

Full Length Research Paper

# When the music moves you: Revisiting the classics in the company of neuroscience

Susan E. Pashman

Boston Architectural College, P.O. 2530, Sag Harbor, New York, 11963, U.S.

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When the music moves you, you dance. The bodily movement that develops in response to music is what is here considered “dance.” Philosophers have long understood music as possessing the power to move us. This paper employs Heinrich Wölfflin’s theory of “sympathetic modeling”—a theory recently validated by neuroscientists’ discovery of mirror neurons in humans—and Antonio Damasio’s neurobiological model of emotion to establish the mediating links between music and the bodily movements made in response. The first “motion” elicited by hearing music is, as Wölfflin suggested, an unconscious “sympathetic modeling,” an internal vocalization of what is heard; this activity involves muscular expansions and contractions. Signals of muscle movement are relayed to the brain by receptor cells imbedded in the muscles. In complex responses, the brain receives *patterns* of movement from throughout the entire body. When these whole-body kinesthetic sensations are made conscious as perceptions of a unified self, they enter awareness as subjectively *felt* emotion: the felt response to music. Such patterns of muscular stretching can be abstracted from the sort of external experience that produces emotion in ordinary life experience and reproduced at will. Thus, a dancer, by deliberately reproducing a pattern of muscle stretching, can re-create a chosen specific emotion. This activity constitutes “expressing” emotion in bodily movement. Performed in response to the emotion elicited by music, it is the expressive gesture of dance. One viewing the dance “understands” the emotion expressed by, once again, employing sympathetic modeling to reconstruct the internal pattern of movement associated with that emotion. In popular, social, dancing, dancers model one another’s movements and, together, model the muscle tension patterns of particular rhythms and melodic lines; this situation is easily accounted for by what is now known about mirror neurons. Neuroscience thus explains what happens when the music moves you.

**Key words:** Emotion, movement, music, dance, aesthetics, neuroscience.

## INTRODUCTION

When the music moves you, you dance. The movement we—and perhaps other animals—perform in response to music is known as dancing, even when no one is watch-

ing, even when no prescribed movements are involved, even when those movements are never repeated. Whether we dance privately, in public spaces such as

E-mail: [susanpashman@yahoo.com](mailto:susanpashman@yahoo.com). Tel: 631-725-9818.

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such as dance halls, at parties, at the beach, or as we walk along a road, headphones in place--wherever and whenever it occurs, body movement that develops in response to music is what is considered in this paper as "dance."

As far back as Plato and Aristotle (Plato, 1945), philosophers have understood music as possessing the power to move us. The question addressed here is *how* did this come about? What is the link between music and the bodily movements that develop in response? The phenomenon of the body's felt response to a musical situation—the experience of the body as both "in" the music and "in" the dance it is doing-- is one aspect of the story told here; a second aspect concerns the neural underpinnings of such felt responses, a story to which recent developments in neuroscience, especially in the work of Damasio (1999), have much to contribute.

To understand the dancing body as a response to heard music it is necessary to consider the key mediating phenomenon, emotion. Music, after all, does not actually move our limbs in dance; nor are dancing limbs a reflex response to heard music, the outcome of a simple neural arc like the "kick" of a leg when a knee is tapped. The first "motion" that arises upon hearing music is *e-motion*, an unconscious, internal movement that may produce a specific subjective affect, a distinct *felt quality*. *Felt* emotion is a conscious, subjective experience we may then ex-press, as Dewey would have it, a feeling we "press forth" (1932) in a continuous gesture. It is this continuous gesture I consider as dance.

The question, then, is a complex one. First, how should we understand the connection between music and the unconscious, internal movement with which we automatically respond? Second, what is the connection between the way that internal movement is consciously *felt*—the way it makes itself known to the subject--and the bodily movement with which we express that feeling in dance?

A related question— considers at the end of this essay—concerns the dancing that occurs in such social contexts as on a dance floor, what Crease (2002) referred to as "popular dancing." To what extent is it the dancing of others around us that moves us to dance? Does seeing another dancing body move us to join in? Here, again, neuroscience contributes significantly to our understanding.

### **What Philosophers Have Always Known: Music Moves Us**

Philosophers (Plato, 1945; Nietzsche, 1872) have long understood that music affects the way we behave, the overt movements our bodies make. As a practical factor in shaping society, music has been valued by some philosophers as having the power to bind separate individuals into a more perfectly cohesive social entity; others consider music a malefactor that stirs up trouble, a

threat to the social bond that must be vigilantly monitored, if not vanquished altogether.

Plato famously weighed in on the negative side of that debate. In considering the education of the Republic's guardians, he observed that merely imitating the linguistic habits and bodily gestures of a literary character can mold the character of the young guardian; but beyond the poem's content, its mode and meter—the *music*—employed in singing it will profoundly impact his soul (Plato, 1945, 85-92)

Music, says Plato, strikes the appetitive part of the soul, the part from which action springs. Music has the power to *shape* those appetites, conforming them to the emotions conveyed by the music. Thus, modes expressive of sorrow, used in dirges and laments, soften the will and should be excluded from the guardians' training; nor should the "slack" Ionian and Lydian modes be permitted to touch them lest they fail to develop strong, courageous characters. Eventually, Plato banned from the Republic all but two of the classic modes: the Dorian, which "fittingly represent(s) the tones and accents of a brave man in warlike action or in any hard and dangerous task" (Plato, 1945; p.87) and the Phrygian, which is suited to peaceful actions and embodies feelings of "wise restraint."

Plato's rigid censorship of music is easy to dismiss as indicative of a too scrupulous or overly prudish concern for the influences that shape a young person's character, but careful attention to his remarks about music's powers reveals a keen sensitivity to the ways music moves us. A guardian's character-- his pre-disposition to act--depends on the way his appetitive nature, the source of his actions, is tempered by his sensuous environment. Plato's concern about the power of music to shape a young person's possibilities for *action* in later life is perhaps echoed in contemporary concerns such as those registered by Scruton (2010) about the influence on the young of rap music with its relentless rhythms and melodic flatness.

Aristotle is characteristically less censorious when, in his *Politics*, he considers the role of music in training good citizens (Aristotle, 1962, pp.339-52). Music, he notes, has always been regarded by "the forefathers" as necessary in educating citizens who can hope to enjoy the leisure to cultivate their minds, whereas for the lower classes, music can be restorative after the exertions of daily labor. But it is when he considers the role of music in moral training that Aristotle turns to music's power to shape character and *behavior*.

Like the other arts, Aristotle believes, music supplies "images" of the virtues; by pairing feelings of pleasure with those images, music presents virtue as pleasurable, and so makes a moral impact by "habituating us to feel pleasure in the right sort of way," allowing us to understand the virtuous life as desirable. But apart from the pleasure music affords, it has a direct effect on the soul. Even merely "imitative sounds" which lack both

meter and melody, Aristotle argues, induce feelings of *sympathy* for what is imitated; but sound that acquires the structures of rhythm and melody—music— provides us with more accurate *representations of states of the soul* than any other art form can.

*[M]usical times and tunes provide us with images of states of character... which come closer to their actual nature than anything else can do.... Objects of sight may do so, but .... the shapes and colors presented by visual art are not representations of states of character; they are merely indications (Aristotle, 1962, pp.343-344).*

Art thus functions at two distinct levels because it affects the soul in two distinct ways: Visual art uses shapes and colors to *indicate* emotions, but music *directly produces* what Nietzsche, following Schopenhauer, would later refer to as a direct “copy” of the willing, appetitive soul (Nietzsche, 1872). The soul instinctively “sympathizes” with unformed sound, but it naturally *imitates* or *shapes itself* to structured sound. Because we automatically “sympathize” with it, music has the power to create distinct, correlative, states of the soul, internal “shapes,” that we call “emotion.” Both Nietzsche and Schopenhauer may thus be understood to have taken up Aristotle’s initial intuition when he sensed that it is by providing representations of soul states that the soul can “conform to” or “make itself congruent with,” that music can shape feelings and the behavior that naturally ensues. Feelings and music, then, are both understood by Aristotle as having *shapes* such that the shape of a melodic line can “represent” the shape of a “state of the soul,” a felt emotion.

Now, we are not concerned here with what Aristotle takes to be the moral, character-building effects of music so much as with what he considers to be music’s power to move us to dance. But what is “character” for Aristotle if not the propensity of the appetitive soul to act—to move—in a particular way? (Aristotle, 2004) Good character, for Aristotle, is formed through development of good habits, through learning by doing; once formed, good character is a tendency or *potential* of the appetitive soul that may be actualized in overt movement. Appetites and emotions cannot be suppressed or gotten rid of as Plato had supposed; they are, for Aristotle, body-based, natural functions that can at best be habituated by practice to become reasonable. A good life—a life of good *actions*—depends upon a reasonable set of appetites and emotions, for it is in appetite and emotion that all bodily movement—behavior— begins. When we develop the habit of “sympathizing” with temperate modes of music, our unruly appetites and excessive emotions, by “modeling” themselves to that music, are shaped toward reasonableness, making likely the sort of reasonable action that makes for a happy life. Thus, music not only shapes moral behavior, it shapes *all* the body’s activity, including the way we dance.

The “directness” with which music connects with inner life, as compared with the less immediate influences of the visual arts is, according to Aristotle, what gives music its enormous power over us. For Nietzsche, too, music alone among the arts possesses extraordinary powers. It is because music is a *direct copy* of the emotions that it could move the Dionysian celebrants to engage in licentious behavior even to the extent of hurling themselves to their deaths. For all the reasons that Plato suspected music, Nietzsche extolled it, hailing it as the antidote to Socratism, a cure for the Western bias toward intellectualism that engineered the death of art. By resurrecting the god of music, Nietzsche believed, we can liberate our natural instinctual selves to live authentically. For Plato, the social bond—and so, the stable state—is endangered by the body-based, “individuating” emotion that music stirs up. But Nietzsche understood music as promoting social cohesiveness: Overcome by the power of music, the citizens of Athens, gathered in the embrace of an amphitheatre, felt the boundaries that separated and individuated them dissolve as a sense of oneness swept over them; in a music-induced ecstasy, they felt themselves merge with the Primordial Unity, that is Nature.

It surely strikes modern readers as odd to find both Plato and Aristotle, as well as Nietzsche and Schopenhauer, conceiving of felt emotions as having representable, model-able “shapes.” Feelings, after all, are not spatial and so cannot be thought to have actual shape. But if we read this notion as mere metaphor, we are left to wonder what actual state of affairs the notion of “congruent” or “conforming” shapes is a metaphor for. It is this puzzle that contemporary neuroscience helps us address and clarify. Neuroscience today, it turns out, *also* views emotions as corresponding to specific shapes or *patterns* (Damasio, 1999; De Rivera, 1977). That such patterns reliably correspond with dynamic patterns of movements external to the body—such as the movement of a melodic line—has now been experimentally confirmed (Clynes, 1975, 1980). What both Plato and Aristotle intuited—that each of the musical modes “represented” specific emotional affects—thus comes remarkably close to the findings of neuroscience.

Thus it turns out that, even in their earliest intuitions, philosophers made much of what they sensed to be a direct and intimate connection between music and emotion. Contemporary neuroscience bears out these intuitions as it discloses actual patterns—shapes—in our unconscious bodily responses to heard music, responses that can be accurately and universally correlated with specific emotions.

### ***E-motion As Motion***

Both Plato and Aristotle—along with Nietzsche— understood emotion as the dynamo that generates overt bodily movement. But, as movement can only come from

movement, emotion must itself turn out to be movement.

Again, in their understanding of emotion, some philosophers anticipated developments in modern neuroscience. Determined to describe human nature in exclusively bodily terms, Hobbes (1651), for example, reduced emotion entirely to motion.

*[The] small beginnings of motion, within the body of man, before they appear in...visible actions, are commonly called endeavor.*

*This endeavor, when it is toward something which causes it is called appetite or desire....And when the endeavor is fromward something, it is generally called aversion. (16: p. 47)*

The emotions—love, hate, contempt, delight, joy, grief, hope, fear, anger, indignation, curiosity, dejection—all turn out to be names for variations of “toward” or “fromward” movements for, at root, “there is nothing but motion or endeavor.” Character traits—covetousness, valor, magnanimity, kindness, lust—are, likewise, variations on these same small movements. In the final sections of his discussion of human nature—his discussion of “natural rights”—Hobbes discloses the underlying source of both “toward” and “fromward” movements: Man is by nature “free to use his own power... for the preservation of his own nature; that is to say, of his own life”. Man, like any other living thing, possesses innate survival mechanisms which move him instinctually *toward* what promotes his survival and *away from* what threatens it. Hobbes’ account anticipates the account rendered by evolutionary biology, and also the account of emotion rendered by the neurobiological model recently put forward by Damasio (1999), a model relied upon in what follows. In the neurobiological model, emotion is always a matter of unconscious “toward” and “fromward” movements; when these movements make themselves known in consciousness, they are subjectively felt affects, feelings.

Spinoza’s account of emotion also comes down to a matter of internal movement (Spinoza, 1632). His notion of *conatus*, the instinctual impulse toward self-preservation, mirrors Hobbes’ biological view, and his notion of emotion essentially traces Hobbes’ understanding of it: All emotions are variants of pleasure or pain, the one, reflective of an increase in the organism’s power to sustain itself, the other, a reflection of a decrease in that power.

In “What Is An Emotion?” (1884), James argued, along the lines of both Hobbes and Spinoza, that emotions are simply felt aspects of purely physiological, survival-based, reflex responses to external stimuli: Emotions are thus the way various bodily movements *feel*. There is, James insists, no intervening mental event. Thus, the racing heart and cessation of digestive processes that follow upon my suddenly encountering a bear are reflexive bodily responses; and the subjective affect of

those processes—the way they feel to me-- is what I call “the feeling of fear.”

[T]he more rational statement is that we feel ...afraid because we tremble, and not that we tremble because we are fearful.... (James, 1884).

Dewey (1895) approved James’ behaviorist approach and its Darwinian grounding, but emphasized that the behavior engaged in is automatic, either instinctual or habitual. Both an intellectual reflection on the nature of the stimulus—“that is a bear to be run away from”—and the “feel” of the bodily movements involved in running, follow upon the reflexive response. The neurobiological model of Damasio, as will be seen, incorporates experiential learning, an intellectual component, into the reflex response itself. For both James and Dewey, a felt emotion is the way a specific pattern of movement feels; what the neurological model supplies is an explanation of how small, internal bodily movements come to be sensed and then consciously perceived by a self as *its* emotional feelings.

### **Damasio’s Model**

The speculations of Hobbes, James and Dewey as to the roots of emotion in actual motion have been experimentally validated by contemporary neuroscience. In *The Feeling of What Happens* (Damasio, 1999), Damasio constructs a neurobiological model that roots emotion in movement. In experiments with brain-injured patients, Damasio demonstrated that those who could not move at all could not experience emotion; patients whose injuries permitted limited movement of the upper body, however, could experience those emotional responses that involve movements of respiratory musculature and of the head and neck. “Feeling,” Damasio concluded, is the conscious awareness of *patterns of movement* throughout the body; it arises when movement that initially occurs out of consciousness is “represented” to a conscious self. Damasio reserves the word “emotion” for the initiating internal movement that occurs out of consciousness in all organisms, both those that have a sense of self and those that do not.

On the Damasian model, emotion is a bodily process involving either electrochemical signals from bodily movements or chemical signals from hormone secretions and other internal reactions, both of which processes result from *movements* that occur out of consciousness. The conscious perceptions of such reflexes—phenomena we refer to as *feeling* angry, sad, joyful, fearful, etc—are *later* phenomena, both temporally and developmentally, and require an evolved sense of self. The *start* of conscious feeling, however, is, in every case, a “motion” of some sort: e-motion.

This unusual use of the term “emotion” seems contrived to neatly fit with James’ and Dewey’s view of emotion as a bodily reflex, but Damasio modifies that

view, noting that learned and remembered body modifications—stored cognitive data—constitute part of what is processed in the non-conscious “evaluation” that triggers an emotional reflex; that is, stored *cognitive* data contribute to the determination of the initial instinctual response, the “toward” or “fromward” unconscious movement. The cognitive component in emotional response is thus built into it at the very earliest, still unconscious, level of the survival-based reflex.

Feeling, on the Damasian model, thus comes about as follows: In response to an event outside the organism, *preset* neural mechanisms spring into action, instantaneously *assessing* or *evaluating* the stimulating situation and automatically either withdrawing the organism from harm or propelling it toward what enhances its chances of survival. This is simple bi-directional movement, a matter of approach or retreat, reward or punishment, pleasure or pain, advantage or disadvantage. In every experience of the world outside us—in fact, in every lived moment—signals sent to the brain from the rest of the body aim at or actually produce *movement*. Emotion is just what Darwin took it to be: a survival mechanism by which the organism protects and sustains its life. All living things, whether they have the means to be aware of it or not, experience emotion. When an emotion becomes conscious—when it is “represented” to a self capable of owning it— it is a “feeling.”

Now, toward or fromward movement must be, in every case, an event that involves the muscles located throughout the body. To speak of all movement as fundamentally a matter of approach or retreat is to say that wherever in the body the response to a stimulus occurs— wherever the responding muscles are located— those muscles are engaged in either expansion toward the stimulus or contraction, withdrawal from it. So emotion, we now understand, is always a matter of expansion or contraction of muscles, muscle tension. “Felt emotion” is, then, the way such tensions feel when they arrive in consciousness.

The question of how an unconscious internal movement becomes consciously “felt” is the familiar question of how a sensation becomes a perception, a question that plunges the inquiry into the morass of the mind-body problem. Damasio and his fellow neuroscientists fully appreciate the difficulties their models encounter at this point, and understand that the philosophical problem of crossing from bodily mechanism to consciousness can no more easily be resolved in this context than in any other. All the neuroscientist can say is that there are strict, reliable *correlations* between the internal movements that constitute unconscious sensations, and the felt subjective qualities that arise from them as perceived feelings. Neuroscience thus validates the speculations of Hobbes, James and Dewey, that the source of emotion is unconscious internal movement; neuroscience also makes clear the distinction between emotion and feeling. Clarifying this distinction allows us liberate our concept of

expressive artistic form from metaphysics and metaphor, as will be demonstrated in what follows.

The minute internal movements that eventually reach consciousness as feelings are, in most instances, the movements of spindle cells, long receptor cells embedded in the muscles throughout the body. When muscles move, even slightly, spindle cells either expand or contract, sending electrochemical “messages” of their movement to the brain. As receptors, spindle cells are akin to receptor cells in other sensory organs; like the sensory receptors in the retinas, the tongue or the nostrils, they are the “first responders” to stimuli and, like other receptors, their activities take place out of consciousness. Spindle cells differ from other receptors, however, as to the sources of the stimuli they respond to: Spindle cells report on events that occur within the muscles, events taking place *inside* the body. These receptors are thus the starting points for a “sixth sense,” a sensory function in addition to the traditional five senses enumerated by Aristotle, a sensation often referred to as “kinesthesia.” Emotion, as Damasio defines it—internal unconscious movement toward or away from a stimulus, e-motion—is nothing more or less than the *sensation*, kinesthesia.

There is another significant respect in which the sensation of kinesthesia, of muscle movement, is distinguishable from other sensations: unlike messaging from the eardrums or the retinas, messaging from the spindle cells of the musculature is likely to arise in many regions of the body simultaneously as the body responds to an external situation. In most kinesthetic events, then, the brain receives a complex of messages reporting movement in several areas of the body, a *pattern* of muscle tensions, a *kinesthetic pattern*.

Damasio’s model distinguishes unconscious movements, “emotions,” from the way those movements feel subjectively, the qualitative effect they produce when they are represented to a conscious self: feelings. Only higher organisms, having developed a sense of self, are capable of experiencing feelings, of representing internal movement as their “own.” It is important to note that, in the case of kinesthesia, the name by which we signify the unconscious *sensation* of inner movements, is *also* the name we give to the conscious *perception* of that movement, the subjective feel of a kinesthetic pattern. It will be critical as we move forward here to keep this double sense of the term in mind, as failure to do so frequently muddies the analysis of aesthetic expression.

When a complex pattern of muscle contractions and expansions is relayed to the brain, the electrochemical changes in the brain are represented to consciousness and are *felt* as a single integrated quality of the entire body, what is sometimes referred to as a “whole body perception.” What we call a felt or perceived emotion— what Damasio calls a “feeling”— is simply a *pattern* of muscle movements made conscious. A feeling of rage, for example, might commence as an unconscious pattern

of contractions in the gut, the throat and the chest; we experience or *perceive* rage—we *feel* it— as a “whole body” state, a specific qualitative “feel” that seems lodged in the entire body rather than in a single sensory organ. The musculature, which is the “sensory organ” of kinesthesia, is situated throughout the body and gives rise to perceptions that are “felt all over.”

The familiar emotions of rage, fear, triumph, joy, disgust, etc. each correlate with distinct *patterns* of muscle tension, distinct *kinesthetic patterns*. Damasio’s explanatory model incorporates the considerable wealth of empirical research that correlates the well-known emotional feelings with distinct bodily *patterns* of neural response (Bull, 1951; Clynes, 1975, 1980; De Rivera, 1977). Recent research has demonstrated, in addition, that different regions of the brain are triggered in each of the emotions; emotions thus differ *neurally* as well as in awareness.

The fact that distinct felt emotions can be correlated with specific kinesthetic patterns is what accounts for our ability to distinguish easily and accurately among the emotions. We recognize the sweaty palms of apprehension, the racing heart of pride, the slowing heartbeat of terror. The differences among kinesthetic patterns also account for our ability to recognize the emotions of others: We recognize the distinct patterns of tightened facial muscles in expressions of anger, fear, and disgust, and the blanching or flushing that signals embarrassment, just as we “get” the body postures and gestures that signify joy, triumph, depression, defiance, sadness or discouragement. Whether it is a matter of emotion *recognition*, or of *expression*, the concern in each case is with *patterns* of movement. As Damasio puts it:

*[Y]ou can find the basic configurations of emotions in simple organisms, even in unicellular organisms, and you will find yourself attributing emotions such as happiness or fear or anger to very simple creatures who...have no feeling of such emotions in the sense that you or I do, creatures which are too simple to have a brain, or, having one, too rudimentary to have a mind. You make those attributions purely on the basis of the movements of the organism, the speed of each act, the number of acts per unit of time, the style of the movements, and so on. You can do the same thing with a simple chip moving about on a computer screen. Some jagged fast movements will appear “angry,” harmonious but explosive jumps will look “joyous,” recoiling motions will look “fearful.” ...The reason you can anthropomorphize the chip or an animal so effectively is simple: emotion, as the word indicates, is about movement... (Damasio, 1999) (Italics added).*

The fact that feeling occurs at a different level of consciousness from emotion and employs a different set of brain regions and neural structures makes it possible for feelings to be induced by stimuli other than those ordinary life situations that usually elicit emotional

responses. Body movements or chemical alterations of the body milieu induced artificially can effectively create feelings that are recognizable to the organism as the familiar emotional feelings of life experiences. The “feel” of an emotional response, of a movement that ordinarily occurs reflexively in a lived situation, may, therefore, be *abstracted*, or *detached* from context and deployed, for example, in an act of expression. It is, in fact, this “abstractability” of feeling that makes artistic expression—emotional feeling apart from a real-life context—possible.

*Thus, what neuroscience has contributed to the ancient philosophical wisdom concerning music and emotion is a neurobiological model of how emotion arises. According to this model, small unconscious movements--contractions and expansions of the muscles’ spindle cells—are relayed to the brain and become conscious as subjectively felt emotion. Emotion is, therefore, the felt aspect of actual movement: What I feel when I identify a feeling as fear, or anger, or joy, for example, is the way particular bodily patterns of muscle movement feel once they are represented to my consciousness as mine.*

### **From Music to Emotion**

When I hear the music, I feel the music; and when I feel the music, I may be moved to dance to it. We have examined the neural link between internal bodily movement and felt emotion, the connection between how our muscles move in response to a stimulus and what we feel when that happens. Aristotle, it has been noted, believed that even merely imitative, disorganized, sound provokes a feeling of “sympathy” in the human hearer; organized sound, he believed, relies on that natural sympathy to *shape* our feelings and does so more directly—and perhaps more powerfully—than does organized form in the visual arts. We have seen that contemporary neuroscience validates the rather strange notion that emotions have distinct shapes: The locations of muscle tensions throughout the body form *patterns* or *shapes*, each pattern correlating to a unique subjective outcome. How, exactly, does music affect the “shapes” of those kinesthetic patterns? How does hearing a melodic line become an emotionally felt experience?

In his prescient doctoral dissertation, “Prolegomena to a Psychology of Architecture” (Wolfflin, 1886), Heinrich Wolfflin sought to explain felt responses to architectural form. Rejecting the traditional view that aesthetic response begins in the sense organs, Wolfflin observed that emotion engages the entire body. We “feel” architectural form, Wolfflin claimed, because we automatically “sympathize” with it. In some way—he couldn’t say quite how—we feel ourselves to “be” the powerful column that helps support a cathedral. To sympathize with architectural form, according to Wolfflin, is to “model” or mimic it, either

actually or imaginatively. Assuming the form--the "attitude"-- of an architectural work, he argued, is the only way we can possibly "feel" it:

*We have carried weights and have experienced what pressure and counter-pressure are; we have sunk to the floor when we could no longer resist the downward-pulling weight of our exhausted bodies. And that is why we can appreciate the proud good fortune of an upright column (Wolfflin, 1886).*

The sympathy that accounts for our response to architectural form is not a product of personal or cultural associations; rather, it is spontaneous and hard-wired, an intrinsic aspect of perception itself.

*One cannot free oneself, not even with a long educational process, from the impression that a figure whose state of equilibrium is disturbed cannot feel itself well. And indeed, will this compulsion ever die out? I think not. It would be the death of art (Wolfflin, 1886).*

The suggestion that we "sympathize" with inanimate objects such as architectural columns certainly offends contemporary philosophical attitudes. However, "sympathy" is not essential to Wolfflin's theory and, in any case, we will see below that recent research into "mirror neurons" suggests a hard-wired human tendency to "model" things and events around us. Wolfflin's critical point is that we somehow instinctively *model* what we perceive, and that, I believe, is something we can agree we in fact do. In a wide open field, we inhale deeply, expanding our chest cavities; in a high-ceilinged cathedral, we stretch ourselves vertically to "take in" the steep space, again expanding our chests and stretching our necks. People in a crowded pub "draw themselves in," but in a luxurious hotel room, we "spread ourselves out." Modeling—assuming a bodily posture or attitude—is, for Wolfflin, absolutely necessary if our response to what we see is to include any sort of feeling. What gives our perception of a cathedral's inner space its feeling of loftiness is, Wolfflin would argue, due to the expansions and contractions of the musculature of our upper bodies, muscle groups that are particularly sensitive emotionally. Modeling always requires movement, and movement always elicits feeling.

The small movements that occur when we model may or may not be perceptible to outsiders; if we model imaginatively, they may not. When we model imaginatively, we tap into a bank of body-memories, each a kinesthetic pattern with its own felt quality. Both the kinesthetic pattern resulting from actual overt modeling and the body-memory elicited in imaginative modeling are patterns of muscle tensions and these patterns are the start of felt emotion. Unless modeling of some sort occurs, what is seen is not connected to a kinesthetic pattern, and without movement and its kinesthetic sensa-

tion, there is no kinesthetic perception, and so no feeling.

The kinesthetic pattern resulting from modeling an architectural column, for example, might include the feeling of drawing back the chin, squaring the shoulders, and lifting the chest. Without such engagement of the musculature, we would experience various visual perceptions but no emotional feeling at all. The result, Wolfflin believes, would be the inability of sensed objects to convey feeling, and that would be "the death of art." Wolfflin attributed the instinct to model to "sympathy;" modern neuroscience understands this somewhat differently, but the essential point is that Wolfflin understood, as Damasio has recently demonstrated, that without some sort of bodily movement on the part of the perceiving subject, there can be no expressive art.

But music is not a material object whose form we can see and then model. What is "sympathetic modeling" in the case of musical form? What does it mean to move the body into the "shape" of a melodic line?

Wolfflin actually began his argument for sympathetic modeling with a discussion of music's expressivity. Like architecture, he said, music is often mistakenly assumed to be "felt" in its respective sensory organ, the ear; but our pleasure in architecture is no more lodged in our eyes than our pleasure in music is rooted in the unconscious mechanism of hearing:

*In order to understand the theory of musical expression, it is necessary to observe ... our own means for producing tones. If we did not have the ability to express emotions with our own voice, we never would be able to understand the meaning of the sounds of others. One only understands that which one can do....the tones of music make no sense unless we regard them as an expression of some sort of feeling....(Wolfflin, 1886) (Italics added).*

In music, what we sympathize with is, according to Wolfflin, the composer himself as he hummed his melody either inwardly or aloud; what we instinctively model is the internal body work the composer performed as his melodic line took shape. It is with the very sensitive muscles in the throat and respiratory system used to *vocalize* a musical line that we "model" a line of music. When we either vocalize, or imagine vocalizing, a melody, we activate the musculature in the region of our bodies where spindle cells are most densely clustered; the resulting kinesthetic pattern *is* a powerfully felt emotion. Thus a line of music, Wolfflin suggests, acquires its emotional quality for the hearing subject because the hearing subject moves—either actually or imaginatively--in response to it, tensing muscles in the throat and respiratory system where the resulting feeling is most intense.

Wolfflin's explanation of music's expressivity finds support in recent developments of neuroscience. Explanatory models of Damasio (8) and others (4,5,6)

link feeling to actual *movement* of the whole body's musculature. Dynamic differences—differences of direction, intensity, duration and acceleration-- in melodic movement have been demonstrated to produce responses with distinct kinesthetic patterns (Clynes, 1975, 1980). Modeling by vocalizing sets the muscles moving; the resulting tensional patterns *are* the various emotions. The location of this particular modeling activity, deep within the body's core, makes the experience of music especially intimate. Without modeling and the movement it generates, we would *feel* nothing, for sound alone lacks the emotional impact of what we understand as music. For the feeling of music to arise, the body of the hearer must move and modeling provides the movement needed.

Wolfflin's theory is borne out in the actual practice of the art of music. Itzhak Perlman, for example, insists that all the students in his Summer Music Program on Shelter Island, New York, study voice during their training on stringed instruments as a means of learning to "feel" in their core body regions the music they are learning to play. People who claim not to be able to "carry a tune" are usually disabused of that notion when they learn to access and activate throat muscles they had neglected to notice; carrying a tune, they soon discover, is a matter of attending to the positioning of the tongue and jaws, and of controlling the opening in the throat in ways they never suspected were necessary. Modeling a melodic line requires muscle control much as any other modeling does; once the appropriate muscles are engaged, the source of musical "movement" —the tension patterns related to the "upward" or "downward" tilts of various melodic lines--is readily grasped.

Expansions and contractions of muscles in the respiratory region are involved not only in melodic movement, but also in the production of rhythm, regulation of volume and other aspects of musical "color." The entire range of music comes to be felt, then, by our internally or imaginatively *vocalizing* it.

To sum up the argument thus far, let us recall that neuroscience demonstrates that emotion is the sensation of movement that occurs when an organism approaches or withdraws from a stimulus as it assesses the stimulus to be either beneficial or harmful so that this movement always involves muscle movement; the expansion or contraction of muscles always stretches the spindle cells embedded in the musculature throughout the body. As many different muscles are involved in most such responses, what is transmitted to the brain is always a complex pattern of muscle tensions. These patterns may occur as responses to ordinary life situations, or they may be deliberately induced as they are when a subject, for example, "models" a musical line by internally vocalizing it. Each distinct pattern, as represented to consciousness, produces its own unique felt quality, the subjective affect or feeling that is specifically correlated with that particular tensional pattern. Music arouses specific

feelings because we instinctually model various dynamic features of the music—direction, duration, abruptness, intensity, etc.-- by either overtly or imaginatively modeling it.

### ***Dancing To The Music***

In 1951, the neuroscientist, Bull (1951), conceiving "emotion" as including both a felt, subjective affect and an overt behavioral expression, demonstrated that the behavioral component occurs in two distinct phases: "the motor *attitude* or *posture* of the body which, being *preparational* in character, is necessarily first in time; and the subsequent activity of *consummatory movement* for which the motor attitude prepares" (Bull, 1951) (*Italics added*). The assumption of a preparatory attitude—what Wolfflin may now be understood as intending by "modeling" --Bull showed, leads to both feeling and action, but the neural mechanisms involved in the two outcomes are entirely different (Figure 1).

*In all...preparatory attitudes the involuntary postural preparation is accompanied by appropriate organic changes, those in the breathing, heart action and digestive apparatus being particularly noticeable.*

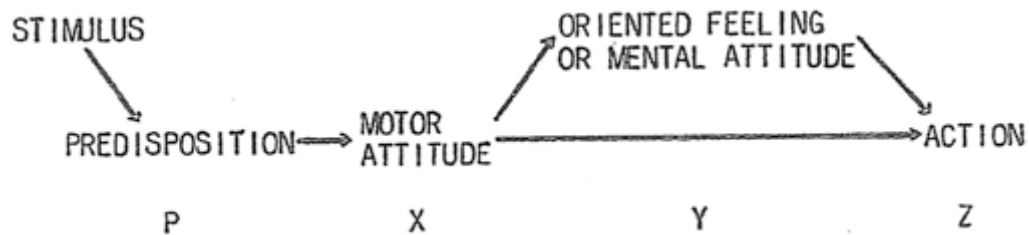
*Feelings of these organic changes combine with the feelings of the orienting posture itself—and with some awareness of the original exciting stimulus—to produce the familiar experience known as an "emotion" (Bull, 1951).*

The felt aspect of a reflexive response to a situation thus occurs as the result of the bodily posture assumed in preparation for the overt action that completes the response. Bull's research demonstrated that *specific patterns of bodily response correspond precisely to—or correlate with-- specific familiar affective states*. Thus, disgust, fear, anger, depression, triumph and joy--the six emotions generally considered by clinicians to be the basic emotions from which others are constructed (Duclos et al., 1989; Ekman and Rosenberg, 1998; Flack et al., 1999) --are each correlated with specific postural attitudes.

Bull's rather more surprising finding was that the connection between attitude and felt emotion *runs both ways*. That is, when a subject was asked to assume a particular posture, described neutrally, the subject reported feeling the related emotion. Thus, a felt emotion is the feeling of an attitude, regardless of whether that attitude constitutes an on-the-way to overt behavior or an assumed posture deliberately or artificially struck by the subject:

*[I]t was obvious...that the feelings experienced by our subjects were feelings of their own behavior and caused by it" (Bull, 1951).*





**Figure 1.** The sequence linking latent attitude or predisposition with motor attitude (posture) as precedent to conscious feeling and motor action.

*Bull's research demonstrated that affective states could be synthetically produced, that specific neuromuscular sequences produce specific affects, even apart from the lived situations in which they ordinarily arise. Not only was there a reliable correlation between expressive posture and psychic states, but behavioral attitude served a generative function: posture or attitude actually produced the felt states correlated with those attitudes.*

Naturally occurring feeling is distinguishable from what results from a deliberately assumed posture in that the latter is, though qualitatively recognizable as a familiar feeling, an "attenuated" form of that feeling. In naturally occurring feeling, Bull theorized, the *attitude of readiness* is like "a tightly coiled spring," not merely a casually assumed bodily position. When emotion is an actual on-the-way within a natural movement—when it is a muscle contraction in preparation for further movement response—it has for the affected subject a recognizable quality, the "feel" of the muscle tensions required to assume a posture of readiness to *act*. Where a particular attitude is merely "assumed," however, the feeling is qualitatively the same but of diminished intensity. Since the posture is not an "on-the-way" to further movement means that there is no "tightly coiled spring" behind the attitude creating more emphatic pressure.

If we are all identical in our neural wiring, a posture assumed by an emotionally affected subject should be easy for others to "read." One person's angry *attitude* should be quickly understood by another as "expressing" anger. An *assumed* attitude, even apart from a provoking context, should communicate the correlate feeling to others, but in a diminished way.

In fact, this appears to be the case. Provocative behavior by another may engender intense anger in me, but when I see an actor make angry gestures—or when I pretend to be angry—the anger I feel, though recognizable as anger, is nonetheless the "cooler" sort of emotion elicited by an experience of art.

It must now be obvious why I referred to Wofflin's dissertation as "prescient:" more than sixty years before Bull carried out her research on attitudes, Wofflin understood that assuming a postural attitude—modeling—was what endowed a visual perception with feeling. The

attitude in which one would model an architectural column is, as Bull demonstrated, correlated experimentally with feelings of triumph. Wofflin's notion of modeling thus amounts to assuming various postures that have now been experimentally confirmed as generative of specific emotions. Neuroscientists following Bull (Duclos et al., 1989; Flack et al., 1999; Lackner and Graybiel, 1979; Morris, 2004) were able to precisely correlate bodily postures with subjectively felt emotions.

Dance, however, involves *gesture*, whole-body movement. Can specific bodily *movements* also be accurately correlated with the felt emotions of those performing those movements, and can specific movements not only reliably convey specific feelings to others but also induce those feelings in the moving subject? Do expression and generation of emotion "run both ways" in the case of movement as they do in the case of postural attitudes?

The research conducted by Manfred Clynes in a field he dubbed *Sentics* (Clynes, 1975, 1980) established precise and universal correlations between subjective feeling and patterns of bodily movement, dynamic kinesthetic patterns. His experiments confirmed both that an observer readily understands the feeling expressed by the movement of another *and* that specific dynamic forms of bodily movement have a "feedback effect" such that a particular dynamic pattern *generates* correlate emotional feelings in the moving subject (Clynes, 1975).

Clynes concluded that both the *production* of certain forms of bodily movement and *recognition* of those forms as expressive of specific feelings were *biologically programmed complementary functions* of the nervous system. The relationship between expressive movement and the feeling expressed by it is neither fortuitous nor the result of cultural associations; the connection is part of the very nature of felt emotion. A specific feeling and its dynamic expressive form constitute a single neural system.

In nature's system of communication of emotions, the message units themselves have spatiotemporal features that act like keys in locks of our nervous system: The language, sender, and receiver are co-designed with vocabulary and meaning evolved by nature" (Clynes, 1980).

Not all feelings, Clynes noted, are expressed in overt

behavior; jealousy and envy, for example, are usually “kept inside.” But those feelings that are generally expressed overtly are easily recognized by others; they are what Clynes termed “contagious,” meaning that others who witness them being expressed, easily moved to actually feel the emotion the particular movement expresses (This result implies, of course, that overt expressions of contagious emotions are, in some respect, modeled by onlookers, that the audience at a dance performance, for example, models what it observes onstage).

Clynes found that contagious emotions, like Bull’s attitude-related felt emotions, “run both ways.” The “generating function” of contagious emotions applies “not only with respect to another individual, but also with respect to *the individual who is expressing it*” (5: p. 563) (*Italics added*). One expressing an emotion gesturally experiences *feedback* from his own bodily movement that generates the specific feeling *in him*.

The emotions Clynes found to be “contagious” include love, grief, joy, anger, hate, laughter, sexual excitement, reverence, hope and fear. Other researchers have since found that disgust, surprise, happiness and sadness are also cross-culturally contagious—reliably and universally communicable (Duclos et al., 1989; Ekman and Rosenberg, 1998).

Clynes began with the merely intuitive assumption that the specific *pattern* of muscle tension and movement correlated with a particular feeling would be implicit in *any* expressive modality. He assumed that the specific pattern or *style of movement* utilized by a subject to express a particular feeling would be dynamically identical regardless of whether the movement occurred in the face, arm, foot or voice. The entire body, Clynes supposed, expresses a particular emotion in ways that take on essentially identical dynamic features of muscle tension regardless of which part of the body is involved. Thus, the dynamic patterns of muscle tension involved in singing a particular melody could be shown to be *structurally identical* to the dynamic patterns involved in dancing to that same music.

Clynes’ bold assumption proved experimentally correct: each contagious emotion correlates with a unique kinesthetic pattern that characterizes muscular response whether that response occurs in the large limbs, the fingers, the respiratory musculature, the neck, throat, face—or voice. Clynes concluded that expression is governed by brain programs specific to each emotional state, brain programs he dubbed “essentic forms.”

*Essentic forms turn out to underlie expression regardless of the sensory modality in which they are expressed; thus, an expressive musical phrase, a tone of voice, a dance step, and an expressive touch partake of similar essentic forms when seeking to express a particular quality (Clynes, 1980)(Italics added).*

If the dynamic pattern specific to any emotion is invariant

throughout the body’s musculature, the body region involved in expression is irrelevant; for the sake of convenience in testing, Clynes chose the transient pressure of a finger on a key wired to an electronic recording device that created tracings on a spooling graph. The “sentograph” he obtained measured the vertical and horizontal vector components of finger pressure against time. Subjects were told to imagine a particular emotion and then express it by pressing on the sentograph key. The gestures produced differed as to length of *time* the key was depressed, *acceleration and de-celeration* of the pressure, and *angle* of depression toward or away from the subject (Recall Hobbes’ view of emotions as distinguishable according to various subject-object relationships expressed as “toward” or “fromward”).

The notion that patterns of expressive movement are invariant regardless of the region of the body in which the muscles employed are situated is buttressed by Clynes’ experiments that demonstrated that attempts to *retrain* the essentic form so that the form of one emotion can be used to express a different emotion utterly failed. For example, Clynes found that subjects could not be trained to smile consistently in response to sad news or to smile as a way of conveying to another the subjective feeling of sadness. *Each felt emotion appeared to be biologically hard-wired to its respective essentic form*. Additional support for this conclusion comes from experiments with conflictual situations in which the experimenter attempted to generate two or more emotions simultaneously. Thus, it has been found to be impossible for a subject who is expressing one emotion facially, to experience another, conflictual, emotion before the expression of the first emotion has been completed. The connection between a specific body state and a subjectively felt emotion is, again, proven to be hard-wired and resistant to re-conditioning.

In tests conducted over a decade with thousands of subjects across cultures as diverse as Balinese, Japanese and Mexican, clear, uniform correlations between named emotions and specific patterns of movement were established, demonstrating that the links between the bodily movements employed in the production of essentic forms and the emotions they are used to express are biologically hard-wired.

Like Bull, Clynes found that *synthetically* produced patterns of bodily movement generated the specific emotional feelings with which they were experimentally correlated, but that feeling generated both in the moving subject and in the onlooker or audience by movements that are *crafted* rather than reflexive responses to felt situations, tends to be *attenuated* in intensity. Such artificially induced feeling is thus distinguishable from the naturally occurring feeling but recognizable as that feeling. Clynes’ account of why this occurs echoed Bull’s:

*The process of tracing a given essentic form does provide an input to the individual that is similar to at least*

*a subsystem of his sensory experience... [The reason] only a subsystem may be involved [is that] in actual expression, the sentic state itself acts as a driving impetus, ...[but] when an essentic form is re-traced, the experience is the kinesthetic experience without the driving force of the sentic state (Clynes, 1975) (Italics added).*

Dance is a continuously altering pattern of overt bodily movement, a continuum of kinesthetic pattern changes within the dancer's body. Dance movements, we now understand, are both *expressive* of felt emotion and *generative* of specific subjective affects. This correlation is secured by *correspondences* or *congruencies* between the kinesthetic patterns underlying felt emotions and the dynamic patterns of muscle tensions involved in producing danced movement. If the kinesthetic pattern induced in the vocal modeling of a particular melodic line is, as described above, an emotion with a particular correlate feeling, and if a continuum of dance movements is, similarly, generative of a kinesthetic pattern that is correlated with that same feeling, we can be said to be dancing "to" that music, doing a dance that that music "moves" us to do. A particular melodic line moves us to a particular way of dancing because of a shared kinesthetic pattern, the emotion that is generated when the melodic line is "heard as music," that is, when it is translated into bodily movement that constitutes an emotion with a particular pattern or shape.

### **What I Mean By "Congruence"**

It is clear from what has just been said that the argument here turns critically on the notion of "congruence". The usage of the term may recall the notion of "isomorphism" which Gestalt theory employs to account for the translation of tensional patterns from one sensory modality to another. Gestalt psychologists (Arnheim, 1954; Koffka, 1935; Köhler, 1947) theorized that tensional patterns in the brain's electrical field supply the felt qualities of visual experience because those electrical patterns are structurally "isomorphic" to the formal qualities of what is seen. The theory at first met with great skepticism. However, Gestalt theory has recently been revived in a revised form in light of recent validating developments in neuroscience (Sekuler, 2012; Sheets-Johnstone, 2011; Wertheimer, 2012).

The model proposed here, however, differs significantly from the Gestalt model: I am not speculating about tensional patterns in the brain's electrical field; the tensional patterns I refer to are patterns of *muscle* tension that have been experimentally confirmed and demonstrated to be correlated with distinct emotional feelings.

Still, it might be objected, this theory, like the Gestalt theory of visual perception, verges on simplistic mecha-

nism: Surely a pattern of muscle tensions in the thorax, for example, cannot induce "congruent," "isomorphic," body movements of the limbs that emerge as a dance. However Clynes' research on "sentic" implies that the body's feeling of being "in the music" shares significant *formal correspondences* with the body's feeling of being "in the dance." A shared "sentic pattern" informs both the heard sound and the performed dance. The dance turns out as it does because the music is what *it* is; the moving, feeling, body transforms heard music to danced movement because *a single shared feeling mediates* the two activities. The transformation occurs, Clynes would say, because there are not two feelings but only one, the kinesthetic pattern initially set up by the music.

Maxine Sheets-Johnstone, herself a dancer and choreographer, acknowledges this synaesthesia when she advocates using vocalization as a means of tracing the dynamic line of dance movement in choreography:

*A dynamic line may be vocalized first and movement subsequently created which mirrors the line, or movement may be created first and the line reflecting the movement subsequently vocalized. It is thoroughly possible that the line be inwardly heard simultaneously as the movement is created, or that as one vocalizes a line, he envisions movement which embodies that line. The important point, in fact, is that the vocalization and the movement are ultimately executed and apprehended together; phenomenologically, they constitute one and the same projection and intuition (Sheets-Johnstone, 1966) (Italics added).*

It is only possible to *envision* movement which "embodies" a vocalized line because visual shape is transposable into a kinesthetic "Gestalt," that is, because the "feel" of a movement's shape can be correlated kinesthetically with a pattern of stretchings in the musculature of the respiratory system, the "feeling" of a vocalized line. If a pattern of muscle response and the danced dynamic shape "constitute one and the same... intuition," it is because they are *kinesthetically congruent*. If a danced movement can be vocalized, it is because of *kinesthetic* congruence between the pattern of muscular tensions produced in vocalization and the kinesthetic pattern involved in the danced movement.

### **But Beware False Congruence!**

The "congruence" that Clynes posits to account for the contagion of emotion, like the Gestaltist notion of "isomorphism," seems to echo a concept that lies at the heart of aesthetic formalism. Susanne Langer (Langer, 1953), for example, appears to intend "congruence" when she speaks of the "forms of feelings," the intellectually intuited structures that convey felt meaning from a physical object, such as a painting or a dance, to an

observer. The shape of a painted or sculpted form or the shape of a danced movement, says Langer, is somehow also “the form of a feeling.” The supposed congruence of the two explains, so the theory goes, why visible form conveys feeling.

Scruton (26) takes up this same formalist approach in discussing architecture: What is to an animal merely a heap of stones, is to the human eye a cathedral, Scruton claims, because human intelligence can grasp emotional content *in* architectural form. What makes humans capable of the emotional responses appropriate to art, say the formalists, is a function of the intellect whereby it “intuits” a form’s emotional content, finding in a physical shape what Langer calls “forms of feelings.”

Maxine Sheets-Johnstone, who writes prolifically about dance, adopts Langer’s key phrase when she regards the forms of danced movement as “congruent” with “the forms of feelings” (Sheets-Johnstone, 1966, 2010; Sheets-Johnstone, 2011). The audience at a dance performance, Sheets-Johnstone argues, “gets” the emotional meaning of a dance because the dancer’s movements are *congruent with* the forms of familiar emotional feelings. Particular shapes or forms of movement are what the dancer counts on to carry specific feelings from her bodily gestures to her audience.

The problem with this explanation of artistic expressivity is that *feelings do not have shapes or forms*. Feelings, which do not exist in space, are not the sorts of things that can have shapes. It is only as metaphor that we can speak of a “form of feeling” but to employ this metaphor is to assume one’s conclusion, namely, that expression depends on intellectual intuition of non-spatial “forms.” Worse, the error of treating feeling as something that can have shape then infects the crucial notion of congruence. Congruence is a relationship between two shapes such that one shape may be perfectly fitted over the other. “Congruence,” like the “shapes” whose relationship it describes, applies to *spatial* objects. Feelings cannot be said to be “congruent with” anything.

The notion of “congruence” as used here, however, does not fall to this criticism. Feelings, on the Damasian model, are private mental events that are correlated with *actual patterns* of muscle tensions, and muscle tensions are real bodily events that do, in fact, occur in space. The Damasian model permits us to articulate precisely how a felt emotion may be considered to have a form: The form of an emotional feeling its *correlate dynamic pattern of kinesthetic tensions* throughout the body. *In this sense only* can the shape of a dancer’s bodily movement or the movement of a melodic line be thought to be “congruent” with a feeling or, as here, congruent with each other. The feeling itself is *not* described as having a shape, but only as being reliably correlated with patterns of muscle tension, the underlying unconscious e-motions which *do* occur in space .

The key to arriving at a notion of “congruence” that furthers reasonable explanation is to bear in mind that

“kinesthesia” refers to *both* a sensation and a perception. As sensation, the word refers to reflexive movements of the muscles throughout the body and their consequent electrochemical messaging to the brain; in this respect, kinesthesia is a matter of internally-sensed movements. As perception, kinesthesia refers to the felt quality of the sensation, the way the internal pattern of muscle tensions is represented to a self. Such representation is what we normally call a felt emotion. Whereas the sensation of kinesthesia does, in fact, occur in specific *spatial* patterns, the whole-body conscious perception of that pattern is a felt quality which is not locatable spatially. Kinesthesia is both a mind-event and a body/brain-event. The double nature of kinesthesia accounts for the precise and reliable correlation between a spatial shape and a feeling: They are two sides of the same phenomenon. It is only when kinesthesia is accurately understood that we can make proper sense of the phrase, “forms of feeling” and thus use the notion of “congruence” accurately and meaningfully.

### ***Is The Neurobiological Model Mechanistic?***

Is the link between music and dance a mere mechanism? Input some music, get a dance? Not really.

The mediating factor in this model is emotion as Damasio defines it. His account of the process whereby an external stimulus produces electrical and chemical events in receptor cells is a familiar one, as is his account of the process whereby such reactions are registered as electrochemical events in the brain. These unconscious processes occur in even the lowest forms of life and are in every respect mechanical.

However, the Damasian model considers that electrochemical brain processes must be “represented” to a conscious self in order to be experienced as feeling, and it is at this critical point that the model moves beyond mechanism to consciousness. Unconscious emotion, the link that establishes congruence between heard music and performed dance constitutes the neural underpinning to what is consciously experienced as the feeling of the music *and* the feeling of dancing to that music.

Does this explanatory model characterize dance as an involuntary response? Does the dancer not have a choice about what sort of dance to do, or about whether to dance at all? Well, of course she does. Not every instance of hearing music is an instance in which we get up and dance. But we do, often enough, *feel like moving* when we hear music. We nod our heads or tap our toes or make small gestures with our hands. Music, as both Plato and Aristotle pointed out, (Sekuler, 2012; Aristotle, 1962) has the power to move us; but we have sufficient power to resist. An emotion generated by art arises apart from a lived context; it is, as both Bull and Clynes demonstrated, an *attenuated* emotion. Modeling a musical line at best *suggests* that we move and *suggests* the

sort of movement that would be appropriate.

The formal dynamic characteristics—duration, acceleration, direction, intensity—of dance movement will be discovered in the dynamic characteristics of the emotion generated by the music, but the subject experiencing that emotion can decide whether to yield to it. A feeling of intense rage at a bully may urge the victim to hurl a brick at his provocateur, but the victim can resist that urge. As it is merely an “attenuated” emotion that urges us to get up and dance, we should understand that that urge can be even more easily resisted. So much more so are we free to resist the “attenuated” emotion that urges us to get up and dance. The emotional response to music merely establishes the dynamic structure of the dance, what a dance would be like should we allow the music to have its way with us.

The sensual, languorous quality of a tango’s melodic pattern is manifested as bodily movement in the sliding, dipping, sweeping movements of tango dance; the barely-suppressed hurt and anger of flamenco singers, clappers and guitarists is echoed by the posturing and gestures of the flamenco dancer. In each case, the dancers are “moving to the music.” What an adequate understanding of kinesthesia and of recent developments in neuroscience provides is an explanation of how all these come about. It is only because emotion, which mediates between the music and the dance is itself *movement* that the experience of being moved *by* the music is connected to the experience of moving *to* the music. A single *pattern* of movement imbues both the music and the dance. Anyone who doubts this should attempt to dance the Lindy while listening to the *Liebestod*.

### **Dancing With Mirror Neurons**

In the 1990’s, researchers in Parma (DiPelligrino et al., 1992) isolated the neural underpinnings of a familiar phenomenon: monkey see, monkey do. When a researcher grasps a peanut, a monkey does likewise; when the researcher puts the peanut in his mouth, the monkey does the same. Working with macaque monkeys, the research team located the precise neurons that account for this behavior (Winerman, 2008).

These same “mirror neurons” have now been confirmed in humans. Humans, it turns out, really are wired to mimic motor behavior that they observe in other humans. But motor behavior, we now know from Damasio, is what generates felt emotion. A human mimicking another human, then, must experience something akin to that other human’s emotions: When I see you wince and clutch your hand to your heart, I imaginatively model your movements and ...I feel your pain.

Well, not *your* pain exactly. I feel, as Clynes and Bull both demonstrated, an “attenuated” version of your pain. Additional research on mirror neurons supports the

distinction Clynes and Bull both drew between casually struck postures and “faked” movements on the one hand, and those that are actually motivated by survival-based impulses on the other.

Mirror neurons respond equally when a subject performs a specific action as when that same subject witnesses another perform that action. Neuro-imaging demonstrates that an actual feeling of “disgust,” for example, activated the identical neurons in the brain as are activated by watching someone else experience disgust or “look disgusted.” The same area of the somatosensory cortex was activated both by lightly touching a subject with a feather duster, and by having the subject view pictures of someone else being touched in the same spot (Thomas, 2012).

The neuronal underpinning of Wolfflin’s “sympathy” will likely turn out to be the mirror neuron; Wolfflin’s notion that we are hard-wired to model the movements of other humans is now experimentally verified fact. The implications for dance aesthetics are enormous. Whereas we previously needed to rely on the questionable notion of “sympathy” to account for how dance movements convey the dancer’s feeling to her audience, we now understand that mirror neurons account for the modeling whereby an audience member comes to feel what the dancer conveys by her movements. In the case of dance, at least, modeling occurs pretty much as Wolfflin supposed. Mirror neurons now fully explain the empathic loop running between the movements of others and the feelings such movements engender in those who observe them.

### **Dancing With Others**

In his article on “popular dance”, Crease (2002) considered the source of our pleasure in the kind of dancing that usually takes place in a dance club. In such a situation, the dancers are dancing “for themselves,” for the sheer pleasure derived from their own bodily movements. The dancer in such a situation, Crease says, enjoys the kinesthetic responses his own body makes to the music *and to the surrounding dancers*.

As Clynes demonstrated-- and as the experiments with mirror neurons confirm-- body movement is *contagious*. Far from being a metaphor, contagion, we now know, is a fact of neuroscience: human bodily movement seen by another human is modeled by that other human in ways that reproduce, albeit more faintly, the feeling generated by the initial mover’s movement. It follows that even when I dance only for my own pleasure, I communicate my feelings to others who may happen to be watching me, whether or not I intend that result. In this way, I “move” those around me to join in my dance. Such is the infectious nature of the dance club, a characteristic that draws to it people in search of the pleasures of dance who, as Crease views it, may find it difficult to let go and

improvise dance on their own (Crease and Robert, 2002).

Of course, for Nietzsche (1872), music itself is a powerful social integrator, instigating that loss of self-consciousness that allows individuals to break free of restraints and cross the boundaries that ordinarily separate them. Music promotes a sense of oneness, a feeling that drives social bonding. In a dance club, then, it is *both* the music and the dance movements of others that draw an individual onto the dance floor and into the dancing crowd. Both the music and the dances of others move us. As Crease goes on to remark, social dancing presents the social bond not as a sacrifice of personal interests for the sake of others, but as something intrinsically pleasurable and desirable. Being with and for others is experienced as fun, and this is how both music and the dancing it encourages ultimately serve a moral function. Perhaps Aristotle, an astute biologist, guessed, even then, that we would someday discover mirror neurons in humans.

The dancer who is “dancing for his own pleasure” inadvertently draws others to him because those who watch him are reflexively led to produce movements congruent with his. This congruence is helped by the dance music for, as Clynes demonstrated, kinesthetic patterns may be congruent over a variety of modalities: A heard musical line or musical rhythm has cognates in all the other sensory modalities.

In a dance hall filled with people modeling the same musical line, most will soon move in similar ways; when they are also mirroring the same dancers’ movements, their dances become more similar still. With similar movements come similar kinesthetic perceptions, that is, similar feelings. In the dance hall, then, dancers approach experiencing a single felt quality, a shared emotional experience, with all the social outcomes that entails.

## Conclusion

Philosophers have always known the extraordinary power of music to move us, and everyone would agree that often it moves us to dance. Choreographers have always known that different kinds of music—different melodic lines, rhythms, tempos, harmonies—demand different dance gestures. No one doubted that deliberately crafted dances are shaped to “fit” the music that accompanies them. Whether the dance is arranged to suit the music or the music selected to fit the dance, there has always been a sense that the two must be somehow “congruent.” What contemporary neuroscience allows us to discover is precisely what that “congruence” consists of and just what is congruent with what.

Specifically, the neurobiological model distinguishes two levels of experience. At the unconscious level, sensation, *actual movement* occurs as reflexive muscular contractions or expansions which stretch the spindle cells lining the muscles. In responding to the complex stimuli

of ordinary experience, many such movements are activated throughout the body in *patterns* specific to each type of circumstance. When these patterns of actual internal movement—kinesthetic patterns—are made conscious as representations of the body’s state to the self whose body is involved, they are *felt* patterns. Consciously felt movement is emotion; each pattern of such movement can be correlated with a specific named emotion. Thus kinesthesia, the sensation of internal movement, becomes in consciousness a perception, an emotion which is also sometimes referred to as kinesthesia.

With careful attention to the double sense of “kinesthesia,” we can connect kinesthetic patterns to specific emotional feelings, and by understanding emotion as a dual event—kinesthesia as unconscious sensation and kinesthesia as felt emotion—we can grasp precisely how emotion forms the conceptual and neurobiological mediating link between music and dance. Neuroscience thus lays bare the physiological underpinnings that explain what happens “when the music moves you.”

## Note 1.

What has not been empirically tested, so far as—and what mirror neurons do not explain—is whether the same hard-wiring that makes it possible to accurately feel and know the subjective affects of other *humans*, also makes it possible to accurately “read” the body postures or forms of *non-human* objects, such as architecture or abstract sculpture. Wolfflin believed “sympathy” endowed non-human forms with feeling. It remains an open question whether such anthropomorphic sympathy in fact exists as part of the neural wiring of the human brain. Clynes noted that one of the conditions for contagion of feeling to occur is a formal symmetry of biological form; that is, monkeys and humans can “read” one another’s body language because of the similarity of their bodies’ structures, but it is impossible for a human to as easily “read” the body language of a spider or a turtle. To the extent that a human possesses something of the form of a building—uprightness in defiance of gravity, say—it might make sense to Clynes that humans instinctively “trace” or “model” works of architecture. Certainly, it makes sense to imagine human modeling of some representational works of sculpture. Whether neuronal underpinnings exist that would explain the way static visual arts convey feeling remains to be investigated. So far, however, it appears that neuroscience supports Aristotle’s distinction between the ways visual and musical arts “move” us.

## Conflict of Interests

The author has not declared any conflict of interest.

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