Rhythm, Evolution and Neuroscience in Lullabies and Poetry

Abstract

 This paper will attempt a methodological configuration to link the natural sciences (evolutionary theory & neurology) to literature (lullabies and poetry, specifically). It uses findings in neuroscience and animal neurology as well as the theories of evolution by natural selection in to examine patterns in lullabies, and then connect these to poetry. As one will never find a ‘metaphor gene’, nor do genes even code for behaviors –coding instead for traits- is it possible to even locate overlaps between the disciplines of natural science and literature? Doing so requires a mixed methods approach. This article seeks to build on the existing philosophical and theoretical ground of current natural science in order to establish a dialogue with current cultural and literary theories.

**Key words**: Charles Peirce, Susan Haack, mirror neurons, lullabies, evolution, literary theory

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 Methods and Meanings

 The philosopher Charles Peirce said, “Let us not pretend to doubt in philosophy what we do not doubt in our hearts” (1974: 157). The fact of evolution by natural selection has long been established as thoroughly as any scientific theory, and yet it is puzzling to witness the continuing doubt regarding its potential influences in the humanities, and in literary studies specifically. “Among the sophisticates, the controversy does not center on the basic fact of evolution but on certain consequences, such as the importance of natural selection and especially the relevance of evolution to human affairs. The intellectual positions most fiercely opposed to ‘sociobiology’ and ‘evolutionary psychology’ include social constructivism, postmodernism, and deconstruction” (David Wilson 2005: 21). I would like to suggest that mapping the connections between seemingly incommensurable disciplines is in fact possible, through an interdisciplinary methodology. Recent discoveries in animal neurology (human and non-human) and the brain’s relation to rhythm, music and isopraxic mimicry open doors for the interrelation between the brain and language, the interrelation between the evolved human brain and a work of literature. Specifically, I will look toward poetry as an extension of basic neural reaction to rhythmic sound and pattern, trace that through mirror neurons and symbolic representational action, and then try to bridge these to poetry by examining patterns in lullabies owing to their reliance on metric form, musicality and metaphor, all of which will be shown to have a strong relationship to the human brain’s neurological functions. The strong reliance on science here necessitates that fallibilism remains the guiding ethos.

 Susan Haack outlines a definition of fallibilism along Peircean lines. Fallibilism, for Haack, helps to avoid the trap of the hypothetico-deductive method of Popper while also staying clear of linguistically relative traps of a more modern philosophical stripe (Haack, 2013: 181-183). These notions are especially important in attempting a methodology compatible with literature. Literary works are by their naturei falsified and heightened accounts of a kind of ‘reality’ which needn’t bear any resemblance to the present one. But, literary works also bear certain common aspects such as theme, narrative and poetic effects that are too similar to ignore, and these similarities bear the stamp of a human nature which must owe its presence to the common evolutionary ancestry of the human species and its evolved traits. A fallibilist methodology will help to avoid the twin pitfalls of reductionism and linguistic relativism. Though Haack is speaking of fallibilism in relation to the philosophy of science, it will serve the present purposes well enough. She says, borrowing Peirce’sii term, “Critical Common-sensist theory … is not skeptical, but fallibilist; it focuses less on demarcation than on continuities between science and other kinds of empirical inquiry; and it is not purely logical, but worldly” (2013: 190). The key for Haack is that beliefs and perceptions both imbue the human experience with meaning (192). Using these criteria along with what Haack calls “epistemic likelihoods” (193) against a kind of reductive probability, I believe that the evidence to be provided supports the main claim that evolutionary theory can be used to analyze certain aspects of literature; also, that the evidence provided is independent of the claim (Babylonian lullabies were not, obviously, influenced by the theory of evolution –like a modern lullaby written by, say, a sociobiologist might be); and, while I cannot claim comprehensiveness, I will look at a lullaby in Babylonian, and then attempt to bring these findings to bear on a twentieth century poem in English.

 What might be needed here is a shift in the definition of literature to something more akin to scientific inquiry that will retain interpretive range of textual materials. Brian Boyd offers one such definition in *On the Origin of Stories*. He seeks to define literature (or rather art in general) as a type of ‘Darwinian machine’ that evolvesiii as an interplay between evolutionary tendencies in a species and its environment, both in territory and sociality. For example, the poetic possibilities of what constitutes a poem relies on variation, which will likely deviate from current social (or aesthetic or whatever) dispositions. For example, there will be certain social practices based on tradition, culture and innate/evolved traits which codify the institution of ‘poetry’ against which a particular artist (like a mutation in an organism) then puts into the environment. The author cannot know in advance that the new ‘poem’ will be liked or accepted, but it is not until the introduction of the new variant that such modifications of what constitutes a ‘poem’ may take place. This is not artistic definition by natural selection, but by what Boyd calls ‘unnatural selection’ (2009: 405-406). Art changes, drifts, comments, refuses to comment, may reveal tendencies of the human species, or those tendencies may be suppressed by an author with an anti-evolutionary bent after having learned of it. While this kind of possible occlusion may seem a glaring methodological flaw, by relying on Haack’s fallibilist ground, we may safely proceed. By looking at integrative “continuities between science and other kinds of empirical inquiry” (Haack, 2013: 190), we can try and identify the borders of the disciplines and map not only innate dispositions like sexual desire or parental investment strategies, but also note where these natural processes give way to cultural ones, those places and patterns and rhythms on which ‘art’ rests and also resists, creating new forms of personal and cultural expression. Boyd continues in outlining eleven ways that art generates variation in its creation (2009: 121-123). Two of these will be useful for spatial limitations: numbers three and eleven. “3. Because art appeals to our cognitive preferences for patterns, it is self-motivating: we carry innate incentives to engage in artistic activity … 11. We appreciate even minor variations within established forms as worth of attention and response. With our senses highly tuned to basic patterns, we enjoy repetitions and variations on a theme in art as in play” (121-122). Patterns, rhythms, variations, syncopations.iv These are core tenets of the arts of poetry, fiction and music. I will seek to tie these notions back to evolved tendencies in the brain and suggest new avenues for reading literary works.

Such a wide-angle view, however, requires a wide lens in which to figure it. I am, in a way, simply following Boyd’s earlier idea of ‘unnatural selection’. The fields of neuroscience and literary studies might seem unrelated, a problem further complicated by the background philosophy and methodology of each. Hence the methodology and backing will require some extra length for explication. Much of the difference between literary studies and neurosciences may be related to the recent dominance of cultural studies in the humanities and their subsequent blurring of ‘facts’ as relative forms of interpretation, kinds of discourse, mere apparatuses. This kind of modern dualism update is found “(i)n current mainstream literary study, [where] dualism most often takes the form of ‘cultural constructivism’ –the idea that culture has an autonomous causal force and is not constrained by innate dispositions” (Carroll, 2011: 65). The line of thinking contends that if human action can only be described in language and if language is culturally bound in its determinate meanings and social function, then because all cultures differ in various degrees, there is no foundation from which to begin speaking of an ineradicable ‘human nature’ because there is no vantage, no “gods’ eyes view” (with apologies to Putnam) from which to begin to speak. To claim that there is no truth is in fact a nugatory affirmation of a statement of truth, which refutes itself (and remains a variation of the liar’s paradox).v Also, this line of thinking, that all cultures differ, that all art is subjective, that all language is slippery and shifting, ignores an even deeper observation: the universal existence in the human species of culture, sociability, language, art. Boyd says:

If cultural anthropology has shown that human nature is much more diverse than any one society had assumed, evolutionary biology and anthropology have also begun to discover that culture exists in many animal species (dialects and fashions in bird and whale song, for instance, or in chimpanzee traditions of toolmaking), that there is a universal human nature, and that in humans, too, culture is not apart from nature but part of nature. And as many have noted, ‘explaining’ human cultural variation by the power of culture is too circular to be an explanation at all. (2005: 149)

Lacking a full and integrative picture, art could only be rendered and interpreted through the blurry linguistic lens of slippery meanings and definitions which tend almost invariably toward variations of linguistic relativism.vi Of course while paradox, irony and ambiguity are important literary techniques, they cannot serve as methodologies for understanding themselves. Indeed, had the common social functions -like art, culture, sociability and language- lacked a deep root in human nature, had they been prone to the vagaries of mere linguistic drift, had they not somehow conferred a survival advantage on early humans, the odds are that they wouldn’t be seen in modern human activity. Those traits whose resulting behavior granted the individual or group no advantages would have likely disappeared. Nor would it be possible to glean these self-same activities in the human DNA records, fossils, neural activity, and historico-anthropological records. But these very data are traceable, locatable, identifiable. If one focuses on the (self-refuting) statement that homo sapiens is a social/linguistic construct, surely one will be asked, How far down into the nature of our species can a linguistic/constructivist theory hope to delve? How far into the nature of what it means to be human can cultural theory go? Surely what is meant is the social human, the linguistic side of human activity, and not the neural processes and cellular activity, and so on. And if the biological properties are to be ignored or subsumed and only the conscious cognitive properties are emphasized, then what is presented is a return to a type of dualism, here between the biological/evolutionary and the linguistic, or worse, the claim that language creates consciousness.vii

A new conscious state, new information, an epiphanic moment, is not a purely novel reconstitution of the world, just as the brittleness of a hip-bone is constitutive of the bone itself and not merely the whim and caprice of the person identifying that brittleness (and very much less the language or term used in the identification). In this, John Searle would argue that “Consciousness is literally present throughout these portions of the brain where consciousness is created by and realized in neuronal activity [which] runs contrary to our Cartesian heritage that says consciousness cannot have a spatial location” (2004: 63). It is a reconfiguration of neural activity and stimuli to a particular brain composed of brain-stuff which cannot be reduced or exactly replicated, thus sloughing off charges of reductionism (or epiphenomenalism) or the grotesqueries of solipsism. It has to do with brain states in a brain evolved (teleologically ateleological) to grant meaning to itself, and that self-ascribed meaning might be labeled ‘belief’. “The point is precisely that [these beliefs] are complex dispositions including dispositions to respond to/to use sentences in a public language, or other non-natural signs; it is the dispositions, not the sentences, that are in the head” (Haack, 2012: 231). Beliefs and sentences about beliefs have proven quite useful for the human species, and both belief and evolved abilities have proven incredibly advantageous. Christian notes (2005: 140) that the total amount of energy controlled by the human species from the Paleolithic to the present has grown nearly 50,000 times, suggesting the incredible adaptability and intelligence of the human species largely due to the power of what he calls ‘collective learning’, a bringing together in language of particular skills, forms of knowledge and observation; as Christian sums the figure, “This is a staggering amount of energy to be controlled by one species, and it helps to explain why our species has had such an impact on the entire biosphere” (2005: 140). Here is an example that seems to blend together –or at least blur distinction- between the natural sciences and the status of sociality/culture in homo sapiens. Yet, interestingly, as a species, humans are 99.9 similar genetically (Witherspoon, et al., 2007: 351). In fact, “(M)ost of the genetic variety within modern humans occurs within African populations, which suggests that this is where humans lived the longest” (Christian, 2004: 177).viii How can any constructivist model which claims plasticity in human character and behavior by linguistic model alone thereby account for the remarkable lack of variation in the genes of the total human population? Language and belief have an effect on human behavior, no doubt. But the case might have been overstated seeing that a staggeringly statistical phenotypic regularity suggests an almost complete lack of variation, throughout the cultural/linguistic explosion of human history.

In the case of language itself, it is of course possible that mutations in the genetic code might have resulted in the human species’ knack for language. The occurrence of the FoxP2 gene in human and non-human animals, a gene associatedix with language use and language learning, is incredibly suggestive. But, such findings must be met with critical common sense: correlation here is only suggestive. Churchland is quick to point out that phenotypic variation like height is associated with nearly 50 gene sequences, and to suggest that any particular gene is responsible for advanced behavioral and social tendencies and traits like warfare or even language must be carefully trotted out (2014: 160). But cross-species genetic recurrences are tantalizing nonetheless. As Marzluff notes, “The song- and speech-learning systems of songbirds and people … involve neural interaction with their auditory systems: in people this includes extensive involvement of multiple thought centers within our forebrains; in birds multiple forebrain regions are likewise involved in song learning and song production” (2012: 52). Analogous neural areas between birds and humans suggest the mimicry, pattern recognition and rhythm syncopation abilities in the two species share some common ancestry, and if shared, push the human language capacity back into the deep realms of evolution (2012: 53-54). Some of these similar characteristics involving sensitivity to sounds and rhythms derive partially from the FoxP2 gene (2012: 52, 56). This gene was also found in the sequenced Neanderthal DNA (Finlayson, 2009: 106), and gives rise to speculation that homo sapiens’ ‘cousin’ might have also had some limited language ability, though analyses of their skulls suggests that they lacked the physical ability (due partially to a different larynx shape) to manipulate sounds as effectively as homo sapiens, despite their physically larger brains (Christian, 2004: 175). Again, the primacy of language as a force of social and cultural change is not to be undercut as it conferred a distinct advantage to the human species. The linguistic ability of early humans was largely responsible for what Christian calls ‘collective learning’ and was probably the very thing that allowed ‘extensification’ (viz. slow migration) of the species (2004: 190). The more the natural sciences are brought to bear upon human activity, the less the human species seems to stand apart. This is not reductive. It is instructive. It does not seek to eschew the importance of culture in human development but to deepen the vantage. As the literary arts are human productions, and human productions must necessarily bear the stamp of an evolutionary heritage, even strange bedfellows like evolution and literary theory must be brought together.

It doesn’t seem presently necessary to engage the particular issue of what a ‘culture-based’ theory may or may not get right,x and it will not be necessary. The methodological configuration will continue by outlining the general aims of Literary Darwinism and then proceed to some recent discoveries in neuroscience and will end by connecting these together by comparing lullabies and poetry, again under the aegis of a fallibilist ethos. While fallibilism, for example, served as Charles Peirce’s primary maneuver toward his Pragmaticist philosophy, this paper will not be making a Pragmatic/Pragmaticist argument.xi Further, the use of neuroscience must be tempered with such fallibilism to avoid reductionist charges of determinism or epiphenomenology. How then to explore the connections, the overlaps, between animal neurology (here, meant to include *homo sapiens*) and rhythm in poetry with an ear toward patterns and rhythm in lullabies, a pattern that stretches back to the earliest recorded ones of Sumerian and Babylonian culture? Mixing methods requires a lengthier explanation. But all of this comes with a fallibilistic caveat, as when attempting to apply fMRI scans and genetic information to human activity. As Deacon says, “Consider functional brain imaging, such as positron emission tomography (PET) or functional magnetic resonance imaging (fMRI). (I)t would be a serious mistake to imagine that the function in question is in any sense ‘located’ in the identified ‘hot spots’, or to believe that a metabolic ‘snapshot’ would be in any sense a simple correlate to what is involved even at a gross level in the performance of that activity” (2012: 176). With this fallible mindset firmly in place, we may begin to proceed. For the most part.

Moving Toward the Human

 One question often lacking in the discussion of art is, Why does art even exist? If human activity has been shaped for aeons back into our primate past -long before language- by evolution and natural selection, why would humans engage in such a time-intensive endeavor, spending valuable time and energy on the creation, production and consumption of artistic work? This is quite a different question than asking whether science has anything at all to say about art. The pushing apart of science and the arts has been a principle notion since post-modernism’s early foundation. For example, in 1979 Jean-Francois Lyotard described the incommensurability of ‘language games’ between science and narrative,xii saying, “It is therefore impossible to judge the existence or validity of narrative knowledge on the basis of scientific knowledge and vice versa: the relevant criteria are different” (1984: 26). This line of reasoning (echoing Wittgenstein) runs through the interstices of post-modernism, post-structuralism, social constructivism and the updated post-theory (or whatever it calls itself these days)xiii, though Lyotard here is not calling the incommensurability a positive thing. Rather, he notes that it is merely a symptom of postmodern/poststructural thought. Joseph Carroll addresses this sentiment seen often in the ‘post-X’ movements in relation to science, saying, “In the move to post-theory, one grants the general validity of evolution … but also then declares that it is irrelevant, … that it alters not one jot the way we would read this or that text or describe this or that historical cultural moment … In reality then, ‘post-theory’ is just the latest incarnation of cultural constructivism” (2011: 68). If, as in social constructivism, language dictates the gamut of human behavior (Boghossian, 2006: 16-19), the science of evolution (or physics or biology or neurology) have no basis from which to speak, and they should thus lack in predictive power. That is simply not the case. It is quite clear that modern critical/cultural theory is ideologically and thus methodologically incompatible with natural science, and if science can be proven to have at least some interpretive power in regards to literature, then a revaluation must take place. While it is important to examine things like gender or racial discrimination, modes and methods of power, in fields like the sciences, humanities or society in general, it is quite another thing to deny that science and culture have nothing to say to one another except at a minimal or cursory level. Yet, often enough the ends of both disciplines seem to be the same: to establish a better society, a more tolerant and compassionate culture, and to strive for dignity of all members of our species. I would offer this definition of dignity: Dignity is the moment when *homo sapiens* becomes human being. It is that synapse and that jump, and it must be bridged by an accord between the natural sciences and cultural theories. The same holds in literary studies. The attitude in literary studies that sees science as simply another ‘discourse’ follows the “Passes-For Fallacy: what has passed for, i.e., what has been accepted by science as, known fact or objective evidence or honest inquiry, etc., has sometimes turned out to be no such thing; therefore the notions of known fact, objective evidence, honest inquiry, etc., are ideological humbug” (Haack, 2007: 27-28). Literary Darwinism (hereafter LD), however, has made strides in the past 20 years to bring the arts and sciences closer together.

 Speaking from the LD side about the necessity of evolution as part of the interpretational repertoire, Brian Boyd says, “Unless we revert to myths of divine creation, evolution must be part of any complete account of the human, including human art … If evolution can help explain art –human behavior at its freest and most creative- any fears that it implies determinism or denies culture should be dispelled once and for all. No one was ever ‘genetically determined’ to write or to read something as unprecedented as *Ulysses*” (2004: 147). LD attempts to explain literary events and phenomena in relation to general evolutionary patterns such as adaptation, survival and reproduction, among other concerns and areas of focus. There is no need here to wade into the fray between LD and the prevailing moods of post-structuralistxiv theories except to agree with David Sloane Wilson when he says that “Social constructivists are first and foremost trying to imagine and implement a better world. What they imagine may strike some as naively optimistic or wrongheaded, but it is perfectly sensible, even in biological terms –equality, respect, basic necessities for all, the end of repression, and so on” (2005: 22). If the goal of literary studies is to provide grounds for interpreting literary texts, then it remains as Jeremy Fernando notes that “(i)n other words, interpretation is nothing more, and infinitely nothing less, than the promise of the possibility of interpretation” (2013: 195). If the goal, as Fernando rightly labels it here, is possibility, an expanding outward toward multiplicity, then the inclusion of an evolutionary function of literary interpretation can only widen possibility and bring a better concord between the natural sciences and the humanities in their interpretational scope. Interpretation involves, among other things, pattern recognition, and homo sapiens are capable of pattern recognition like no other animal, as Boyd notes. We are the most adept species at identifying pattern from the chaos of the environment (2009: 88-89), and it causes pleasure. It is a pleasure to try and predict what a character in a book or movie will do, what rhyme might be coming in a poem, or what variations a rhythm or melody in a song might take. Boyd says, “Only humans have the curiosity to seek out pattern in the open-ended way that once led our ancestors to see constellations in the skies, then to infer first the revolution of the Earth from the motions of the stars and planets, then the expansion of the universe, then possibilities beyond our patch of the multiverse” (2009: 89). If pattern could be loosely defined as a kind of regularity of rhythm, a kind of symmetry, then even human infants demonstrate an innate attraction to complex patterns and stimuli. Indeed, human infants tend to show more attraction to symmetrical faces (Quinn, et al., 2008; Jones, et al., 2007), show aesthetic preference in facial attractiveness (Samuels, 1994), and demonstrate intentional understanding (action prediction) in adult movement (Hernik, et al., 2014). Quinn, et al. found that infants’ attention is drawn to certain “entities (attractive faces) more than others (unattractive faces) because of a family of preferred perceptual features that includes but may not be limited to particular features such as large eyes … and the complex geometric attributes that characterize the spatial relations among the features such as their location (e.g. height) and arrangement (e.g. symmetry, top-heaviness) within the whole.” What is being shown, albeit briefly, is a prelinguistic tendency in infants toward aesthetic considerations. This kind of ‘appreciation’ is not singular to our species.

If visual pattern recognition is a fundamental part of the species’ evolutionary heritage, it stands to reason that it would figure heavily in artistic representation, and this is of primary importance to the Literary Darwinist hypothesis. What of auditory pattern recognition? What of literary pattern recognition in fiction and especially in poetry? Brian Boyd says, “For the poem or the fiction has been designed to appeal to still more of our preferences for pattern, situation, character, or story and thereby to catch and hold the attention of any audience, far beyond the naturally shared focus of a moment, a situation, a friendship” (2005: 148). Even in this brief quotation, there are two key premises to note. The LD account of literature does not reduce artistic endeavor to a knee-jerk causal relationship between the very broad fact of evolution by natural selection and a particular artist’s idiosyncratic creation (cf. ‘unnatural selection’). This permits many aesthetic theories to discuss the typological and semioticxv values of art without having to necessarily label these as ‘adaptations’. It also quite succinctly outlines ways in which evolution may be brought into aesthetic domains. For example, in “Studying Synchronization to a Musical Beat in Nonhuman Animals”, Aniruddh Patel outlines similarities and differences between human and non-human animals in rhythm and syncopation to music. He says, “(H)umans likely resemble other primates in hearing pitch roughness, though we may be the only primate that forms aesthetic preferences for consonant and dissonant musical intervals based on this precept” (Patel, Iversen, Bregman and Schulz, 2009: 459). While this definitely suggests a more refined aesthetic appreciation in the human species for music and rhythm, it also strongly suggests non-human’s innate ‘appreciative’ capacity. Some of Patel’s other findings are compelling as regards non-humans’ sensitivity to rhythm and music. Patel’s study originated in studying a cockatoo from and internet video which seemed to be bobbing its body to a particular musical beat. Examining and testing the bird, Patel found that the bird could modulate its ‘dancing’ syncopation to match slower or faster rhythms (2009: 459-460). This beat-perception and synchronization (BPS) would seem to suggest that, while not perfectly displayed in those animals so far studied, that there exists a kind of ‘appreciation’ or sensitivity to patterned music which (in most forms of popular music) produce sounds that would never occur in nature. Patel hypothesizes (2009: 462) that this ‘appreciation’ ability is only found in vocal learning species which include homo sapiens, but is also “an evolutionarily rare trait shared by only a few groups of animals, including humans, parrots, songbirds, hummingbirds, dolphins, seals, and some whales” (2009: 462) and other primates like bonobos (2009: 465).

 The interesting conclusion here is that if the ability to appreciate and synchronize to rhythms in music is not particular to humans only, then aesthetic models that do not in some way treat with evolutionary and neurological evidence are to be found lacking. If evidence continues to suggest deeper and larger structures that dictate at least some human activities in continuum with non-human species, then these data must be continuously nudged toward consilience. While certainly neither totalizing nor easily realizable, such research and endeavor is key. For example, sensitivity to rhythm and sound is a hallmark of poetry, and this could serve as connective tissue to move toward language in a related chain of possibly linked causal relationships: rhythm, sound, music, language, song, lullabies, poetry. A study by Fadiga, Craighero and D’Ausilio, “Broca’s Area in Language, Action and Music”, examines the relationship between Broca’s Area of the brain in humans and non-humans. Broca’s Area is a key location in the inferior frontal gyrus which is important for language production. But, as Fadiga et al. report, “A growing body of neuroimaging evidence indicates that Broca’s area, in addition to its linguistic functions, appears to be engaged in several cognitive domains. These domains include music, working memory, and calculation” (2009: 451) in addition to motor domains in the primates studied (2009: 451). The relation to music via auditory-motor interactions is interesting regarding Broca’s area because of its proximity to a large cluster of mirror neurons (2009: 450-451).xvi As Patricia Churchland explains, “Mirror neurons are a subset of neurons in the frontal cortex of the monkey [and also human beings, my note] … that respond both when the monkey sees another individual grasp an object (e.g. I put food in my mouth), and when it performs that action itself (e.g. it puts food in its mouth)” (2011: 135). Advances in fMRI research have allowed the discovery of this same neural activity in humans, and in fact the mirror neurons fire when performing an action, seeing action, hearing action, hearing descriptions of an action (Iacobini, et al.: 2009: 11-12), and have also been shown to fire when an individual reads of an action (Aziz-Zadeh, et al.: 2006).xvii Returning to Fadiga’s study, it is important to note that while there seems to be a correlation between mirror-neuronal activity and Broca’s area, thus suggesting a brain-based (and thus an evolutionarilyxviii causal explanation) “these sources of information (neuroimaging and electrophysiological techniques), although very compelling, offer only a correlation between activity of a given area and the task the subject is performing” (2009: 452). As always in a fallible manner, the evidence must be further weighed.

That the brain does not operate specifically in discreet modules has been roundly challenged if not outright disproven (Deacon, 1997: 157-158), and in fact, neural activity tends to be spread through systems and areas rather than easily localized regions. As Deacon notes, “Once we abandon the reification of language areas as modular language algorithm computers plugged into an otherwise non-linguistic brain, it becomes evident that language functions may be widely distributed and processed simultaneously in many places at once” (1997: 293). But, if there is a neural origin for at least some form of ‘aesthetic appreciation’ (like sensitivity to rhythm) and that humans beings’ brains physically react even to written action (when mirror neurons fire) as if that action had been visually witnessed, the potential overlaps of evolution and literature through LD, become more and more apparent. There likely never will be any form of reductive ‘smoking gun’ evidence that links evolution directly to literary works, but this seems no great problem. How could there be direct evidence? One cannot extract Odysseus’ DNA of course or plug Achilles into an FMRI, but this kind of guffaw is nothing more than a straw hominid. Overlaps can be brought to bear on another. The disciplines do require different vocabulary and utilize different methodologies, but as with any set of languages, translation is always possible, and the more each side practices this translation, the easier and more accurate it becomes. Carroll notes, “To generate adequate interpretive commentary from an evolutionary perspective, we must construct continuous explanatory sequences linking the highest level of causal explanation … to particular features of human nature and to particular structures and effects in specific works of art” (2011: 69-70). While there is only a correlative relationship yet proven, the confirmed proof is interesting enough to legitimate some of LD’s claims. As more and more fMRI studies are done, there will be a surfeit of further understanding on the brain’s functions.

Rhythm, Lullabies and Poetry

 Just as the marvels of Lascaux and Chauvet caves prove that -among the many examples of Neolithic cave art (Clottes, 2008; see also McBrearty and Brooks for a sweeping account of hominin development)- humans, as a species, have been artistic, have been sensitive to their environment, to the animals around them, to the issues of life and death, for a very long time. Musical instruments extend back at least 35,000 years in the form of flutes made of vulture bones and ivory, found in southwestern Germany. (Conrad, et al.,2009) The implication is clear that a musical tradition - in order to have instruments, especially ones requiring skills sophisticated enough to craft complex instruments- would be much older than the discovered artifact. This is the same for the elaborate and highly ornate painting styles of the Neolithic artists. It is the same with language and communication. Christian suggests that in order for early hominins –the precursors of modern humans- to survive and migrate, they must have had some form of language that conferred survival advantages (2005: 159-168). While the implications are clear that language and art are older than probably suspected, physical evidence is of course scarce. Once again, though, it is clear that the compounding of evidence, be it neurological or anthropological, suggests very old and deeply rooted broad trends in human behavior. This is neither reductive nor left to sheer ‘mind-mystery’. It has long been known that honey bees communicate (Esch, 1967 & Frisch, 2011), that chimps can be taught rudimentary symbolic language (Zlatev, 2008: 142), that vervet monkeys have particular sound relations to identify predatory animals (Diamond, 2003: 45), and that corvids are capable of abstract tool-use and reasoning (Marzluff, 2012: 1-10) and these birds even have language-learning brain centers similar to those of humans (2012: 41-64). It would seem odd to somehow figure the language of homo sapiens as anything other than similar instance of a shared continuum. In human language use, sensitivity to rhythm leads to manipulation of rhythm and syncopation to create differing types of meaning, much in the same way that non-humans -like the vervets- control pitch to indicate different predators. That rhythmic meaning stems not just from linguistic or dictionary definitions. The human brain is a primate brain, and as such, bears distinct similarities to non-human brains, despite the obvious and incredible semiotic/linguistic range displayed by homo sapiens’. The structures are biological,xix not linguistic. “It is far more reasonable to expect language processes to be broken up into subfunctions that have more to do with neural logic than with linguistic logic” (Deacon, 1997: 288).

 A brief glance at any literary tradition -Egyptian literature (Foster), early Greek poetry like Archilochus and Sappho (Constantine, et al.), the *Epic of Gilgamesh* (Gardner)- shows that these texts quickly push past the merely cultural and environmental concerns of the authors. It reveals a stunning singularity among the many voices of primary concerns like sustaining life, the rearing of children, mate selection, not just the more philosophical and religious quandaries of who and where and when. As has been shown, human language is entirely bound up in neural activity, and that neural activity is at least connected to an evolved primate brain, which bears some stamp of its evolutionary heritage. The addition of technologies like paper have given something like a fossil record to the words and shapes of ideas of early civilizations’ oral antecedents. Scholars like Milman Parry, in the early twentieth century, discovered the mnemonic and structural similarities between Homeric verse and Serbocroatian oral poetry (Parry: 1971), suggesting that human brains have not changed much -and more pointedly do not change much from language to language- in nearly 3000 intermediating years. Each oral poetic tradition used very similar mnemonic devices to facilitate the recitation of the poems/songs. It begs a further question: Why is it that across nearly 3000 years and in different languages and social contexts that very similar patterns emerge regarding memory and rhythmic pattern use? What is seen here is nothing less than a deep and telling similarity of form, function and theme owing to the distinctive similarity of evolved human brains.

 Poetry is a literary genre which requires a high sensitivity to sound, rhythm, form, content, visual (when written) typographical meaning and vocal (when spoken) modulation. All of these combine in a poem to create various and simultaneous meanings. Things like alliteration, consonance and assonance are hallmarks of the genre and are consistent across poetic traditionsxx, underlying the surface concerns of content and focus of particular poems. Looking for overlaps between the neural and the poetic might at first seem strange. It will serve to first examine a cousin to the poem in order to draw out patterns of similarity and then apply this to a ‘poem’ proper.

 In ‘Magic at the Cradle’, Farber provides a translation of several Babylonian lullabies which show very similar patterns and structures to any modern equivalent. Once again, reifying my claim (or to parallel Parry’s) that despite linguistic, cultural or formal poetic concerns, emerge the more common patterns of rhythm, sound and the associated meanings that these effects have. Lullabies, the songs and chants sung to infants to calm them, are ubiquitous (Trehub, 1998: 44) across culture and language, once again reflecting a shared ancestry and use. They will serve effectively as a starting point because human infants -as pre-linguistic entities- would not be listening necessarily to the meaning of the words, but rather the meaning of the rhythms and sounds themselves (as accompanied by a melody of some sort), which helps hearken back to earlier proven accounts of human and non-human neural sensitivity to things like rhythm and sound. He says, “(I)t seems clear to me that such little poems, aimed at quieting babies still unable to articulate their helplessness, pain or anger, must be common all over the world, both in cultures with, and without, a written tradition” (1990: 135). The lullaby he cites was established and socially integrated into the Old Babylonia period of c. 1950-1530 BCE (1990: 140), and contains similar patterns of rhythm (with alliteration and consonance primary among them) that can be seen in any other modern lullaby. The text is as follows (with the English translation after):

sehrum wãSib bit ekletim

lú tattasâm tãtamar núr èamèim

ammin tabakki ammin tuggag

ullikia ammin lã tabki

ili bitim tedki kusarikkum iggeltêm

mannum idkianni mannum ugallitanni

sehrum idkika sehrum ugallitka

kima Sãtu karãnim kima mãr sãbitim

limqutaãàum èittum

Little one, who dwelt in the house of darkness –

well, you are outside now, have seen the light of the sun.

Why are you crying, why are you yelling?

Why didn't you cry in there?

You have roused the god of the house, the kusarikkum has woken up:

"Who roused me? Who startled me?"

The little one has roused you, the little one has startled you!

"As onto drinkers of wine, as onto tipplers, may sleep fall on him!" (1990: 140)

What should be clear, despite a lack of knowledge of the Babylonian language and particular pronunciation,xxi is the constant alliteration and consonance, the particular rhythms that these effects cause. One can compare them to such random examples as ‘Rock a Bye Baby’ in English, where each lullaby builds through repetition of rhythmic consonant sounds; English utilizing B, T and L sounds, not to mention the qualities of assonance. The Babylonian lullaby here (and Farber admits on 140 that the English translation was made to reflect content, not sound) uses T, M and G sounds to create its particular rhythms. Farber says of the Babylonian text, “The form of the poem emphasizes simplicity and is thus particularly suited for memorization. Taking all this together, I consider the text to be not only a typical, but also an especially impressive example of purposeful folk poetry” (1990: 142). The question here -since what is being examined is a style of poetry which is not attempting to be artistically ornate- is why the overall similarity of sound and rhythm functions in the various lullabies unless there is an innate appreciation in the infants (and thereby has always been if a 4000 year spread is to be believed) for exactly the same kinds of rhythms and metric patterns? Dissayanake says of universal trends in mother-infant engagement and bonding, “The utterances also appear to be organized primarily into what can be transcribed as lines (or phrases), judged either by number of words, or by timed length, generally three to four seconds” (1999: 380). She builds her theory of musicality on Turner’s and Poppel’s ‘neural lyre’ in which they note an absolute universality in relation to poetics, meter and attention to rhythm. Turner says, “All over the world human beings compose and recite poetry in poetic meter; all over the world the meter has a line length of about three seconds, tuned to the three-second acoustic information-processing pulse in the human brain. Our acoustic present is three seconds long” (1999: 22). The evidence here, again, seems very compelling that these rhythms speak to a broader pattern of appreciation and utility (indeed, what parent would choose to soothe a child with a song or set of sounds that wouldn’t work) in the pre-linguistic infant brain which can only be based on neural and therefore innate and evolved tendencies. It is precisely that the infant cannot process the lullaby’s sounds as anything more than rhythmic moments that is the most telling feature as the lullabies’ rhythms push past mere word meaning and cultural association, let alone the nearly universal tendency for poetic lines to be about three seconds long, roughly the same length as the Babylonian lullaby from millennia ago. That these same patterns and rhythms show up in all cultures’ lullabies and poetics, there is no doubt that another force deeper and broader than ‘culture’ can explain.xxii

 To foray into poetry, and into a modern example, one can turn to W. H. Auden’s conveniently titled poem, ‘Lullaby’ (1979: 50-51), for a similar use of rhythm and sound. Of course, with Auden’s poem, the sounds are more complex and subtle, but the same effects can be seen. Quoted in its entirety:

Lay your sleeping head, my love,

Human on my faithless arm;

Time and fevers burn away

Individual beauty from

Thoughtful children, and the grave 5

Proves the child ephemeral:

But in my arms till break of day

Let the living creature lie,

Mortal, guilty, but to me

The entirely beautiful. 10

Soul and body have no bounds:

To lovers as they lie upon

Her tolerant enchanted slope

In their ordinary swoon,

Grave the vision Venus sends 15

Of supernatural sympathy,

Universal love and hope;

While an abstract insight wakes

Among the glaciers and the rocks

The hermit's carnal ecstasy. 20

Certainty, fidelity

On the stroke of midnight pass

Like vibrations of a bell,

And fashionable madmen raise

Their pedantic boring cry: 25

Every farthing of the cost,

All the dreaded cards foretell,

Shall be paid, but from this night

Not a whisper, not a thought,

Not a kiss nor look be lost. 30

Beauty, midnight, vision dies:

Let the winds of dawn that blow

Softly round your dreaming head

Such a day of welcome show

Eye and knocking heart may bless, 35

Find the mortal world enough;

Noons of dryness find you fed

By the involuntary powers,

Nights of insult let you pass

Watched by every human love.40

Reading the poem aloud with sensitivity to the internal rhythms yields an interesting piece of the poem’s meaning. All lines when spoken (without rushing them) are about three seconds long, but it is when the speaker addresses the supernatural, the gods, vague abstractions or people, like the hermit, who deny the importance of human agency (stanzas 2 and 3), the poem’s rhythms change subtly but considerably. It is only in the first and last stanza where the poem takes on a more patterned (almost trochaic tetrameter, except that the lines tend to contain two trochees and a cretic foot) rhythm, as if the subject of human propinquity, mortality and tenderness (and the calling up of the agency of death) required the poem to do what lullabies, like the Babylonian, Korean and English ones do: to calm and to reassure the listener, while the contrasting imperfections of the poem’s rhythm call up the imperfect nature of love and those who would try and define it. There is thus a tension between a culturally assigned level of meaning in the poem and its rhythmic structure. That the earlier cited lullabies do this in rhythm and sound to pre-linguistic infants, and that these same effects can be seen in Auden’s poem, do not seem coincidental. Since this poem is not addressed to a pre-linguistic baby, the message of the poem can be read in accord with its metric level of meaning and implication. Certainty in the poem becomes linked with the pedants and the gods, and their boring excesses, and to any heavenly/supernatural messages of love and hope. Certainty is not promised to the ‘faithless’ speaker or the ‘human’ beloved.

 The form of the poem is regular enough, alternating between seven beats (trochee, trochee, cretic) and trochaic tetrameterxxiii, with a regular rhyme scheme that employs both perfect and near rhymes (abcbadcee’d: the paired e rhymes are slant/imperfect), and the pairing of rhymes seems to suggest a type of ‘bond’ or pairing between the speaker and addressee. These patterns are interrupted in the syncopation of those lines that keep their meter while being more difficult to read aloud (lines 5-6, 13-14, 16, 19-20, 24-25, 38). This tension between a regular meter and the consonantal/alliterative disruption (in rime and onsetxxiv) creates a level of meaning in the poem which should grate on the ear of a careful listener. “Onsets and rimes not only define the possible sounds of a language; they are the pieces of word-sound that get manipulated in poetry and word games” (Pinker, 1994: 170). This disruption and interference on the level of the message and the rhythmic patterns in contrast to the other more regular stanzas that convey the more loving and considerate message are compelling in their sound effects. Auden uses the line and form against the poem’s ‘meaning’ to establish two levels of rhythmic address in the poem, as a mother might have two levels of address while singing an infant back to sleep: the spoken voice and the rhythms of the song sung. Compression of the sound features in Auden’s poem make voicing/reading aloud (and in the head) subtly difficult. Just as the lullabies play on rhythmic repetition to pre-linguistic infants, so too do poems, like Auden’s, because “features, not phonemes, are the atoms of linguistic sound stored and manipulated in the brain” (Pinker, 1994: 175). Poetry necessarily plays with the onset/rime rules in language to create rhetorical, intellectual or emotional effects, deviating from the conventional ‘spoken’ laws of a language. Auden’s play of metric tension against the onset/rime pattern in the poem to create another level of meaning has its ground in the human brain’s delight and sensitivity to rhythm and pattern.

That such sensitivity to rhythm and sound as a form of ‘appreciation’ has been shown in birds and non-human animals, and that these rhythms can be utilized over a 4000 year time span in vastly different languages, and that the same techniques can be seen in more complex versions in a modern poem, all point toward the neural capacity or appreciation of an evolved brain in continuum, and not merely in linguistic relativity to the meaning of the words of the texts themselves. What one should see if artificial selection (say, via language) were overpowering natural selection (a case which would have to be made by social constructivists to sustain a linguistically-oriented nurture-over-nature line of reasoning) is a much wider variation in devices like alliterative and consonantal form. If language had the titanic shaping power claimed by some, there would also be much more genetic variation due to isolated gene pools or selective marriage and reproductive habits. We do not see this. The few cases of lullabies cited here are suggestive of patterns that go beyond mere cultural facades. Culture and language don’t shape the brain. They refine its innate abilities and capacities.xxv

What evolutionary aesthetics, in its variant forms, is trying to do is tease out the connections between the human evolutionary past and the relationships to literature. Some of the better-known champions of the evolutionary aesthetic camps do differ in their exact modeling, some arguing that art is an adaptation while others see it as a byproduct of evolutionary forces. Ellen Dissayanake and Brian Boyd see the former, while Joseph Carroll sees the latter as more likely. Carroll in fact notes, fallibilistically, that ‘(a)t this level of explanation, all these arguments are structurally parallel. To make further progress in understanding, we have to move from that level of conceptual parallelism into the contexts of paleoanthropology and psychological mechanism” (2011: 49). The jump suggested here into a neurobiological account might seem at first glance to have little if no bearing on literary studies until one stops to examine the chain of intermediating logic. Evolution by natural selections shaped, over hundreds of thousands of years, the modern human brain. This is a fact, and literary studies would be best suited to accept it and adopt it -else to parallel inaction with evolutionary trends- it will simply become irrelevant and disappear from record. Perhaps a prescient quotation from Charles Peirce, writing in 1913, would be sufficient to close this paper. Peirce says,

For although there is as much reason to believe in the unity of origin of humankind … the extraordinary variety of languages, customs, institutions, religions, as well as the many revolutions [these] have undergone in the brief half-dozen of millennia to which our acquaintance with them is as yet limited, as compared with the almost insignificant variations, -these facts, I say, make the old-fashioned notion that because there is no immediate appeal from instinctive ratiocinative conviction that there can be no improvement or growth in fundamental ratiocinative procedure, appear to a modern a good deal in the attitude of a schoolboy perched on a stool with a fool’s cap on his head. (1998: 468)

What literary studies avoid in eschewing the natural sciences is nothing less than the origin of the species’ humanity, the font of dignity from which we may be better equipped to understand ourselves through our artistic endeavors, not just understanding what these books and poems and paintings mean, but why they have meaning to us in the first place.

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neuroscience. *Journal of Physiology* (Paris), **102**, 137-151. PDF File.

i No pun.

ii Peirce would say that the denial of ‘Truth’ as a quality of reality is trapped in a logical contradiction and thus cannot be entertained. He says, “Every man is fully satisfied that there is such a thing as truth, or he would not ask any question. *That* truth consists in a conformity to something *independent of his thinking it to be so*, or of any man’s opinion on that subject. But for the man who holds the second opinion, the only reality, there could be, would be conformity to the ultimate result of inquiry. But there would not be any course of inquiry possible except in the sense that it would be easier for him to interpret the phenomenon; and ultimately he would be forced to say that there was no reality at all except that he now at this instant finds a certain way of thinking easier than any other. But that violates the very idea of reality and truth [Peirce’s emphases]” (1975: 129).

iii Though he is not suggesting that the arts somehow evolve autopoieically and autonomously. He outlines first- through third-level Darwinian machines (2009: 403-407) and says, “I mean only that art involves highly deliberate human choices, both individual and cultural, even if our choices derive ultimately from nature” (406). There’s no fallacy of equivocation here in use of the term ‘evolve’. For more on Darwinian Machines, see Plotkin.

iv This sensitivity to rhythm is not particular to humans. Hattori, et al. (2013) note that chimps can spontaneously synchronize their tapping to rhythmic music.

v And is very similar to the argument Socrates uses against Protagoras in the dialogue of that name (Plato).

vi Relativism can be easily avoided by adopting a fallibilistic methodology. For this, see Peirce, 1998: 42-56.

vii Churchland (2013: 251) discusses the disruption of language centers in the brain using navigated transcranial magnetic stimulation (nTMS), inhibiting patients’ ability to speak yet had no effect on the patients’ consciousness, showing that consciousness does not derive from language.

viii And this would also suggest a narrowing of the population per some extinction event in our species’ past.

ix And as with any gene, it cannot be reduced to a simple cause-effect chain. No one gene codes for any one phenotype or behavior (Churchland, 2013: 153-161).

x Currently, I am finishing a book, *World Enough* (forthcoming from Atropos Press), which will deal with this issue adapting Peirce’s semiotic system and philosophy as an experimental connective language.

xi Peirce was to later rename his philosophy Pragmaticism to distinguish it from William James’ version of Pragmatism. Peirce would almost certainly disagree with recent trends in neo-pragmatism like Rorty’s ‘linguistic turn’. For an account of Peirce’s development away from James, see Karl-Otto Apel.

xii Narrative here to mean cultural products like art as something diametrically opposed to natural science.

xiii Though I think one can take issue with the straw hominid Lyotard presents on page 27 of the scientist who deems narratives (myth, stories, fables, legends) as fit only for women and children. This seems unfair in comparison with his other more salient assessments.

xiv Nor to debate how these particular movements define or name themselves. They are adequately understood by their common monikers.

xv Or whatever particular aesthetic concern is deemed worthy of discussion.

xvi Also, mirror neurons seem to be involved in action anticipation in infants (Hernick, at al., 2014), and others have argued that mirror neurons form the basis for human empathy (Keysers, 2011).

xvii It is staggeringly easy to overstate the function of mirror neurons in the human brain. They are presented here as possibilities, but fallible ones. Pinker (2011) downplays their importance, and Hickok’s book does much to undo many of the extraordinary claims about mirror neurons. Until scientific consensus is reached, I will merely follow the information stemming from the labs and experiment center.

xviii Of course one can say the conflation here is mere equivocation, but my article’s fallible ethos should help to at least roughly stitch these together.

xix Winkler, et al. (2008) found that newborn infants detect beat patterns in music and when certain beats are omitted it causes neural activity associated with expectation violations.

xx Perhaps an overly broad statement, but it does hold up under scrutiny of poetic traditions from language to language and culture to culture. Deviations from this general rule are innovations and reactions against convention which only undergird the statement’s truth.

xxi Farber notes (f. 140) that the pronunciation is similar enough to German.

xxii It should also be noted that deviations from this trend are normal and show innovation and plasticity in form and attention by humans. This is nothing surprising and the deviations only serve to highlight the statistical tendencies from which the deviations move.

xxiii For example, I’m counting line 19 as seven beats with ‘and the rocks’ read as a single iambic foot. Note that line 20 does not allow for such elision and contains 8 beats, making it trochaic tetrameter.

xxiv Consonants at the beginning of particular syllables are called onsets, while the vowel sounds following are called rimes in linguistic terminology.

xxv Pinker (2007: 136-148) argues against the vaguely Sapir-Whorfian flavor of certain constructivist arguments, or what Casasanto (Pinker 139) calls, ‘crying Whorf.’ Discussing the lack of complex number systems in hunter-gatherer societies, Pinker notes that “both number words and numerical reasoning … developed from existing cognitive resources” (139). It is not the other way around. Language and abstract reasoning -like number concepts- are products of brain states (thus evolved), like sensitivity to rhythm and pattern.