist and parent concerns the plastic brain as a physiological warrant for uniting "play" and "learning" upon the common foundation of sensory stimulation. In Chapter Two, neuroscientist Joseph LeDoux was quoted as saying that nature and nurture were really just two ways of doing the same thing: wiring synapses. The same can be said here of play and learning. After all, one could ask, didn't the rat studies discussed earlier show that toys in the home lead to better performance on certain tasks? Didn't researchers attribute this performance gain to the domestically-enriched synapses of the more stimulated rat? Doesn't this make all toys, then, in the truest sense, "educational?"

This unification of what had historically been considered, in the mainstream at least, oppositional activities (i.e. playing is not learning) is taken up vigorously in the marketing of children's toys. In fact, it is hard to find the word "toy" in these texts, most likely because it continues to be burdened with connotations from an earlier, static brain period where leisure time activity was presumed to be more or less academically neutral. Not anymore.

> Playing with your baby is not only a wonderful way to get to know each other, it's a key part of the way children learn. As you introduce sights, sounds, textures, and experiences to your baby, you help prepare a memory bank that feeds imaginative thinking, improves cognitive skills, and reinforces the milestones of physical development. Along the way, the patterns of play become the patterns of learning.[115]
>
> Parents Play+Learn™ toys are not only fun, they are the ideal educational tools to stimulate your baby's sense of sight, sound, and touch.[116]
>
> Congratulations, and welcome to your new role as parent – and educator. Even when you're not aware of it, your child will be learning – and you will be an important part of that process...As you talk, sing, and play with your baby, you lay the foundation for learning. Play is learning. For babies, learning is synonymous with play. The experiences of play offer the chance to learn about

[115] *Learning Patterns.*

[116] "Strike Up The Band!".

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> the world around them. Your baby's passion for learning will be an ongoing treat for both of you.[117]

Not surprisingly, this rhetoric of learning has permeated the promotional materials and catalogs for children's toys. *Baby University* is the title of Fisher-Price's 53 page catalog-cum-child development primer that is packaged with its larger products. Its cover features a smiling white baby wearing a felt mortarboard and its table of contents is laid out as a scrolled document featuring what it calls the "core curriculum" that Fisher-Price makes available to enrolled (and paid up) students. The curriculum offers: Music Appreciation, Language Development, Sensory Stimulation, Architectural Design, Oceanography, Physical Achievement and Creative Expression. Where kids once played with stuffed fish, they are now "learning to appreciate the mesmerizing effects of water". Sorting shaped blocks into their correct holes requires the "little architect" to ask "These funny shapes must fit together somehow. How does it all stack up?" Companies with names like Baby Einstein, Genius Babies, Brilliant Babies, and Neurosmith market products designed to help baby excel, reach their full potential, and get a "head start" by interacting with particular objects that provide particular forms of stimulation to the brain.

Important to remember is the fact that, although there is a real surface affinity between the terms "toy" and "learning" – no doubt largely a result of many years of industry marketing – the substantive definition of these terms gets decisively altered upon textual contact with the plastic brain and this alteration serves to create a kind of two-track state of affairs. On one track, the plastic brain is said to unite once and for all the well-entrenched definitions of "toy" and "learning" in a way which makes possible – and "true" – the baby mortarboards, genius babies, and the general "toys = smarter babies" equation. This track emphasizes loving **interpersonal interaction** between **parent and child** and regards toys as **objects** which will enhance that **relationship** by providing

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[117] *Baby University.*

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opportunities for **pleasurable collaboration**. On this track, the plastic brain provides a new, "scientifically-proven" foundation but does not substantively alter the value or meaning of the terms "toy", "learning", "parenting", or "interaction".

On the second track, however, the plastic brain not only provides this new foundation or, in a Burkean sense, 'scene' against which well-defined terms interact. Instead, it actively "gets in to" the key terms and revises them from the inside out. The terms on this second track remain the same but their *value* when placed against the backdrop of the plastic brain is radically different. This track emphasizes **synaptic intervention** between **environment and child-brain** and regards toys as **instruments** which **target environmental stimulation** onto particular skill/knowledge sets that will enable **optimum results**. On this track, "parenting" is the creation of enriched environments, "learning" is the physiological consequence of environmental stimulation, and "interaction" takes place between one's sensory ecosystem and their synapses.

My point in concocting these two tracks is not to suggest that people actually read these texts in that way, but rather to illustrate precisely the opposite: that these two tracks aren't linear, discreet tracks at all but more like habits of reading which get mixed and matched by each individual in their own way and which may or may not add up to anything at all in a given moment. It would be easy for me to write that, while people might *think* they are reading along track one, what is *really* happening is that they are being taken for a ride on track two. While this might make for a good op-ed piece, my goal is to invent, not reduce, complexity. I have tried to do this in three distinct ways in this chapter. First, I identified how the plastic brain has been used to herald the productive – not just preventative – possibilities of pregnancy by redefining "bonding" and "education" as species of biological intervention. Second, I showed how the plastic brain requires both conceptual and practical distinctions to be made between a child and its brain. Third, I discussed the equally important obligation to make the so-called PARENT – CHILD relationship more precise and more practical by reconceiving it as a

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nonlinear dynamic system comprising PARENT – ENVIRONMENT – BRAIN - CHILD. This indeterminate system decomposes the traditional sovereign authority/agency of parents into a decentralized network of environmental stimulation. Finally, given the uncertainty and consequent anxiety that are inherent in this kind of system, I showed how "toys" get framed as instruments whereby parents can regain some of the agency/authority lost by the move from static to plastic parenting by selecting "toys" that are designed to evoke the sort of brain-child development that they desire for their child.

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CHAPTER V

SCHOOLING THE PLASTIC BRAIN

> We're not responsible for the genes, and we usually can't directly do anything about the experiences that students bring to school - but we are responsible for the quality of their school experiences. It's our task to make sure that school experiences enhance the development of a student's brain.[118]

In the previous chapter it was shown how the plastic brain redefines "learning" as increased synaptic complexity and refashions parenting as a sustained biological intervention upon an incessantly-developing brain. While previously it would have seemed silly to think that a 7-month old could be "taught" anything, this redefinition of learning encompasses the entire domain of environmental stimulation and expands indefinitely the site of "education". In this way, the circulation of the plastic brain has had the effect of blurring traditional distinctions between parent and teacher. And yet, it is important to devote a separate chapter to an examination of the uptake of the plastic brain in discourses of education and pedagogy. Doing so will allow us to see the various ways that the many institutions, agencies, professional organizations, businesses, and political bodies that have a hand in the practices and outcomes of public education have responded to both the promise and the threat of the plastic brain as it works to rewrite many of the time-honored assumptions that have motivated public education for the past one-hundred years.

The immanence of the plastic brain effectively calls into question every aspect of the school: its architecture, its ornamentation, its program, its pedagogy. Each of these elements, once (re)articulated through the plastic brain, is understood to be a particular modality of stimulation to the developing brain, stimulation that must be managed so as to compel an advantageous trajectory of synaptic development. The school environment, it is said, must be reformulated and, above all, *enriched* in a way which takes into

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[118] Robert Sylwester, *A Celebration of Neurons: An Educator's Guide to the Human Brain*, (Alexandria, Virginia: Association for Supervision and Curriculum Development, 1995): 139.

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account what is now known about the brain. The first section of this chapter engages such calls for re-forming the environment of the school to bring it into line with the dictates of the plastic brain.

How do these calls get translated into practical classroom techniques?

> Two rules come from the field of brain research and enrichment. One is to eliminate threat, and the other is to enrich like crazy. Before we understood the collective impact of an enriched environment, it may have been acceptable to justify a minimalist classroom. Gone are the days in which any teacher could justify a barren classroom with one-way lecture as the only input. Today, the evidence is overwhelming that enriched environments do grow a better brain. In addition, the early developing brain grows fastest and is the most ready for change. The opportunity must be seized.[119]

Similar to the techniques of parenting discussed in the previous chapter, teaching the plastic brain presents both conceptual and a practical challenges to educators who are encouraged to utterly revise their thinking about what it means to teach in a radically different way. Accordingly, the second section of the chapter will examine professional discourses of education in which the plastic brain is said to require significant reorientation of long-standing warrants for and techniques of a socially and individually edifying education. Central to this section will be a discussion of how the plastic brain gets utilized as a resource from which to make arguments about proper and improper styles of teaching and theories of education. For example, when Jensen refers to "one way lectures" with "barren classrooms," techniques of responsible teaching are being (re)articulated to/through the plastic brain in such a way as to sanction particular techniques and particular teachers and reprove others. After all, in light of knowledge about the plastic brain, teachers can no longer simply "do no harm." Rather, their reluctance or inability to employ brain sensitive techniques does not simply "fail to teach;" it achieves an improper, even dangerous, kind of "success." The specter of

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[119] Eric Jensen, *Teaching with the Brain in Mind*, (Alexandria, VA.: Association for Supervision and Curriculum Development, 1998), available at <http://www.ascd.org/publications/books/1998jensen/chapter4.html> (accessed 22 Sept 2003).

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poorly-stimulated brains appears throughout these texts as an ethico-political warrant for the embrace of a revitalized educational establishment (re)founded on principles of the plastic brain.

Now, it is clear that most teachers and school administrators want what's best for their charges. There is then an imperative for educators, like parents, to provide appropriate modes of stimulation for the students/brains under their care. It would be a mistake, however, to think that the effectivity of the plastic brain is limited to selfless calls to improve pedagogy or enhance the development of students/brains. Rather, the plastic brain is also clearly being articulated to/through a professional crisis of legitimacy and lack of state/local financial support. The plastic brain is said to offer hope to those who are attempting to enhance social commitment to public education and redeem the significant life role of a quality education. For this reason, the final section of this chapter will examine how the so-called "education establishment" has embraced the plastic brain as a vehicle with which to pull themselves out of the current political and social dissatisfaction with public education.

One thread common to the thematic sections of this chapter regards the necessity for teachers to learn all they can about brain science. Becoming brain sensitive requires teachers to become knowledgeable about the brain. This is said to be necessary for two reasons. First, it is said to protect the profession from being seduced by the hucksters and fly-by-night reform movements which have tend to burst onto the educational establishment on an almost yearly basis:

> Can a profession whose charge is defined by the development of an effective and efficient human brain continue to remain uninformed about that brain? If we do remain uninformed, we will become vulnerable to the pseudoscientific fads, generalizations, and programs that will surely arise from the pool of brain research. We've already demonstrated our vulnerability with the educational spillover of the split-brain research: the right brain/left brain books, workshops, and curricular programs whose recommendations often went far beyond the research findings. If we can't offer informed leadership on the complex educational issues arising from

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> current brain theory and research, we can expect that other people—perhaps just as uninformed as we are—will soon make decisions for us.[120]

Here, to remain "uninformed" is to surrender not only professional self-determination but its correlate: self-respect. This respect has been damaged previously by inadequate attention to "research findings" and not repeating past mistakes requires serious engagement with the terminology, methods, and assumptions of experimental neuroscience. When it (re)defines the "charge" of the teaching profession as "the development of an effective and efficient human brain," the fragment both illustrates and performs an essential distinction between previous (failed) and current (sufficient) iterations of brain-based education.

The second reason professional educators must, it is said, begin reading and incorporating insights from neuroscientific research is that doing so enables them to speak effectively to legislators and others who control the resources that public schools so desperately need. This is a major theme in statements by professional organizations of teachers. "Finally, teachers are being treated as professionals," she [Pat Wolfe, "a former classroom teacher who's now a consultant specializing in the application of brain research to education practice"] says, "and are being given a scientific knowledge base for what they do."[121] Perhaps more to the point:

> [N]euroscience, with its reputation as a "hard science," could be a potential ally for educators. Educators for years have claimed that the early years of childhood were critical to learning. But their own studies, coming from a body of scientific work perceived as "soft" and lacking in the kinds of graphic evidence that come from brain scans and biological studies, have sometimes fallen on deaf ears. "If you tell decision makers or parents, 'Your child will have a better brain if you do this or that,' then that seems to have a more seductive appeal than anything we educators

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[120] Sylwester, 6.

[121] "Inside Scoop: News on Brain Gain." *NEAToday Online Topic.* retrieved from http://www.nea.org/neatoday/9903/scoop.html (accessed 12 Jan 2003).

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> can say," says Edward Zigler, the director of the Bush Center in Child Development and Family Policy at Yale University.[122]

The problem of the plastic brain is highly productive when articulated to/through the concerns of professional educational organizations. This problematic, once attached to the organ of the brain, is dispersed throughout discourses concerning school funding, pedagogy, professional legitimacy, and the role of the school in preparing/producing productive individuals.

A Facilitating Environment

To be sure, this is by no means the first time that the body has figured highly in discourses of education and environment. Attention to the school plant as an important guarantor of physical and mental health was prominent throughout the 19th and 20th centuries, particularly in statements defining the role of the public school in a growing yet fragile democracy. For example, regarding the importance of proper posture in the design of mid-19th century schoolhouse, physician SB Woodward advised

> The seats in school rooms should be so constructed that the whole thigh can rest upon them, and at the same time the foot stand firmly upon the floor; all seats should have backs high enough to reach the shoulder blades; low backs, although better than none, are far less easy and useful than high ones, and will not prevent pain and uneasiness after sitting a considerable time. Young children should be permitted to change their position often, to stand on their feet, to march and visit the playground. One hour is as long as any child, under ten years of age, should be confined at once; and four hours as long as he should be confined to his seat in one day.[123]

Unhealthy schools were a "serious evil" that had to be reformed in order to avoid the production of well-educated but sickly scholars. At the turn of the century, aggregate

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[122] Debra Viadero, "Brain Trust." *Education Week.* (September 18, 1996) available at http://www.edweek.org/ew/ewstory.cfm?slug=03brain.h16&keywords=%22brain%20trust%22 (accessed 12 Jan 2003).

[123] S.B. Woodward, "Dr. Woodward on the Construction of School Houses," *Connecticut Common School Journal* (May 1, 1839): 146.

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effects of urbanization and industrialization on Chicago's air quality led muckraker Burton J. Hendrik to describe that city's school students as "kiln-dried" by the oppressively-hot air produced by steam boilers.

> In the fall, the Chicago schools open their doors to thousands of bright-eyed, rosy-cheeked boys and girls. Then the janitor turns on the steam, the teacher shuts down the windows, and lessons begin. Soon the color disappears from the children's faces, the brightness from their eyes, the activity from their bodies. They grow listless, stupid, irritable; they fall behind in their lessons, and become a problem and a torment to their teachers.[124]

Finally, increased speed of food delivery and processing led commentators like *Health* magazine editor George Keene to indict the effects of poor nutrition on the education and overall vigor of school-aged children. In a 1912 article in *Health*, Keene argues:

> Little real progress can be made in the schools until children are assured of healthful surroundings in both schools and homes. Proper feeding is essential to the development of mind and body. White bread, biscuits, cakes and crackers are unbalanced, because the best element has been eliminated in the milling. Cold storage meats, eggs and fish often poison the body, rather than assist its growth. Bad water and impure air complete the work of destruction. Is it any wonder that so many children are weak, under-nourished and unfit, unable to keep up with their studies and unequal to the tasks of later life? Many of them also suffer from impure ice cream and candies, made by unscrupulous manufacturers merely to tempt the pennies from their pockets.[125]

These fragments suggest two things about arguments that link bodily health and well-being to intellectual/educational ability. First, this topos has a long history, dating back to the ancient Romans, for whom strength of intellect and fitness of body were both considered necessary components of a virtuous life. *Mens sana in corpore sana.* Second, even though each of these arguments identify a specific linkage between biology and learning, they are grounded in a general critique of the institution and funding of public education. This feature is evident regardless if the specific exigency of the argument concerns air quality, nutrition, posture, or, as in the case of the following

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[124] Burton J. Hendrik, "Oxygenizing a City," *McClure's* 35 (August 1910): 373.

[125] George A. Keene, "Physical Culture Department," *Health* 62 (August 1912): 180.

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fragment, brain development. The key novelty of arguments about enrichment of the plastic brain versus arguments about the importance of posture, nutrition, or air quality is that, whereas installing ergonomic desks or better circulation ducts is relatively straightforward, enriching a public school for plastic brains is definitely not. Where does one begin?

One answer to this question can be found throughout discourses of educational architecture, both from the community of professional architects and from educational writers who are interested in putting the plastic brain into the service of greater attention to the relationships between physical spaces and educational achievement. While no one has (yet) designed and built a single-family house explicitly with the plastic brain in mind, its uptake into these discourses of educational architecture has been swift. This is not surprising given the long history of attempts to design schools that complement and help materialize reigning assumptions about how people learn. In fact, one could tell an interesting story about the changing attitudes about and methods of education simply by looking at the various theories, schools, and designs of the public school house. The potentially-positive impact of "brain-based learning environments" represents the latest chapter in this ongoing story and comes with a clearly stated injunction: "Brain-compatible learning requires much more interaction with the environment than current facilities allow. School structure and site should be considered as an integral part of the learning environment, providing opportunities for neural growth around every corner."[126]

But how, specifically, to do this; what are the specific technologies and architectures of "neural growth"? In addition to notions like "flexibility", "adaptation", and "interaction", the most prominent design mantra is *balance* between too much and too little stimulation. Recall that this was also a prominent theme in the previous chapter

[126] Bob Valiant, "The Brain and Learning: Turn on the Lights! Using What We Know About the Brain and Learning to Design Learning Environments," *CEFPI Issue Trak Briefing Papers* (August 1996). Available at http://www.cefpi.org/issue5.html (accessed 21 Feb 2003).

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regarding the proper design of domestic space. Indeed, there is very little difference between how educators are encouraged to design their classrooms and schools and how parents are encouraged to design their homes and kid's rooms. Substitute parent for teacher and the following fragments could easily appear in *Parenting* magazine. Regarding the importance of spaces for physical activity in the school, Chan and Petrie write

> Physical activity is essential in promoting the growth of mental functions. Exercises such as spinning, crawling, rolling, rocking, tumbling, swinging, and jumping strengthen the brain's main areas: the basal ganglia, the cerebellum and the corpus callosum. Exercise brings more oxygen to the brain, enhancing connections between neurons (Palmer, 1980; Brink, 1995). Jensen (1998) suggests that learning is enhanced by daily stretching, walking, and dancing, as well as other physical movement. To accommodate these activities, schools need spacious areas. In classrooms, moveable, stackable, or collapsible furniture helps clear space for physical activities.

Harkening back to the overtly-physiological concerns of the early-20th century, they continue

> Brain research suggests that color and lighting may influence learning. Birren (1977) reported that warm colors and brilliant lighting increased muscular tension, respiration rate, pulse, blood pressure, and brain activity. Insufficient lighting causes visual fatigue. Distracting color combinations can lead to task confusion and slow reaction. Quality lighting and appropriate colors improve visual processing and reduce stress (Birren, 1972). Researchers agree that an optimal learning environment requires comfortable temperatures and protection from distracting sounds. Physical discomfort and noise sends distress messages to the brain, causing the cerebellum (our brains' central processor) to limit the brain's normal operations.

In all, "the brain learns faster in challenging, creative, accommodating, and healthy environments."[127] These environments have been standard fare among educational architects since the 1960's, but the recent "backing" from the scientific community that is represented by the plastic brain provides a wholly new source of legitimation for those

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[127] Tak Cheung Chan and Garth F. Petrie, "The Brain Learns Better in Well-Designed School Environments," *Classroom Leadership Online* (November 1998) available at http://www.ascd.org/readingroom/classlead/9811/2nov98.html (accessed 21 Feb 2003).

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arguing for school renovation, new construction, and generally increased funding for public school facilities.[128]

In a 1999 article in *School House Journal*, Jeffery Lackney, an architect with extensive experience planning educational facilities, laid out the following "school design principles based on brain-based learning research":

1. Rich-simulating environments – color, texture, "teaching architecture", displays created by students (not teacher) so students have connection and ownership of the product.
2. Places for group learning – breakout spaces, alcoves, table groupings to facilitate social learning and stimulate the social brain; turning breakout spaces into living rooms for conversation.
3. Linking indoor and outdoor places – movement, engaging the motor cortex linked to the cerebral cortex, for oxygenation.
4. Corridors and public places containing symbols of the school community's larger purpose to provide coherency and meaning that increases motivation (warning: go beyond slogans).
5. Safe places – reduce threat, especially in urban settings.
6. Variety of places – provide a variety of places of different shapes, color, light, nooks & crannies.
7. Changing displays – changing the environment, interacting with the environment stimulates brain development. Provide display areas that allow for stage set type constructions to further push the envelope with regard to environmental change.
8. Have all resources available – provide educational, physical and the variety of settings in close proximity to encourage rapid development of ideas generated in a learning episode. This is an argument for wet areas/ science, computer-rich workspaces all integrated and not segregated. Multiple functions and cross-fertilization of ideas are primary goal.
9. Flexibility – a common principle in the past continues to be relevant. Many dimensions of flexibility of place are reflected in other principles.
10. Active/passive places – students need places for reflection and retreat away from others for intrapersonal intelligence as well as places for active engagement for interpersonal intelligence.
11. Personalized space – the concept of homebase needs to be emphasized more than the metal locker or the desk; this speaks to the principle of uniqueness; the need to allow learners to express their self-identity, personalize their special places, and places to express territorial behaviors.
12. The community-at-large as the optimal learning environment – need to find ways to fully utilize all urban and natural environments as the primary learning setting, the school as the fortress of learning needs to be challenged and conceptualized

[128] William W. Cutler, "Cathedral of Culture: The Schoolhouse in American Educational Thought and Practice since 1820," *History of Education Quarterly* 29 (1989): 1-40.

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> more as a resource-rich learning center that supplements life-long learning. Technology, distance learning, community and business partnerships, home-based learning, all need to be explored as alternative organizational structures for educational institutions of the present and future.[129]

Lackney acknowledges that most of these are "principles any good designer would use." However, since these principles are now based on *what we know* instead of (mere) aesthetic judgment or informed experience, those who veer from them are not only practicing "bad design" but actively obstructing student enrichment and therefore achievement. The question is no longer "why aren't more schools better designed?," but "why do so many people, educators and design professionals make instructional and physical design decisions that contradict these [scientific] findings?" Just as parents have always known that a lack of interaction with a child would dull the child's emotional range, educators have always known that a poorly-designed facility would hamper educational achievement. After all, each shift from one design paradigm to another – from one-room schoolhouse to industrial high school to school campus to open school to brain-based school – has been motivated by a desire to more complementarily align physical space with pedagogy. Up to this point, though, the changes have been purely additive in the sense that each paradigm has in hindsight been assumed to emphasize different but more or less equally legitimate styles of learning and teaching. That is, while 21st century educators may criticize the cramped industrial schools of the 1920's, the argument was not that those schools actively *harmed* students, but that educators of that time simply didn't have adequate resources or know what we know today about the importance of environment for learning. However, this generally pluralistic attitude about the diversity of educational environments evaporates once the neural opportunity cost of non brain-based educational environments is made evident by those concerned with enhancing educational outcomes through environmental intervention. The fact that

[129] Jeffery A. Lackney, "Twelve design principles for schools derived from brain-based learning research," *Schoolhouse Journal* 2 (January 1999): XX.

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non brain-centered classroom environments – however they might be defined – can now be said to have an actively *harmful* impact on student brains is mobilized as a powerful warrant for making the demands of the plastic brain the overriding priority for teachers and others who design educational environments. Before examining the particulars of these warrants, it is necessary to make a few comments about the status of "Science" as it gets produced through the texts in this chapter.

How Much is Known? How Much is Enough?

Since educators, architects and engineers aren't typically also neuroscientists, it should be neither surprising nor disconcerting to discover that educators, architects and engineers almost never refer directly to neuroscientific research papers in their writings. For example, footnotes referenced in the above cited Chan and Petrie and the Lackney texts direct readers to papers in publications like *Educational Leadership*, *Nations's Schools*, *Reading Teacher*, and *Educational Technology*. The Association for Supervision and Curriculum Development (ASCD) alone has in the past ten years published over thirty books and one hundred articles addressing the brain and education. The Educational Resource Information Center (ERIC) returns almost five thousand hits when searched using the keyword "brain". Lackney cites the Jensen book from which the earlier "enrich like crazy" comment appears. All this looks a bit unseemly when looking at it from outside the public educational profession; i.e. everyone citing everyone else to such a degree that over time the sheer volume of texts comes to serve as its own source of legitimation. This is of course how it works in every field of inquiry but the fact that "there is no science" in these articles tends to upset commentators more than if, say, neuroscientists were to try to say something about education.

Indeed, John Bruer, president of the James S. McDonnell Foundation and a vocal critic of what he calls the educational establishment's "simplistic embrace" of brain

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research, points to the "lack of science" in their texts and criticizes educators for committing the same sin that journalists do when they write about brain research for the general public, namely, overstating what is currently known about the specifics of brain-environment interaction. Brain science's "seductive appeal," coupled with the very small amount that is known about the brain, makes for a dangerous combination from which it is "relatively easy to formulate bold statements about brain science and education that are speculative at best and often far removed from neuroscientific fact."[130] At the conclusion of an article that is highly critical of the very idea of "brain-based education", Bruer writes

> We should not shrug off this problem. It is symptomatic of some deeper problems about how research is presented to educators, about what educators find compelling, about how educators evaluate research, and about how professional development time and dollars are spent... The brain-based education literature represents a genre of writing, most often appearing in professional education publications, that provides a popular mix of fact, misinterpretation, and speculation. That can be intriguing, but it is not always informative.[131]

It is easy to unthinkingly adopt Bruer's argument, conditioned as we are to man the castle walls when the fortress of scientific knowledge is under attack from the popularizing horde. But only a seconds worth of reflection is enough to see how flawed it really is. By "flawed" I do not mean that Bruer commits any logical error or that his warrant does not adequately connect claim to evidence. In fact, the article is generally persuasive and grounded in a kind of common sense. Rather, the flaw stems from the extremely narrow criteria which must be met before Bruer will deem a given strings of words "informative" rather than (merely) "intriguing". While Bruer more or less reserves the appellation "informative" for what he calls "neuroscientific fact", this is an active designation on his part; more rhetorical achievement than self-evident truth. To be clear, there is nothing inherently wrong with the tight-coupling of "neuroscientific fact" and "informative", I

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[130] John T. Bruer, "In Search of...Brain-Based Learning," *Phi Delta Kappan*. 80 (May 1999): 650.

[131] Ibid., 657.

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wish simply to point out the constructedness, rather than the givenness, of this identification. This comment is not "anti-science", it is "anti only science".

Once one backs away even the slightest bit from the association encouraged by the text, it is clear that "brain-based educational literature" is, contrary to Bruer, **extremely informative** for the hundreds of writers on the subject and the many thousands of educators who now think about the brain in a much more hands-on way than they ever did before. Not to mention the millions of parents, dozens of school architects, scores of brain-based educational resource producers, and – oh yeah – the kids.

As stated earlier, Bruer's primary criticism is that purveyors "brain-based education" and their spiritual brethren in the journalistic and commercial communities misrepresent the scientific process by suggesting that brain scientists have already discovered everything about the brain and have discovered the precise developmental consequences of all possible environments and forms of interaction. He asks whether the brain-based education literature "accurately captures what neuroscientists know about synapse formation early in brain development" and wonders "how well does the neuroscientific evidence support popular understanding?"[132] While educators think they know enough about the brain to begin revising longstanding principles of pedagogy, Bruer would rather emphasize all that brain scientists *don't* know and argue that this ignorance contaminates attempts to operationalize brain science into effective environmental or pedagogical interventions. How to explain this divergence? Bruer and other critics would have readers understand it as a simple matter of differing standards of proof along a single hierarchy of value, illustrated in Figure 5.

[132] John T. Bruer, "Neural Connections," *Phi Delta Kappan* 81 (December 1999): 265.

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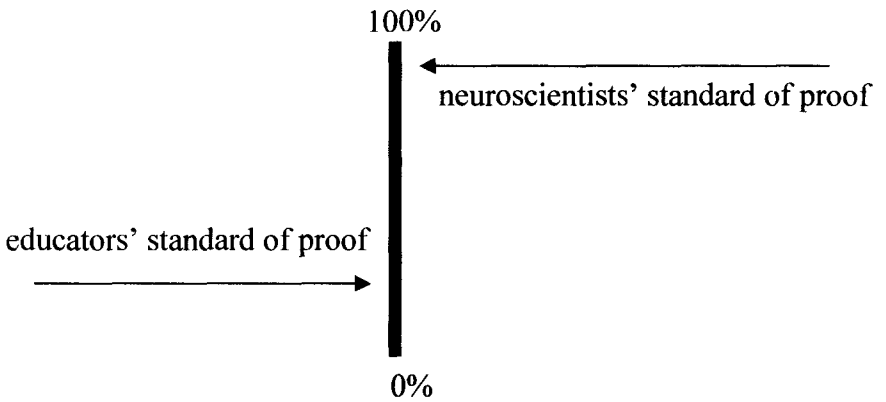

Figure 6. Bruer's Desired/Implied Hierarchy of Value

All manner of binaries flow from this diagram: educators are too eager, easily convinced, desperate, and simplistic, while scientists suspend judgment, have "higher standards", are patient, and more concerned with truth than (mere) effectiveness. This breakdown is of course more or less identical to that sketched by Socrates in Plato's *Phaedrus*, in which rhetoricians only had to be concerned with what an audience believed was true, rather than what was actually True. The analogue works even better since the sophists were, after all, **teachers** of speech. And yet, the conceit of a unified hierarchy of value is no less transparent now than it was in Plato's day.

What upsets people like Bruer and Plato is not simply the fact that educators act according to their own unique hierarchy of value, but that they can make use of Science without capitulating to **its** hierarchy of value in the process. This is evident in a 2002 article Bruer published in *Nature Neuroscience*. Titled "Avoiding the Pediatrician's Error: How Neuroscientists Can Help Educator's (and Themselves)", the article presents examples of how brain-based educators

> spin stories about how brain research, as they understand it, supports their favorite educational practices. High synaptic density and ease of learning early in life underscores, they claim, the importance of rigorous early childhood education; adolescent synaptic pruning requires intensive early learning to save synapses from elimination and thus increase adult intelligence; the brain's high neural

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> connectivity demands integrated curricula, experiential learning and whole-language instruction; classroom activities should be (and can be) designed to maximize neural branching.[133]

After outlining how brain-based educators "ignore" evidence with which they disagree, Bruer's underlying frustration that educators aren't scientists becomes especially evident. Even though educators tend to reify the scientific process by assuming more than is actually known, Bruer points out what else needs to be known before it is possible to enact brain-based recommendations. Among other things, he writes,

> we would like to know considerably more about how changes in synaptic density contribute in mental development and cognitive skill acquisition. Whatever these structure–function relations are, they will unlikely be the simple linear relationship endorsed neural folk-theory. The relationships may well vary depending on the specific kind of learning involved and on the specific brain system underlying that kind of learning. We might also expect that structure–function relations will be different for sensory systems like vision and audition, where evolution has resulted in systems that expect natural environmental inputs to fine tune neural systems, than they will be for higher cognitive functions, where learning to read, solve differential equations, and play chess depends on socially and culturally specific experiences.[134]

That this research will require hundreds of scientists decades to accomplish may be par for the course in neuroscience. But from an educator's or parent's point of view it seems the height of arrogance to demand that everyone wait until the House of Science is in absolute order before it can be inhabited by squatters. Besides, it is already too late.

So what is it that has got scientists like Bruer so upset? Probably statements like these:

> As the future unfolds, we see a path showing us how to move forward:
>
> 1. People need to help learners more fully capitalize on the potential embedded in their brains.
> 2. The way to tap this potential depends on grasping more fully the interconnectedness within each brain.

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[133] John T. Bruer, "Avoiding the pediatrician's error: How neuroscientists can help educators (and themselves)," *Nature Neuroscience* 5 (November 2002): 1031.

[134] Ibid., 1032.

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3. At the same time that people come to terms with this higher-order level of brain functioning, they need to appreciate that the interconnectedness in the brain is an aspect of the interconnectedness inherent in all social and physical phenomena.
4. Thus, we are seeking to tap the brain's potential to prepare people to live in a new reality.[135]

Q: What does all this mean for teaching and learning?
A: "When something is fun, when an activity is hands-on, kids remember it," says Pat Wolfe, a former classroom teacher who's now a consultant specializing in the application of brain research to education practice." What brain research is doing is validating what good teachers have always done," she notes. "Finally, teachers are being treated as professionals," she says, "and are being given a scientific knowledge base for what they do."[136]

Revolutionary discoveries in brain research have generated new insights about how the brain naturally learns best. From these findings, a powerful approach to education called brain-compatible learning has evolved. A brain-compatible approach integrates the engagement of emotions, nutrition, enriched environments, music, movement, meaning-making, and the absence of threat for maximum learner participation and achievement. When these principles are applied, dramatic results follow. Since 1993, The Brain Store® has been bringing state-of-the-art brain-compatible resources into homes, classrooms, and businesses worldwide. Check out our online store! The products we offer promote smarter thinking, greater productivity and achievement, more inclusive teaching and learning strategies, better recall, and increased personal success. Tapping into the potential of your brain has never been so easy.[137]

In Chapter Three, I discussed how the (alleged) finite period of synaptic branching leads to the figure of the child's brain as a "resource" which must be invested with time and energy if it is to be appropriately stimulated before the biological window of opportunity slams shut. If this temporal imperative comes down hard on parents, it arguably weighs as heavily on teachers since it is they who are explicitly charged both with creating an appropriate environment for learning (background) and populating that environment with

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[135] Renate Nummela Caine and Geoffrey Caine, *Unleashing the Power of Perceptual Change: The Potential of Brain-Based Teaching* (Alexandria, VA: Association for Supervision and Curriculum Development, 1997), available at http://www.ascd.org/publications/books/1997caine2/chapter1.html (accessed 2 March 2003).

[136] "News on Brain Gain," *NEA Today Inside Scoop* (National Education Association, 1999) available at http://www.nea.org/neatoday/9903/scoop.html (accessed 2 March 2003).

[137] "About TBS," The Brain Store. available at http://www.thebrainstore.com/store/about.asp (accessed 3 July 2003).

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effective practical teaching techniques (foreground). This can be clearly seen in the text above. While architecture provides for the general contours of human interaction in the school, the day-to-day particulars must be invented and carried out every day by individual educators. Not surprisingly, then, principles and techniques for creating a proper (i.e. brain-based) classroom environment constitute much of what one finds in texts addressing the education of the plastic brain.

By far the most visible element in this discussion is the importance of emotion and sociality in/for learning. Along with Nature v. Nurture, another binary that has been reinscribed through circulation of the plastic brain throughout discourses of pedagogy is Reason v. Emotion. Methods and curricula created to teach static brains, in place since the beginning of the 20th century, contain both implicit and explicit biases towards logic, abstraction, and factuality. Students sit in rows, curricula divide subject matter, tests test memorization, teachers give letter grades, bells tell everyone when to move. The picture is pretty bleak but that's ok since education doesn't require and may even be hindered by too much engagement of a student's emotions. Emotion and learning/reason are inversely related; inflame the animal passions and one's ability/desire to learn plummets. Not so, say proponents of brain-based education. Still, it is difficult to reconstruct the conditions of possibility that have led to the redemption of emotion as a topic of practical concern for those concerned with learning and pedagogy.[138] What is *not* difficult to see is how the education of plastic brains requires serious attention to and management of student's emotional and social well-being. As neuroanatomist Marion Cleeves Diamond puts it

> How can parents and teachers provide conditions that will most effectively promote growth and change in our children's nerve cells with their branching dendrites? Dendrites are like the trees of the mind, growing like poplars in the sun. How can parents help a child to develop his or her full potential and set a

[138] Three such conditions are surely the diffusion of Gardner's concept of multiple intelligences, the increasing ability to image the interconnectedness of brain systems, and the operationalization of "emotion" as an experimental object.

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> pathway of lifelong learning? Parents and teachers should create a climate for enchanted minds to obtain information, stimulate imagination, develop an atmosphere to enhance motivation and creativity and discover the value of a work ethic.[139]

Diamond goes on to create what she calls "a recipe for an enriched environment to determine academic success." In it she lists important components of a brain-sensitive classroom. Number one on this list concerns the importance of "setting the stage for enriching the cortex by first providing a steady source of positive emotional support - love, encouragement, warmth and caring." A bit further down the list, after proper nutrition and balanced exposure to many different styles of instruction, come items addressing the importance of ensuring "social interaction for a significant percentage of activities" and "an enjoyable atmosphere that promotes exploration and the fun of learning."

Of course, the importance of a proper learning "environment" or "climate" has been central to pedagogy since the classical period. Socrates conducted inquiry in the streets of Athens, medieval monastics got right with God as much through corporeal asceticism as textual exegesis, the guild system perpetuated itself by requiring apprentices to learn on the job, and American factory-style schools of the mid-twentieth century socialized (male) students for success in large-scale industrial hierarchies. Each of these moments represents not only different definitions of "proper educational environment", but also different visions of the occupational and sociopolitical environments in which students were to ultimately make use of that education. By articulating brain research as a warrant for revising longstanding distinctions between Reason and Emotion, those who write about brain-based educational practices seek to recenter the school not only as a place of information transfer but as a space in which one becomes an ethical subject. This is in many ways an extension of the Deweyite,

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[139] Marion Cleeves Diamond, "What are the Determinants of Children's Academic Successes and Difficulties?" *News from the Neurosciences* (New Horizons for Learning Inc., 1999), available at <http://www.newhorizons.org/neuro/diamond_determinants.htm.> (accessed 6 July 2003).

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experience-based pedagogy that has dominated educational thinking since the middle of the last century. Indeed, given Dewey's underappreciated research into the intimate relations between environment and the brain, he would most likely have strongly embraced BBE.[140] Importantly, though, while Dewey advocated wholesale reform of both modes of assessment as well as instruction, the logic of subject formation that is central to BBE remains vested in factuality since the perceived importance of a brain-based environment stems from the fact that only that kind of environment will maximize the classroom's efficacy as a place of information transfer. This is because, other than increased self-satisfaction of the educator, the primary proof that BBE is 'working' and that students are becoming more engaged in their own education continues in the vast majority of schools to be tests and letter grades.

This circularity and BBE's tight-coupling of the affective and the rational enables two conflicting desires to be reconciled. In fact, though they are certainly desires, they are also discursive elements that are better understood as exigencies to which any (successful) argument must attend. First, the discourse of brain-based learning offers hope and professional legitimation to teachers who want to connect with their students and humanize the educational experience. Indeed, the promise of brain-based education has been most vigorously advocated by constructivists, who have long argued the need for a more holistic, relationship-centered approach to learning. I will address this further in the final section. The second exigency engaged by the discourse of brain-centered education concerns the desire of educators to satisfy their professional obligations using the means and metrics that are available to them. In the vast majority of school systems this means standardized tests, standardized curricula, overcrowded classrooms, letter grades, and so on. While the rare teacher can sometimes satisfy both of these desires and accomplish one through the other, educators more often are forced to make small daily

[140] Thomas C. Dalton, *Becoming John Dewey*, (Bloomington" Indiana UP, 2002): 88-89.

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choices between, adopting Habermas's terms, the 'lifeworld' and the 'systems world'. A great part of the appeal of brain-based education stems *not* from the fact that it values Relating over Results or Emotion over Reason, but rather from its ability to put both of those hierarchies of value into a relationship whereby each becomes essential for the success of the other.

The Metropolitan Omaha Educational Consortium's report, "Principles of Brain-Based Learning," illustrates this reconciliation of reason and emotion in both format and phrase. The text is structured in a Principle/Explanation/Implication format through which readers are presented with a list of twelve "principles of brain-based learning", which are each followed by a brief explanation of that principle, and then a statement detailing that principle's "Implications for Educators". What follows is the section concerning emotion.

> *Emotions Are Critical To Patterning.*
>
> We do not simply learn things. What we learn is influenced and organized by emotions and mind sets based on expectancy, personal biases and prejudices, degree of self-esteem, and the need for social interaction. Emotions and thoughts literally shape each other and cannot be separated.
>
> *Implications for educators:*
>
> Teachers need to understand students' feelings and attitudes will be involved with and will determine future learning. Students' beliefs about the support that they receive from teachers and administrators further affect their learning. For example, day-to-day classroom encounters affect learning, as does the everyday communication involved with meeting a student in the hall or cafeteria. These chance encounters affect students' beliefs about the level of teacher/administrator support and respect which in turn, affect learning.[141]

The fragment begins by embracing a holistic view of education and locates learning as much in the predispositions and daily contingencies of the student as in a textbook.

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[141] "Principles of Brain-Based Learning," Combined Elementary Task Forces of the Metropolitan Omaha Educational Consortium (Omaha, NE: University of Nebraska at Omaha, 1999), available at http://www.unocoe.unomaha.edu/brainbased.htm (accessed 8 July 2003).

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Teachers are then encouraged to invest more than they had before in "chance encounters" with students because this will "affect students' beliefs about the level of teacher/administrator support and respect." Although indirect, "learning" is impacted because students want and are able to accomplish more if they believe they are respected by those around them. Importantly, and perhaps contrary to what is often implied by the move to brain-centered learning, the core definition of "learning" doesn't expand to take in the sociality of the school or the emotional attachments that are formed by chance encounters. Instead, learning remains firmly anchored in the classroom under the responsibility of the teacher. After all, it is the teacher who is charged with incorporating BBE in her classroom and responsible for building a productive learning environment. In the end, because "thought and emotion cannot be separated," the enrichment of students' emotional environment in school will "determine future learning." Passion and Reason are then no longer seen as competing approaches to education. Emotional engagement – always already biological engagement – within a brain-centered environment becomes the most effective means of raising test scores, meeting testing requirements, and securing one's own professional future in the school.

Only alluded to till now has been the degree to which the plastic brain has been taken up as an argumentative resource used to legitimize particular traditions and theories of instruction. While the earlier discussed emphases on environment, emotion, and stimulation encourage educators to embrace a general attitude about the best kinds of education, it is important to point out that this attitude and the practices it encourages align – or have been made to align – with more down to earth interests of the education establishment writ large particularly in light of shrinking budgets, increasing professional requirements, and expanding societal expectations. Not surprisingly, then, reformist elements in the professional education community have incorporated the plastic brain into their existing arguments advocating the need to overhaul public education for the 21st century. This narration of the plastic brain into more general calls for a renewal of the

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public's commitment to education has been well documented.[142] I am here interested in the more internecine use of the plastic brain as a mark of distinction within the educational community itself. That is, rather than examine how educators make use of the plastic brain in arguments for increased public (i.e. external) support, I discuss both how educators are encouraged to associate themselves with the plastic brain in order to signify their efficacy as teachers and how the commercial marketing of brain-based instructional techniques frames those techniques as markers of internal, professional distinction.

In the same way that any discussion of a 'plastic brain' implicitly generates a parallel discussion of the 'static brain', statements concerning the advantages of brain-based education spawn criticisms of the deficits of static brain instruction. This argument anti-matter is typically unintended, unrecognized and in most contexts it is not even interesting to point it out. Here, though, it is significant because it enables us to see how arguments about pedagogy, profession, and politics are nested within what on the surface seems to be a relatively simple question concerning how educators should make use of brain research. Consider the following fragment

> Two rules come from the field of brain research and enrichment. One is to eliminate threat, and the other is to enrich like crazy. Before we understood the collective impact of an enriched environment, it may have been acceptable to justify a minimalist classroom. Gone are the days in which any teacher could justify a barren classroom with one-way lecture as the only input. Today, the evidence is overwhelming that enriched environments do grow a better brain. In addition, the early developing brain grows fastest and is the most ready for change. The opportunity must be seized.[143]

Jensen's remark about classroom enrichment and the elimination of threat flows smoothly into an indictment of existing professional practice. We all know that barren

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[142] The most high-profile of these public calls to re-value education in light of brain research was probably 1997's *White House Conference on Early Childhood Development and Learning: What New Research on the Brain Tells Us About Our Youngest Children*, available at <http://clinton3.nara.gov/WH/New/ECDC/>.

[143] Jensen, *Teaching with the Brain in Mind.*.

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classrooms and one-way lectures are still very much with us, and yet the plastic brain provides a means of marking a decisive break between the old and the new. Jensen then normalizes this break when he parlays it into an occasion to distinguish good teachers from bad. Similarly, Kathy Nunley, a highly-sought educational consultant who conducts brain-based education workshops, emphasizes how individual teachers can use research on the brain and learning in the best interests of their students.

> First, I think we can all agree as educators, that simply asking students to memorize or 'learn' certain material and then regurgitate it back at a future date leaves us feeling like something is missing in education. Rote learning has some merit and is useful for things we need memorized for convenience sake such as the alphabet or times tables. Any type of learning is certainly good for building neural pathways in the brain too. But, for the most part, learning is more meaningful when students are given the opportunity to play with, apply, and assimilate new ideas into their own schema.[144]

Here readers are presented with a choice of sorts: do I include myself in Nunley's "we"? Or do I stand by a style of instruction that she says is less effective and leaves something missing? The choice is forced and readers are presumably already interested in alternative modes of instruction, but the net effect is to bolster both one's decision to investigate the brain-based literature and one's sense that they are going the extra mile for their students. The focus on individuals is significant since, although advocates for increased public funding are using brain research as a warrant for increased public funding, there are no guarantees that such advocacy work will have any impact in the near term. This means that, in the meantime, the move to brain-based instruction is purely voluntary, an individual choice concerning how one wishes to do one's job. Some teachers and administrators look in to brain-based literature, most do not. This relative novelty, along with the rhetoric of professional distinction exhibited above, help explain why educational discourse on the classroom application of the plastic brain rely so heavily on personal narrative and evidence from experience.

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[144] Kathy Nunley, "Why Layer Your Curriculum?" available at <http://www.help4teachers.com/why.htm.> (accessed 28 December 2003).

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Furthermore, when examples of individual educators who have utilized some aspect of brain-based technique appear in the professional literature, their embrace of the plastic brain gets framed as a major turning point in their career and in the success of their students. These texts are typically structured as conversion narratives in which a teacher describes how her frustration with the repeated failure of business as usual spurred her to the slightly mysterious but ultimately life-changing world of brain-based education. For example, the following exchange is excerpted from a lengthy interview with a Tennessee school administrator whose district has, since he took over, "like a phoenix, literally risen from the ashes" of low test scores and high drop out rates.

> **BC:** Can you talk about how important you think brain research is to education and what strategies Oneida has implemented that take advantage of that research?
>
> **Brown:** Learning is development of the brain, pure and simple. I have gotten as much information on brain research as I can find and I have absorbed it as much as I can. We knew the earlier we got to students, the better chance we had to correct any damage done. So our schools are high on development of the brain. Research has also shown that you need to lower the student to teacher ratio, so we've tried to do that. Music is a big part of our curriculum, too. A while ago, I read about research that showed that children with formal training in music were more proficient in math, and I filed that away. I knew there had to be the same process in the brain with music as with math. So now, all children in our schools know how to read music by the time they leave the fifth grade. We also have the goal that every middle and high school kid be involved in extra curricular activities. We don't have many loafers. Also, our schools are spotless schools and bright and have all the comforts of a school. They're safe. That's important, too.[145]

In many instances, there is an imputed identity between brain-based learning and student/professional success. That is, rather than quantify the positive impact of BBL, educators instead emphasize the degree to which they have implemented brain-centered practices and treat that as evidence of the new pedagogical success.

> The principles and related activities reflect Baker School's efforts to create a brain compatible learning environment. We have been fortunate to receive guidance from many brilliant and caring educators. Baker School, and the instruction that takes place in it, may have come further than many schools in creating a brain

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[145] "Teaching Appalachia Style: An Interview with Mayfield Brown," BrainConnection, (November 2000), available at <http://www.brainconnection.com/gen/?main=conf/nov00/brown-int.> (accessed 31 December 2003).

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> compatible setting, but most schools now have some of these components. When educators are conscious that they are making choices based on their knowledge of how the brain learns, they will strive to learn more. Then their schools will be moving in a brain compatible direction.[146]

"Moving in a brain-compatible direction" is said to be a good thing because the more that we know about "how the brain learns" the better able we are to cater to its needs and maximize its potential. An important consequence of this formulation is that the question of assessment or quantification of BBL gets transferred from the educational to the scientific domain since it is scientists, not teachers, who discover how the brain works. After all, since brain-based teaching techniques are said to be dispassionately derived from brain research, they will always be effective. The upshot of this is that it is *scientists* who ultimately find a given curriculum, class organization, or lesson plan brain compatible or brain incompatible, effective or ineffective. An educator's job then becomes the creation of a brain-centered – over and against a student-centered - environment wherein a transfer of technique from lab to classroom can be as smooth as possible. In this way, the reduction of 'a student' to 'a brain' not only collapses the space between classroom and labroom, it softens typical distinctions between teacher and scientist. I will return to this below.

As you may have noticed, if you replace 'student' with 'child' and 'teacher' with 'parent' the above picture is identical to that sketched in the previous chapter on parents and the plastic brain. Whereas the reduction of person to brain directs a parent's anxiety towards the purchase of stimulating toys and the brain-sensitive design of domestic space, in an educational context it serves to assuage the professional and personal anxiety triggered by the material poverty and psychic immensity of the task of public education. Weighed down by inflated social expectations, diminished resources, and overworked bodies, the prospect of teaching "the brain" rather than teaching Pedro, Aisha, Hunter,

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[146] Richard Bucko, "Toward a Brain Compatible Elementary School," *Classroom Leadership* 2 (November 1998), available at <http://www.ascd.org/publications/class_lead/199811/bucko.htm.> (accessed 3 January 2004).

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Anne, Jerome, Nathan, and Liz is – understandably – extraordinarily attractive to classroom teachers. This attraction is enhanced by the many commercial voices that appear alongside and in service of calls for professional renewal through brain-based reorientation. In the final section I examine these voices and show how they articulate themselves to the reformist injunction of the plastic brain by offering the training and materials said to be necessary for carrying out that reform in the classroom.

Professionalizing Plasticity™

> Package B: You'll never look at teaching the same again! Two Day (5 hours/day) workshop covering Brain Biology, Layered Curriculum™, Memory Systems, Problem Solving, Grading, & Rubrics. Participants will leave with a complete unit of Layered Curriculum™ which they could use in their classroom.[147]

The absence of any large-scale adoption of brain-based education by primary educational institutions (public school districts, schools of education, etc.) means that those educators who end up investigating or implementing BBE do so primarily as a matter of individual choice. This self-selection, coupled with a set of principles that are said to be politely inimical to established practice, authorizes a rhetoric of exceptionalism on the part of those who write about and profess to be adherents of BBE. As a consequence, those individuals who have made or are considering the move to BBE constitute a lively economic market and over the last ten years this market has spurred a sizeable industry of consultants and professional development firms seeking to respond to and expand it. I focus in this section on how the marketing of these products and services fulfills educators' desires for personal-professional fulfillment both by capitalizing on the alleged failure of the static brain-entrenched educational establishment and by pitching

[147] "2004 Layered Curriculum™ Workshop Packages." Help4Teachers, available at <http://www.help4teachers.com/packages.htm.> (accessed 18 January 2004).

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BBE as an alternative model which will enhance not only student performance but, interestingly, the morale and mental health of the educator as well.

One of BBE's primary modes of circulation and publicity is the professional development workshop. These are either paid for by school districts and take place on-site or by funded by individuals who travel to multi-day workshops/retreats in the summer. While on-site workshops are typically free for those educators who wish to attend, retreats typically cost upwards of $1000 for five days excluding transportation, lodging, and meals. Included in both kinds of workshop are workbooks, handouts, lists, and other materials which help educators design lesson plans and units that are consistent with the terms and principles of the particular version of BBE being advocated. These versions and their vocabularies have been created by each firm and function like unique brands of BBE. The creation of a specialized vocabulary is an effective way to insinuate oneself into everyday talk and encourage personal identification with this or that school of BBE. For example, counselor and speaker Lowell W. Biller designed a four part framework for BBE called I-CAN: Instructional climate, Cerebral engagement, Abundant connections and Neural practice. This framework is outlined in his book *Creating Brain-Friendly Classrooms* and is utilized by he and other speakers and workshop leaders who are sympathetic to his particular vision of BBE.[148] Another framework, designed by Renate and Geoffrey Caine of Caine Learning LLC, is based on twelve "Brain/Mind Learning Principles" from which they derive the three "interactive teaching elements" that constitute the core of their version of BBE. The three elements are Relaxed Alertness, Orchestrated Immersion in Complex Experience, and Active Processing.[149] Finally, Kathy Nunley's Layered Curriculum™ consists of three elaborately-constructed

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[148] Lowell W. Biller, *Creating Brain-Friendly Classrooms*, (Lanham, MD: Rowman and Littlefield, 2003).

[149] "Principles Wheel." Caine Learning LLC, available at <http://cainelearning.com/pwheel/> (accessed 20 January 20 2004).

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layers: C layer for basic knowledge, B layer for application of C layer knowledge, and A layer for critical thinking and analysis.

One would assume that the most manifest basis of appeal made in marketing these workshops and texts concerns their ability to increase student achievement. This is true but only indirectly. Instead, student achievement is framed as a waystation between a teachers occupational frustration and satisfaction, making the primary end of BBE professional advancement and personal fulfillment.

> Lean in. Read closely. In the next few minutes you'll discover how an extraordinary 6-day workshop can change your life. You'll find out how to make your job easier, more fun, more fulfilling. At the same time you will learn how to boost achievement, learning and test scores. It's not a pill you can take or some other near-magic formula, but it's as close to it as I've ever seen.[150]

Despite reading like the script from an early morning infomercial, I do not want to suggest that this easy equation between achievement and satisfaction is unseemly. In fact, it seems necessary given the essentially reciprocal nature of the student-teacher relationship. After all, how does one distinguish a student's achievement from their teacher's effectiveness? Who deserves credit or blame? Is it appropriate to assume that students and teachers have the same definition of success? Absent these distinctions, claims about BBE take on a revolutionary air since it is alleged that **everything** will change once educators read this book or attend that workshop.

- Accelerate Your Professional Skills Into The Next Century
- Gain Sky-High Confidence
- Get 100+ Specific, Practical, Useful Tools and Applications
- Make a Bigger Difference
- Enjoy Affordable, In-depth programs
- Teach or Train with Less Stress
- Choose from Convenient Dates and Fun Locations
- Put More Joy in Your Work[151]

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[150] " Six Day Workshops," Jensen Learning Corporation, available at <http://www.jlcbrain.com/six_day.html.> (accessed 23 January 2004).

[151] "Training and Workshops," Jensen Learning Corporation, available at <http://www.jlcbrain.com/trng_wkshp.html.> (accessed 26 January 2004).

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> Inspire active learning with these proven teaching tools! Years of research confirm that certain teaching tools awaken the desire to learn in students by engaging their brains. And, once their brains are engaged, synthesis and retention of information will soar![152]

> Learn powerful and practical success strategies to boost motivation, attention, understanding, meaning and recall. Transform any school into a complete learning organization by integrating what we now know about the brain with standard education practices. You'll learn how to apply brain-based learning principles with this reader-friendly, easily understood format to achieve immediate results. These principles work because they are based on the way our brain naturally learns best. This updated version uses the most current information from the recent explosion of brain research as it applies to teaching and learning.[153]

What authorizes this unbounded enthusiasm? What is alleged to make BBE different from the dozens of earlier would be revolutions in public education? There is one answer to both of these questions: the difference is that BBE **must** work. That is, proponents are so excited and able to pull out all the argument stops about BBE because, as the above fragments state, "years of research confirm" and "these principles work because they are based on the way our brain naturally learns best." The brain does things its way and, once scientists have discovered this way, as long as educators learn how to implement it in the classroom *they cannot fail*. Simply put: there can be no failure of BBE. Failure can only be explained by inadequate execution in the classroom and is therefore the fault of the teacher. The only way to avoid failure is to learn as much about the brain as possible and to develop an ability to critically distinguish good science from bad.

The following is an explanation of what teachers should look for in order to ensure that they are practicing brain-based learning.

> Brain based learning is the informed process of using a group of practical strategies that are driven by sound principles derived from brain research. If you are doing what's working and your students are having fun, that still doesn't mean it's brain-based learning. If you agree with the principles of brain-based

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[152] Description of Marcia L. Tate, *Worksheets Don't Grow Dendrites*, available at <http://www.thebrainstore.com/store/productlist.asp?department=21.> (accessed 26 January 2004).

[153] Description of Eric Jensen, *Brain-Based Learning*, available at http://www.amazon.com/exec/obidos/ASIN/1890460052/qid=1075131355/sr=2-1/ref=sr_2_1/104-7806393-4689547. (accessed 26 January 2004).

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education, or went to a brain-based workshop, that doesn't mean you're doing the real thing. So, how exactly would you know if you were doing something brain-based?

1. You would be able to articulate what the brain-principle was you were using and why you chose the strategy you chose. Your work would be purposeful. *(e.g. "I understand that certain emotions can enhance memory. I'm going to first use suspense and then a celebration with this activity.")* You would also know the critical "how we learn" principles that give you guidelines (constraints and possibilities).

2. You would know the research or where to find the research on the particular strategy you used. Your work would be authentic. *(e.g. "I know some very good work on this topic was done by Dr. Larry Cahill at Univ. of Calif. at Irvine.")* You would also know 10 of the hottest and best WEBsites, four of the top "brain-based" universities and a half dozen of the elite, premier sources for staying current with the exploding new brain research.

3. You would know what kind of results you could expect and if you needed a change of strategies. Your work would be flexible. *(e.g. "I know enhanced noradrenergic activity boosts long-term memory for explicit learning.")* Even more importantly, you'd know what are the variations and exceptions to the rule and how to present them. In most cases, the devil is in the details and you'll want to learn them.

4. You would be challenged by the prospect of changing student brains on a daily basis, yet feel up to the task. Your work would be meaningful. *(e.g. "I know that the human brain can and does change every day and I'm excited to be part of that process.")* Knowing THAT you change brains every day is very powerful, but it's also daunting. What you need to know are the 14 specific variables that enhance positive change in the brain. Knowing how and when to enrich is empowering and exciting.

5. You would have the content knowledge matched with the presenting skills so that what you knew became what was learned. Knowing about the brain is useless unless you're a neuroscientist--educators *must have the tools* to translate it. That means you're using top quality presenting skills. Why? Most of what students learn is NOT in the lesson plan. Unless your posture, tonality, gestures, directions, expressions and activities are fully aligned with the other content-related messages, the strongest message (implicit, nonverbal) will win out![154]

In short, teachers must become more like scientists. To do otherwise would be to guarantee professional decline and, as Jensen warns, "probably be dangerous for our learners." Here we see stated more explicitly what was only implied in the previous chapter. While the idea that parents should undertake their role as would a scientist

[154] Eric Jensen, "Brain-Based Learning: Where's the Proof?" available at http://www.jlcbrain.com/truth.html. (accessed 26 January 2004).

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"working on the brain" remains for now more than slightly controversial, the future of education as it is charted here is premised entirely on just such a shift. This chapter has shown how educators are encouraged to 1) design their classroom space in a stimulating manner, 2) instruct in a manner that engages the emotional brain, and 3) train themselves to be a reliable vehicle for the transfer of pedagogy and practice from laboratory to classroom.

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CHAPTER VI

THE TEENAGE BRAIN

An examination of the role of "the expert" in news coverage of school shootings might not strike one as terribly pressing. School shootings disquiet the nation by breaking the rules thought to hold society together, and this motivates journalists to (re)constitute institutions of social authority as agents that can potentially prevent similar events from happening in the future. Within this context one would expect that the "experts" relied upon for recommending potential sources of agency would be people who spend a great deal of time with or even devote their lives to the betterment of youth. But of course, there are *many* individuals who fit this description; people with different occupations, different social roles, and different forms of institutional authority and socio-political capital. Indeed, the number of people conceivably available for inclusion as "experts" on kids is quite large: teachers, parents, coaches, youth ministers, band directors, friends, lawyers, legislative representatives, sociologists, community workers, and grandparents among many others. For this reason, then, the choice of which "expert" to include in a news story, especially a news story concerning a school shooting, is one of the more significant choices that a journalist will make, given that that expert's statements are likely to be crucial for how readers will make sense of and act in response to the story.

With this in mind, the question can be asked: what "expert" voices does one most often find in school shooting texts? Put differently, which community of "experts" is able to offer its interpretation of the event and how does this condition readers' experience of the event in and through the text? Perhaps not surprisingly given the affective context of confusion and uncertainty, journalistic texts and commentary on school shootings more often than not call on scientists to help set things right by simultaneously constituting and appealing to the existence of a practical, objective body

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of knowledge which offers hope for effectively addressing these catastrophic social events. More specifically, what one finds when examining print coverage of school shootings is that, despite the occasional inclusion of law officers and legal authorities, the expert witnesses most often called upon in print coverage of school shootings are individuals identified as "psychologists" and "neuroscientists." Clearly there are important implications for these two disciplinary appellations as they attain value within particular texts, and I discuss these as they become important. Importantly, and in spite of the crucial distinctions that exist between these two disciplines, what unites them as they appear in news stories about school shootings is the fact that they come at the issue from a scientific (not religious, historical, philosophical, etc.) perspective.

In this chapter I examine several ways that journalistic texts rhetorically frame the statements of scientists so as to bring brain research into contact with the concerns of parents and educators against a textually-produced backdrop of teen violence. This narrative backdrop of sorrow and fear is important especially since up to this point the explicit consequences of "improper" stimulation and brain development have mainly been left for implication. That is, when the synaptic benefit of a particular toy or mode of interaction between a parent and child gets presented in or by a journalistic text, the clear implication is that that benefit will be forgone if that toy is not purchased or that mode of interaction is not pursued. In chapter two this was called 'synaptic opportunity cost.' Despite its tendency to induce a kind of unrelenting anxiety – since the path not taken is always an unknown quantity and therefore potentially more desirable than the path begun – parents have more or less up to this point been spared the direct normative narration of what happens when the plastic brain goes horribly wrong. The reality of teenage violence, however, brings this picture into sharp relief, with clarity that becomes particularly evident when statements concerning the plastic brain show up in news stories ostensibly about school shootings and statements about school shootings show up in news stories ostensibly about brain research.

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These texts offer perhaps the clearest illustration yet offered of the double movement by which the descriptive power of scientific research attains prescriptive value when circulated through journalistic texts and the prescriptive power of journalistic texts attains descriptive value as its subjects get circulated through scientific research. This double movement works to identify the laboratory with the living room and, in so doing, illustrates how journalistic texts serve as the material locus of discursive articulation wherein textually-produced "facts of science" can diagnose pathology within while deriving their legitimacy from everyday, "non-scientific" experience. In the conclusion of this dissertation I more fully elaborate this double movement and its implications for thinking about rhetoric, science, and journalism. Here it will be enough to point out that it is through this double movement that one is able to see how "scientific knowledge" does not possess any *a priori* dominion over other modes of expertise or understanding, but rather achieves practical value by virtue of its textually-secured insight into the practical realm of human experience.

The majority of this chapter, however, is concerned with identifying those literary technologies through which journalistic texts manage to bring scientific statements about the plastic brain to bear on the topic of school shootings and teen violence. First, I examine the expert testimony from psychologists that is presented by journalists to readers. Reading what these experts – or people who are said to be experts – have to say is a crucial prerequisite for illustrating how a plastic brain-sensitive understanding of school shootings operates. Here I also analyze the narrative situation of scientific knowledge in school shooting narratives. That is, where in the story is the testimony presented and how is the putatively separate topic of brain development warranted within particular texts? Do brain scientists show up in the conclusion of the story? The beginning? Are they used to explain violent acts or to provide ways to prevent them? Most importantly, how is the effectivity of the expert statement vis-à-vis practical intervention or self-assessment a feature of its placement within the text?

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Second, I examine statements about the plastic brain that are made absent the textual presence or mediation of a scientist. These statements often begin with the conceit "Scientists say....." Unhindered by the requirement of fidelity to the testimony of a source, these statements are, perhaps not surprisingly, quite far-reaching in their claims regarding the explanatory and practical insights afforded by developmental neuroscience. Importantly, and in keeping with this project's general attitude about journalistic discourse, it is not the gap separating Truth and the layperson's gloss that is of concern. Rather, at issue are the ways that news stories work to (re)form the conceptual and practical terrain upon which the problem of school shooting will be addressed.

Finally, considering the overwhelming importance of *narrative dissemination* - that is, the existence of multiple narratives within any given text or discourse - I present a brief analysis of magazine stories that "report" on recent "advances" in "our" understanding of "the teenage brain." These stories are not ostensibly "about" school shootings, and yet the figure of the school shooting gets scripted into these brain research stories in a way that offers teen violence as a warrant for the value of the plastic brain as a field of intervention. Still, whereas previous chapters have addressed how the plastic brain encourages readers to enter in to a kind of managerial relationship with someone or something *else* (parent and child, child and environment, teacher and child), I conclude this chapter by showing how the plastic brain serves to (re)cast teen violence as essentially an effect of one's own neuroscientific constitution that is most successfully mitigated through techniques of <u>self</u> experience-environmental intervention. After all, with the passage of childhood, the teenager enters a period when the locus of responsibility moves inexorably from Other to Self. While in the past this transition entailed the gradual extension of curfew time or an after-school job, the imperatives of the plastic brain help introduce an entirely new kind of "responsibility", or what Foucault called "technology of the self". The new responsibility, the new maturity concerns one's ability to successfully train <u>ones own brain</u> in a way that ensures its appropriate

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development. To fail to succeed in this task is to risk not only one's own eternal adolescence, but the lives and safety of everyone around one.

Writing Psychology Into School Shooting Narratives

Rather than attempting to document the deployment of brain science in coverage of each school shooting, and rather than focusing on one or two particular incidents, I will concentrate instead on texts that engage (but also constitute) the school shooting as a problem. These texts typically appear after the most recent shooting and weave/narrate it into a continuing meta-narrative which could be called "The Tragedy of American School Shootings." The titles of two such texts gives a sense of the tone of these articles: "When Boys Go Bad" and "Toward the Root of Evil". These stories do not address the specifics of any particular event, but rather speak more globally about the problem of teenage boys in light of the most recent school shooting. As can be guessed from their titles, these stories also narrate chronological and biographical details of the school shooter as a case study in psychological and moral decline. In this way, despite the fact that any one psychologist wouldn't be an expert on a specific case, the stories engage psychologists as experts in the field of "violent youth."

What quickly becomes apparent upon examining these texts is that the distinction I assumed earlier - between what psychologists say and how their statements are inflected in the text - is unproductive. How does one begin to parse the "actual statement" from its placement in the text without offering a superficial reading of both? Consider this de-contextualized example from a story called "When Boys Go Bad":

> "Luke's head is apparently filled with craziness about his world...and himself," wrote defense psychologist Mick Jepsen, who believes Woodham suffers from a serious depressive disorder.[155]

[155] John Cloud, "When Boys Go Bad," *Time* (July 6, 1998): 58.

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What can one say about this excerpt? It appears to be a fairly straightforward account of juvenile psychosis. Now read a slightly larger piece of the paragraph from which the above excerpt was taken and notice how quickly we move from banal description to something entirely different:

> "Luke's head is apparently filled with craziness about his world...and himself," wrote defense psychologist Mick Jepsen, who believes Woodham suffers from a serious depressive disorder. [Luke] Woodham talked of visiting demons. "The glowing one with the red cloak came to me" the very night before the shootings, he told a court-appointed psychologist. A few hours later, Woodham went after his mother with a baseball bat and an Old Hickory butcher knife, and then his schoolmates with a rifle.

This transition from psychological fragment to matter-of-fact description of multiple homicide gives a more nuanced idea of how journalists incorporate testimony from multiple sources into a seamless narrative of guilt and motivation.

The statements of brain scientists typically fall into two general categories, explanation and advocacy. Importantly, the designation of this testimony is based on its placement and inflection in the text rather than what the psychologist says *per se*. This being so we should examine how expert psychological testimony is made legible in the text, rather than assess the "adequacy" of the testimony in the abstract. Explanatory statements are those which attempt to offer reasons for 1) why young boys commit such acts; 2) why these boys felt they had no other option; 3) what indicators might suggest violent tendencies, and, what underlies these all, 4) what cutting edge neuroscientific research has to say about the biological bases of violent behavior. Two examples of this kind of statement can be seen in the article "Toward the Root of Evil":

> "Many boys have impulse-control problems," says Gil Noam, a professor of education and medicine at Harvard. "They don't think, What are going to be the consequences for the rest of my life?" Bringing them through the treacherous pathways of mass culture takes a watchful adult. Things that merely amuse a grownup can injure a child, whose brain undergoes a powerful development surge before age 14. "Parents don't understand that taking a four-year-old to True Lies--a

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> fun movie for adults but excessively violent--is poison to their brain," says Michael Gurian, author of The Wonder of Boys.[156]

This testimony is presented as an objective description/explanation of the thoughts teenage boys have when they are in situations that might sanction violent or antisocial behavior. The psychologist is presented as having an "inside view" because the thoughts and motivations of teenage boys, whose capacity to induce fear derives precisely from the fact that their behavior cannot be predicted or understood by non-experts. In their role as experts on "violent youth," the psychologist assumes the same authority as the plant biologist when discussing heliotropic behavior or the astronomer when discussing the behavior of comets. The human psyche is, as suggested earlier, their area of expertise; expertise that gets certified in these texts by the ability to speak authoritatively about the relations between psychological well-being and human behavior.

This same authority is constituted in the second category of statement: advocacy. These comments 1) recommend behaviors that might circumvent future violence; 2) suggest the importance of increased attention to the lives of youth; and 3) assert the inadequacy of existing ways of dealing with disaffected youth. Two examples of this type of statement can be seen in a story titled "When Teens Fall Apart":

> We know how to help troubled children. Yet "we don't put resources into meeting their psychological needs," says Marin County therapist Madeline Levine. "We pay for computers in their classrooms but not counselors in their schools." Perhaps Littleton will change that. For now, however, the gap between what we know about prevention and intervention and what society puts within parents' reach is a yawning chasm—a chasm that is swallowing our most vulnerable children...A gunman is as likely to be the bullied as the bullier. Yet when parents of bullied children report the taunts and pummeling to school authorities, the institutional response is too often, " 'You brought it on yourself; you need to take care of it yourself'," says psychologist John Crumbley, who helped evaluate Kinkel after his arrest.[157]

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[156] Richard Lacayo, "Toward the Root of Evil," *Time* (6 Apr 1998): 38.

[157] Sharon Begley, "When Teens Fall Apart," *Newsweek* (May 10, 1999): 42.

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These statements situate the psychologist as expert within social institutions that are at the mercy of contradictory policies, inadequate funding, and lack of political will. Against this textually-achieved backdrop, the psychologist is framed within the journalistic text as one who speaks not as a scientist offering objective descriptions of a complicated topic but as concerned community member making the most of their expertise by drawing attention to important social issues that may not be best served by the kind of detached and "impartial" diagnoses presented in explanatory statements.

Regarding narrative placement, or where these two statement categories are commonly situated within full school shooting texts, one feature deserves comment. While explanatory statements appear throughout the text, advocacy testimony is typically placed at the end of the story. What is to be made of this? There is temptation to think that this is a radical move since the story ends with a call to action and may motivate readers to do something about the issue. This reading could certainly apply to the following excerpt from the May 3, 1999 issue of *U.S. News and World Report*:

> But as much as the culture of violence, the Colorado shootings illuminate a more solvable problem: that of teachers and parents and students who don't pay enough attention. "What I'm about to say, I don't think America wants to hear," says Scott Poland, a school psychologist who led crisis teams at past school shootings. "We have a number of troubled children who have a history of bullying, are fascinated with guns, violence, and bombs, have been teased, or [are] outcasts. It's time to end the culture of silence."[158]

By concluding with this statement, un-analyzed or otherwise inscribed by the journalist, readers are enrolled as actors within the ongoing narrative since it is only through their action that the "culture of silence" can be ended and the narrative brought to a desirable closure. Unfortunately, however, this is not always the norm. Rather than frame the expert testimony as providing a charge to readers, advocacy statements that appear at the conclusion of school shooting narratives typically get bookended with a comment from the journalist. Within the school shooting story as narrative, the customary function of

[158] Angie Cannon, "Why?" *U.S. News and World Report* (May 3, 1999): 16.

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these comments is to remind the reader of the psychic magnitude of school shootings. However, I argue that these statements also function rhetorically to constitute readers as mere observers who can only mourn these events from afar. Consider, for a second time, the final paragraph of "When Teens Fall Apart"

> We know how to help troubled children. Yet "we don't put resources into meeting their psychological needs," says Marin County therapist Madeline Levine. "We pay for computers in their classrooms but not counselors in their schools." Perhaps Littleton will change that. For now, however, the gap between what we know about prevention and intervention and what society puts within parents' reach is a yawning chasm--a chasm that is swallowing our most vulnerable children.[159]

This expert testimony offers a strong critique of reigning economic priorities and educational practices, a critique based no doubt on the experts personal experience as an actor on the "frontline" of the issue. However, Begley's comment at the end effectively writes readers out of Levine's "we" by suggesting that "Littleton" might "change" the situation Levine describes. One might ask here, can "Littleton" do anything? Is "Littleton" anything other than an amalgamation of countless discourses, narratives, images, commentary, etc. that means just about anything someone says it means? By suggesting that "Littleton" has some kind of extra-discursive agency that operates outside of human concerns, Begley effectively paralyzes Levine's critique. Further, the pathos at work in her vision of a "yawning chasm swallowing our most vulnerable children," authorizes quiet reflection on the moral condition of society rather than an expanded consideration of the ways that individuals and groups can actively address this issue in their own community.

Another excerpt where a potentially progressive prescriptive statement from a psychologist is circumscribed and constrained by concluding commentary from the journalist can be found in a May 1999 *U.S. News and World Report* story titled "Do You Know Where Your Children Are?":

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[159] Begley, 44.

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> Don't give up. "There is a lot of ignoring that goes on in these kinds of situations," says James Garbarino, codirector of the Family Life Development Center at Cornell University and author of Lost Boys. "Too many parents give up too early on their children." The bottom line, say experts: Know where your children are. Physically-- and mentally. "I'm very upset with the parents [of the two gunmen]," said grieving parent Shoels. "They should have watched their children. If my child had had six butane tanks in my garage, don't you think I'd ask him about it?" he said, referring to barbecue-type propane bottles the killers turned into bombs. "If I didn't, it would suggest that I don't give a damn about them." Where were their parents? Reports are that before any of the suspects was identified, Dylan Klebold's father -- through an intermediary -- contacted authorities to tell them his son might be involved and to offer help. But by then it was too late.[160]

Although more subtle than the earlier example, this excerpt illustrates a similar delimiting of the scope of agency in the testimony of Garbarino and Shoels. Stein's narrative settles on a note of sadness; an ex post facto reflection on a decision made too late. Klebold's father didn't give a damn about his son, acted too late, and Shoels' son (along with 14 other people) are dead as a result. Garbaniro's plea that parents "not give up too early on their children" becomes a kind of bridge across which the reader must travel in order to reach the end of the narrative. Because he appears *after* the expert's call to not give up on one's children, Klebold Sr. is the clear object of blame. As a result, a comment most likely meant for all parents is directed to only one. Narrated by Stein, and in the presence of the father of one of the victims, the psychologist-expert indicts the guilty party.

Having discussed the ways in which expert testimony gets framed in news stories about school shootings, I now examine a second element: the ways in which journalists "take over" from the direct statements of the experts and utilize the cultural authority of science in the absence of any explicit scientific authentication. This move provides a link between the framing of expert testimony discussed in this section and the discussion of expansive circulation of the figure of school shootings in the final section. This connection enables us to trace in the final section how the discursive value of "the school shooting" articulates with and circulates through other discourses concerning brain

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[160] Lisa Stein, "Do You Know Where Your Children Are?" *U.S. News and World Report* (May 3, 1999): 23. My emphasis.

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development, youth violence, and the significance of the teenage years. But first it is necessary to see how journalists constitute the authority of science in the absence of expert testimony.

Who Speaks in the Name of Science?

Some may be tempted to criticize the depiction of science in news stories about school shootings on the basis that the journalists who write the stories almost certainly have little to no knowledge of the current state of child psychology or neuroscientific research. This critique might entail an examination of the use and mis-use of Science by these non-experts. While such a critique will be helpful for those who feel compelled to reassert the allegedly all-important distinction between the scientist and the layperson, there are a number of important reasons for not indulging in it. Most significantly, it would necessarily subordinate the making-legible function of the journalist to the knowledge-producing role of the scientist. That is, such a move would constitute the scientist as a creator of Knowledge and the journalist as simply a reporter of that knowledge. This move forces the critic to overlook the ways that journalistic texts – or any text for that matter – both produce AND comment on a unique world wherein certain ways of thinking and behaving are more accepted than others. For our purposes, it is immaterial whether or not the journalistic text presents an "accurate" description of the state of neuroscience since the truth value of the text operates independently of its relation-to or erstwhile representation-of the "real" world "outside" of the text. The most important issue for us is how the mantle of neuroscience is deployed in journalistic texts and how this narrative construction sanctions particular ways of understanding violent crimes and the people who commit them.

As mentioned earlier, in the texts under consideration the discursive authority of science is constituted primarily through statements which suggest that any discussion of

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school shootings "obviously" must consider the cutting edge of scientific discovery. Take, for example, the following excerpt from "When Good Boys Go Bad":

> Geneticists predict that a simple blood test will one day tell which tykes become terrors. For now, though, there is more folklore than science. Some kids, it is said, are simply born twisted. It's possible that these five boys possess some murderer gene within, but a look at their upbringing and surroundings yields plenty of old-fashioned misery, both within and without.[161]

Notice the rhetorical acrobatics performed in this excerpt: 1) make prediction; 2) refute prediction; 3) retain essence of prediction (biological determinism); 4) explain events using biological determinism; 5) characterize examination of social-material conditions of the event as "old-fashioned." One does not have to embrace the doctrine of authorial intent in order to admire this construction of the superiority of scientific knowledge. A brief introduction to a discussion of results from the psychological tests of five school shooters, this excerpt endorses a sympathetic but skeptical reading of the pathos-ridden histories of the culprits.

Another way journalists appeal to/constitute the supremacy of scientific knowledge is by characterizing a person's behavior as something essentially, but not completely, determined by their biology. In this way, school shooting narratives are inscribed by the eternally-productive topos called "nature v. nurture." For example, Begley writes:

> There seems to be a genetic component to the vulnerability that can turn into antisocial-personality disorder. It is only a tiny bend in the twig, but depending on how the child grows up, the bend will be exaggerated or straightened out... A baby who is unreactive to hugs and smiles can be left to go her natural, antisocial way if frustrated parents become exasperated, withdrawn, neglectful or enraged. Or that child can be pushed back toward the land of the feeling by parents who never give up trying to engage and stimulate and form a loving bond with her. The different responses of parents produce different brains, and thus behaviors. (*Newsweek* May 5, 1999)

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[161] Cloud, 60.

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Here the genetic "component" of the brain, because it is the foundation acted on by human actors, is or should be the primary place for attempts to combat youth violence to occur. The action of teachers and parents, reform of the public school, increased awareness and involvement by counselors and other mental health professionals - these factors have a *supplemental* effect; they can only go so far. Begley continues:

> The good news is that understanding the roots of violence offers clues on how to prevent it. The bad news is that ever more children are exposed to the influences that, in the already vulnerable, can produce a bent toward murder... It isn't the brains kids are born with that has changed in half a generation; what has changed is the ubiquity of violence, the easy access to guns and the glorification of revenge in real life and in entertainment. To deny the role of these influences is like denying that air pollution triggers childhood asthma. Yes, to develop asthma a child needs a specific, biological vulnerability. But as long as some children have this respiratory vulnerability--and some always will--then allowing pollution to fill our air will make some children wheeze, and cough, and die. And as long as some children have a neurological vulnerability--and some always will--then turning a blind eye to bad parenting, bullying and the gun culture will make other children seethe, and withdraw, and kill.[162]

Although these stories do not explicitly advocate some sort of physiological inspection with which to determine who has a "twig" that is predisposed to being "bent" in the wrong direction, the analogy of asthma to the "neurological vulnerability" which can "make other children seethe, and withdraw, and kill," presents the prospect of such a test as being just as reasonable as the test for asthma. Within this formulation, a neurological vulnerability to violence, like a genetic predisposition to asthma, compels even those individuals who are not predisposed to alter their personal behavior in order to make sure they don't do something that will set someone off or damage someone's brain. The significance of this notion of self-control will be discussed more fully in section three.

Apart from the fact that the excerpts in this section concern those moments in school shooting news stories where journalists discuss the science of violence while not in the (textual) presence of someone who is said to be an expert on the subject, there is a

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[162] Sharon Begley, "Why the Young Kill," *Newsweek* (May 5, 1999): 32.

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second key difference between the excerpts used in the two sections. Careful readers will have noted that the expert identification and the science discussed in the first section was clinical or child psychology while the "scientists" and the science presented by the fragments in the present section come from genetics and the neurosciences. This shift can be illustrated by revisiting the excerpts previously presented and identifying their key terms. (Re)consider the following fragments presented in journalistic texts founded on psychology and the expertise of psychologists:

> "we don't put **resources** into meeting their psychological **needs**" . . . " teachers and parents and students who don't **pay enough attention**" . . . " Too many parents **give up too early** on their children" . . . " It's time to end the **culture of silence.**"

The operative terms in these fragments illuminate particular attitudinal and behavioral characteristics *of people*, with the implication that change is possible. When journalists employ the field of psychology – either speaking in its voice or presenting voices from the field – their tone can be characterized as ethico-cognitive in that concepts such as motivation, awareness, care, and regret are mobilized in such a way as to interpellate readers as ethical subjects. As such the issue is not reality or objective truth, but *states* of reality and different *conceptions* of truth. Compare this with fragments from texts which use primarily biological science:

> "will one day **tell** which tykes become terrors" . . . "can be **left** to go her **natural**, antisocial **way**" . . . "can **produce** a **bent** toward murder" . . . "will **make** other children **seethe**, and **withdraw**, and **kill**"

These fragments occupy an absolutist logic where "telling," "producing," and "making" reign supreme. In common parlance, biological discourses are "hard" and psychological discourses are "soft." Of course, these markers are motivated by a variety of historical and technological conditions which *do* change over time. In the 1920's and 1930's, for example, the science of psychology was considered to be "hard" partly because the discourse norms characteristic of a behaviorist psychology tended to be more categorical

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than later cognitive psychology with its talk of "representations" and "needs". The point is that the move from therapeutic to absolutist frame presents readers with different interpretive trajectories and as such has important consequences for how readers are encouraged to think about school shootings.

For example, school shooting texts that mobilize terms from clinical psychology emphasize *looking back* on the shooting event. They are in response to and, as such, do not directly address the desire for prevention that was so pronounced after the Columbine shooting. This desire can be illustrated by recalling the pervasiveness of the expression "warning signs" in news stories and television programs after each shooting. Owing partly to the commercial need for talk show guests to be concise and partly to the journalistic practice and rhetorical tactic of providing "the bottom line", psychologists, therapists and counselors throughout the country were being put on the spot, even pressed, to offer to a desperate audience clear-cut signs that a teenage boy (a student, a son) might be violent. From the *Today* show:

> COURIC: Meanwhile, coming up in this half hour, we're going to have more on that school shooting in Oregon. There have been at least six shooting incidents at schools over the past eight months, all committed by students. As a parent, it makes you wonder if you can be sure your own child won't snap some day and reach for a gun or perhaps a classmate might do that. This morning, we're going to talk with a psychologist about the warning signs. Matt...
>
> LAUER: Katie, remember back in April, a devastating tornado ripped through Oak Grove, Alabama...[163]
>
> A script from *Extra: The Entertainment Magazine*:
>
> Teased Segment - School Shootings. In the wake of the Jonesboro Arkansas shooting Americans are asking a lot of questions. There are warning signs.
> Visual - Jonesboro shooting.
> Visual - Paducah Kentucky shooting.
> Visual - Pearl Mississippi shooting. Three school shootings and they all had warning signs. Jonesboro Westside Middle School students knew that Mitchell Johnson had a bad break up with a girlfriend. He said he was going to get even.
> Interview - Robert Butterworth, Psychologist PHD, says we can recognize signs.

[163] *Today,* National Broadcasting Company, (May 22, 1998).

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These students do poorly in school and have poor relationships.
Visual - Pearl High School.
Visual - West Paducah Kentucky school. Michael Carneal said something big was going to happen.
Interview - John Devine, Professor New York University, says we don't pick up the warning signs and do something. David Jackson reporting. Schools are fighting back against violence. They are getting metal detectors, security guards.[164]

These warning signs are assumed to be visible and typically encompass a fairly narrow set of attitudinal and aesthetic choices. "What do we look for?"

> MARK HALPERIN: What are the telltale signs for a school or for parents who see their children, friends of their own children to say this is a group of students who are banning together in a way that is troublesome?
>
> Dr. PATRICIA FARRELL: Well, I think you **look for** antisocial behavior, negative behavior, destruction of property, breaking of rules, dressing in a rather bizarre fashion, going and trying to intimidate other kids. I mean, this was a very dramatic, almost like a film, that went on the way they were dressed in black, long coats, ski masks or things like that. It was very, very theatrical.[165]

Now recall the frustration produced when psychologists were either unable or reluctant to supply this list of bullet points. They had only complications to offer.

> LAUER: Just very briefly, Mr. Poland, what do you say to parents when they ask that most simple of all questions, why?
>
> Mr. POLAND: I think that the answer is a very complex one. Even in the situations where the perpetrators have been apprehended and have been now put in jail, they have not given us the answer to that question, really, to anyone's satisfaction.
>
> LAUER: Right.
>
> Mr. POLAND: I think the answers lie in the complexities and in the violence that permeates our society.
>
> LAUER: Scott Poland. Good luck to you as you travel to Littleton, sir.[166]

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[164] *Extra: The Entertainment Magazine*, Syndicated television program, (March 29, 1999).

[165] *ABC World News This Morning,* American Broadcasting Company, (April 21, 1999).

[166] *Today,* National Broadcasting Company, (April 28, 1999).

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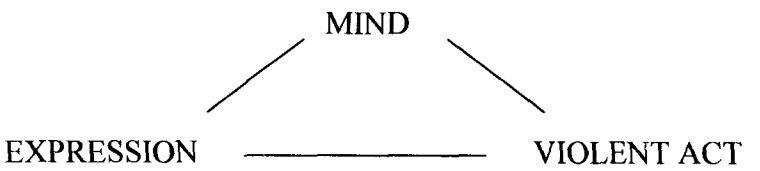
> Ms. PIRRO: It's not just parents, it's not just guns, it's not just videos; it's a whole combination...
>
> MATTHEWS: OK.
>
> Ms. PIRRO: ...and we need to recognize the warning signs.
>
> MATTHEWS: Jeanine, I agree with you on that. We should have seen those trench coats coming.[167]

The irony, and in some sense the tragedy, dramatized in these fragments is that, when it mattered most, Psychology – the discipline concerned with understanding what goes on in people's heads – could only explain teen violence in sociological, cultural, or historical terms. What makes someone enter their own school and kill their classmates? Those clinical and child psychologists called upon to offer expert explanation could only offer indirect possibilities since for them understanding school shootings meant looking at an array of third variables in hopes of triangulating – rather than diagnosing – the mind of the killer. The picture looks something like this:



Tellingly, this diagram and the explanation it offers calls to mind the standard illustration of C.S. Peirce's definition of a Symbol. A Symbol, for Peirce, is the species of Sign in which the Sign and its Object are related arbitrarily (by convention, history, mere repetition, etc.). In the above diagram EXPRESSION signifies the "warning sign" or, to stay with Peirce's terms, the "warning Symbol." Of course, there is no necessary connection between a black trench coat and a violent act. Everyone knows this. And yet, due to cognitive and clinical psychology's disciplinary embeddedness/indebtedness in Symbolic explanation, that kind of loose association was essentially as good as it was

[167] *Hardball with Chris Matthews,* CNBC, (April 30, 1999).

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going to get. Furthermore, in spite of the benefits bestowed by symbolic, purely conventional, relationships within the domains of language, music, and the arts, the aftermath of six school shootings in two years left the American public in no mood to celebrate the uncertainty inherent in Symbolic explication. Such accounts were satisfying up to a point, but the personal and institutional implications of the course of action they entailed (e.g. suspicion of everyone wearing a black trenchcoat, more guidance counselors in schools, more quality time with one's kids, more money for after-school programs) presented an almost insurmountable rhetorical impediment to what was, in the end, only a correlation not an explanation. For this reason, when criminologist Jack Levin says to Paula Zahn, "Well, you know, after a massacre at a school, everybody becomes a psychologist," his observation that anyone can be a psychologist points to the limits of the Symbolic when it is positioned against other, seemingly more direct, ways of knowing.[168] The essential ambiguity and, for many, inadequacy of existing modes of inquiry into the problem of youth violence has become ever more apparent in the years since the Columbine shooting. This is especially evidenced by the thinly-veiled outrage evoked when, for example, "warning Symbols" lead authorities to arrest a 13-year old in Texas for writing a Halloween essay that was deemed "terroristic"[169] or jail a 14-year old for titling his English essay, "Goin' Postal":

> SUSAN, STUDENT WRITER'S MOTHER: A gifted and talented child, an excellent writer. He's got stories in here from third grade that he's going to go to Africa and study voodooism, and it's just a creative imagination that they're trying to stifle, and they're trying to control his thoughts, his feelings, and now, his writings.
>
> KNAPP: Do the boy's essays reflect real life?
>
> STUDENT WRITER: Not really. Because, I mean, it's something I like to write about, but something I'd not like to do, or even consider doing.

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[168] *The Edge with Paula Zahn,* Fox News Network, (November 11, 1999).

[169] *Talkback Live,* Cable News Network, (November 5, 1999).

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> KNAPP: His parents say a psychologist evaluated their son and found no problems. The school district says it's not taking any chances.[170]

This dilemma is unavoidable because the contingency and historicity of a "warning Symbol" is erased once that Symbol, provided by committed and compassionate psychologists, is translated into school policy. What results from this translation is no longer a Symbol, but what was for Peirce a wholly different species of Sign: an Index.

Peirce explains that indices are signs which are "rendered such principally by an actual connection with their objects."[171] The warrant for the final section of this chapter is provided by the examples and illustrations through which Peirce seeks to clarify what he means by index.

> Let us examine some examples of indices. A sundial or a clock indicates the time of day...Geometricians mark letters against the different parts of their diagrams and then use these letters to indicate those parts...A rap on the door is an index... A low barometer with a moist air is an index of rain...The pole star is an index, or pointing finger, to show us which way is north...A weathercock is an index of the direction of the wind; because in the first place it really takes the self-same direction as the wind, so that there is a real connection between them.[172]

What is common to each of these examples? It is telling that when Peirce wants to exemplify Indexical signs he does so with magnetism, geometry, acoustics, and meteorology. Recall that Indices are Signs in which there is what Peirce calls an "actual connection" between Sign and the Object. This is not a conventional relationship subject to the whims of culture and history; it is both logically necessary and causally grounded, and will continue to be so for all time. It is likely that if modern day readers were asked to imagine examples of an "actual connection", they, like Peirce, would provide illustrations from the various scientific technologies of indication (weather vane, barometer, etc.). Smoke is an index of fire so – there is and will never be any doubt –

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[170] *The World Today,* Cable News Network, (May 8, 1998).

[171] C.S. Peirce, "The Icon, Index, and Symbol," *Collected Papers* 2 bk.2 ch.3. #284.

[172] Ibid., #285-286.

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where there is smoke there *will* be fire. The connection works the other way too: where you have fire you *will* have smoke. The two objects are linked in the most certain and undeniable of ways.

This detour through Peirce's theory of signs sheds new light on the frustration brought about by psychological (Symbolic) explanations of school shootings. It also helps identify the source of the nation's desire for a more "actual" [read: physiological] connection between violent act and individual. It also explains the increasing presence of neuroscientists in news stories about school shootings. After all, not just anyone can offer an Indexical explanation. Instead, in response to teenage violence, people don't want a warning sign or warning symbol. People want the certainty and security of a warning *index*. We want to turn on the *Today* show and hear, "Yes, Katie, there **is** something that distinguishes sociopathic violence from normal teenage angst, and here it is..." To be fair, we want to hear this not (only) because we want to surveil certain people but because we want to help them, insofar as that is possible. It is against this backdrop of mental health and mental help that I now engage texts that help to disclose and address the need for a warning index of teen violence. This is done by scripting into the tragedy of school shootings a figure we have become quite familiar with over the course of this project: the plastic brain.

Probing / Provoking the Teenage Brain

Perhaps the first thing that should be said is that texts connecting brain research and teen violence did not begin appearing until the middle of 1998, when, in the aftermath of Columbine, the nation was asked to confront the situation of youth violence as it never had before. Despite this, the texts I examine in this section do not appear alongside stories "about" Columbine or any other school shooting. Although these stories typically appear under headings such as "Health", "Parenting", and "Science", the figure

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of the school shooting makes frequent appearances. One example is from the opening of a story titled, "Inside the teen brain: Young minds are still taking shape":

> One day, your child is a beautiful, charming 12-year-old, a kid who pops out of bed full of good cheer, clears the table without being asked, and brings home good grades from school. The next day, your child bursts into tears when you ask for the salt and listens to electronic music at maximum volume for hours on end. Chores? Forget it. Homework? There's little time, after talking to friends on the phone for five hours every night. Mornings? Your bluebird of happiness is flown, replaced by a groaning lump that can scarcely be roused for school. In short, your home is now inhabited by a teenager. The shootings in Littleton, Colo., focused the nation's attention on aberrant adolescent behavior, but most teens never come close to committing violent acts. Still, even the most easygoing teenagers often confound their elders with behavior that seems odd by adult standards.[173]

It could be argued that "the nation's" attention wasn't focused *by* "the shootings in Littleton, Colo." but rather that this text constitutes its audience *as* "those whose attention was focused on aberrant adolescent behavior by the shootings in Littleton, Colo." In this way, the audience is to read the remainder of the story as a report on brain research that has pertinent, socially responsible meaning. Although it may seem odd to follow the allusion to Columbine with the comment, "but most teens never come close to committing violent acts," the remainder of the article is structured by a similar logic of deviance, wherein some people turn violent but most do not. Rather than perpetuate non-scientific "assumptions" about adolescent development, Brownlee writes that "the true source of teenage behavior lies north of the gonads. It's that 3-pound blob of gray and white matter known as the brain." Still, as suggested in the final sentence of the fragment, even the behavior of the *non-violent* teen can be baffling to parents and teachers. In this regard, this text is similar to many that have appeared in the wake of Columbine which have explicitly articulated brains with teenagers and their unique propensity for violence.

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[173] Shannon Brownlee, "Inside the teen brain: Young minds are still taking shape," *Newsweek* (Aug 9, 1999): 44.

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Two examples are particularly noteworthy for the ways they introduce the plastic brain into the discourses of parenting teens and adolescent mental health. The following fragment comes from the very first page of one of these texts, a book by adolescent psychologist Michael J. Bradley titled, *Yes, Your Teen Is Crazy: Loving Your Kid Without Losing Your Mind*

> Michael's mom sat in my office sobbing, repeatedly attempting to reason with her raging and verbally vicious adolescent son. After watching his endless bullying and her tormented begging for too long, I sent him out of the room, turned to her and said, "Why are you talking to him like he makes sense?" "What do you mean?" she sobbed. I gave her the same shrugging "Duh" gesture her son had just used a dozen times and I almost yelled, "He's nuts! You can't talk to crazy people like they make sense." Her eyes and mouth flew open, astonished at my insensitivity. Slowly her wrenching sobs transformed into chuckling, softly at first, then building to a crescendo of raucous laughter that rang off the walls. "Oh, God," she howled, "How I needed to laugh like that! It feels wonderful! You're right. Michael is nuts. And I'm nuts to sit here and talk to him like that." In our final session several months later, she reminded me of that exchange. "That," she said, "was the beginning of our healing."[174]

The question that drives this book is "why does my teenager act this way?" and the term "training" is used to indicate that parents need to unlearn what their parents taught them about parenting and bone up on the new world. "Parenting an adolescent in today's world is much the same as flying a jet aircraft or performing brain surgery. Any training you received 30 years ago is not only useless, it can actually impair your ability to perform well. Neurosurgeons and pilots constantly upgrade their skills, replacing outmoded thinking with new training that reflects contemporary realities" (4). There are several elements to this "new reality" that Bradley argues requires a skills upgrade, but the primary foundation – the first step that is necessary to retrain oneself as a parent – is "to learn how your kid's brain works." In the following passage, Bradley offers a historical survey in order to illustrate the inadequacies of Psychological/Symbolic explanations of school shootings discussed earlier.

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[174] Michael J. Bradley, *Yes, Your Teen Is Crazy: Loving Your Kid Without Losing Your Mind,* (Gig Harbor, Washington: Harbor Press, 2001): 3.

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> Up until now, psychologists had a lot of great-sounding theories to explain why adolescents tend to act so crazy at times. We believed that all that risk-taking, judgment-impaired, aggressive, and oppositional behavior was a function of early childhood experiences, peer pressure, the hormonal effects of puberty, and, most hurtful of all for too many mothers and fathers, poor parenting. No one thought that massive structural changes in teenagers' brains were largely to blame. We had no clue that their brains were changing. (5)

When Bradley implicates the "great-sounding theories" "we believed" "up until now" in the "most hurtful" condemnation of "too many" mothers and fathers, he calls upon readers to redirect that same condemnation back onto what psychologists used to believe. This is not to say that some degree of this may be warranted, but the general effect is to align readers with Bradley's hard-nosed version of brain-savvy parenting and call upon them to educate themselves about, of all things, their kids brain.

According to Bradley, the first thing parents must recognize about their teen is that "Technically speaking, they're crazy." In a section called "How We Found Out", Bradley explains his earlier comments to Michael's mother by presenting two studies that "found" that two systems of the teen brain – the prefrontal cortex and the limbic system – were "under construction" through the teen years and not already finished, as was previously thought. Teens are "technically" crazy because, although the teens limbic system – a "primal emotional center that deals with emotions like rage and fear" – is very active during this time, the prefrontal cortex – the so-called "executive center" of the brain – is not yet fully developed and so cannot moderate or direct the teen's emotions in an appropriate way. "Emotional control, impulse restraint, and rational decision-making are all gifts to us from our prefrontal cortex, gifts your kid hasn't yet received." (7) The teen brain is similar to the brain of a toddler in that

> Both the toddler and adolescent brain at times are unstable, dysfunctional, and completely unpredictable. They both have developed a bunch of brain circuits that may fire off unexpectedly. Also, they both have neurologically deficient controls to moderate these impulses and to understand the likely outcomes of their actions. In the science of mental health, we have a word for that. We call it crazy. (8)

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Another book, *The Primal Teen: What the New Discoveries About the Teenage Brain Tell Us About Our Kids*, takes the same basic premise and agrees that what it means to be a parent needs to undergo a massive shift in perspective.

> Teenagers, even the very best of them, can be crazy. But confronted with that craziness, the new brain science gives us another arrow in our quiver of response. Faced with that occasional insolent stare (or worse) in my own house, I can now think what a difference that time will make – time for actual brain development, time for the brain to grow, to change, to mature, time for some spit and polish on those prefrontal cortices, time for teenagers to become who they really are.[175]

Notice how terms traditionally used to refer to a human being – what a difference time will "make," "grow," "change," "mature," "become who they really are" – are, in this fragment, directed not at the child but at the child's brain. Indeed, the only person that readers are shown is said to be crazy, insolent, or worse. It is the *brain* that will grow, change and mature and, even though the paragraph ends with a reference to "teenagers", one has to wonder why parents would even bother complicating matters by parenting what they now know to be a second-order object.

In an op-ed published in *New York Times* the week following the 2001 school shooting at Santana High School in Southern California, the director of the Clinical Brain Disorders Laboratory at the National Institutes of Health Daniel R. Weinberger took the next logical step from Bradley and Strauch and argued that the immature prefrontal cortex of the teenage brain gives it a unique propensity for violence. In a now familiar move, Weinberger explicitly contrasts the explanatory power of the plastic brain with the inability of traditional psychological explanations to do the job.

> This week's shootings at Santana High School in California led quickly to now-familiar attempts to explain the seemingly unexplainable in terms of culture and circumstance: violent entertainment, a lack of accountability for deviant behavior, broken homes. While each of these issues may play some role in the tragedies of

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[175] Barbara Strauch, *The Primal Teen: What the New Discoveries About the Teenage Brain Tell Us About Our Kids,* (New York: Doubleday, 2003): 211.

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> school shootings, to understand what goes wrong in the teenagers who fire the guns, you have to understand something about the biology of the teenage brain.[176]

While Weinberger throws a bone to Symbolic explanations by leaving open the possibility that "culture and circumstance" "may play some role" in school shootings, he stacks the deck in favor of an Indexical account by making the biology of the teenage brain something "you have to understand" while the alternative "may" or may not be much help at all. Understanding the teen brain is necessary, all else is secondary. Furthermore, whereas in Chapter Three we saw how texts celebrating plasticity during a child's early years framed it as a "resource" or as "potential", plasticity during the teen years is said to be an indication of an "immature" brain for which experience-environment intervention and management takes on a distinctly uneasy tenor. Teens have an immature prefrontal cortex and so lack "an effective, efficient executive" with which to moderate emotional impulses. The end result is that "the 15-year-old brain does not have the biological machinery to inhibit impulses in the service of long-range planning." Weinberger concludes by trying to reassure readers that his "brief lesson in brain development is not meant to absolve criminal behavior or make the horrors any less unconscionable"

> But the shooter at Santana High, like other adolescents, needed people or institutions to prevent him from being in a potentially deadly situation where his immature brain was left to its own devices. No matter what the town or the school, if a gun is put in the control of the prefrontal cortex of a hurt and vengeful 15-year-old, and it is pointed at a human target, it will very likely go off.

Guns don't kill people, teens don't kill people, teen brains kill people. At least one reader, anti-psychiatry gadfly Thomas Szasz, wasn't convinced. "Mr. Weinberger's disclaimer – 'this brief lesson in brain development is not meant to absolve criminal behavior' -- is unpersuasive. That's exactly what it is. Such fashionable neurologizing of

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[176] Daniel R. Weinberger, "A Brain Too Young For Good Judgment," *New York Times* (March 10, 2001): A13.

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bad behavior is destructive of civilized discourse and human relations."[177] Szasz argues that, "in the final analysis, children shoot up schools because they decide to." He would rather direct attention at the institutions of mental health which he says have created and profited from the "myth" that all children are good but that some are "mentally ill" and require medication, therapy, and other forms of control in order for that innate goodness to come through.[178] Szasz's fear is that if people begin thinking about teen violence as a biological phenomenon then they will (as he argues was the case with mental illness, psychotherapy, and psychopharmacology) play into the hands of those who promise they can "cure" or "treat" those "personal illnesses" by engaging in practices of repressive control instead of addressing the macro institutional, historical, and political structures in which teen violence is rooted. Despite his unique rhetorical position - simultaneously rejecting both violent movie and biological explanations of teen violence - Szasz is but a loud voice in a diminishing minority of people who are doubtful about the potentially productive contribution to be made by biological explanations of behavior.

Indeed, like *Yes, Your Teen is Crazy* and *The Primal Teen*, most texts that want to insert the plastic brain – in a strongly causal, indexical way – into practical discourses of teen parenting and adolescent mental health repeatedly emphasize that in order for the "new brain sciences" to "tell us about our kids," parents, teachers, and, above all, kids themselves need to be actively listening. While Strauch takes the long view, Bradley puts the case more baldly when he writes, "the good news is that Mother Nature anticipated our parenting failures and gave us a second chance to reprogram our kids in adolescence – but this is likely the last train. Don't miss it."[179] But what about for kids? How do they benefit from educating themselves about brain development? Strauch presents one

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[177] Thomas Szasz, "Anatomy of a Teenage Shooting," *New York Times* (March 13, 2001): A18.

[178] Thomas Szasz, "With Friends Like These, Pity America's Kids," *Los Angeles Times* (March 15, 2001): B11.

[179] Bradley, 135.

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answer provided by David Fassler, chairman of the council on Children, Adolescents and Their Families for the American Psychiatric Association.

> "For the teenagers, this knowledge can be empowering," he says. "It really helps kids to tell them that this problem they have, if it is depression or whatever, is not their fault. We can tell them that the problem is in how their brain is wired, and we can work together to figure a way around it, maybe with therapies or medications or with learning to recognize early warning signs. Knowing how all this works on a neurophysical level, and knowing that there is potential for change, can give kids a sense of mastery."

A similar comment is made by Mel Levine, director of the Clinical Center for the Study of Development and Learning at the University of North Carolina, who calls the process in which a child is told about their brain wiring "demystification". In his wildly-successful book, *A Mind at a Time*, Levine writes

> When people, adults and children, learn about their own gaps, they frequently show, or actually report, a sense of relief, because for the first time in their lives they are able to understand exactly why they've been struggling to meet certain demands and how they can go about conquering or bypassing these challenges. They can forgive themselves and set about becoming stronger people. Insight is liberating – and forgiving.[180]

Despite the "name it and claim it" theme prevalent here and in so many of the education texts discussed in the previous chapter, Levine's insight is only liberating in the sense that jumping off of a cargo ship is liberating: you may be "liberated", but the challenge of being adrift in the open sea quickly makes the inconveniences of ship life look not so bad. No, in the great majority of texts concerned with presenting brain research as both a valid and satisfying explanation for teen violence, considerable emphasis is placed not on the transformative power of simply "knowing" but on the *kinds* of experiences teenagers go through and the impact of those experiences on the not-yet-mature teen brain. As the NIMH's Jay Giedd puts it, "If that teenage brain is still changing so much, we have to think about what kinds of experiences we want that growing brain to have."[181]

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[180] Mel Levine, *A Mind at a Time: America's Top Learning Expert Shows How Every Child Can Succeed,* (Simon & Schuster: New York, 2002): 26.

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On its face this doesn't look too different from the basic theme of Chapters Three or Four or Five in that attention is directed at the relationship between experience-environment and kind of brain, between choice made today and the implications of that choice ten years down the road. And yet, Giedd makes a series of comments in another venue where he clarifies in a very practical way the importance of the plastic brain for every teenager. In a sense, his comments help to close the circle of this project in that we have moved from individual as a child to parent/home to school and back to individual as a teenager. Whereas babies rely on someone else to create experience-environments, Giedd speaks with refreshing (but problematic) directness about the new, personal responsibility compelled by the plastic brain. "'Teenagers are choosing what their brains are going to be good at – learning right from wrong, responsibility or impulsiveness, thinking or video games. This argues for doing a lot of things as a teenager,' says the NIMH's Giedd. 'You are hard-wiring your brain in adolescence. Do you want to hard-wire it for sports and playing music and doing mathematics–or for lying on the couch in front of the television?'"[182] Brownlee picks up on Geidd's lead

> During adolescence, many higher mental skills will become automatic, just the way playing tennis and driving do. Kids who exercise their brains, in effect, by learning to marshal their thoughts, to measure their impulses, and to understand abstract concepts, are laying the neural foundations that will serve them for the rest of their lives. (45)

In the end, it seems, the ultimate responsibility for making the most out of the brain rests with the teen and no one or no thing else.

This assertion achieves immense value when it is put into contact with the specter of school shootings and then generalized to teen behavior writ large. And yet it yields a hopelessly conflicted message. On the one hand, teens are told that they are "technically

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[181] Strauch, 21.

[182] Brownlee, 45.

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crazy" since they physiologically lack the brain/ability to moderate their emotional impulses, while on the other hand they are told that they must somehow rise above this deficiency and have the foresight necessary to engage in activities that will ensure a strong neural foundation for the rest of their lives. The anxiety visited upon parents when told that the tone of their voice would have a physical effect on their baby's brain, the fully-researched decision to buy this toy instead of that, the teacher's struggle to refashion her classroom and curriculum so as to comply with the administration but also to take advantage of the next big thing; all of these worries and expectations come down – hard – on the fifteen-year old who bagged my groceries yesterday. He is both slave to and master of his brain and, therefore, his future. The once plentiful and exuberant resource provided by his infant brain – the smiles, optimism, first steps, infinite potential – has diminished and been re-placed by the imminent danger and dysfunction of his immature brain.

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CHAPTER VII

EPILOGUE

This dissertation has attempted to map the dispersed effectivity of the plastic brain as it has been taken up into public discourse practices of child development, parenting, pedagogy, and adolescent mental health. Rather than treat the textual products of this circulation as popularizations or "dumbed down" science (and therefore presumably not 'science' at all), I have treated them on their own terms by granting whatever truth-value was desired or produced by each text. Bracketing the question of factuality has, I hoped, helped to greatly expand the space of rhetorical criticism since it allows inquiry of all texts equally without first requiring a scientist to vet each claim, analogy, or metaphor by comparing it to the current state of research. Despite the threat of sapping science of what most consider to be its crown jewel (e.g. its claim of exclusive access to objective description of the natural world), I hope even skeptical readers will have found something of value in this project as an exercise of rhetorical criticism without presuming that all scholarship which engages science should itself be 'scientific' as such.

Two additional justifications for bracketing the question of factuality emerged as this dissertation was being written. Both concern the selection of the plastic brain as a specific object for study against the general theoretical backdrop of the preceding paragraph. The first concerns the still nascent status of the plastic brain as an object of scientific and social research. Despite the fact that its "discovery" and textual presence reaches back almost twenty years, both professional and non-technical reviews of the field of developmental neuroscience invariably begin or end with some variant of the statement "We still know next to nothing about the structure or function of the human brain." This stated novelty is then (re)produced and amplified by the kind of "textual fanfare" for the plastic brain that was discussed in the second chapter. It seems likely that as long as the plastic brain continues to be described as "revolutionary" due to the

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fact that it has "overturned" a century-long "dogma" of the static brain, questions of factuality are likely to take a back seat to more general, empirical and conceptual implications of the ongoing shift from static to plastic brain. Indeed, as we have seen, the vast majority of voices considered in this project have positioned themselves against this more panoramic backdrop rather than against a backdrop composed of, pace Sgt. Friday, "just the facts".

A second, more global justification for bracketing the question of factuality goes to the indeterminacy that lies at the heart of the plastic brain itself. Whereas the static brain provided certainty of process (how the brain developed) and certainty of outcome (what a 'normal' brain should be able to do at any given time), the plastic brain eliminates certainty of outcome and distills certainty of process to a single axiom: use it or lose it. Once thought to be governed by genes, and therefore somehow "safe" from external perturbation, a person's unique outcome of development is now said to be nothing more or less than their brains' cumulative history of synaptic response to stimuli presented by environment. This move from genetic to developmental/environmental determination serves to revise the calculus of human betterment by shifting responsibility for outcome from fixed biology to the resolutely *unfixed* social, economic, and political spaces populated by the behaviors of self and other. In this new context, the establishment of factuality is no longer the exclusive domain of science, but rather is dispersed throughout the womb, home, school, and their texts, as we have seen. In this way, the move from static to plastic brain both requires and illustrates the potential of full and critical engagement with non-technical – yet no less "scientific" – texts.

At this point I would like to return to a line of inquiry which was initiated in Chapter Four. A question arose in that chapter as we were reflecting upon the presence of the term **toy** throughout many sorts of texts, from scientific research papers to the marketing materials of laboratory suppliers to manuals for children's playthings. Here is how the question was posed on page 83.

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> The question is this: if it is appropriate for brain scientists to say they use "toys", is it then also appropriate for parents to say that they use instruments of science? If scientists observe the brain/behavioral effects of environmental enrichment by cleaning (or not), providing a diverse diet (or not), providing play partners (or not), and providing stimulating objects (or not), can parents then also claim field expertise in this scientific endeavor?

This question became more pertinent once it was pointed out that there was an essential interchangeability of the names given to 'toys' for lab rats and those given to 'toys' for children (Tunnel O' Fun, Coconut Cabana, etc.). The question became essential once we identified the use of the term 'enrichment' when discussing both rats in a cage and kids in a home.

Simply by substituting subjects from toy to teacher, this line of this inquiry can also account for the specifics of Chapters Five. There, we saw how educators, like parents, are obliged by the plastic brain to create certain kinds of environments in hopes of producing particular sorts of brain. The logic of this outcome-oriented, environmental intervention was shown to be more or less identical to current objectives of plasticity researchers, who are attempting to develop the ability to correlate specific sensory stimulation with specific synaptic effect. The question to be asked from Chapter Five is then: to what extent can this logic and the techniques used to pursue this objective be said to mirror that of teachers who seek to correlate particular activities or seating arrangements – and the synapse stimulation they provide – with high student achievement? Does their adoption of the terms and techniques of the plastic brain effectively re-certify educators as neuroscientists on the cutting edge of stimuli-synapse correlation? If so, does not a neuroscientists' use of "toys" and other techniques of enrichment transform the laboratory into a learning space not unlike the local high school, where some classrooms are richly-appointed while others remain tortuously dull?

Finally, in Chapter Six we saw how journalists and others argue for the necessity of re-orienting parental behavior and expectations along coordinates laid down by the plastic brain. These 'arguments' are produced, regardless of anyone's intent, whenever

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writers script the Indexical statements of neuroscientists into stories about human behavior or juxtapose the (alleged) clarity of science with the disorderliness of daily human life. The tragedy of this disorder is compounded by the apparent inability of existing understandings and interventions to reliably confront the reality of youth violence. Importantly, this inability is a textual effect, brought about by the constant use of terms like "inexplicable" or "senseless" to describe school shootings. These terms force readers to confront the limits of their own experience and yet hold out the tantalizing possibility that a different, more reliable path exists. This is the promise of the plastic brain. By incorporating its terms and techniques into their conception and practices of parenting, parents are offered a lifeline out of the stormy domain of Symbols and into a more ordered world governed by Peirce's "actual connections."

Of course, the only 'actual connections' that matter for the plastic brain are those between synapses. As a result, the orderliness proffered by the plastic brain concerns only – and frustratingly – precisely that which parents, teachers, and individuals cannot directly influence. Instead, as we have seen, the way to a person's brain is through environmental intervention, which presents an incredibly dense matrix of stimulation, which may or may not have any impact on a person's brain, much less an impact that is desired or desirable. In this way, and contrary to its initial promise to simplify the flowchart of development and thereby assist increasingly stressed parents/teachers/selves, the plastic brain instead *dramatically decreases* certainty of influence by radically dispersing developmental (read: synaptic) efficacy throughout a potentially-infinite set of locations, actors, and behaviors. To an important degree, turning towards the plastic brain requires turning away from the person. Like the orchestra maestro, parents and educators may be spirited architects of sensory stimulation, but their backs remain turned to the beneficiaries of their performance.

This theme – of moving from (the assumption of) direct influence to (the assumption of) an overdetermined matrix of dispersed effectivity – has also been central

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to the reading practices utilized in this dissertation. In fact, my reading of the plastic brain relies heavily on a notion of what might be called 'plastic science', in which the truth value of science is not presumed to adhere statically to "scientific texts" but instead gets produced whenever and wherever terms and techniques that are said to be 'scientific' get textually articulated to vocabularies or practices of human interaction. Like the plastic brain, plastic science is shaped less by the veracity of an utterance than by its repetition, less by rational calculation than by incidental exposure, and less by its context of origination than by its context of application.

Appreciating the dynamism and contingency intrinsic to the notion of a plastic science will require an equally agile mode of inquiry. Such an inquiry would require facility with, interest in, and access to* a vast array of texts of all genre, time, tradition, and terminology. It would also require a willingness to make intuitive leaps between texts in order to identify – and, more often, create – points of articulation through which texts can attain situated value in light of the topic at hand. It would, finally, treat texts as resources for critical creativity rather than repositories for timeless truth. These features distinguish rhetorical inquiry from all others and I hope to have demonstrated some small measure of its merit in this study.

* The case for the textual interdependence of 'science' and 'society' is only as strong as the particulars on which it is based. This is why, although it may at first seem somewhat trivial, the fact that the Internet allowed me to access the Otto Lab Supply Company catalog, the user manual for the Fisher-Price crib mobile, and the transcript of the November 11, 1999 edition of The Edge with Paula Zahn is significant not only for my specific project but for the general prospect of a new mode of rhetorical study of science.

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