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SELECTED PAPERS (1972-1993) ON SENTICS AND MANFRED CLYNES

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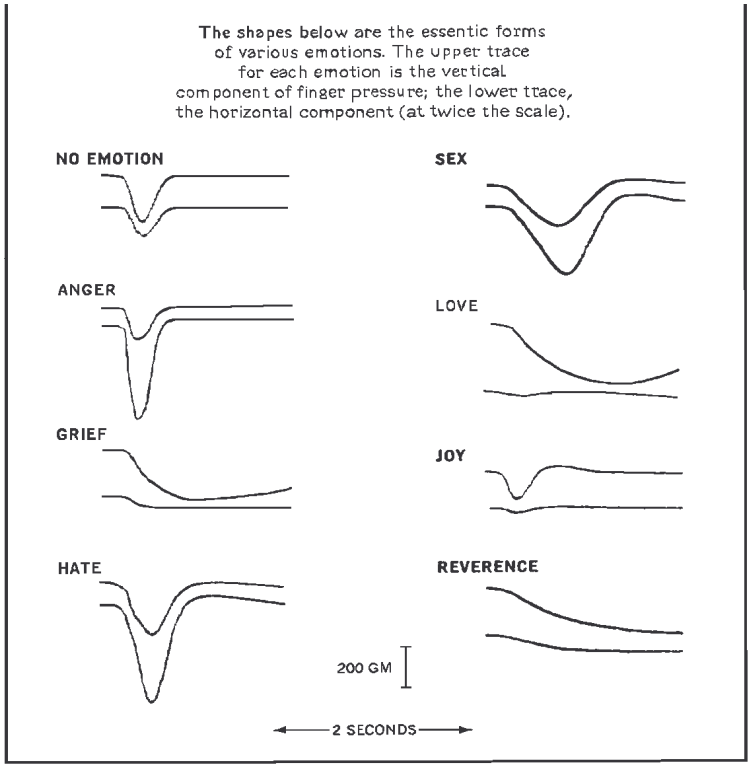

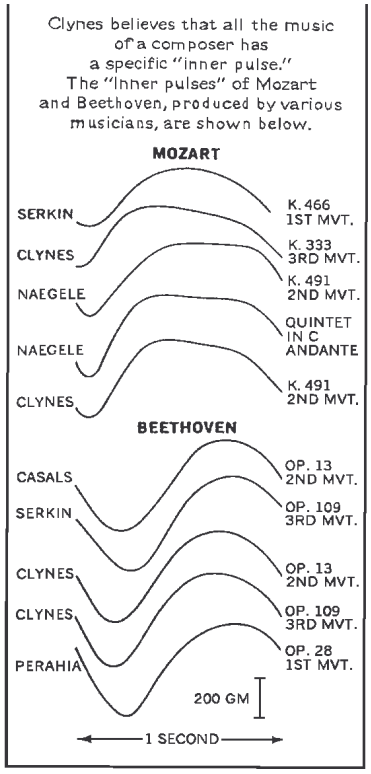

Figure 1A Figure 1B

Figure 1A: Essentic forms of emotions: When people are asked to push a button while they experience particular feelings, the patterns of pressure on the button approximate these averaged 'pure' forms (essentic forms). The upper lines represent downward-upward pressure, the lower lines forward-backward pressure.

Figure 1B: The "Pulse" of two composers (Mozart and Beethoven) performed by different artists.

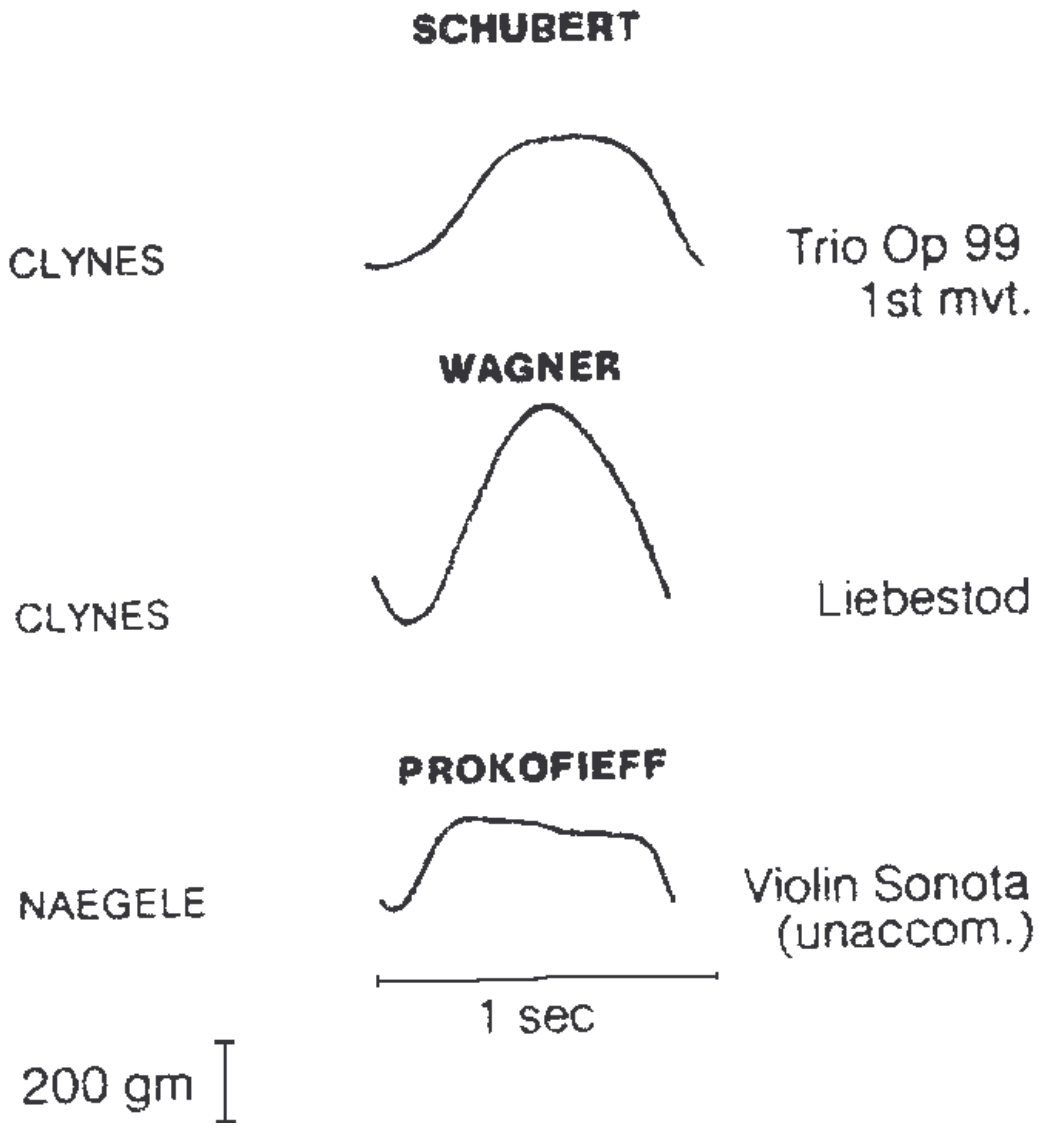

Figure 2: The "Pulses" of three other composers (Schubert, Wagner and Prokofieff)

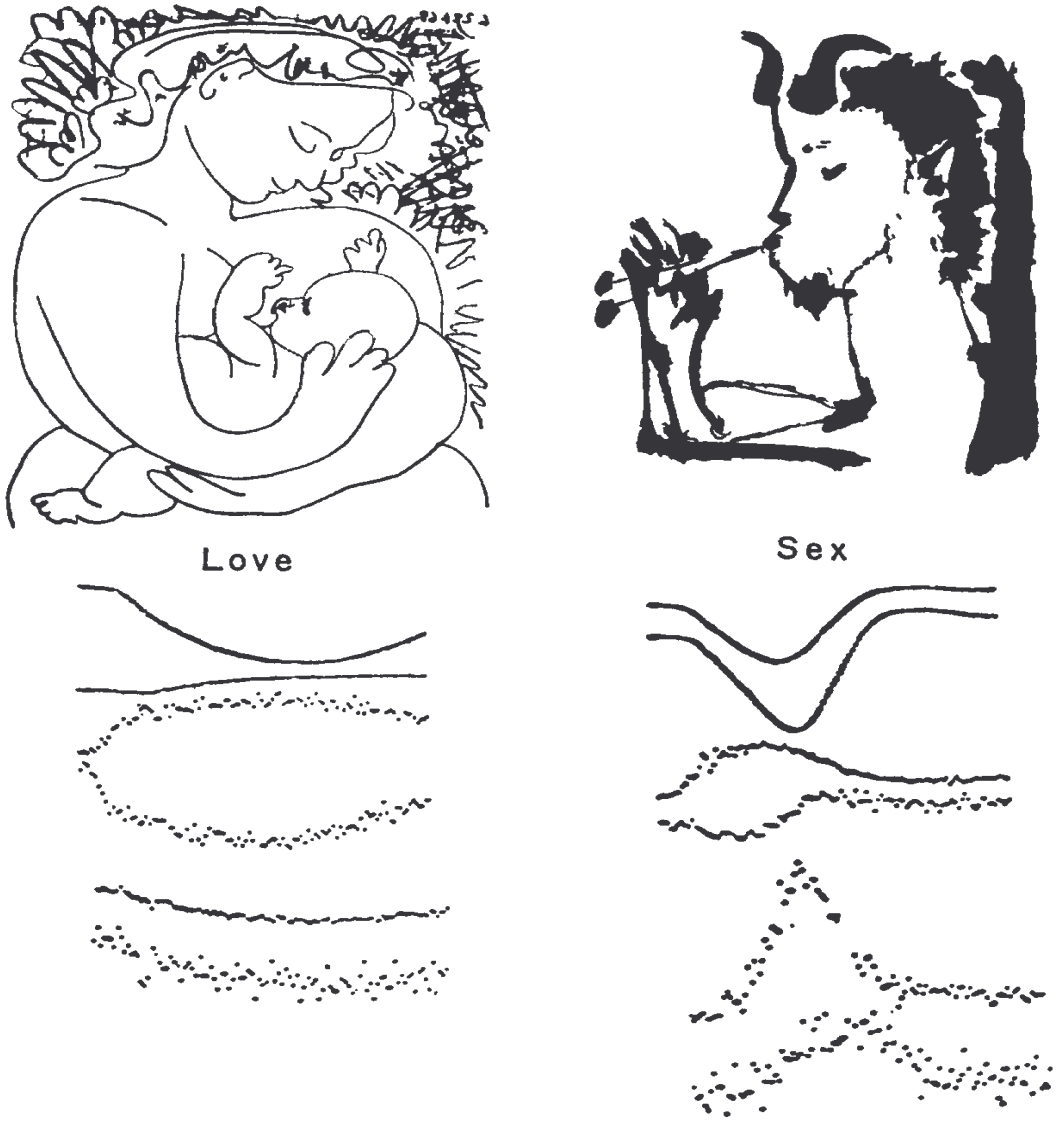

Figure 3: "The essentic forms of love and sex and their associated muscle activity as compared with drawings by Picasso of mother and child, and Pan, respectively. There appears and analogy between the special rounded forms of the mother and child drawing (embracing and enfolding arms) and the measured essentic form for love. An embrace as illustrated visually and its dynamic tactile representations in the essentic form show resemblance. On the right the accentuation, and particular angularity of the horns, arms and shoulder with the strong dark accents and implied thrusts compared with the measured essentic for of the sexual quality with its secondary accents of muscle activity. It would seem as if the dynamic visual impressions, communicated by a great artist, correspond to the biological shapes of expression as measured through essentic form. In obtaining the pure essentic forms one is not too far removed from some aspirations of the artist." (Clynes, M. 1970, "On being in order," Zygon: Journal of Religion and Science, v. 5, #1, 65-84, Figuare7)

1. ON MAKING GREAT MUSIC

By Sidney Stevens, High Performance Review, Fall, 1992, pp. 65-68

Pinpointing what makes some music great over merely good is no easy task. HPR asked some experts to try.

If you love music, really love it, you may remember moments when your full attention was turned to the sounds and suddenly they seemed to envelope you and fill some deep place inside you. And, when the music stopped, you may have felt as if you were waking from some profound dream, having glimpsed some inner richness and magic, some wondrous new world of higher meaning. Indeed, those who have basked and revealed in the spirit of music never forget it.

Not all music, though, has the power to mesmerize and uplift. Clearly the "greatest" music, created by the "greatest" composers and played by the "greatest" musicians is most likely to do this. But what is it that makes music great?

Dr. Douglas R. Hofstadter, a Pulitzer Prize winner, cognitive science professor at Indiana University, and composer, suggests that all great music shares three things: It appeals to a fairly large audience; it has an enduring originality that invokes strong emotions in people; and it may contain certain structural properties that he believes have yet to be clearly delineated.

First of all, for music to be great, it obviously has to be judged great by someone. An audience -- an appropriately sized one with certain key members-is essential, says Hofstadter. It cannot be too large, nor can it be too small. Many people, he says, mistakenly believe that only a relatively small, very high-brow, audience can appreciate greatness. "We tend to think (great) composers must be part of some extreme or 'out there' but in some way their tastes have to be very central. Their own natural responses are actually resonant with a large number of people," he notes.

That's not to say, though, that those in the upper echelons of social and intellectual thought aren't the ones who first deem it great. The larger audience, says Hofstadter, must contain what he calls the "opinion makers," those "at the top of the pyramid where influence emanates." Greatness, however, is much more than the size and composition of its audience. According to Hofstadter and others, great music must also challenge and haunt its audience. It must touch people in a complete way--from the gut-level all the way up to the loftiest spiritual and intellectual centers of the mind.

For most of us, says Robert Abramson, a composer and music professor at New York's Juilliard School, the word that comes to mind when we describe great music is that we were "moved.."

"I take it quite literally," he says. "People mean they really felt movement. Some performers play technically well, but they don't move people, while others can make all kinds of mistakes and still move people."

Dr. Jenny Boyd, whose... book Musicians in Tune chronicles the creative lives of 75 contemporary (mostly rock) musicians, believes that great music taps what Carl Jung called the "collective unconscious." It was his belief that everyone shares a world, or group, soul, in which certain common ideas, symbols and motifs are somehow built into our psyches. These "archetypes" seem to show up repeatedly throughout history in literature, mythology--and less literally in music. Boyd believes that great musicians are the ones most able to seize those motifs from the collective unconscious and bring them to life in sound. They are the ones who capture the essence and spirit of our times and immortalize it. "Artists have an extra-special antenna," she suggests. "They pick up on these feelings and communicate them. They touch that part of us that we have difficulty expressing ourselves."

Put another way, creative geniuses "touch upon truths or feelings that are universally shared," says Dr. Howard Gardner, a Harvard professor and author of the ... book The Creators of the Modern Era. And, these truths must not only be communicated in an understandable way but must be presented in some unique way that continues to surprise and transport us even after repeated listening. In other words, for music to be great its originality must stand the test of tune. It must continue to sound fresh, even groundbreaking, across the centuries and to generations of new ears.

Another property of greatness, the structure of the music itself, according to Hofstadter, is less easily defined. In one sense, perhaps it boils down to something jazz man Duke Ellington once said, "If it sounds good it is good."

Indeed, music theorists have yet to really pinpoint or quantify those elements of composition, if any, that make music most appealing to us -- thus great. In Western music, says Hofstadter, greatness is usually linked with the idea of tension and resolution that runs throughout a piece or music. Theorists, though, are a long way from actually understanding what particular sounds, and in what combinations, produce these feelings of conflict and release. "I don't think we realize the extent psychological perception plays," he observes. "Most of these theories fail to take human psychology into account."

That's not to say that scientists and others have given up trying to unlock the structural mysteries of great music. Dr. Manfred Clynes, for instance, a neuroscientist and accomplished pianist (he studied with Pablo Casals), says it's not only possible to scientifically delineate those sound shapes the human ear finds most meaningful, but he has actually programmed a computer to play interpretations of Mozart, Schubert and Beethoven compositions, among others, with all the spark and emotion he says these composers meant their music to have. What's more, he contends, nearly everyone can learn to play (at least get a computer to play) with this level of feeling and emotion.

Clynes' basic premise is very simple. First, he says, all emotions -- grief, joy, love, hate -- are coded into our nervous systems and each is elicited by its own specific trigger-kind of like a lock and key. The better the "fit" of the trigger, the more cleanly and perfectly an emotion will be unlocked. Second, because music elicits emotional responses in listeners, the more clearly a performer can convey these emotions in the music the better the music. He began investigating his theory by testing volunteers on a sentograph, a highly sensitive instrument he devised that measures and records the smallest nuances of pressure applied by a fingertip. When Clynes asked the volunteers to use finger pressure to express various emotions, he discovered that each emotion had a corresponding "pressure print." Even more interesting, he found that these shapes were universal across cultures, suggesting that our emotions are, indeed, pre-wired. [see Figures 1 and 2]

Clynes also discovered that when great artists, among them Pablo Casals and Rudolf Serkin (who were subjects in his experiments), conducted on the sentograph as they mentally rehearsed the music, the resulting finger-pressure patterns shared strikingly similar characteristics for each composer. In other words, different Mozart sonatas elicited the same pulse patterns from all the subjects. Clynes had hypothesized that all great composers of the 19th century have an inner pulse that is theirs alone -- a glimpse of their intimate personal nature that can be precisely measured, recorded and reproduced. [see Figures 1A and 2 at the beginning of these papers]

According to his theory, music is experienced as a double stream. One stream is the repetitive pulse revealing who tells the story and the other is the unfolding emotional story of the music. Our central nervous systems perceive both streams simultaneously.

The greatest composers, says Clynes, are the ones that best arouse our emotions, conveying most clearly and purely the shapes and patterns of these emotions that are programmed in us. Their music is most moving or satisfying to the brain-and thus considered great.

Unfortunately for us, Clynes laments, composers are unable to clearly translate their feelings, subtleties of emotion and meaning (which he calls the "microstructure" of the music) into their musical scores because of the limitations of musical notations. We are hopelessly dependent, he complains, on musicians and conductors to revive the microstructure each composer intended. However, after years of deadening music lessons, most are not up to the challenge. "If you play it the way it was written it sounds terrible" he notes. "You need to resuscitate it. You need to put the microstructure back in to get the original musical thoughts out." Great music, after all, is only as good as its interpretation, he explains.

Thus, Clynes set out to resurrect dozens of musical scores by several composers. First, using a computer to produce the tones, he discovered precise mathematical parameters for the pulses of various composers by assigning numerical values to the minutest aspects of musical tone groups of a particular composition, including relative loudness and duration of each tone. He could then use these numbers to help play these pieces to their fullest effect, varying parameters to change the musical meaning.

Clynes has since licensed a company, Microsound International in Sonoma, CA, and …[has marketed] his programs to the public. With them, he says, everyone, and particularly non-musicians, should be able to take the basic score of any work on disk, feed it into a computer, and add their own interpretation on top of that-in essence, creating great music. Clynes believes it can be used in schools to teach real musicality, to show, for instance, how small changes in the music can change the emotional quality.

Likewise, professional musicians can use it to improve their playing. Already, Abramson of Juilliard uses a recording of composers' pulses to release his students from the tyranny of their musical training. By having them conduct along with one of the computerized works, he says, "their bodies become a receptor. It's not just their ears hearing it. They begin to feel it in their muscles and begin to think 'How can I get an audience to feel this?'"

But should everyone be able to play music brilliantly? Absolutely, says Clynes. Music can touch us in unimaginable ways, making us stronger and better. "Too many people think classical music is boring but it's not boring when played well," he says. "It enlarges our view of life. Great music opens up visions for us. If it communicates love, then it opens us up to love."

For purists who believe that greatness is -- and should remain -- a rare gift, not to worry. No one, not even Clynes, has yet developed a computer that can compose its own truly great music or one that allows any of us to do it. Clynes' program only helps composers assign a set of numbers to define their own pulses so they can publish a microscore to ensure their music is played as they want it to be, but that doesn't mean the music is good to begin with. Other attempts at computer-generated music are still judged to be too mechanical.

Hofstadter dismisses the idea that it will ever be possible to program the secrets of brilliant composition into a computer. Artificial intelligence experts, he notes, have yet to define that mysterious combination of wiring (or genetics), emotions and experiences that great human composers have. "I'm the first person to laugh at and deride the notion of a computer that, say, has a Chopin setting. You push a button, and you get a new Chopin piece," he says "It's a very disgusting idea -- like saying that the depth of the music is in some sense an illusion."

Still -- with everyone complaining about all the bad music out there, can we fault someone for trying to bring us more that's good? Says Clynes, "Music is in a dying stage in our society. It's all commercially driven with only a small range of expression. We don't get any real joy from it. Humans are a singing, dancing animal. Everyone should play (or produce) wonderful music."

1.1 Summoning The Muse

To most of us, inspiration is probably as foreign and unfamiliar as some distant, unseen galaxy. Rest assured, the process by which music is created is not much clearer to those who actually do the creating. Even a great composer like Beethoven was stymied by his abilities, in awe of the muse that often visited without notice or bidding. Musical ideas, he said, "come uncalled, sometimes independently, sometimes in association with other things, stirred into being by moods which the poet would translate into words, but which I put into sounds; and these go through my head ringing and singing and storming until at, last I have them before me as notes."

Every composer, according to Aaron Copland in his classic book What to Listen, For in Music, begins with a musical idea. These ideas come in many forms, such as a one-line melody or unusual rhythm, sparked by any number of emotions, thoughts or events. For a few rare composers like Franz Schubert, symphonies and songs seem to rush out spontaneously in nearly finished form, Copland notes. More common, though, are the composers that take their musical ideas and expand upon them, molding and sculpting them into completed works. Beethoven, says Copland, was such a musical creator.

In her ... book, Musicians in Tune, Dr. Jenny Boyd theorizes that musical inspiration wells up from the unconscious almost like a gift from somewhere else, usually when the conscious, or rational, mind is at rest or suspended, as it is just before sleep, or in meditation. Many musicians, says Boyd, are compelled, almost driven to create when an inspiration comes, unable to do anything else until they get it down.

For some, the moment of inspiration is spiritual or magical. Psychologist Abraham Maslow called this a "peak experience" -- the moment when a creator suddenly feels at one with the creation. Lost in the moment, at the highest level of human perception and understanding.

Interestingly, Boyd found that peak experiences are contagious. Other musicians in a band, as well as the audience, are sometimes mesmerized and transported into a similar state by a single musician in the grip of peak playing.

2. MEASURED RESPONSE DO EMOTIONS HAVE SHAPES YOU CAN SEE AND THEN REPRODUCE? MANFRED CLYNES'S 'SENTOGRAF' FINDS DISTINCT PATTERNS IN MUSIC AS WELL AS LIFE: CONSTRUCTING A NEW GIGGLE

By Timothy K. Smith The Wall Street Journal, Monday, September 23, 1991, Vol. CXXV NO. 5

New York -- When a man with a unique beard announces that Beethoven's last quartets are actually storage devices for novel emotions -- emotions that he can now reproduce with an Apple computer -- some sort of background check is in order.

Now then: Who is Professor Manfred Clynes, and what are his scientific credentials?

Professor Clynes, an esteemed neuroscientist, formulated the basic biological law that explains, among other things, why it is impossible to smell the fading of an order. He also invented the machine that was for many years the standard laboratory device for measuring brain waves.

Fair enough. And his musical credentials? Prof. Clynes has performed piano recitals to great acclaim on three continents. He studied with Pablo Casals. Sir Yehudi Menuhin, the violin virtuoso, calls him a friend and "a brilliant musician."

Well. And his literary credentials? Prof. Clynes is a published poet and the author of five books. He coined the word "cyborg." He also coined the word "sentics" to describe a new science entirely of his own devising.

Anything else? A fan letter from Albert Einstein maybe? "Your art combines a clear understudying of the inner structure of the music with a rare spontaneity of expression...! am convinced that you will meet with the understanding to which your achievement entitles you," Einstein wrote to Prof. Clynes in 1953, after hearing him perform a program of Mozart, Beethoven and Schubert.

Why have few people heard of so eminent a polymath as Manfred Clynes? For one thing, the 66-year old scientist [1991] has spent the past 12 years in Australia. For another, "He's working on things that are so far out that people don't follow up on them much. It's time that more people looked into them," says Marvin Minsky, the Harvard scholar and dean of artificial intelligence research.

2.1. Papable Feelings

Prof. Clynes proposes that when human emotions are expressed, they have shapes -- real ones, shapes he has measured with a machine, the same from one person to the next, as recognizable (and reproducible) in a painting, a gesture or a song as in a frown. His proposition is so embarrassing to traditional scientists that when he first presented a paper on the topic, at a conference 1968, the audience laughed out loud.

But he has been refining his theory ever since, and influential thinkers are taking notice. "I think artificial intelligence isn't going to approach human capability until it understands that emotions aren't really separate things, but different kinds of knowledge," says Prof. Minsky. "That's one of the reasons the field is stuck."

Perhaps, some day, Prof. Clynes's work will enable computers to feel, and then we will have a few words with them. But his theory actually has far more immediate implications. If he is right, it should be possible to measure reverence. It should be possible to experience a new kind of laughter. It should be possible to sit down with a musical score and an unfeeling computer and synthesize a performance of Beethoven that is as Beethoven meant it to be played. All these Prof. Clynes says he has done.

2.2. A Different Voice

The music Prof. Clynes has produced is still recognizable as synthetic -- synthesizers aren't yet up to producing sounds absolutely faithful to instruments. But it is also recognizably moving. "I threaten my students with it." says Robert Abramson, a professor of music at New York's Juilliard School. "I say, This is what a computer can do. Can you do better?"' And Prof. Clynes' music is, as much as anything, a demonstration of his ideas about the brain -- a logical approach, as music contains a much richer vocabulary that words do for conveying emotions.

The root of Prof. Clynes' theory goes back to his boyhood in Vienna, where his father designed paddle-wheelers that steamed the Danube, his mother wrote plays and studied physics, and his maternal grandfather invented the soda siphon. "When I was a child, I used to have these wonderful moments of ecstasy that seemed tremendously important. And I assumed that other people had them all the time; only much later I found out that wasn't the case."

His family migrated to Australia in 1938, and there Prof. Clynes studied music, engineering, physics and mathematics. Eventually his path led him to biocybernetics research laboratories at Rockland State hospital in Orangeburg, N.Y., where he took some transistors and a tape recorder and built the first Computer of Average Transients for measuring human brain waves.

After hooking up his invention to the scalps of many volunteers, Prof. Clynes made a startling discovery: Different people's brains respond in the same, orderly, predictable way when stimulated by the color red. Prof. Clynes began to wonder whether the process could be reversed that is, whether inner states would register uniformly when different people were hooked up to an output device. So he built another machine, an exquisitely sensitive instrument for measuring the pressure applied by a fingertip, which he called a sentograph.

Casting about for a way to test his hypothesis, he remembered the observation by a German musicologist that experienced musicians, when asked to wave a finger to

"conduct" pieces by different composers, tended to produce patterns, or shapes, that were characteristic for each composer. He hooked himself up to his sentograph and thought his way through pieces by Beethoven, Mozart and Schubert, and sure enough, the printout showed that his finger pressure made clearly different shapes for each composer. Were they just his own shapes? Or were they somehow absolute?

Here Prof Clynes verified his findings using the fingers of Pablo Casals and other accomplished musicians, and was able to derive shapes representing the "inner pulses" of different composers -- not unlike the brush stokes of different artists. He concluded from this that touch expression and musical expression have the same origin in brain function. Could it be, he wondered next, that emotions themselves were similarly hardwired, as firmly rooted in physiological reality as is the genetic code?

He hooked his sentograph up to hundreds of subjects, recording the patterns they made when asked to use finger pressure to express anger, lust, hate, joy, reverence and other conjured emotions. [see Figure 1A] He took the machine -- a pre-industrial-looking thing in a wooden box -- to Mexico, Japan and Bali to factor out cultural bias. The shapes of emotions, which he called "essentic forms," were the same wherever he went. The experience of a given emotion and its expression, he concluded, were an indivisible unit, programmed in the brain. That explained why emotional communication was so often unambiguous: why children cringe at scowls, why Michelangelo' Pieta evokes grief, why the whole word knew what Khruschev meant when he banged on a desk with his shoe.

It might also explain why some music is great and other music is not great why, in Prof Clynes' words, "anyone who has heard Beethoven's last quartets tends to become stronger." First he discovered mathematical parameters for the "inner pulses" of various composers, and then he set to work programming a computer. He used the program to manipulate phrases, amplitudes, individual note shapes and infinitesimal pauses, looking for essentic forms in music that would give maximum satisfaction to the brain -- the kind of satisfaction that his own young brain had experienced listening to Casals.

2.3 Music's Measure

Lest this seem like labour that only a monk could love, Prof Clynes quickly points out that it still depends on a programmer's artistry. Overcoming the tyranny of technique, it allows a musician to refine a performance outside of time -- to stop, back up and fix phrases at an unprecedented level of detail, working like a sculptor toward an ever-more prefect sonata.

There are sceptics. "We will never have great performances coming through that route," says Yehudi Menuhin. "It's like using a thermometer. It tells you something about what's going on, but it doesn't cure anything-"

And there are believers. "We have taught [musicians] to read the notes, but not the music." says Juilliard's Prof. Abramson. "What comes out is a simulacrum of music,

without any of the meaning. [Prof. Clynes] is showing people that there are ways of actually transmitting emotions in music. But this is stuff that nobody can talk about."

Prof. Clynes has obtained patents on his computer program and set up a company called Microsound International Ltd. in Sonoma, Calif., to refine it.

About that new form of laughter: Try putting your middle finger on a flat surface, setting up an internal giggle and preventing your throat from moving. Now press down with your finger, about five beats per second. If you get it right it can be hard to stop.

3. BREAKING THE CODE OF MUSICALITY

Special Issue of the Brain/Mind Bulletin, January 21 and Feb. 11, 1985 Vol. 10, Nos. 4/5

How does music achieve its meaning? Why do we say that a piece of music is "sad" or "happy"? What emotional structures in human beings resonate with musical expression?

A neuroscientist-concert pianist in Australia has revealed a dramatic predictive connection among music, the nervous system and emotions.

The implications are impressive. Manfred Clynes has answered long-standing questions about how music derives the power to change states of mind. And he explains why some musicians transcend their more technically skilled colleagues in engaging the listener.

Using what he learned from decades of experiments, Clynes told Brain/Mind Bulletin that he has programmed a computer "to be able to play artistically any melodies by Mozart, Beethoven and Schubert with sensitivity and subtlety."

One clue: He found a correspondence between the *melodic contour* -- the shape of the melody -- and the appropriate *amplitude shape* (changing volume) of individual notes.

This might be compared to the relationship between the dramatic story line of a novel and the varying intensities of images elicited in individual words and phrases. If the novel works, if it is "moving," the reader experiences a congruence between the felt intention of the author in telling the story and the choice of words that establish the tone.

Clynes earlier had discovered a phenomenon he calls *essentic forms* -- primary emotional responses. Subjects exerted finger pressure on a sensitive device (sentograph) to express emotions.

Distinct forms were found for anger, love, grief, sex, reverence, joy and trust. [See Figure 1A at the beginning of these papers; for further background, see section 4 following.)

When he mathematically translated the pressure pattern of an emotion into an actual sound shape, Clynes found that experimental subjects could identify the original emotion from nothing more than that sound.

The phenomenon was cross-cultural. Aborigines listening to the sound accurately named the emotions originally produced by middle-class city-dwellers.

Through this and other exploration, he has now found mathematical equations that could revolutionize the world of music.

Clynes can create emotionally expressive music through:

- Computerized shaping of the *loudness and softness* within individual notes.
- Computerized minute *deviations in timing*.

Such subtleties of amplitude and duration give music its meaning, Clynes said. Music sounds dead and uninteresting without this "microstructure."

Yet a musician cannot mechanistically impose it. Microstructure seems to be almost as unconscious as breathing, a result of the performer's automatic sensitivity.

Because these elements can now be written as a microscore, meaning can be inserted into a musical score by computer.

Clynes compares the composer to a storyteller. The microstructure -- the loudness -- softness shaping of individual notes -- is the emotional content or story. The composer's pulse drives the microstructure. It affects the microstructure of tones with what Clynes calls "a high degree of discrimination and sensitivity." The amplitude can vary by as little as one per cent.

Small differences in microstructure "sharply change the psychological character of the music," Clynes said.

The research helps explain why both critics and music-lovers talk about the performer's sensitivity or "soul" as a factor more vital than technique.

3.1 Turning Musicians into Artists; Music into Science

What will Manfred Clynes' exciting findings mean for the future of music?

Musical forms now become like sculpture, he has suggested. "Time becomes the ally of the artist rather than his inexorable master.

"He can take his time, listening inwardly and outwardly. Like a painter who works for many years on a painting to perfect every aspect, he has the potential to shape the form of music with a subtlety that no human real-time executant can match."

In describing the computerized generation of meaningful musical expression, Clynes pointed out that he is not talking about conventional electronic engineering of sound, which is limited to using simple measurements of the rise and decay of tones. The

Australian government recently awarded him and the New South Wales State Conservatorium of Music a grant to introduce his computer technology into the public schools.

"This new work is exciting," Clynes told Brain/Mind Bulletin. "The research findings are now being proved every second. We have discovered the secret of living music. A 12-year-old child can interpret his own music, complete with nuances. People don't have to spend years studying scales before they perform. It can revolutionize the enjoyment of music."

With Clynes' program, which is being patented internationally, a computer can customize amplitude shapes for individual tones of a melody -- even if the music was composed for instruments incapable of such a modulation. Modem technology "lets us create the most subtle musical forms with discrimination, stability and repeatability beyond the power of any living musician."

Musical pulses apply to ethnic music, baroque music -- in fact, any music in which there is a repetitive beat, including jazz and rock. Rhythmic accompaniment is not the only dynamic factor.

In most synthesized music, the melodic line is essentially unmodulated in intensity by the pulse, Clynes said. "Pulse should affect both the melody and rhythmic accompaniment in an integral way. Only then is the living character fully realized."

3.2. Musical Law Reflects Deep Principles, Untold Secrets

Connie Zwieg

In a masterly joining of science to art, Manfred Clynes has begun to break the code of musicality. A pianist and neuroscientist, he has unearthed some of its deep and simple laws, opening great questions for reflection.

A mathematical set of relationships lives between the composer and the performer. Do the great performers tap into the M[ind]-field of a composer, recreating an original intention?

Music has the ability to elicit pure emotion, deep feeling without personal association. Do composers create new emotions -- clearly they create new feelings -- by blending essentic forms into novel sequences?

Are essentic forms like the wave-form of a "felt sense" passing through the body? Can they teach us about communication and learning, about how feeling is encoded in the human nervous system?

By studying the amplitude curves of essentic forms, Clynes can provide a look into the underlying nature of emotion. Grief, for instance, can be broken down into its parts. Music can be prescribed to release sadness, loneliness, even regret. A different

composition can bring healing -- a sensation of being carried upward, even to be followed by a gentle return.

Application can be highly specific, he said. "The upward sweep is not the result of physical exertion, as in the joyous activity of some of Schubert's works. Rather it is from being carried by an ambiance, almost a swoon -- as if a magic event has occurred. All of that can be implied by a short theme of a few notes played with appropriate nuance and inflection."

Clynes bridges two great traditions. His precise and lyrical language suggests a new possibility for those who respect head and heart:

"These expectations of feeling and of form clothed in microstructure create the flow of music, transporting us, always surprised, into a state where joy and sorrow, love and death can exist in us -- so real that we sit motionless, transfixed, and know we are not dreaming."

3.3. Music's Meaning Lies Beyond the Score

A musical score achieves living meaning. Manfred Clynes says, only when musical microstructure is read into it, both in thought and performance. Music theory until now has primarily considered the relationships between notes of the score.

The structure and microstructure are actually an "indissoluble unity ... a reflection of the subtlety of our own nature. As we study its subtlety, we are amazed at the seemingly unlimited ability to evoke meaningful musical qualities in their pure form.

"This wealth to be unearthed is in fact the secret of art and is also its power to suffuse our state with transcendent experience." Microstructure happens on too short a time scale to be individually controllable. "By thinking the pulse form, with one thought we establish an entire pattern that is then reproduced throughout the piece."

"The experience is therefore much larger than just the elements of the story. It includes empathy with the being of the composer and by extension with all beings -- proof that the most intimately personal is also the most universal."

3.4. Essentic Forms: A Shape Language for Human Emotion

Emotional qualities are expressed through time as what Manfred Clynes calls essentic forms.

His book, Sentics explains how the 'shapes' of joy, anger, love, sex, hate, grief and reverence have been determined through experiments involving hundreds of subjects in various cultures.

These shapes endure for about two seconds [see fig 1A at the beginning of these papers]. As Clynes views it, they are a property of the central nervous system. Their purpose: the communication of feeling.

Essentic forms are common to such sensory modes as touch and sound -- and perhaps more primary. "Essentic form is biologically given and appears to be genetically preserved," he said.

We perceive emotional qualities in music if we are attuned to the "language" in which they are embodied. This is not unlike the way the tone of voice in speech reflects essentic form and is easily understood by everyone in a culture.

The way in which essentic form is embodied in the musical fabric tells a story. It is its "tone of voice."

When Clynes asks people to push a button while they experience particular feelings, the patterns of pressure on the button approximate these averaged 'pure' forms (essentic forms). The upper lines represent downward-upward pressure, the lower lines forward-backward pressure. Breaks in lines represent unevenness of pressure. (see Figure 1A at the beginning of these papers)

3.5. Composer Pulses are Unique

Manfred Clynes

Starting in the second half of the 18th Century, the pulse has marked the individuality of the composer. (see Figures 1B and 2 at beginning of these papers)

If modem electrical facilities had been available to earlier composers so they would have clearly known the varying extent of these deviations, a more precise musical notation might have developed from the needs of musical expression. One may surmise that theorists would have been inclined to study these deviations carefully.

Some 18th Century composers pointed out the power of inflections that needed to be read into the score. Leopold Mozart, father of Wolfgang, emphasized the importance of such inflections.

Different music has different pulse forms. But composers of Western music in the period 1750-1900 evolved an intimate, personal pulse of their own that imbues all of their music.

[Clynes demonstrated the pulse by having musicians like Pablo Casals and Rudolf Serkin listen to several works by the same composer. The musicians "conducted" through finger pressure on the sentograph. See figures 1B and 2 at the begging of these papers]

We can speak of a Mozart pulse, a Beethoven pulse, a Schubert pulse, a Brahms pulse. We have determined the precise character of the pulse forms and how they affect the duration of loudness of individual tones that form a pulse group.

They apply to the entire work of the composer, to both slow and fast movements and to different meters.

As handwriting or a brush stroke of a painter can, the pulse reveals aspects of the intimate, personal nature of the composer, his unique point of view. A Mozart piece played with Beethoven pulse sounds bizarre. But it is not a matter of style -- even Haydn and Mozart have different pulse forms. In the absence of the composer's characteristic pulse, any of his compositions sound unauthentic and unconvincing. It's as if his presence has been withdrawn.

3.6. Clynes on Musical Memory: Initial Pulse Tied to Melody

Adapted from Manfred Clynes

Time form printing is a property of the central nervous system. This function makes it possible to execute repeated movements with only one initial command requiring specific attention.

The initial command determines the shape and rate of the repetitive movement such as a repetitive beat executed by an arm and hand. Full attention is required in establishing the shape and rate of the pattern. Repetition conserves both the rate and shape of such movements -- then can be carried on automatically. Therefore, they can be carried on while the person does something else.

This short-term memory function of the central nervous system is also used in the musical pulse, whether it is manifested by actual repetitive movement or occurs in thought only.

While one thinks the musical pulse, subliminal motor actions take place in a manner similar to those that occur when the sounds of speech are thought. The pattern of the musical pulse, once taken, tends to naturally conserve itself throughout the piece. But it is crucial that the pulse be established initially in its appropriate form with all its subtlety.

The mental shape of the musical pulse as a spatio-temporal form determines to a large extent the subtle character of the music. We now know that it does this in two ways: The

loudness of individual tones of melodies is molded according to the character of the pulse -- the duration deviations of the tones from the arithmetic ratios given in the score (such as a quarter or a half) also are systematically molded by the pulse. Introducing the pulse to a naked score already provides a considerable amount of enlivening.

The brain detects very small differences when hearing a musical phrase or motive more than once. These differences may affect only one note.

A musical phrase may not be perceived as perfect when heard the second time, even though it is played exactly the same way -- as can now be done readily by computer performance.

The second playing needs to be slightly different to escape an impression of a certain deadness. The difference between second shape and first indicates a composer's point of view. For example: in the theme of the third movement of Beethoven's violin concerto, the first five notes are repeated, and here the repetition needs to have a more emphatic statement. A lesser emphasis detracts from the energy of the theme and is too relaxed, while an equal emphasis to the first would be dull.

Even a two per cent difference in amplitude of certain tones is enough to show the difference in a repetition. It provides a point of view of detachment, a "considered" view of the music, from what may appear to be a point of view of eternity rather than ego.

In this way such slight differences give rise to larger differences of spiritual meaning -- and we may say that at the least they are necessary to achieve such meaning.

3.7. Amplitude Shaping Brings Out Emotion

Expression in music does not require vibrato or variation of timbre. Changing the amplitude alone, with tiny variation in the duration of notes, can trigger strong emotions. "This mode of expression, while simple, is not primitive," Manfred Clynes said.

Like the dots in a pointillist painting, the amplitude contours of each note detail the emotional idea of the melody.

"The combined effect of frequency and amplitude contours is unmistakably more powerful as an emotional clue than either is alone," he said. "*A melody becomes fully expressive only when its tones are appropriately shaped by the amplitude*."

In other words, the expression of joy, sadness or love requires not only that a pattern of tones be suitably spaced in time and pitch, but also that these be organized in terms of amplitudes to correspond to the appropriate essentic form.

The more purely the form is realized, the greater its power to move the listener. In this way, a melody can engender emotions without the help of any other symbolism, Clynes said. "It can touch the heart as directly as a physical touch."

3.8. Shapes of Individual Tones Form Melody

For a wholly expressive performance, each melodic tone needs to have its own distinct amplitude shape, according to Manfred Clynes. These shapes vary considerably from one tone to the next.

Many instruments, such as the organ and piano, cannot effectively produce varying amplitude shapes for different tones of a melody. To a greater or lesser degree, performers on other instruments, such as woodwinds, shape individual tone according to the musical requirements of the melody.

When an instrument cannot modulate the amplitude shapes, listeners excuse the shortcoming and *imagine these amplitude shapes in their minds* even if they do not actually exist.

When the tone amplitude shapes produced by a musical instrument or singer correspond to those of musical thought (the shape of the melody), people feel a particular delight.

How does the contour of the melody shape the tones? Clynes explained that the clue provided by the melody is the slope of the "pitch time curve," which includes both *time* and *changes of pitch*.

This curve influences the amplitude shape of a particular tone to deviate from a basic shape as follows: "If the time slope of the pitch time curve is upward, the shape is skewed forward. If the slope is downward, it is skewed backward. In both cases it is in proportion to the slope."

This has a powerful effect: The shape of the present tone is governed by the nature (pitch and time) of the tone to follow.

The shape of the present tone clues the listener to the tone to follow. This relationship is a significant element of musicality. It helps engender what Clynes calls "a feeling of continuity and continuity of feeling." Music blends expectation and surprise.

In producing a melody, a composer apparently places the notes so that they fit the outline of the appropriate essentic form -- the universal shape of feeling. The musical thought – composition -- uses the template of essentic form, or emotional shape, to fill the notes.

Musical tones are pitched at suitable points along the path of an essentic form so that internally they can act as markers in the generation of the form. The musical tones engender internally the motor pattern of the essentic form.

3.9. Music/Endorphin Link

"Musical thrills," the shudders elicited by listening to music, may result from the release of endorphins the brain's own opiates.

At the Addiction Research Center in Stanford, California, Avram Goldstein used music chosen by experimental subjects to induce these thrills. Injections of the opiate blocker naloxone disrupted the sensations in a great number of people.

Thrills reflect spreading electrical activity in some region of the brain connected to both limbic and autonomic control centers, Goldstein said. Musically induced "highs" may be caused by a shot of endorphins released into the bloodstream on musical command.

3.10. Music Medicine: A New Field Emerging .... Biology of Music: How is it Made? How does it Heal?

Like sports medicine, music medicine soon may become a field of its own. The biology of music making and the medical/psychological problems associated with performance are gaining attention from scientists, educators and health professionals.

Two recent conferences in the U.S. and Europe have opened the dialogue between medical and musical people.

"The Biology of Music Making," held in Denver, was sponsored by the University of Colorado, the Denver Center for the Performing Arts and the World Federation of Neurology.

Conference chairman Frank Wilson, a University of California neurologist, said, 'We don't yet know whether the difference between musicians and non-musicians exists because of training or biological predisposition."

Wilson investigated activity in the brain when a composer is making music. Using neurological and physiological techniques, he verified that music is best performed with a minimum of conscious thought about mechanics.

The rapid, precise muscle movements required for most musical endeavours are far more sophisticated than those of Olympic athletes, he said. These movements are too quick to be measured in the brain. They seem to occur with a will of their own.

Computers, now used to evaluate athletic performance, may assist musical performers in the same way. At the conference, Leonard Jansen of , the United States Olympic Committee said, "Just as a fraction of a change in an athlete's performance can mean the difference between winning and losing, a professional musician's performance can also be improved from a critical standpoint. "

Conference participants also discussed the occupational hazards of musicians. Many performers complain of chronic problems produced by overuse or misuse of the hand and arm, Wilson said. Damage to the ear from exposure to high sound levels may go unrecognized.

Furthermore, one physician said, rigorous training and competition produce stress comparable to that reported by medical students.

Among the brain/music connections:

- Brain scans reveal that music produces more complicated left/right activity than was previously thought. Using PET scans, John Mazziotta of the Reed Neurological Institute at UCLA found that the right temporal lobe was more active than the left in non-musicians during simple tone perception tests. In musicians he found that both sides were more active. Earlier research has indicated more left-brain activity in professionals.

- Robert Effron, professor of neurology at the University of California, Davis school of medicine, is studying the ability to isolate complex sound sources in space. The brain appears to program the ear to pick up information that is of interest. When a conductor focuses his attention on one instrument in an orchestra, this process is engaged. "This is probably the most complex cognitive thing a human being can do," Wilson noted.

- Other clinical research affirmed that musical aspects of speech -- intonation and rhythm -- seem to be functions of the right hemisphere. Performance skill, by comparison, seems to depend on a specialized system -- the motor strip, basal ganglia and cerebellum -- to refine highly skilled movements.

- Composer Milton Babbitt discussed the synthesizer's influence on perception and musical memory. The new technology provides advanced control of the temporal dimension of music. Musical memories are typically attuned to recognition of pitch and pitch transformation, he said. With synthesizers the high speeds change our perception of pitch. They create a new memory process.

"The limitations are no longer in the technology," he said. "The new limitations are the most mysterious and little understood: What can be heard? How fast can the machines go so that you do hear them and make music of them?"'

Information: Colorado University-Denver College of Music, (303) 629-2727; Wilson: Permanente Medical Group, 1425 S. Main Walnut Creek, Calif. 94596.

At an international symposium in Ludenscheid, West Germany, investigators revealed striking clinical evidence for the effects of music on the body. Music appears to massage organs, entrain biorhythms, alter hormone levels, reduce stress and increase learning.

In Japan, one group of anesthetized surgery patients listened to music on headphones, while another group did not. In the music group, cortisol and noradrenaline levels in the blood did not increase as much as in the control group. Blood pressure and heart rate tended to decrease slightly after patients listened to music.

EEG studies of music perception and performance by investigators in Austria showed new distinctions in brain activity. Subjects were tested with eyes open and closed while they hummed a children's song or listened to Mozart. Controls heard someone reading aloud from a newspaper. The distribution of electrical activity is different for singing and listening to music. Memorizing a song differs from both.

In Norway, scientists use a "music bath" to treat mentality retarded and spastic children. Bombarding them with audible low-frequency sound waves induces sleep and relaxation.

The next world congress on Music in Medicine was held in Greece in October, 1985. Information: R. Droh, Sportkrankenhaus Hellersen. D-5880 Ludenscheid

3.11. Conductor Thomas Hohstadt: On Music and the Power to Which it Points

Thomas Hohstadt, conductor and musical director of the Midland -Odessa (Texas) Symphony, writes about his experiences in the world of music. In the following excerpt from a ... book Hohstadt tells a personal story that remarkably parallels the findings of Manfred Clynes.

Endless surveys and common knowledge keep telling us the same thing: The general public thinks the fine arts are boring. We arty, sophisticated types respond, "it's not our fault the public doesn't appreciate good things."

This is not called the scientific age for nothing. Today, for example, music education is blessed with amazing analytical theories, razor-sharp techniques and encyclopaedic histories. We are not only products but crowning achievements of solid rationality.

Like a Greek athlete, I used to see myself as a conductor carrying the flame of carefully analyzed, immaculately precise and historically accurate performances into the concert hall. Why, then, did these performances strike me as incomplete? And why did my favorite superstar conductors provide the same emptiness on so many occasions?

As I look back on it now, my rite of passage began several years ago with a most unfortunate experience. Backing out of the driveway on my way to a concert, I ran over my own dog. The poor thing was so blind and deaf that he couldn't have gotten out of the way in time. Climbing grief -- stricken to the podium, I withdrew from my usual operating context. There were no thoughts, just an internal gaping wound -- an intense bleeding presence. My soul searched the black mystery for the dear little friend for anything that would bridge the deep separation.

That concert was a profoundly meaningful experience. Somehow it broke through: Music is not a rational thought process. Its essence cannot be proven or disprove, named or even described. Obvious, right?

Yet I had received what is generally considered to be the best music education available in the U.S. and Europe, and no one had ever told me that.

Not long afterward, on an airplane to the next concert, I read an article by a well-known scientist. He said, "We like to think our minds were created to serve as truth-finding instruments, but it is difficult to imagine a mechanism that could do a worse job of straight thinking, and yet give the illusion of doing a first class job."

The article further stated: "What we call reality might better be described as an illusion.... Through quantum physics, we have now proclaimed that an exact picture of the material world is forever unattainable .... The world beyond our senses is the *real* world... the universe is a vibrating, dancing organism.... In a word, both the universe as a whole and we in particular are not matter but *music*."

I could have stepped out of the plane and flown the rest of the way myself.

On the podium at the next concert, I was excited by the prospect of an emotionally charged evening. Even though training is almost entirely rational, musicians are expected, by tradition, to "put in the expression." I had always, as a matter of course, faithfully and sincerely attempted a poetic, inner statement in my performances. *That* night, however, I made an attempt to capture the unusually profound and compelling experience of the first concert.

With my attention focused more than ever on the emotional content, I was startled by a discovery. The emotions of music are just what we would expect to find at the surface level, but they are drastically changed and even nonexistent at a much deeper level, as though in another world.

Completely opposite emotions -- joy and sorrow, pleasure and pain -- are linked and lead to each other through infinite shades and gradations. A comic image carries with it something that is not comic; the image of something terrible is rarely without the atoning element of loftiness.

It came as a surprise: Emotion was not the right word for the experience. It was something different. For example, the "other worldly" experience of fear is far different from the experience of natural fear: I found the other world type to be a different physical reaction (creeping flesh). The sense of awe was gentle rather than disrupting, and it had the added awareness of "uncanniness."

The next evening, I was not on the podium but rather in the audience with friends. They were preoccupied with their moods and the visual appearance of the hall. Unwittingly,

my friends convinced me that they were not prepared to experience any unfamiliar emotion.

The obvious became clear. The world of music is a subtle, secretive and hidden world. Its communication is not the sounds with which it is woven, not even the emotions that it awakens. Its message is indirect through mystical yet clear, intuitive awareness.

I knew then that I would have to discover a new way of knowing, a new way of understanding. It was still almost impossible to believe that there might be another reality -- truer and more powerful than the one I had known. For the first time in my life, the idea of being a conductor was more than a career: It was a mission.

Soon afterward, in the midst of despair just moments before a concert, I became ill. There was no one to replace me, and I could barely make my way to the podium. I faced the audience for the perfunctory bow. Then it hit me like a bolt of lightning: The height of the stage and podium did not exalt me. I knew that the audience and I shared a common truth when we were emotionally broken. I was also certain there were many others present just as broken as I, but for a multitude of reasons. I wanted desperately to say something to the audience before we began, if only "I'm sorry." As I turned, I was overwhelmed with the desire to express musically some kind of hope, some kind of healing. But I found no strength.

There was no choice but simply to stand there and allow the music to pick its own time, its own place and its own content. I was barely rendering assistance to the performance. The raw edge of my illness finally prompted me, even compelled me, to make several last-minute, unplanned, interpretive decisions. How I was willing to risk this, I don't know.

And then amazing things happened. Something was going on far beyond the usual "musical insight." There was a meaning and a power that were definitely not mine.

Afterward, trying to put the pieces together, I concluded that technique was, after all, a rational tool. a systematic procedure doomed to fail in terms of hearing the unheard, seeing the unseen. With its emphasis on control, it relegates content to a secondary role. It becomes the regulator, and music becomes the regulated. I had finally reached the bottom line: *Music springs only from the power to which it points. The dominant role of technique short-circuits the whole thing*.

I knew that something had to replace technique if a musician had any seriousness about meaning. It's strange what I recall happening next. A silly line from the Wizard of Oz story kept running through my head: "Follow the Yellow Brick Road, Follow the Yellow Brick Road...." Instead of techniques, there were paths, which not only gave permission to any outcome but required a total commitment much broader than playing an instrument, conducting an orchestra or building a career.

Since then I have explored these paths and looked for new ones. I am finally coming around to the possibility of once more calling them techniques, but with a new understanding of that word. First of all, these techniques are non-rational, designed for "listening when there is nothing to be heard, seeing when there is nothing to be seen." Second. they are used on behalf of quality -- not the quality of a cosmopolitan sophisticate, but the quality of profound meaning.

Most importantly, these new techniques are motivational, freeing, designed to lure the interpreter and the listener beyond his limits. Finally we enable -- we do not own or control -- the meaning of music. Our techniques must serve a musical truth that springs only from the power to which it points.

To name that power is a fair request but one impossible to answer. And, mysteriously enough, that is the answer. The experience could be described as an encounter with ultimate truth -- a reunion with that to which we would be united.

3.12. Music is Refined to Quiet Babies, Relieve Stress, Enhance Sport

Music is being tailored to meet many needs: healing, relaxation, exercise, learning. Among the innovative applications:

Unborn babies may gain greater musical aptitude by listening regularly to music before birth.

Donald Shetler of the Eastman School of Music at the University of Rochester had pregnant mothers play classical music. The women placed stereo headphones over their abdomens and played brief excerpts from Handel, Vivaldi or Bach at least twice a day. The mothers reported feeling physical responses from the babies during the sessions. Once the "musical babies" are born, Shetler will test them every eight weeks for musical and language ability.

Nursery songs may help babies cope with hospital

At Pacific Medical Center in San Francisco, attendants play "Twinkle, Twinkle Little Star" and "Hickory, Dickory, Dock" on a Sony Walkman. They report that the songs seen to keep babies from kicking and yowling.

In a study of 28 children by research psychologist Jill Claire, two-thirds showed reduced signs of stress while listening to music. Interestingly, lullabies and calming songs were less effective than nursery rhymes. Their mothers' voices typically made the hospitalized children more upset.

Music enhances the effects of biofeedback training in relieving tension.

A recent experiment tested the differing effects of biofeedback, sedative music or the two combined on muscular relaxation. Researcher Joseph Scartelli found that sedative music paired with biofeedback was the most effective condition.

Scartelli reported in Journal of Music Therapy 21: 67-78. His address: Radford University, Radford, VA. 24142.

Music is now [1985] being composed to accompany jogging, skiing and bicycle riding.

According to Raul Espinosa, creator of "synchronized high-performance music," sounds can be scientifically composed to enhance a specific experience. His company produces tapes that "set a cadence and rhythm for each activity."

Music in Motion: Box 2688, Alameda, Calif. 94501, (415) 530-0618.

3.13. Music Triggers Generalized Emotions, Heals by Enhancing Larger Order: From Sympathy to Empathy

A startling result of Clynes' new findings: Emotion can be seen as a pattern that exists in the nervous system independent of content.

"Generalized emotions" can be triggered without association to a person or event, he said. Joy, sadness or love can be felt with no reason other than the shape of the musical phrase.

When the shape (or essentic form) of the emotional quality is expressed purely, it communicates most powerfully.

The greatest music may ennoble us by eliciting emotion without an object. By experiencing joy or sadness without content or association, we gain another perspective: Music may train us to become more peaceful and rational in the face of strong feeling.

Emotions are tied to general thinking patterns that make up our world views, Clynes said. By generating a sequence of generalized emotions, music potentially touches on all facets of life.

These thinking patterns tied to generalized emotions are not to be confused with specific events or associations. For example, Clynes mentioned a recent series of experiments that demonstrated an inherent link between love and trust.

Observing a repeated sequence of expressions of love and anger, Clynes found that even a small, insignificant lie temporarily tended to block the experience of love. The same lie did not block anger -- and in some instances even enhanced it.

13.14 SOURCES

Clynes, M. (1977/1989) Sentics; The Touch of Emotions, Anchor Doubleday

Kit on "sentic cycles" (finger rest, cassette tape, instruction booklet) also available MicroSoundInternational Ltd., Sonoma, CA 95476.

Clynes, M. (ed) (1982) Music. Mind and Brain, Plenum

4. KEY TO EXPRESSION: CLYNES CITES PERFORMER EMPATHY AS'CENTRAL FACT OF MUSICAL MEANING'

Brain/Mind Bulletin, Volume 8, Number 2, 1982 December 13

Manfred Clynes' study of essentic forms is motivated by the desire to illuminate a central fact of musical meaning.

The researcher asks: "How does it come about that a single phrase of music when performed by a great artist can move and transform the state of listeners, penetrate their defences and make them glad to be alive -- while the performance of the same phrase by a lesser artist, only slightly different in form, does not have this power?"

The answer is not to be found in the musical score, Clynes asserted. Musical notation cannot prescribe masterful phrasing, since each instrument has its own unique tonal qualities and each performing environment its unique acoustic properties. Artistry lies, instead, in the performer's "feel" for the phrase in a given instrumental setting, much like a cyclist who adjusts his vehicle from moment to moment according to the feel of motion, road and wind conditions, other traffic and the condition of the vehicle itself.

Just as a cyclist is guided by the direction he wants to go, the musician is guided by what Clynes calls the itinerary of the piece. He expresses each tone according to his concept of the piece being performed. This concept, in turn, "springs from the total empathic knowledge of the musician."

The greater the musician's empathy, the more clarity in his expression and the deeper the listener's response. "The clearer a musical expression is, the more powerfully does it act in scanning our whole being and experience for its likeness. And a clearly expressed musical idea is one that is true to its essentic form."

4.1. Nervous System Codes Linked to Feelings, Music

Codes in the nervous system may explain why certain musical compositions evoke specific feelings. This influence may not only condition one's response to the emotional and rhythmic qualities of musical expression but also affect the initial creation of these qualities.

Evidence of possible neurobiologic emotional codes is outlined in [his]… book, Music, Mind and Brain: The Neuro-psychology of Music, edited by Manfred Clynes .

A concert pianist and neuropsychologist in Sydney, Australia, Clynes has produced experimental evidence that anyone can recognize and produce specific forms of emotional expression. These "essentic forms" are represented visually by Clynes as graphed curves. He also translates them into auditory form as tones.

Clynes says that essentic forms do not act upon the nervous system arbitrarily. "Like keys in a lock, they activate specific brain processes to which we react in some sense emotionally. "

Research by Clynes and others suggests that essentic forms have innate meanings that transcend cultural learning and conditioning and are therefore neurologically coded.

Clynes' research utilizes a computerized, push-button transducer that converts the form of the push -- the pressure pattern of the finger on the button -- to a tone or a line on a graph. He initially instructed people in four countries (U.S., Mexico, Japan and Indonesia) to push the button with each of seven emotions: anger, hate, greed, love, sex, joy and reverence.

The graphic representation for each emotion was approximately the same for all individuals regardless of their culture (see figure 1A at the beginning of these papers).

His research also revealed that systematic practice of the button pushing exercise could have therapeutic results. In some individuals, dormant emotional capacities were awakened (see Brain/Mind Bulletin, 1977 June 20).

Using a computer, Clynes averaged into "pure" forms the emotional tones generated by white city dwellers for anger, hate, greed, love, sex, joy and reverence. MIT and other university students, hearing them for the first time, identified them with unusual accuracy. So did 40 aborigines from Central Australia.

Joy was the most accurately assessed emotional sound. More than 80 per cent of each group identified the tone of joy correctly. Nearly 70 per cent identified the sounds of anger and grief. Fifty per cent identified sex, 40-50 per cent hate. Reverence and love were highly confused by all groups.

Males and females did equally well.

In addition to forms for emotional expression, Clynes and other researchers have found potential evidence of "an extra-ordinarily stable psychobiologic clock" in individuals that governs musical rhythm. The evidence: nearly split-second rhythmic consistency in successive recordings more than 20 years apart of the same musical passages by the same artists.

This rhythm clock appears to be "stable to one part in 500 over decades," exceeding the evidence of stability in such rhythmic behaviour as speech patterns.

Clynes believes that the study of essentic forms, which he calls the science of "sentics," has profound implications for musicians.

- *Interpretation*. Musical masterpieces embody the unique 'pulse' of their composers, which can be evoked by sensitive performers.
- *Performance*. Musicians can 'take the pulse' of their own essentic forms. Being true to one's own pulse form, he said, enables greater control of innate musical potential.
- *Composition*. "The composer now has at his disposal a powerful method of evoking various emotions in his discourse and [can] combine them in ways that he chooses." Clynes has developed a computer program for selecting and combining essentic forms. The composer can mix feelings just as a painter mixes colors. In this way, Clynes said, his sense of discrimination is sharpened, and he can make choices that may prove to be artistic.
- *Electronic music*. Sentics could advance the art of synthesizing sound, Clynes said. With synthesizers, he noted, it is possible to obtain expressive performances of existing works that surpass most or all real-time performance.

Unlike conventional instruments, synthesizers provide unlimited opportunity for artistic shaping of individual tones or phrases. At present, he said, electronic music concerns itself mostly with imitating the sounds of conventional instruments rather than surpassing their temporal limitations.

A recording of the seven emotional tones, along with melodies generated from the tone for grief, is included in Clynes' book Music, Mind and Brain: The Neuro-psychology of Music (1982, Plenum Press). His earlier book, Sentics: The Touch of Emotions (1977/1989, Anchor/Doubleday), elaborates the theoretical basis for the technical studies presented in the new volume.

When people are asked to push a button while they experience particular feelings, the patterns of pressure on the button approximate these averaged 'pure' forms (essentic forms). The upper lines represent downward-upward pressure, the lower lines forward-backward pressure. (see Figure 1A at the beginning of these papers)

4.2. Music Facilitates Healing, BodyMind Coordination

Music, once almost exclusively an aesthetic pursuit or entertainment medium, now aids in a variety of specialties: healing, psychotherapy, stress reduction, meditation, body/mind conditioning and sports fitness. As a consequence it has become the subject of scientific as well as artistic interest.

The music of California harpist Georgia Kelly, widely used in hospitals and other therapeutic settings, currently [1982] is employed in clinical research at the University of Massachusetts Medical Center in Worcester.

Kelly recently videotaped a specially composed 51-minute concert that is prescribed for twice-daily viewing in lieu of tranquilizers and painkillers by cancer patients and others who are seriously ill. The videotape also includes instructions for meditation and breathing. It is narrated by Jon Kabat-Zinn, director of the center's stress reduction program.

Researchers will assess the relative effectiveness of Kelly's tape compared to drugs. Until now, the musician told Brain/Mind Bulletin, doctors have been using her audio tapes with very little understanding of why they work. Five years of experience with therapeutic applications has convinced Kelly that music must have certain rhythmic and melodic qualities to be an effective aid to healing.

"Music with a variable rhythmic structure and a tempo slower than the average heartbeat seems to have a calming effect on the listener," she said. But even more important than rhythm is melodic phrasing.

"As the listener follows the melody, often he or she moves beyond body awareness-becomes relaxed, falls asleep or feels less pain. Anything that moves one away from identification with the body will automatically be calming and reduce awareness of mental attachment to pain."

In Kelly's experience, music is most effective when spoken instructions -- for meditation, relaxation, guided imagery -- are in the background. "The instructions 'get in' much better if you are more conscious of the music than the voice."

Kelly's interest in therapeutic applications of music began when she was using a voice-only relaxation tape. She discovered that by listening to slow choral music and middle (largo movements of symphonies) as the tape played, relaxation occurred more quickly and deeply.

Melodic phrasing is of primary importance, she said, because it determines the rhythm. This is contrary to the way that most popular music is recorded. Customarily, the percussion track is taped first and musical phrasing forced to follow the beat mechanically.

"This leaves no room for feeling, and music without feeling is not healing."

The harp is especially suited to generate music with feeling, she said, because its resonance is directed through the back of the instrument directly onto the body. "You can feel every nuance and know from the feedback how well your intended feeling is conveyed by the music."

Kelly, who performs frequent concerts, said she has lost interest in playing solely for entertainment. She is experimenting with formats that incorporate "meditation and other aids to spiritual growth."

Kelly: Box 954, Topanga, Calif. 90290, (213) 455-2864. Kabat-Zinn: U-Mass. Medical Center, 55 N. Lake Ave., Worcester 01605.

A musically paced transcontinental bicycle race from Santa Monica, Calif., to New York City, completed in nine days, 23 hours and 15 minutes, set a world's endurance record. One cyclist claimed a 25 per cent improvement in his performance from using specially programmed audiocassette tapes.

The tapes featured instrumental music designed to synchronize cardiovascular and muscular activity according to the demands of long-distance cycling.

Similar tapes for jogging and skiing, for use in Walkman and other portable stereos, also have been produced. Information: Music in Motion, Box 2688, Alameda, Calif. 94501, (415) 522-0224.

5. TUNING INTO THE HEALING POWER OF THE EMOTIONS: SENTIC CYCLES

Pamela Allardice, Nature and Health (date 199?), Australia

Imagine for a moment the different turn the 20th century works events would have taken if Adolf Hitler had been able to confront and overcome the extraordinary feelings of hate which distorted his view of the world. And, in terms of today's more pressing issues, would it not be marvellous if the money-hungry land-owners of the Amazon basin could relearn feelings of joy and reverence when they visualize the mighty rain forests they seek to destroy?

Such scenarios are no longer the impractical domain of the idealist. It is not unlikely that the work of Dr. Manfred Clynes, who has pioneered the use of expressive forms of touch and music in the communication of emotions, will develop into an important adjunct to healing therapies. And, certainly, it is the only existing art form of touch.

Born in Vienna, Clynes was first acclaimed as a musician while still a teenager, going on to distinguish himself as a concert pianist in the major cities of Europe and Australia. As a musician, he studied with the likes of Pablo Casals and Sascha Gorodnitzki.

He is also an eminent authority in the field of dynamic emotion communication and holds a doctorate in neuroscience from the University of Melbourne and also a Masters Degree in Music from the Juilliard School in New York.

Dr. Clynes is best known for his significant research in neurophysiology, integrated with his interest in music and the nature of the emotions. This study led to his revolutionary discovery and naming of the "Sentic Cycles". His idiosyncratic background explains his

description of these Cycles in terms of music and art, for he cites their use as being much the same as the way a musician plays and masters his instrument. A musical instrument can be played sadly, joyfully, lovingly, etc., and the musician enjoys being able to let his emotions wander free to the limits. Similarly, all of us may exercise and stretch the range and variety of our emotions. By enjoying the pure quality of our emotions, positive and negative, our well-being will respond accordingly.

Basically, the science of Sentics concerns how we produce and recognize expressive movements and "shapes" in music which generate and transmit specific emotions. Each emotion, it has been discovered, has a biologically given true form of expression that can manifest itself in many ways. A Sentics Cycle lets a person generate a succession of emotions merely by repeatedly expressing each one with the pressure of a finger on a finger-rest. The Cycle consists of seven emotions-anger, hate, grief, love, sex, joy and reverence.

To date, Dr. Clynes has provided thousands of people with Sentic Cycle sets, which aim to teach them how to become more in touch with their emotions. Each set contains a Cycle tape which Dr. Clynes describes as "...deceptively simple. Like a Zen garden... the Sentic Cycle probes far deeper and higher than may appear."

The tape has a number of spoken words and simple timing signals, and the user will sit and use gentle finger-pressure to activate the Cycle. The tape may be used in privacy, anywhere, and the method is easy to learn- -- once learnt, it is always known, even by this "Doubting Thomas", who participated in a recent Sentics Cycles session and found its efficacy remarkable:

> *Now I can express my feelings through my finger, although I am still a little incredulous!*

Consistent usage of the tape has been found to be particularly useful in times of acute emotional stress, because it allows the individual to express and generate emotions naturally, without inhibition or fear. For instance, a 42-year-old woman who had recently undergone radical surgery for cancer told Dr. Clynes that she felt under great strain from her experience, both mentally and physically weakened. She found great solace in the Sentic Cycles and was able to say, after two months of regular usage:

> *Sentics has enabled me to hang together during these trying times. Otherwise, I should be splattered in a dozen directions by now ... I don't feel maimed anymore, merely different. The missing breast still matters, but not in the same way.*

Those experiencing events such as the break-up of a relationship, relocation in a different city, adjustment to a new job or divorce proceedings have all reported similar refreshing feelings of deep peace on using the Cycles tape. This sense of peace is, interestingly, an active rather than passive state--a positive form of contentment. Patients claim that by being able to experience emotions more freely as they are triggered in day to day living, they feel more at ease with people and less tense in stress-producing situations. A nurse

who uses the Cycles on two consecutive days each week succinctly comments on this balance between Acton and contentment as follows: "I have more arguments, but also more orgasms."

The use of the Cycles helps to modify aggression, help the patient slow down; in fact, Dr. Clynes describes many participants as having a "characteristic contented smile on their face on completing a Cycle." Users claim to look forward to exercising their emotions with great joy. One woman described her sessions as "...both a clarifying and purifying experience," while a young actor attributed "a great sense of excitement and gratitude that have improved ... clarity and precision" to the Cycles. This same fellow went on to add:

> *I'm now looking forward to each Cycle as a performance for my own pleasure of the spectrum of the possibilities of being human. I feel afterwards as if I have created as well as witnessed a great drama.*

Possibly the most important aspect of the Cycles is its simplicity. Thousands of people, from many different walks of life, have been able to use the process satisfactorily--the benefits are accessible to all. Witness the middle-aged "housewife" who finds that "...small things such as household cleaning tasks not only have been accomplished but have given rise to a great deal of pleasure ... this is amazing as I have always resented this kind of work, thinking it menial and tedious." Then there is the 17-year-old HS student who found that the Sentic Cycles helped him to concentrate longer and therefore to learn more. He found he was, as a result, calm and relaxed, "not nervous at all," during the all-important examinations. And there was also his younger sister who used the Cycles to give her confidence when going for a job as a junior sales assistant in the cosmetics department. She believes the Cycles are the reason why she now has greater selling ability and is comfortable with her customers.

Users describe themselves as feeling more "centered," as being able to "live in today, not yesterday or tomorrow" and as feeling "more in tune with myself and others and our emotions." A 30 year-old man participating in a Sentics forum said

> *Almost at the very moment the last click sounded, a feeling of well-being, bubbling and effervescing arose, emerged and fermented my whole being-the most intense I've ever experienced... high sense of peace, at oneness, almost out of my body.*

An older woman experienced similar feelings, describing them as an "...energy flow. I have more a sense of well-being and harmony, brightness--visual clarity, colors are more vivid--a generalized feeling of lovingness and warmth inside myself." Another went on to add:

> *I'm feeling 1 am living much more in the present. I see what is actually going on, rather than living inside my head and judging everything on past plans and) future hopes. I'm more alive, more me--and that's good.*

Dr. Clynes elaborates on her comments thus:

> *.... people ... notice ... a change in their general mental state -- an increasing awareness, fluidity of thought and feeling of well-being.*

As many other methods used in relaxation therapy aim to create a vacuum of emotion which temporarily removes energy, the use of the Cycles represents an important alternative. In short, Cycles help people to mobilize old and new emotional blocks and allow the expression of feelings which are all-too-often held back, poisoning the mental and physical well-being of the individual. Says Dr. Clynes: "The Sentics Cycle ....channels constructive, joyful energy."

The use of Sentics Cycles in producing a "centered" state of relaxation and reducing stress has important ramifications in the field of psychotherapy. Dr. Clynes cites data from an enormous catalogue of case studies, accumulated over the past 20 years. Many people have, for instance, successfully used Sentic Cycles to control their emotional states. These suggest that the education of the emotions is a realistic and practical possibility. A 24 year-old male respondent noted the enormous potential for mankind to control destiny through Sentics as follows:

> *Perhaps in the not too distant. future, Man will be able to say I am responsible for the way I feel. If he can reach that stage, he might then ask himself ""How do I want to feel?*

The burden of sadness can be borne better when expressed through the Cycles. Respondents have found that the Cycles work to free the individual from these blockages to life, and allow energies to be channelled to creativity and self-reliance. Similarly, people are often frightened of expressing their grief. In our society, grief is repressed--it is not seemly to "go overboard" when lamenting the death of a loved one, for instance. A young female had this to say of her experience of the "grief stage" of the Cycles:

> *I'm terrified by this emotion, as I'm afraid I could lose control. Have experienced so much unhappiness in life that have formed the habit of suppression. Would like to be able to express grief in a controlled way.*

Another young woman used the Cycle to focus upon her mother, for whom she felt great compassion and grief, as well:

> *....grief for all her frustrations, her great grief over large and small things most of which she could not express.... this inability to express her emotions she passed on to her children, not because she wanted to, but because she couldn't help it. ... this I understand and accept, and do not condemn.*

Couples have successfully used Sentic Cycles in overcoming difficulties in a relationship and becoming more "in touch" with each other. They have reported being amazed at how

they can traverse the entire spectrum of emotions together. A middle-aged respondent commented

> *Now I realize that the best way to love everybody is to be able to experience love towards a specific person and feel the shared expression of love extend to the whole world. This discovery is an important insight. It is difficult to feel love at all, if its expression is blocked in any way.*

At the end of practicing a Cycle, there is usually a marvellous feeling of intense wonder which can strengthen the couple's empathy for one another and deepen their caring for each other. One 45 year-old female respondent joyously offered this comment

> *The thrill I feel when I hear the commercial "We made it!" because that is how I feel-Grahame and I have made it! When we sing that jingle we throw our heads back and shout for the sheer joy of knowing it. An exhilarating feeling.*

Dr. Clynes adds:

> *Apart from the pleasant experience that doing Sentic Cycles with each other gives you, you will find the period of calm after doing Sentic Cycles invaluable for relating to each other in a new and different way. Matters that may have been troubling you about each other can be discussed in a hostility free atmosphere and you may be able to communicate with each other in a very different way, causing various breakthroughs in your relationship.*

Couples report that they feel as though they have grown closer together when they have practiced the Cycles systematically over several months. Other testimonials refer to "being able to express feelings and desires better through touch" and "to communicate sexual arousal and pleasure, as well as affection and happiness." One respondent specifically described her "breakthrough" experience as follows:

> *Later (five hours), held lover in different way; noticed increase in lubrication for intercourse; length of climax extended.*

Several couples have found that Sentic Cycles are a valuable help in redressing sexual problems. This is not surprising--many sexual problems are the result of anxieties and specific fantasies and the Cycles, by redirecting or re-opening energy paths, will help to bring them to the surface where they may be dealt with. By repeatedly working through the unpleasant associations of several sexual experiences, the person may well remember the original "forgotten situation" that triggered the negative feelings in the first place. They are then able to include this situation in their Sentic Cycle process, thus diminishing its power through distancing, and removing the anxiety source.

The same benefits apply to the individual who is exploring the sex graph in the Sentic Cycles in an attempt to realize sensual feedback. A 69 year-old man, with a history of some sexual difficulty, had this to say after practicing Sentics for six months:

1 am terribly excited. I can't be sure, but I really believe Sentic Cycles are responsible. I am close to achieving orgiastic potency! I am fearfully hopeful-4 so hope, but do not really want to expect that to happen. However, my several recent sexual experiences have been sensational--completely full of feeling, very genital, very satisfying, very compelling, and very selfish. Also, I have fallen again, two times now, once in the company of a woman, and no sense of shame or embarrassment! All my life I've been falling, and always I had first and foremost, prior to and aside from all pain and fear, I had a horrible sense of shame with red face and sweaty brow. Only since Sentic Cycles has this happened.

Historically, women have been taught to repress their sexuality. The cost of such "ladylike" behaviour can be very great and bring much anxiety to an otherwise happy and well-adjusted woman. Several of the females working through the "sex" essentic form and accompanying emotion in Dr. Clynes' sessions experienced quite dramatic breakthroughs in this area:

I found my body stiffening into exciting curves and extensions. My neck seemed arched, as did my spine--both arched backwards to expose my throat. I felt a desire to use my mouth.... my finger and hand seemed to be indulging in the extension and tension of themselves, for their own sake. They then sought sensual feedback from outside themselves.

Very deep, hungry gestures. Nothing light or dainty about this expression. Direct and unabashed statement of sexual need and desire. Need to give and receive sexual love.

.... I felt very sensuous and capable of enjoying a sexual relationship. The clicks seemed too close together, for I really wanted to make each expression last. I felt a sense of assertiveness and ability to make my own wants known, something I have never been able to do during sex. I don't have to be ashamed any more. Hallelujah! I

The "anger" and "hate" cycles are, interestingly, the expressions most people say they enjoy practicing the most. Probably this is because, in ordinary life, we are trained to repress these emotions in particular. Let's look at a few comments from respondents using Dr. Clynes' methods in this area:

I feel a lot better after having done this. 1, feel I have drained myself of 'anything that was worrying me beforehand. If eel I have taken it all out on the little plastic button!

Amazed at the amount of hate of which I am capable. I feel that I am getting even at long last with wrongs against me. I now know that I should have righted these wrongs or defended myself at the time, yet I was always taught to "turn the other cheek. " This is something I will no longer do.

Hate--tense muscles contract; headachy, notice from my body what it feels like physically to hate. Can learn by listening to body hating. ... have already recognized past incidences where conscious knowledge was totally absent, but the body doesn't lie.

Anger just came, a welling up of general irritation towards everything and anything. Really enjoyed getting rid of petty annoyances. Ha! At last I can express my displeasure.

"A healthy mind in a healthy body" said the ancients. Practitioners of Sentic Cycles have testified to using the method for relieving a variety of health problems which are often the by-product of an imbalance in their mental state. Whilst people use the Cycles about three or four times a week, on average, the frequency may be stepped up in periods of stress. For instance, either a "stop smoking" or "lose weight" assault could be facilitated by several hours of Sentic Cycles per day.

Doing the Sentic Cycles reduces stress, anxiety and depression. On one level, they may be used to enhance confidence before a special occasion, such as a lecture, performance or examination. On a deeper level, more regular use of the Cycles can help a patient with psychological or psychiatric problems rid himself of mental or physical "blocks" and to express his emotions more fully. Importantly, such a person may begin to experience true joy at being alive for the first time in his life. Witness the following comments from respondents who had been extremely depressed and sad about their life before experiencing Sentics:

I nearly flew.

Joy. ... Lovely, springing joy--almost completely realized. A surge--a leap-wonderful. Young, alive, carefree, laughing.

I felt myself growing taller and lighter. This quality had a lighter pitch, and rose to that pitch, rapidly. A jubilant bubbling up from within called for more movement. This feeling was unable to contain itself My touch was perky with vitality. I had the sensation of floating over the roofs of houses on Mercury's winged heels, as in some Chagall painting.

Sentics users start to feel a greater range of emotions in their everyday life, and to feel them in a greater variety of intensity, becoming able to discriminate between the emotions and how they change under certain circumstances. By preventing anxieties from building up and frustrated feelings from being repressed for long periods, bodily symptoms relating to anxiety will tend to be correspondingly relieved. Specifically, the 20th century bugbears of hypertension and high blood pressure will often be reduced, while Dr. Clynes can also describe instances where "....headaches, migraines and menstrual pains may be relieved by Sentic Cycles."

He goes on to recommend that if you suffer from sleep disturbances, recurring nightmares or insomnia, you should do Sentic cycles an hour or so before going to bed. By doing this every night, you will re-establish your natural sleep pattern. The method is particularly useful in periods of stress when breathing and postural eccentricities come into play, for the Cycles help break negative "panting" patterns and to relax taut muscles. One respondent who was a chronic insomniac, described his experience with the Cycles as follows:

> *.... feel very calm, a peaceful state of mind --not depressed, though not really happy. Feel exhausted, but tension in stomach is gone. Feel more alert. ... slept very well and felt that I didn't need as much sleep.*

Another was surprised at this effect of the Cycles after her first session:

> *At bedtime I felt highly alert and so prepared to lie awake and absorb my experience further, whereas in fact 1 jell straight to sleep! Next morning I was filled with a sense of well-being, a heightened sense of awareness and a sense of satisfaction, both of which seemed to come from having been intimately in touch with another part of myself*

A happy side effect of using Sentic Cycles in stress reduction is that it makes it easier to give up smoking or other drug dependency. Users claim that doing up to three or even four Cycles a day will help kick the habit. They say the urge to smoke not only disappears completely while actually doing the Cycle, but there is also a considerable reduction in the desire for a cigarette for some time afterwards.

The following is a testimonial from a 26 year-old female, which demonstrates the Cycles' power to transform such health-damaging attitudes and behaviour

> *After a month of heavy smoking (one or two packs a day) and some drinking.... the reaction was extremely positive. There was a marked sense of calmness which included a feeling of unity of self in the modern vernacular, "I got it all together". There was no desire for cigarettes, and a corresponding release of tension. I also had a slight headache and heavy menstrual cramps at the beginning of the sessions and they were relieved.*

The Cycles have been used to deal with dependency on another insidious 20th century "drug"--the television! One female respondent averred:

> *I feel the Sentic Cycles .... help me cut down on my time watching TV Some nights 1 watch the late movies for hours, simply to get a little extra emotion in my life, by association. Now I believe that the Sentic Cycles will satisfy that need.*

In a time when many of us are questioning "religious" concepts, the emotion of "reverence" is one a lot of us find increasingly foreign, difficult to feel--we have lost

touch with it. Many respondents have found this to be the most rewarding emotion they experience whilst working with the Cycles, possibly because of this rarity:

> *On the inhale I traveled to the depth of the center. On the exhale I looked outward from the center to the infinite expanse of my being and the universe. The inhale was dark and mysterious, the exhale, full of light. I didn't want to stop at all. I feel a great need for silence and communion with the Source of my being. I need to visit that higher plane where there is no lack, to refresh myself so that I can continue this earthly struggle.*

Sentic Cycles may be further used to obtain relief from pain. Although the method does not cause the pain to disappear, it makes it considerably more bearable. This has enormous ramifications for the field of physical therapy and for practitioners of all healing modalities. The Cycles have been utilized by a number of patients suffering from life-threatening diseases, such as stroke.

Dr. Clynes refers to a particularly touching case involving a patient suffering from multiple sclerosis. This woman had been paralyzed by the disease for over 20 years and was totally unable to move her body below the neck, having to be positioned and carried from place to place by her husband. Her paralyzed condition left her with little opportunity to express her emotions in the ways other people could.

On being introduced to Sentic Cycles, and first expressing her "anger," Dr. Clynes admitted to being so affected by the "spine chilling ... concentrated, powerful intensity of expression that I could hardly continue". The patient went on with the Cycle, learning to cry in a gentle way during the "grief' phase, rather than the wracking sobs that had previously distressed her without providing solace, or true emotional release. The case study concluded by discussing her positive changes in the woman's personality after daily use of the Sentic Cycles over a period of time:

> *She became less resentful, more calm and cheerful and outgoing. After three months, a transformation had taken place in her relationships with her family and others. She became more interested in them and smiled and was talkative when her husband came home at night, instead of complaining or feeling resentful. She could now enjoy music.... slept better, suffered less from pain and could tolerate it more easily when it occurred. She also required considerably less supportive medicine.*

This case study not only demonstrates dearly the validity of Sentic Cycles as an adjunctive therapy for patients suffering from life-threatening diseases. It also teaches us that although our own bodily functions may be impaired or erratic for some reason, there is a deep wisdom within our emotions. We need to re-establish contact with this wisdom in order to further our own personal relationships and social interactions. As with the woman suffering from multiple sclerosis, Sentic Cycles help us to learn how to tap our inner strength and use it for good

6. THE JOY (GRIEF, LOVE, HATE, ANGER, SEX AND REVERENCE) OF MUSIC

by Jack Finchcr. Human Behavior. 1977, April, pp. 25-:0

We listen to music and care charmed, soothed or saddened. Do we hear the echoes of our own emotions or do we resonate to it like matched sets of crystal? Perhaps Manfred Clynes knows.

Gustav Mahler dismissed Brahms as "really a little man with a narrow chest" when his music was compared with "the blast from Richard Wagner's lungs." Mahler s image is pure metaphor, and not to be taken as an indirect portrait of the two composers. Or is it? Although short, Wagner was chesty, while Brahms in his formative years was frail and anaemic. At West Virginia University recently, students asked to estimate human size by voice alone carne astonishingly close -- within 3 1/2 lb. and one inch, on the average.

Peruvian "whistling bottles" dating back .500 years before Christ and long thought used only to carry water now appear to have had ritual and spiritual purposes. When blown, they give off an intense, high-pitched sound that can "center" consciousness much like the mantra in meditation. Farfetched and accidental? Physicists have found that grains of sand scattered on steel discs and made to vibrate by violin notes inscribe mandalas of concentric squares and triangles, the very symbols of oriental religion. So does the mystic Hindu syllable oat when its spoken vibrations arc transformed into visual patterns of electricity on a screen. For that matter, a French music scholar has turned up impressive evidence that the Old Testament was originally written to be sung. She can prove. she says, that the mysterious words and symbols in the margins of the old Aramaic texts are really scales and notations.

"People often complain that music is too ambiguous, whereas everyone understands words," Felix Mendelssohn once remarked. With me it is exactly the reverse. The thoughts which are expressed to me by music are not too indefinite to put into words, but too definite." Biased exaggeration? Not according to Manfred Clyncs, a concert pianist-turned-neuro-physiologist who believes he has discovered a scientific method for measuring and studying how we communicate emotions. "There seems to be a specific inborn design for each emotion, used both in its expression and recognition," says Clynes, "one programmed into the nervous system inherently. Music is truly a language of these forms."

Our first music must have been the sound of the human voice echoing across the grassy prehistoric savannah, mimicking to his or her own kind, in jubilation or fear, the noisy presence of an animal hunted or hunting.

Somewhere farther along the line of evolution, of course, such primitive utterings grew to include the dynamic sounds of natural forces in collision with inanimate matter. Eventually such mimicry became onomatopoeia--the snap-crackle-pop of storm-tossed tree limb, wind-whipped campfire and lightning triggered thunderclap given audible simulation in the symbol of a word.

With it, the swelling stream of meaningful human sound spilled over into the branching tributaries of speech and song. But long before that, humans began to beat rhythms upon hollow logs and blow tunes through seashells and animal horns. They did this much as they started twisting their bodies in ceremonial dance, molding graven images of their gods and drawing pictures of the tribal hunt on cave walls with charred sticks. Frozen in space, their paintings and sculptures were clearly intended as visual and tactile reflections of their existence. But what was their dance or, more to the point, their music, tossed as it was into the bottomless maw of time? Was it also an unspeakable expression of their life experience?

Judging by the subsequent history of music, its initial forms must have been derived from nature: drumming to emulate the pounding of ocean waves upon the shore, piped melodies to imitate the lyric call of birds. But if scholars are correct, the medium was not the message.

"When they beat upon their drums, it was not just for the fun of hearing the sound" begins one speculative account of the first music. "It was because the different rhythms of the drumbeats would stir the hearts of the people. The slow, somber throbbing would make them mourn the death of a chieftain: a brave, brisk rhythm would urge the warriors on to battle: faster, wilder beats set then whirling and leaping in a dance of victory. When they made flutes of reeds, it was not for sweet music, but for the calls of a shepherd to his flocks or the signals of a leader to his men in times of danger."

So their music, too, mirrored their reality both within and without. As indeed it still does. But how, precisely? And what, in particular, makes it stir the heart'?

Outwardly, the answer seems obvious. The rudimentary notes of a (lute can be used to convey a simple signal independent of their musicality, such as that of a shepherd to his sheep. They can also be employed in variable combinations to build up an auditory impression of his environment by simulating sounds in nature--as do the tone poems of Debussy.

Inwardly, however, musical meaning is far more complex. As the latest findings suggest, are these rhythms really inner pulsings, these melodies actually intimate songs of the spirit from inside?

In his book Evolution of the Brain and Intelligence, UCLA neuroscientist Ham' J. Jerison argues that the perception of sound is central to our nervous system's unique ability to construct an internal model of the outside world. Jerison made a meticulous study of casts taken from the cavities of fossilized vertebrate skulls dating back millions of years before the first human--the only scientific study of its kind. His observations on their development led him to conclude that the early mammal's sense of hearing was both primary and critical in shaping human consciousness, as we know it.

According to Jerison's theory--and it can only be that--the first quantum leap in animal intelligence occurred when a sequence of sounds became lodged in its consciousness as a unified auditor% image: a distinct, reliable and recurring neural impression created by the sense of hearing. Previously, sounds and their significance had faded along with the stimuli. The fear inspired by twigs snapping beneath a predator's foot, for example, diminished as the beast lumbered off. A similar transformation of the visual carne thereafter, Jerison has reason to believe, followed much later by an integration of the two into a kind of sensory cross-referencing.

Next -- coded chemically, electrically or both, the debate over the organic impact of learning still rages--such sounds and sights were linked together and embedded in the brain with their common significance, as a retrievable gestalt or pattern. This relationship is a crude forerunner of the fact that today, as Jerison points out, accomplished musicians can "hear" the music when they scan a written score.

Finally, in human beings during the last million years, such mental imagery has become immune even to the onslaughts of changing place and passing time. So lifelike is imagination, it can be summoned up when the reality it models is "not there." So flexible it can be extended at will not only into time past -- memory -- but into time to come -- foresight.

Where, exactly, is music in all this? As Jerison sees it, having constructed an integrated and ceaselessly modifiable mental model of the outside world from an unending stream of perceptual images-ultimately those of touch, taste and smell besides those of sight and sound -- early humans were now ready to reach out to other humans for a common validation of their senses. They were ready to ask whether all people share essentially the same world experience. And if so, what on earth did it mean to them?

The questions and their answers could be exchanged, the internal models compared. Not only through language, which Jerison calls fundamentally an "image-construction mechanism," but equally important, through art -- our uniquely expressive use of such image-construction mechanisms as painting, sculpture, dance, mime-and music.

That music can construct such subtle and exquisite images in sound is beyond denial. The writings of famous composers are replete with outspoken recognition of that. Music can evoke not merely the quality of joy, for example, but, as Aaron Copland writes, "the specific shade of joyousness--whether it be troubled joy, delicate joy, carefree joy, hysterical joy...."

The reactions that music evokes are not in themselves feelings, adds Paul Hindemith, "they are the images, the memories of feelings. Musical reactions build up, like dreams, a phantasmagoric structure of feeling that hits us with the impact of real feeling .... the memory of which is revived by the musical impression."

That music, moreover, hath power to soothe the savage breast -- and savage the most sublime -- goes without saving. What needs to be noted, however, is its growing use in

treating with that power such emotional problems as the psychological fallout from such handicapping physical maladies as stroke. A West German musicologist, for instance, told a recent European medical congress that paralysis victims, suicidally depressed and suffering from chronic inertia, can be coaxed into therapeutic movement simply by playing songs they like (Glenn Miller and Mantovani are favourites). They begin tapping their fingers, nodding their heads, trying to move legs immobilized for years.

Have music therapists, however crudely, stumbled upon what Aaron Copland calls "the unwritten Esperanto of the emotions"? Perhaps Manfred Clynes knows.

Manfred Clynes -- inventor, physiologist, engineer and concert pianist -- was born in Vienna and reared in Budapest, the son of a naval architect and a poet mother who sang Schubert ballads. With the rise of Fascist anti-Semitism, his family fled Hungary in 1938 and settled in Australia. There Clynes graduated with honours in music and engineering from the University of Melbourne and won a fellowship to study piano at Juilliard, where he received his master's in music. The University of Melbourne later awarded him a doctor of science degree on the merit of his experimental contributions to physiology.

An internationally shining career seemed within his grasp -- indeed, one London critic likened him to Horowitz -- but Clynes soon wearied of the worldwide one-night stands and chronic jet lag that are as much the lot of the concert performer as is his music. In what he now jokingly calls "a pact with the devil," he left that side of the keyboard professionally for a time, although he has since resumed his concerts.

A job in New Jersey as a first-generation computer specialist -- secured by answering an ad in the New York Times -- got him in on the ground floor of the burgeoning new fields of data processing and control-systems analysis. Dr. Nathan Kline, the innovative research director of New York's Rockland State Hospital and a pioneer in the development of tranquilizers, decided that the infant technology might make novel contributions to psychiatric research. He asked Clynes to join his staff.

Clynes soon proved his boss a prophet, although not precisely in the manner expected. It was brain physiology, not psychiatry, that captured his interest and intense energy. Specifically, he wanted to know how the nervous system went about constructing from our sensations--although he might never have put it this way--Jerison's internal model of the outside world.

To study the impressions our senses make on the brain, Clynes found he needed an electronic means that would enable him to winnow out from the brain's ongoing electrical activity the sudden impact of a given stimulus. Metaphorically speaking, he had to isolate from the blizzard a single falling snowflake. And not just winnow it out. Given its quicksilver nature, he had to preserve it and record it instantaneously before he could study it. A large order. Nothing existed that would do that. So Clynes invented it: the Computer of Average Transients (CAT).

The CAT automatically averages all electrical emanations from the brain beneath a ring of EEG electrodes pasted to the scalp. That way, it gets what scientists call a baseline for comparison, in effect, a background level from which any significant departure stands out in bold relief. Thus, when a sudden stimulus is introduced repeatedly, it triggers the CAT to add the responses until their common outline is defined in detail and all other brain activity is averaged out. That common outline is recorded on graph paper as a jagged, telltale distinctive form. So successful has been the technique in manifesting at least some of the higher workings of the brain, including language, that it has encouraged a thriving field of "evoked potentials" research.

Using the CAT, Clynes first determined that the visual perception of both colors and shapes registered electrical patterns in the brain that were distinctively unique, reliable and recurring. Clynes calls Jerison's sensory imaging "elogizing," from the Greek root logos for a corresponding process that applies to all senses. Out of a hundred possible choices of colors and shapes, in fact, a computer Clynes programmed to scan such evoked potentials and compare them with the entire array stored in its memory bank could unerringly pick out any one. And not just in himself. They were identifiably and repeatedly the same in certain key respects for all subjects who took part in his experiments. This, he decided, must surely be true of sound and our other senses, too. But as a musician, Clynes had an even more compelling question. What about expressive sound, communicating sound? Not language; that was for the psycholinguists. What about the sound of music?

It was then that Clynes made what one observer calls a gigantic and elegant conceptual leap: since a consistent reality of outside perception could be found within brain waves, why couldn't there also be a consistent reality of inside feeling? After all, aren't we conscious of our life reflecting both realities, internal and external?

And if the outer world as perceived isn't limited to forms in space--things seen and touched--but includes forms in time -- things heard--why shouldn't the same be so of our inner world of experience, as expressed? Why, in short, shouldn't the brain model the forms of music--Hindemith's musical images and memories in all of Copland's shades--besides those of art and sculpture with all their exquisite subtlety? Not to mention the dynamic hybrid mix (occupying time and space) of dance and mime?

By their very persistence and commonalty, furthermore, it appeared to Clynes from long experience with things both musical and scientific that a limited number of innate organizing principles were involved. These, he decided, must influence the exact shape of musical images in a pre-programmed way, just as our genes encode a microscopic biochemical blueprint that determines the shape of the kidney.

"We communicate ... qualities to one another and to ourselves," Clynes writes, "through the production and recognition of [these] precise forms." But what qualities, precisely, did such musical forms embody? Replies Clynes, "A class of qualities which is inherently linked to the motor system ... emotions."

Theory was one thing; however, proof quite another. How, Clynes asked himself, could the emotional "touch" that lies behind music be "tapped"? Generating and controlling a relatively simple incoming auditory stimulus and extracting its electrical trace from the brain was difficult enough. Extracting the essence of and recording an outgoing expression as ramified as a phrase of music seems all but insurmountable.

Besides, other problems emerged almost the moment the question was formulated Whose music, the subject's or, say, Beethoven's? Played by whom, the subject or somebody else? Music played or music heard, and emotionally was there any difference? The variables were many and formidable. Perhaps too many and too formidable.

Then Clynes remembered a curious experiment by German musicologist Gustav Becking that might be pertinent. Back in 1928, Becking reported that an expert musician rhythmically moving his forefinger in the air to music did not do so aimlessly. On the contrary, he inscribed precise patterns in space that when analyzed proved characteristic of that composer's work. Was the moving finger, as Clynes now suspected, functioning as a "biologic filter," screening out extraneous brain waves, letting the pure expression come through in a genuine transduction of energy from one form to another, from hearing to movement?

If so, any form of human energy transduction could be used, the more easily measured the better. Clynes decided to find out by having a musician-himself, naturally--think a musical score, mentally "transduce" a composition into -- what could be simpler? -- the variable pressure of his index finger. The result: averaging 50 separate pressure "transients" during each of several Mozart works, he found the "inner pulse form" of the resulting curve distinctive to Mozart and quite different from that of Beethoven, who proved to have his own idiosyncratic shape.

To rule out the possibility that he was getting an artefact of his own subjective attitudes, Clynes prevailed upon several other performers he knew to try their hand, notably Pablo C'acals and pianist Rudolf Serkin. The same thing happened Bach performer's set of curves was essentially like the other's, and classifiably distinctive to the composer they were mentally "playing."

Concludes Clynes after further experiments using other composers: Mozart, Schumann, Schubert, Wagner, Mahler, Tchaikovsky, Prokoflev, Debussy, Ravel: each had his own inner pulse.... The stability ... confirms the acute observation of [Becking] that one cannot simply transpose a phrase from Mozart to Beethoven -- even if the phrase is almost identical note for note -- without stumbling over the phrase while conducting; for the underlying musical pulses are quite different. [See figures 1B and 2 at beginning of these articles]

Indeed, Clynes has decided, in tandem with his unique inner pulse, "every good composer uses a wide range [of images] in his musical expression; they are portrayed in the phrase, harmonics, rhythms and motifs, tone color, dynamics and silences of the music."

"The two processes ... go on simultaneously."

But where were the performers in this? The acuity of their emotional insights engaged to the fullest, surely they too had a contribution to make with the communication of their instruments, a fact driven home to Clynes by an incident involving ('awls. At one of the master's advanced classes, Clynes heard an outstanding student play a graceful theme from the Haydn cello concerto "probably as well as one would hear it anywhere." Casals listened intently, then rejected it with a wave of his hand. No, he said to the astonishment of all, it had to be graceful.

Recalls Clynes: And then he played the same few bars--and it was graceful as though one had never heard grace before--a hundred times more graceful .... What was the power that did this? A slight difference in shape .... but an enormous difference in power of communication, evocation, and transformation. Where did this come from? Casals reiterated over and over again that music must be played "naturally." Clynes gradually came to understand that this meant "to listen inwardly with utmost precision to the inner form of every musical sound and then to produce that form precisely. It means to have a precise idea, as well as a precise execution of it. It is not exaggeration to say that in the hands of a master such as Casals, the sound is defined to a precision of hundredths of a tone."

And the listener's emotional role? Given what Clynes believes to be the genetic base for shaping emotion and expressing it through musical images, Clynes is inclined to make the listener a kind of repository for their platonic archetypes. As he writes: "In hearing a melody [we know], we mentally shape each individual tone. Our thought .... of the tone implies its precise manner of growth and decay, both in loudness and tone quality. Actually, we rarely hear performances in which the audible tones correspond to our mental hearing. But in great performances that contrast disappears and the tones we anticipate actually take place, confirming our anticipation. The wholeness of this experience can lead to a kind of ecstasy. It is even possible that the sounds we hear may exceed or 'transcend' our expectations. Such performances are indeed mind-expanding." [see Figures 1B and 2 at the beginning of these papers]

Finally, Clynes went one step further. If musical images were the carriers of emotional qualities, could they, like the instruments of music, be dispensed with, stripped out of the equation, leaving only the emotions themselves to be expressed through a transduction of fingertip pressure?

They could, Clynes found to his satisfaction over the next few years. The method was sheer simplicity. Subjects sat in an armless, straight-backed chair with index fingertip against a smooth plastic disk attached by putty to a tabletop of comfortable height and hooked up to the CAT/transducing device. Then, in response to randomly spaced, soft-spoken commands from a tape recording to "fantasize" each emotion and express it through the pressure of their fingertip, they ran a gamut of projected feeling. Love, Hate, Anger, Grief, Joy, Sex, Reverence. [See figure 1A at the beginning of these papers]

Each of them, to Clynes's delight, had its own curve. And not just across population samplings but also across cultures-as summer field trips to Mexico, Japan and Bali subsequently established. Manfred Clynes left Rockland State Hospital to devote more of his time to the theoretic structure of the "science of emotion communication" he calls sentics.

As an unexpected by-product of his research, moreover, Clynes finds that "sentic cycles" have a therapeutic effect on those who perform them correctly. [see paper # 5 earlier] Subjects report an aftermath of calmness, productive sleep and an upswing in psychic energy, creativity and spontaneity.

All of which has inspired Clynes to this poetic paean in his … book, Sentics: The Touch of Emotions:

> Here on this island, you find
> The order of nature has no inner,
> has no outer
> Centered nowhere, yet everywhere
> ....Touch it and be touched!

6.1. Clarifying a New Vocabulary

Manfred Clynes recently revisited Australia, where the Sydney Conservatorium of Music has invited him to teach, and do, sentic research. The following interview took place shortly before he left, on a park bench high atop a bluff overlooking the Pacific Ocean near his home in La Jolla, California.

Q: You write of sentic states, essentic forms, actons, and idiologs. Why are all these terms necessary to understanding emotion?

A: That's the great problem with this whole field. There is no agreed-upon vocabulary to use in making distinctions. If you have an intense feeling, you tend to call it an emotion. If it's very slight, you call it a feeling. Qualitatively, there's no clear consensus. Pain is a feeling, but is it an emotion? These words are not very helpful. For that reason I had to start with a new scientific term -- the sentic state -- and add others as new concepts were discovered.

Q: Are essentic forms what psycholinguists call generative? That is, can they generate-- as language does with 26 letters -- a limitless range of expression?

A: They are generative in a different way. There may be about 20 basic forms. You can compare them if you like to the colors of the spectrum. There are shades, compounds, seemingly an infinite variety but all composed of certain basic colors.

Q: Have you examined emotions other than the seven you normally use in sentic cycles? To see if some are combinations? You might intuitively expect disappointment or dejection to be composed of unhappiness and anger.

A: We have started working with compound feelings, things like melancholy and envy, yes. It's remarkable how the biologic system seems to communicate the essence of these qualities as mixtures. Your question points up the problems raised by words. How are you to differentiate between disappointment and dejection? Dictionaries are good for looking up words, but I don't look for truth in them.

Q: Any reason why you limit sentic cycles to just seven "basic" emotions--love, hate, grief anger, joy, sex and reverence? What about such feelings as hope, courage, guilt and shame?

A: No basic reason. Having started with these apparently basic seven, we preferred to study them in depth before moving on to the others. Hope and courage, we've measured Guilt and shame, I'd rather not yet talk about. We haven't enough data to say anything definite -- I'm ashamed to say.

Q: You say running through sentic cycles makes you feel good. Is this simply catharsis?

A: Catharsis is only part of it. You're also actively producing positive feelings. You can order the cycles different ways and each order will have a different effect. One reason is, as you experience one emotion, it creates certain responses in your body. Hormones are released in your blood and other chemical changes occur in your brain. They remain there for some time, so when you express the following emotion you don't start off in the same state as before. There's a cumulative effect, depending on the sequence.

Q: What sequence do you prefer for doing sentic cycles?

A: First anger and hate, which involve a relatively strong motor Acton. Then comes grief. It's a motor collapse, a letting go, without hope or help. Then you're ready for the positive, for love.

Q: Why not love-anger-hate grief? Isn't that more typical, at least artistically?

A: You mean tragedy. But the sentic cycle is precisely not that. It gives you a feeling of being glad to be alive. We put sex after love, and joy after sex. And after joy, we end with reverence.

Q: Can you be sure in your measurements that the order doesn't influence the shape of your curves?

A: We find no evidence that it does.

Q. As a "doctor of the emotions, " what can you say about them? Are some emotions more difficult to get in touch with and express than others?

A: In our society, reverence and hate often cause difficulty in clear septic expression. Many Americans, for one thing, simply aren't familiar with reverence. Once they discover it through sentics, however, it becomes very releasing for them. As for hate, we confuse it with anger. The Japanese, in contrast, have no trouble at all differentiating anger and hate when doing sentic cycles. Musicians, actors and dancers, incidentally, have no difficulty with sentic cycles of any kind. They are used to creating emotional forms in time. It's the basis of their art.

Q: Perhaps it's obvious, but why should we care if people have trouble expressing one emotion or another, in life or in sentic cycles?

A: Because practicing sentic cycles, and learning to express faithfully, seems to take away from the human drive toward violence. I can cite you cases of people who in real life have been able to express anger constructively really for the first time after doing sentic cycles.

Q: Can you be sure that fantasy emotions are the same thing as real emotions experienced in everyday life?

A: About 2 years ago I asked Erich Fromm if the fantasy emotions in music were any different. I wanted to have the view of a knowing psychologist. He did answer me. He said, "That's a very complicated question." (laughter) Since then, encouraged, we've been working on it. My book tells what we have found.

6.2. The Sentic Principles

In his book, [Sentics: The Touch of Emotions. 1977/1989, Anchor Doubleday] Manfred Clynes lists seven design principles he has found common to human biology that make sentics a science of genetically programmed emotional expression:

1. The communication of a sentic state is a single-channel system. One can only express one sentic state (which may be basic or compound) with a single act of expression. For example, a person cannot voluntarily express anger with one arm and love with the other at the same time, and experience both simultaneously.

2. A sentic state may be expressed by any number of different motor outputs. Anger, for example, can be expressed by a scowl, a gesture, a tone of voice or all of these.

3. Regardless of the motor output chosen, the dynamic expression of a sentic state is governed by a brain programs specific for that state resulting in essentic forms. These essentic forms act like "keys in the locks of our nervous system."

4. Inherent data-processing programs of the central nervous system are biologically coordinated so that a precisely produced essentic form is correspondingly recognized. The recognized form in turn generates the emotion in the perceiver.

5. Within limits, the intensity of a sentic state can be increased by the repeated arrhythmic, non-mechanical generation of essentic form. For example, a repeated caress, angry gesture or tone of voice increases the intensity of the state experienced

6. Sentic states may be experienced and expressed as pure qualities independent of any relationships with specific persons to generate or receive these qualities.

7. The power of essentic form in communicating and generating emotions is greater the more closely it approaches the ideal or essentic form for that state. The power of such artists as Casals or Picasso makes use of that function. (see figure 3 at the beginning of these papers)

7. THE PURE PULSE OF MUSICAL GENIUS
The Biological Basis for Sharing, Emotion

by Manfred Clynes, Psychology Today, 1974, July, pp. 51-55

Manfred Clynes, an inventor, neurophysiologist and concert pianist who toured the major cities of Europe, received his musical and scientific educations in Hungary, Australia, and the United States. His degrees include an M.S. in music from New York's Juilliard School and a D.Sc. in physiology from the University of Melbourne. At the Rockland State Hospital in Orangeburg, New York, he did research in neurophysiology that led him to construct the science of sentics. Clynes now lives in California, and has ... a book [published by] Doubleday entitled Sentics: The Touch of Emotions.

Music is a language of emotion, and the great composers left distinctive personal signatures in their works. The discipline of learning to generate and express specific emotions precisely would help develop a child's musical talent. Too often, we squash a child s love of music with technicalities that put the composer's intimate personal vision second.

The question of how music communicates-how it changes our moods and even gives us insights -- has traditionally fallen within the province of aesthetics or music criticism. And yet we can also look at the language of music from a scientific perspective; for it's a fact that music involves emotions, and it's possible to predict which emotions it will involve. A good composer who wants his music to communicate joy can do exactly that. A performer who understands the composer's intention can transmit this joy, while a listener in turn can understand the performance and feel joy again, joy the composer created perhaps hundreds of years before. Music, in other words, is a form of communication that transmits emotion, and speaks about emotion, in precise ways. This article (which deals with subjects that are elaborated in my ... book, Sentics: The Touch

of Emotions) will examine the nature of that communication and the nature of musical talent. They are closely related.

Before discussing the nature of musical communication we need to sketch out the theory of sentics. Sentics is the scientific study of the communication of emotion. For many years, scientists have considered the communication of emotions difficult to treat scientifically, in part because the emotions a person experiences have been impossible to measure. Some years ago, however, I discovered that under standardized conditions it was possible to measure the expression of fantasized emotions, because people expressed them in very similar and predictable ways. The important factor to characterize it seemed to me was the dynamic quality of the expression rather than the particular part of the body used. It appeared that this quality could be isolated in the emotional expressions of an arm, a leg or a tone of voice. Therefore, it should be possible to express this dynamic quality by the pressure of a single finger.

7.1. Genetic Inheritance.

Through this hypothesis, I made the task of measurement feasible. My subjects expressed their feelings with only one finger, which they placed on a transducer designed to record transient pressure in two dimensions--up and down, and away from and toward the subject [see "Sentic Cycles: The Seven Passions at Your Finger Tips," Psychology Today, May 1972 ,Article # 8]. When I averaged one person's repeated expressions of grief, for example, on a computer, the curve of the expression looked like that of other people expressing grief. The same was true of anger, sex, joy, love, hate and reverence. Each fantasized emotion, when expressed with a single finger, produced a typical and predictable pattern. The evidence suggested strongly that these typical expressions reflect part of our genetic inheritance. [see figure 1A at the beginning of these papers]

I performed similar experiments in Mexico, Bali and Japan. Remarkably, it appeared that people of diverse languages and cultures expressed themselves in similar ways.

Sentics, then, is the science of the communication of emotion through natural, biologic forms in time and space, these forms are of a completely different kind from culturally developed signs and conventions, such as traffic signals. I have named these natural, expressive movements essentic forms. They are biologically determined expressions that are programmed into us. When we feel anger, we tend to express it in definite "angry" ways and not in other ways. Moreover, essentic forms become precisely measurable when measured through transient finger pressure. It is this precision that makes emotions recognizable as distinct entities.

7.2. Single Actons, Single Thoughts

There are two other concepts one needs to know in order to introduce sentics as a science. One is *acton* and the other is *idiolog*. An *acton* is a particular type of action: a single, programmed, expressive action (with a duration of approximately 0.5 to 3.0 seconds)

which has a clear beginning and end; the term also includes the decision giving rise to the action. This is not an arbitrary definition; it denotes an existing entity. Once a person decides to make a single expressive movement, he continues through to its programmed end unless something forcibly restrains him. The design of the nervous system allows only one decision for each action.

An *idiolog* is a single, natural thought of a quality such as sweet, red, or anger, together with certain electrical and chemical correlates in the brain. Ideologs are thus distinguished from a person's perceptual experience of a quality. Specific qualities produce definite brain responses, as experiments with colors and shapes, as well as emotions, have shown. Thus an idiolog of a certain color or emotion might be called the "clearest idea" of that quality. The possibility of such clear ideas is a part of human nature.

I have mentioned how we measure essentic forms. I must also describe how we may produce them, since musicians, as we shall see, produce them all the time in their compositions and performances.

When my experimental subjects repeatedly produced the particular essentic form of a fantasized emotion, the form appeared to generate itself and became "purer"' with repetition. In other words, someone can generate an emotional state by repeatedly producing its typical expression. Positive feedback allows the person both to increase the precision of the essentic form and to become more aware of how it feels.

It was necessary to study the precise timing of essentic forms in order to generate emotions most powerfully. Signals to express an emotion should come at unexpected intervals, so that the expression becomes part of a dialogue. Moreover, the mean number of signals per minute should be appropriate to whatever emotion the subject is asked to imagine and express. Each emotion has its own best generating frequency. The signals to express anger, hate, sex and joy should come within a mean range of four to six seconds, whereas the mean interval for grief, love and reverence is longer--seven to 10 seconds.

As we generate a fantasized emotion, we begin to recognize a pure essentic form toward which we are striving. We seem to be learning something, although not in the conventional sense of forming a new memory. Rather, we discover an aspect of what we already are but have neglected to cultivate. At first we may imagine particular situations in order to help us fantasize. Soon, though, we can experience and express an emotion without specific imagery. At a further stage, new imagery may spontaneously arise.

[see figure 1A at the beginning of these papers] ESSENTIC FORMS. The expression of each fantasized emotion has its own typical form. Even individuals from different cultures express grief, for example, with the same movements.)

7.3. The Expressions of Music

Sentics provides a conceptual framework for talking about music. Like other emotional experience, music involves expressive forms in time. It has precise beginnings and ends, and is largely an expression of inner gesture and song. Dancing, marching, singing, and certain gestures (which imply emotional states) are at the heart of music.

Meaning in expressive music derives from the essentic forms of its idiolog elements. What this means is that emotional gestures, such as a particular dance step or a caress, have precise representations in the brain. Composers can make sound-structures out of essentic form. Performers are able to recognize and communicate them.

Every good composer uses a wide range of essentic forms in his musical expressions, and he portrays these essentic forms with such variables as pitch, intensity, tone color, duration, consonance, dissonance, rhythm, motif, silence, and harmonic progression. The sentic significance of the beat is particularly important, while the organization of sounds according to motif is intimately related to the timing and shape of essentic forms.

One way in which music is a language of essentic form is in the nature of its precision. Essentic forms are extremely precise, as measurements have demonstrated. Furthermore, the closer an essentic form resembles the pure form for that emotion, the more recognizable and powerful it becomes. In music, too, each phrase, motif, or even single note--if it is going to communicate properly-must be as faithful as possible to the particular essentic form chosen. That is what "purity of expression" really means. Only when the sound produced is perfectly faithful to the inwardly heard essentic form does communication become completely authentic. Then the music can be eloquent and beautiful.

This inner, sentic precision cannot be written in musical notation. Yet we can trust essentic forms to be highly precise and to guide a musician's execution. One cannot accurately notate a dance rhythm, for example, because it is based upon essentic form, and the precision of essentic form doesn't divide neatly into half, quarter, or eighth note values. It is only possible to approximate this biologic precision with musical notation. Thus technical ability in music should refer to the ability to reproduce the precision of essentic form, and not merely to reproduce the letter of the written music. Precision devoted to the letter only is a wasted effort, a waste of years of practicing by many students and performers

7.4. Incredible Precision

Let me give an example of the incredible precision and stability a good musician can achieve. The conductor Arturo Toscanini became a legend for his precise executions. Over the course of 12 years, he made several recordings of the Brahms-Haydn Variations with the NBC Symphony Orchestra. I had read that the duration of his performances in 1935,1938 and 1948 were remarkably similar -- so much so that they aroused my

curiosity and doubt. With the help of the conductor's son, I gained access to the master tapes, which were essentially free of errors in timing due to transfer from the master, introduced pauses and the splicing of different takes.

I discovered after careful time keeping that the total length of two performances differed by less than half a second in 16 minutes and 50 seconds, or about one part in 2,000. These two performances were recorded 10 years apart. The timing data also illustrate that where Toscanini's conception of how the music should be conducted remained the same, there was great stability; but where the conductor changed his conception of one of the Variations, the difference in timing was obvious. Incidentally, Toscanini had written his own metronome marks into his score; his actual performances, however, were vastly more accurate than the steps of the metronome marks.

Between the performance in 1935 and the one in 1948, both of which took place in the same hall, there was a world upheaval. Toscanini aged 13 years; there were innumerable sources of instability -- anxiety, fatigue, humidity, to name a few. One would expect, considering all these changes, that no two performances would ever have the same duration. But such changes meant little compared with the extraordinary precision and stability of the conductor's idiologs, actons, and essentic forms. There can be no question, moreover, about Toscanini trying to remember how he had conducted the work 10 or 12 years before. A good artist feels his work anew; and besides, remembering would hardly allow such accuracy. It was the precision of feelings that led to Toscanini's precision of execution.

Arturo Toscanini Conducts the Brahms "Haydn Variations"						
Section	1935		1938		1948	
	Cumulative Time	Time	Cumulative Time	Time	Cumulative Time	Time
Theme	1:56	1:56	1:52	1:52	1:53	1:53
Var.1	3:04½	1:08½	3:03	1:11	3:03	1:10
Var. 2	3:56	0:51½	3:56½	0:53½	3:57	0:54
Var. 3	5:29	1:33	5:32	1:35½	5:34	1:37
Var. 4	7:26	1:57	7:33	2:01	7:33½	1:59½
Var. 5	8:14	0:48	8:21	0:48	8:22	0:48½
Var. 6	9:21	1:07	9:28	1:07	9:29	1:07
Var. 7	12:21	2:01 1:01	12:30	2:03 0:59	12:25	1:58 0:58
Var. 8	13:18	0:55	13:25	0:55	13:17	0:52
Var. 9		3:26		3:25½		3:33½
Total		16:44		16:50.6		16:50.3

IDENTICAL CONCEPTIONS. Timing data in minutes and seconds point to nearly identical performances of several Variations, despite the years that separated each performance. Precision of emotion and an unchanged conception of the music account for this incredible feat.

7.5. The Key to Talent

Rhythmic notation isn't the only aspect of printed music that fails to match a good performance. In hearing a melody, we mentally shape each individual tone. Our thought or idiolog of the tone implies its precise manner of growth and decay, both in loudness and tone quality. Actually, we rarely hear performances in which the audible tones correspond to our mental hearing. But in great performances this contrast disappears, and the tones we anticipate actually take place, confirming our anticipation. The wholeness of this experience can lead to a kind of ecstasy. It is even possible that the sounds we hear

may exceed or "transcend" our expectations. Such performances are indeed mind-expanding. They enlarge our capacities and our sense of discrimination and of values.

Thus music is truly a language of essentic forms. Musicians use this language in order to communicate emotions and qualities to others who recognize the language. Access to essentic forms is part of what musical talent means: the most gifted musicians are those who are able to achieve the greatest purity of essentic form. The purest forms are the most recognizable by others; they communicate with the greatest power to transform. Clearly, there is nothing arbitrary about this talent. Talent does not amount merely to "somebody's opinion." Talent is real.

Some people are able to produce essentic forms readily and communicate them through the language of music, while others seem to be more or less out of touch with them. Essentic form is a key that fits certain locks in the nervous system; without recognizing that key, music cannot be understood. Many people, for example, describe themselves as more or less "tone deaf." In fact, however, everyone can modulate his voice expressively and interpret the inflections of other voices. (Even a dog can interpret a tone of voice.) When someone really cannot modulate his voice we think of his "monotonicity" as pathological. The ability to use tone of voice in order to convey meaning makes use of the essentic forms inborn in all of us. And so I don't believe that there really is such a thing as tone deafness, as it is commonly defined. Most people who think they are tone deaf have not chanced upon the proper key to understanding in the course of their development.

Training in the use of essentic form might weld be considered a basic need of education, and not just for music. Children can learn to recognize and produce essentic forms at an early age. One way to teach them, possibly the best way, is by letting them do "sentic cycles," a series of fantasized emotions expressed by our method of finger pressure. Sentic cycles can give firsthand knowledge of essentic forms as they well up from within.

Essentic form is as eloquent in simple music as it is in the most complicated symphony. Thus the discipline of essentic form is satisfying and enjoyable, and children can learn a great deal about it before their love of music is squashed by technicalities that place the living quality of music second. The proper technique is to produce essentic forms precisely. This includes a clear idea and a clear execution -- faithfulness to an inner sound, which must be accurately produced. That is the end toward which practice should be directed, and that is the way to develop musical talent.

KEY TO UNDERSTANDING. Many composers have a characteristic emotional rhythm that remains the same throughout their work. Understanding essentic forms is the key to musical talent. [See figures 1B and 2 at the beginning of these articles] The Shape of the Inner Pulse.

7.6. Inside Classical Music

We have dealt in general with communication through music and with the nature of musical expression. Let us now discuss a special channel of musical communication that developed during a particular period of Western music, namely the "classical" tradition. We shall see that certain composers created a highly evolved and personally intimate use for the language of essentic form.

In the 18th century, beginning about the time of Mozart, there appeared in the great music of Europe an element of the musical beat which carried (and still carries) an intimate septic charge. We call this the "inner pulse." Without the inner pulse, the individual phrases of Mozart cannot sound "Mozartian." The inner pulse in a subtle way represents the composer's point of view, and if the performer empathizes, he can recreate that point of view and make the composer live.

"Inner pulse" may sound vague but is not. The inner pulse can be measured with methods similar to those used to measure essentic form. I asked the subjects of my experiments, who were all sensitive musicians, to think certain musical works, in real time, as if they were singing or performing them, and at the same time to "conduct" with the pressure of one finger. Seated in a chair, and maintaining continuous finger contact with a pressure transducer, a subject would repeatedly press his finger in accordance with his experience of the inner pulse. I recorded these pulse shapes and averaged them with a computer.

The results were interesting and clear. The inner pulse, for example, of Beethoven's music assumed a definite shape; and it seemed to make little difference whether Rudolf Serkin or Pablo Casals was doing the thinking, or whether they were thinking of Opus 13 or 109. There was a single inner-pulse shape for Beethoven. Other composers also produced characteristic pulse shapes. Mozart, Schumann, Schubert, Wagner, Mahler, Tchaikovsky, Prokofiev, Debussy, Ravel: each had his own inner pulse. In virtually every case, the composer's inner pulse remained stable no matter what piece of his work the musician was imagining and expressing.

The stability of inner pulse confirms the acute observation of the musicologist Gustav Becking, in 1928, that one cannot simply transpose a phrase from Mozart to Beethoven--even if the phrase is almost identical note for note, without stumbling over the phrase while conducting, for the underlying musical pulses are quite different.

7.7. Empathy and Point of View

In terms of sentics, what is happening here? A conductor's beat is a rhythmic alternation modified in expressive, dynamic ways. The inner pulse, however, is an internally conducted beat. It is "inner" in two senses of the word. In one sense, it is not explicit in the written music; in another, it pulses as a sequence of acton idiologs within a person who understands the music.

Sentics has given us insights into the process of empathy, which may be defined as the ability to have another individual live inside oneself through an act of imagination. This act of imagination includes a view of the entire other person, and is different from sympathy. Sympathizing with another person generally amounts to a kind of resonance with some particular emotional state.

The best musicians, I believe, empathize sentically with a composer. The music, through its inner pulse, communicates an essential aspect of the composer's identity to the living musician. A musician who is sensitive to the inner pulse has perceived the personal signature of the composer. It is a sentic matrix representing the composer's point of view. We may feel his point of view as a "presence." (The stability of inner pulse forms seems to derive from the same process that gives each character in our dreams a consistent presence and personality.) Empathy in music is a kind of resurrection.

Points of view, as they appear in the inner pulse, may be distinguished according to whether they represent Acton in the present, reminiscence of the past, or anticipation of the future. We may further classify them as the view of a spectator or actor, as in our experience of dreams. Mahler's point of view is predominately that of spectator reminiscing. Beethoven's tends to be that of actor in the present; Mozart, spectator in the present; Schubert, actor with expectations of the future.

As one goes deeper into the meaning of a composer's point of view, one discovers more and more of the subtle yet precise play of essentic forms. For example, experience of the inner pulse implies an image of the self. Who is spectator or actor? Who recollects the past, lives in the present, longs for or dreads the future?

Answers to such questions implicit in Beethoven's music are reflected in a subtle change of his inner pulse. His middle-period music is dramatic and Promethean; a striving individual actor often seems contrasted with universal forces. In his last works, however, Beethoven surmounted the duality of individual and universal and achieved a fusion of being that eliminated struggle from the inner pulse. Although the shape of Beethoven's later pulse has not changed substantially, it is no longer accompanied by the same steady, binding, muscular tensions. In Beethoven, the concept of actor and spectator underwent a transformation. He transcended the distinction between looking and doing. Accordingly, the power of his music changed from the strength of opposition and ethical restraint, to the strength, security and peace of being at home in the wonder of existence.

7.8. The Language of Emotion

Both in composing and in interpreting, there is a continuous interplay between the dictates of the inner pulse and the expression of particular essentic forms. Every composer, as I have said, invokes most of the spectrum of emotions; but the point of view from which the emotions spring influences their realization in sound. With the aid of these two principles of communication we find the freedom and power to create interpretations that are eloquent and yet not exaggerated. When we exaggerate we are as unfaithful to essentic form as when we are indifferent. Being true to essentic form gives

us a confidence based upon reality. Essentic form is basic to communication through any music, whether Indian, Japanese, Western, popular or classical.

Earlier, I mentioned "sentic cycles." Let me say a final word about them because they demonstrate basically how the science of sentics applies to music.

It seems that when a person imagines and repeatedly expresses a single emotion-and then another emotion -- and then another--and so on through an ordered range of primary emotions, the result is a feeling of satisfaction, wellbeing and deepened insight into one's own emotional life and the lives of others. These sequences of fantasized emotion and expression are what I call sentic cycles. They require that a person sit down and, with a single finger, express "no emotion," anger, hate, grief, love, sex, joy and reverence, in that order. Psychiatrists have investigated the therapeutic uses of sentic cycle tapes, which appear very promising. Needless to say, there are close parallels between sentic cycles and the effects of music. When a person does sentic cycles, it is as if he were a composer. And when a musician brings forth eloquent music, he must sing and dance within. The two forms of expression use the same inborn language of emotion.

Today we can explore the scientific basis of the mind-expansion some music produces. This magic is not supernatural, but it is universal. The magic involves a language of essentic forms, in which emotions, and ideas about them, may be passed from person to person and from age to age. To have talent in music, one needs to understand this means of communication. It would be good if one could teach it to many people, especially while still young. I'm convinced it's possible.

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8. SENTIC CYCLES: THE 7 PASSIONS AT YOUR FINGERTIPS

by Manfred Clynes. Psychology Today, 1972, May, pp. 59-60, 68, 70, 72

Specific emotions -- anger, hate, grief, love, sex, joy and reverence -- produce distinct muscle movement. They're the same in Mexico, Japan, Indonesia, and upstate New York. When you run through a cycle, expressing each of the seven with your fingertip, you feel better for it.

In 1967 I took part, as pianist, in Pablo Casals' master classes in San Juan, Puerto Rico. One day when Casals was teaching Haydn's Cello Concerto, he asked a participant, a young master in his own right, to play the theme from the third movement. His playing was expert, sure and graceful. But for Casals something was missing.

The master stopped the performance. "No, no!" he said, waving his hands. "That must be graceful!"

He took up his own cello and played the same passage. And it was graceful, a hundred times more graceful than we had just heard. Yes--it seemed as though w e had never heard grace before. We had experienced one of the least understood forms of human communication--a powerful and clear transmittal of feeling without words, a feeling that penetrated our defences and transformed our states of mind.

Casals played the same notes, and at similar speed. But the muscles of his hands and arms acted precisely together with his cello according to his very clear idea of grace.

How was this possible? How, precisely, was Casals' expression different from the student's? And how did the sound of his cello carry the idea and feeling of grace from his mind to ours?

8.1. Action

These and similar questions that I thought about for many years led me to record and measure the precise motions of expressive Acton. My experiments on impulses from the pressure of a single finger, precisely expressing various fantasized emotional states have shown that there is a specific dynamic form of Acton underlying the expression of each emotion, and that the dynamic character of this Acton-form probably is universal, unlearned, and genetically programmed.

Emotions may be experienced in various aspects: 1) in a real situation, or 2) through fantasy -- as when one imagines being with a loved person. Also one may experience emotion through empathy with another person who is either 1) really experiencing the emotion, or 2) experiencing it as fantasy -- as when one is watching a play or movie.

It is hard to study the quantitative effects of emotion in a real situation. In most experiments it is difficult to specify situations that reliably produce a given emotion. Repeated experiments are difficult to carry out under the same conditions. Emotions, in real situations, may today be less amenable to scientific study than fantasized emotions are. I have found a way of generating and expressing fantasy emotions that allows precise, repeated measurement.

8.2. Signs

How can one know what another person is feeling? Psychologists and other scientists have tried to identify outward, physical signs that correspond to each emotion. Perspiration, pupil-diameter, skin conductance, heart rate--all have been used as objective, observable indications of internal states. But these are not uniformly related to experience--anger turns some persons' faces red, others, pale.

And yet, artists, musicians, dancers and actors are aware of the precision of emotions that may be communicated. They may communicate through movement of hands, legs, mouths, eyes, the whole body, and through tone of voice. The precise way that one uses his body to express an emotion is more important than the part of the body one uses.

8.3. Anger

We may consider that there is a common brain program for specific emotion that determines the character of the movement and its precise time course, regardless of the particular body movement that expresses it. For example, in expressing anger no matter what part of the body one uses, the brain program that determines the character of its time course is revealed. And this is in turn what we notice when we watch the movement and perceive anger.

In this method of generating and expressing fantasy emotions by a succession of single, expressive, appropriately timed acts, the fantasy-emotion increases with each expression, until it reaches a peak that may be maintained for a time and then gradually dissipates. This dissipation takes place even though one continues to perform the expressive acts.

8.4. Finger

In view of this, I decided to use the expressive pressure movement of one finger as a standardized basic measure of expressed fantasized emotion. In my experiments, the subject sits in a straight back chair and rests the middle finger of his right hand on a finger rest. I ask him to fantasize a given emotion (say, anger or love) for the next few minutes. Whenever he hears a signal-a soft click -- he is to express that emotion as precisely as possible through the single, transient pressure of the finger. The clicks come at unpredictable intervals that vary by several seconds. The finger-rest is mounted with two pressure transducers that produce two graphic tracings of finger pressure during the two seconds immediately following the click. One tracing measures the finger's vertical pressure: the other measures its horizontal pressure, toward the body and away from it.

8.5. Trials

Most subjects find it easy to express a fantasy emotion with a single finger pressure. About 70 percent can do it on the first set of trials.

To get a stable overall measurement, I usually have a subject express each emotion 50 times, then I feed the data into a computer of average transients (CAT) that averages the vertical tracings for a given emotion into one common vertical form and, likewise extract a common form from the horizontal tracings. I have found that the more a subject practices a clearly separate fantasy emotion, the more his individual expression tends to approach the common form for that emotion.

Usually I have a subject express anger, hate, grief, love, sex, joy, reverence, and a state of no emotion.

Expressing no emotion in this method is like the mechanical movement of typewriting: primarily downward, and slightly outward, away from the body. Anger is a similar motion, but with reversed emphasis: outward movement is more pronounced than downward movement. Anger is a brief expression -- the finger returns to its original position in less than a second. Love is slower, and takes two seconds or more. Changes in pressure during love are gradual and smooth, and the horizontal tracing often shows an inward embracing movement. The form for sex is distinct from love.

Measurements of electrical activity in the muscles show that there is a secondary delayed pressure that begins after the expression has started. Such delayed muscular activity also occurs in hate -- another passionate emotion. Hate, like anger, involves a push away from the body. Grief is slow, like love, but is flatter and slightly outward. In joy, after an initial

downward push, the finger pressure rebounds above its starting position, as if one were jumping for joy. Reverence is similar to love, but lacks the inward pull and follows a longer time scale -- the full expression of reverence may take three or four seconds. I first included fear among emotions that a subject was to fantasize, but I found that fear implied withdrawal and the inhibition of expression and our technique could not measure this.

8.6. Oxygen

In many cases I have measured additional physiological variables during an experiment, and these measurements confirm both a specific pattern for the expression of each emotion, and the persistent physiologic changes that accompany sustained fantasy emotions. During an expression by this method, the electrical activities in separate muscle groups (the forearm, upper arm, front shoulder and back) show reliable, identifiable patterns. Respiration also tends to follow a specific pattern: a subject tends to exhale as he expresses hate or grief, for example, and to inhale when he expresses joy.

Heart rate and oxygen consumption show definite, characteristic changes while a particular emotion is fantasized. Oxygen consumption appears to be highest in the states of hate and sex lowest in love and reverence.

8.7. Stability

Emotional expressive forms measured in this way are stable and apparently universal. A subject will give essentially the same tracing for a single emotion on different occasions, and different subjects from different cultures produce remarkably similar tracings for a given emotion. We can state the degree of correspondence between any two measurements as a correlation in which zero indicates no relationship between one measure and the other and 1.0 indicates a perfect match. Between two measurements of the same emotion in one person, the vertical tracings usually correlate above .90, whereas cross-correlation's between different emotions are generally lower than .30. The forms are also remarkably consistent between individuals; correlations between two persons' expressions of an emotion are generally above .80. Dramatic differences can occur, and the discrepancy can be instructive. For example, when I compared my expressions to those of another subject, I found that our tracings were similar for most emotions (correlations of .80 or higher), but that for anger they differed sharply, with a negative correlation of .22. We learned that we interpreted the word anger differently. I had expressed an irritable ready-to-strike-out anger, whereas my colleague's anger was of the slow, burning type. The tracings seemed to detect that the word anger designates two different emotions.

8.8. Test

This observation raises an interesting question. Suppose two persons expressing an emotion (joy, for example) produce slightly different wave forms. Does this mean that they express the same emotion in different ways, or does the slight shape discrepancy

imply a corresponding difference in the way the two feel joy? We cannot answer, but my research indicates that when there are large differences in form, there are large differences in the emotions experienced.

For example, I have tried to train subjects to express one emotion with the expressive form of another emotion, but they cannot learn to do it. I asked subjects to fantasize anger and try to experience this with the pattern associated with love, and vice versa. When a subject's tracings approached the love form, he received praise; when he produced anger-shaped waves, he was warned. But no matter how hard he tried, no subject could generate and express anger by finger pressure resembling love.

With repeated expression, a subject's fantasies often become more and more intense. He may shed tears while he expresses grief, or become aroused.

Several investigators have shown that human beings can learn to control their bodies to an extent previously considered impossible. Peter Lang finds that, through immediate visual feedback about what some of his organs are doing, a subject can learn to control these as he would learn to drive a car [see "Autonomic Control or Learning to Play the Internal Organs," by Peter J. Lang, Psychology Today, October 1970].

We gave our subjects no feedback about the shapes they were producing--and yet their tracings became more accurate and precise as the trials went on. Clearly, something different from instrumental learning is involved here. It is as if one were discovering within himself those precise emotional expression programs that were there all along. This uncovering of the forms, and their resistance to change, suggest that the different basic emotional expressive forms are inborn-not culturally learned -- a hypothesis that gains support from my finding that the forms are much the same from one person to another and from one culture to another. (The effect of culture may often be to suppress access to these forms, at some stage of development.)

I tested subjects in Mexico, Japan, and Bali-Indonesia, and their basic shapes were the same as those of Americans. The few cross-cultural inconsistencies could be traced to language differences. Indonesians have no word for hate, and in Mexico *alegria* ("happiness") was the closest approximation I could find for joy. Disparity between *alegria* tracings and the typical joy shape showed just how inaccurate the translation was. (see figure 1A at the beginning of these papers)

8.9. Rubicon

The brain programs the entire course of a single brief movement before it acts. Once the decision to move has been made--a swing of a bat, or an eye movement, for example--it must continue; for 200 milli-seconds one cannot change the movements of a limb or muscle by another decision because of limits in the nervous system. The existence of specific, universal brain programs corresponding to certain basic elements of experience is not a new discovery. In 1965, Michael Kohn and I measured the electrical activity originating from different parts of subjects' brains while the subjects looked at various

colors. We found that with the help of a computer we could identify more than 100 separate brain responses to specific visual stimuli -- and the patterns had consistent physiologic code elements in all the subjects we tested. We could thus tell what color a subject was looking at from the pattern of electrical activity in his brain.

The spectrum of our emotions, like our perception of color, is precisely programmed by the brain. This programming is different for different emotions. We call a single programmed movement having a clear beginning and end, together with the decision giving rise to it, an *acton*. The emotion-seeking expression modulates *actons* into different *E-actons* for each emotion. *E-actons* are so precisely programmed into the brain that we have been able to find a differential equation that can be used to simulate these human forms of expression on a computer.

To understand how the idea of an emotion directs the body's movements, consider what happens when a pitcher throws a ball at a target. He must have 1) a clear idea of where he wants to hit the target and 2) a precise execution. The idea of the target modulates his throwing motion, so that eventually one may choose any object within a certain range, think of hitting it, and a spatio-temporal form will direct the exact movements of the arm. As many a major-league pitcher has demonstrated, practice can refine the accuracy with which the idea is executed.

A similar process determines the expression of emotions. Effective emotional communication depends on 1) a clear idea of the emotion one wants to express and 2) a precise execution of the muscular acts involved--finger movements, gestures, tone of voice, etc. The capacity to develop a clear idea of an emotion (which I call an *idiolog*) is as much a part of human nature as the ability to perceive red or sweet or hot. The *idiolog* accurately dictates the specific expressive movement (if it is permitted to do so).

8.10. Animals

Any number of bodily movements can express a given emotional *idiolog*. The specific brain program for anger, which can turn an innocuous arm-raising into an angry threat, also can direct angry movements of the foot, or the mouth, or the tone of voice. In successful communication the specific brain program effectively commands a movement--with no inhibitions to block the expression. We generally interpret direct, unhindered expression of emotion as faithful or sincere.

When one perceives an emotional expression, the nervous system recognizes the form, and decodes it into a corresponding emotional *idiolog*. As the receiver of such messages, the nervous system is programmed to interpret the shape of movements, and there is little we can do to change this program. We even attribute appropriate characteristics to animals whose movements remind us of human qualities we are programmed to recognize (for example, a graceful antelope or an uncouth hippopotamus).

8.11. Cycle

In my first exploratory studies, I usually expressed no emotion 50 times in sequence and then expressed each of the seven emotions 50 times. The entire process takes about 30 minutes. I call this a sentic cycle, according to the terms in my formal theory, in which the specific expression of an emotion is an essentic form, and the emotion brain program that produces the form is a sentic state.

Although at first a subject may like to imagine various scenes to help him fantasize the emotion, he soon finds out that he can express an emotion without directing it at a specific person or imagining a specific scene. He learns to experience the emotion in itself, as in music, without needing specific provokers or recipients for the emotion. This pure emotion does not imply lack of consideration for the individual: when we understand and experience emotion in its most general sense, we are also most able to become genuinely concerned about and close to a particular person, that is, to develop empathy.

8.12. Peace

Often I go through several sentic cycles at a sitting. (A straight-backed chair and a correct arm position, I have found, are crucial to performing sentic cycles reliably and without fatigue.) When I first began doing sentic cycles for several hours at a stretch, I was surprised to find that I was neither bored nor tired, but refreshed and satisfied, and that I required less sleep than usual the following night.

At first, I attributed these effects to enthusiasm and curiosity about a new discovery and to the satisfaction of completing a good day's experiment. But I soon found that others reported similar feelings of well-being and satisfaction from repeated sentic cycles.

In further, systematic observation, I had subjects go through one hour sessions made up of two sentic cycles. Most subjects reported that after the second cycle (which they often experienced more fully than the first), they felt calm, content -- some compared the experience to marijuana high. [see paper # 5 for descriptions of reactions to doing the cycles.]

Other researchers have confirmed the general observation: performing sentic cycles makes one feel better. Subjects experience lessened anxiety for three to 24 hours. And, together with calmness, they often show marked increases in mental energy. It is not necessary to record the expressive movements to reap these benefits. Practicing sentic cycles in the home, in the proper position and with the finger-rest, works as well as performing in the laboratory.

8.13. Release

Many persons work off anger by punching at a wall or chopping wood. They say that the physical activity makes them feel better -- it releases the anger, "lets off steam." But it may not he the amount of energy expended that is effective, but the quality of anger that is expressed repeatedly. One can work off anger by appropriate and repeated pressing of a finger as effectively as by chopping a pile of wood.

Most of us tend to suppress emotions in our daily lives, but in sentic cycles one can express a spectrum of emotions freely, without embarrassment or fear of social censure. This freedom to discover and to be what is natural contributes to the satisfactory results of a sentic session. In addition, there is the satisfaction of finding that one can summon up various emotions at will. This creates a condition of sentic fluidity -- as compared with the rigidity found in emotional disturbances.

Whatever their cause, the beneficial effects of sentic cycles have many applications. In fantasizing emotions one experiences relief from daily emotional tensions. Fearful or anxious persons have reported that sentic cycles help relieve their symptoms. [see paper # 5 for descriptions of reactions to doing the cycles.]

Psychiatrists Alfred P. French and Joe Tupin have found that sentic cycles provide "immediate and dramatic relief of symptoms of depression," in some patients. Other researchers have evidence that they may also relieve psychosomatic disorders, perhaps because during sentic cycles one naturally expresses emotions that might otherwise be shunted to various parts of the system causing long-term internal stress.

8.14. Touch

After experience with sentic cycles, one comes to appreciate the language of touch: he becomes more sensitive to the emotional signals in another person's touch, and more aware of the emotions he communicates through his own touch.

Learning to express and control emotions in the way I have described may help drama and music students learn to be better, more convincing communicators. Feedback in the form of tracings can show them when their expressions approach the true essentic form. The measurements might shed light on what we call natural talent.

Training a person to express fantasy emotions in this manner, to be in touch with the spectrum of emotions, may help in the treatment of emotionally disturbed, neurotic, or psychopathic personalities. It also seems to lend itself to rechanneling of anxiety-driven aggressiveness to a creative energy, in which the expressive act itself gives satisfaction. We should be able to learn more about the basic human emotions, and perhaps someday, possibly with help from geneticists, discover new ones better than we have yet experienced. Indeed the experience of the sentic cycle itself is a step in this direction.

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9. MANFRED CLYNES AND THE SCIENCE OF SENTICS
Love, anger, sex – you can express them with your fingertip

By Gerald Jonas, Saturday Review, 1972, May 13, pp. 42, 44-46, 51

Even among his most ardent admirers, Manfred Clynes is not known for his modesty. But then-as even his most emphatic critics would concede-he does not have that much to be modest about. As a teen-ager, he was acclaimed one of the most promising young pianists in Australia, where his parents settled after they fled from Fascist Hungary in 1938, While an undergraduate at the University of Melbourne, he majored simultaneously in music and engineering, and he won honors in both. Since then he has toured the major cities of Europe as a concert pianist, and has a sheaf of laudatory newspaper reviews to show for this. He has done significant research in neurophysiology, and he invented the

Computer of Average Transients (CAT), which has become standard equipment in many research laboratories. (The CAT improves the signal to noise ratio of a recurring electrical signal such as an EKG reading by automatically averaging the values of each point in time.) Clynes has chatted about music and theoretical physics with Albert Einstein and is on intimate terms with Pablo Casals. In his spare time he paints and writes poetry. In short, he has spent most of his life with one foot in each of the "two cultures," the arts and the sciences.

[In 1972), at age forty-six, Clynes has worked out what he believes to be the foundation of a whole new science that aims at the precise measurement of emotional expression and of those qualities of expressive form that we "intuitively" recognize in a great work of art. The science is called sentics. He has also discovered, as a by-product of his research, a simple method of relieving nervous tension and depression, which in certain subjects produces a remarkable sense of physical and mental well-being -- without, as he notes, "the use of any particular dogma or drug." [see paper #5 for other reactions to doing sentic cycles]

Clynes is well aware that his claims of even limited success in such areas are bound to rub a lot of people the wrong way -- especially coming, as they do, from a researcher whose professional qualifications do not include an M.D. or training in psychology or psychiatry. (Clynes has a B.S. in engineering and a doctorate in physiology from the University of Melbourne, and an M.S. in music from The Juilliard School in New York.) Some of his own staff at Rockland State Hospital in Orangeburg, New York, where he is chief research scientist and director of the biocybernetics laboratory, have made it clear that they prefer not to take part in any work on sentics. "There is a mistaken attitude," says Clynes, "that emotions are vague, ill-defined, and not very appropriate entities for scientific research." The fuzziness of our everyday language contributes to this attitude. It is further reinforced by observations of people under emotional stress: One person says he is "angry" and turns pale; someone else says he is "angry" and turns red; a third person exhibits first one, then the other reaction when provoked, yet insists that he is not "angry" but only "annoyed."

As a pianist, Clynes has long been aware that emotions can be expressed and communicated with great precision through the medium of music. As a scientist, he has searched for a key to this precision in the fundamental structure and organization of the human nervous system.

Man's brain is so complex that any attempt to compare its workings to other natural or man-made phenomena inevitably results in drastic oversimplification. Nevertheless, as long as the limits of the comparison are recognized, most researchers in the field would agree that there is an instructive analogy to be drawn between the functioning of the brain and the functioning of an electronic computer. The most sophisticated computer is nothing but a mass of inert hardware until a program, a set of step-by-step instructions, is fed into it. To transform the raw data of a problem into a useful solution, the program determines exactly what operations a computer will perform, and in what sequence it will perform them.

Obviously, the human organism starts life with many complex operations already "programmed" into it. Everyone's kidney is kidney-shaped because the human embryo develops according to quite specific instructions encoded in the DNA molecule; barring genetic damage, everyone's DNA contains a similar set of instructions on how to build a kidney. One of the great questions of the life sciences is: How far does such pre-programming go? More specifically, the science of sentics asks: If certain "shapes in space," such as the kidney, are determined genetically, what about certain "shapes in time," such as the characteristic slow caress that a loving mother uses to soothe her fretful infant? According to Clynes, for each primary emotion, or "sentic state" -love, hate, anger, joy, grief, and so on -- there is an innate brain program that provides a "command shape" for all expressions of that emotion.

This command shape does not vary from individual to individual any more than the shape of the kidney does. Of course, the same emotion may be expressed at different times through different outlets -- hand gestures, facial movements, tone of voice -- just as a computer that is programmed to add up a column of numbers may print out the result on a typewriter keyboard, or punch it out on an IBM card, or record it on a spool of magnetic tape. Since our genetic endowment includes a capacity to learn from experience, an individual may come to modify, inhibit, or even repress entirely certain forms of emotional expression. (A public manifestation of grief, for example, is encouraged in some cultures, severely frowned upon in others.) But, according to sentic theory, every individual, no matter where he lives or how he is brought up, carries around inside his head the same neurophysiological reference for each primary emotion. This means, for example, that everyone is born with a similar potential to express and communicate love, and to recognize and respond to a loving gesture or tone of voice.

Like proponents of nineteenth-century instinct theory and modem ethology-not to mention Noam Chomsky and Claude Levi-Strauss-Clynes emphasizes the innate (unlearned) elements of human nature. The difference is that Clynes has worked out an ingenious method of testing his theories in the laboratory. Although his interpretations of the results are highly controversial, his work itself has created a flurry of interest in the scientific community; several studies have already supported his basic findings.

Clynes' original approach to the objective measurement of subjective feelings was as bold as it was simple. In order to provide a standardized mode of expression for all emotions, he asked his subjects to express their feelings through the touch of one fingertip on a pressure-transducer, a standard laboratory device that transforms variations in physical pressure into variations in electrical current. To someone who has never tried it, the idea of expressing strong emotions such as anger and love with nothing but a fingertip sounds absurd. But if emotions are really generated by basic brain programs, it should be reasonable to ask a subject to express any given emotion with virtually any part of the body, just as an actor in a workshop exercise may be asked to express "anger" with nothing but his eyebrows, or "love" with nothing but his feet In fact, highly unconventional modes of expression-those that have not had a chance to be complicated by learning--should provide us with the most direct insight into the brain's genetic

programming. According to Clynes, this is exactly what happened in his early experiments.

The subject in a typical experiment was seated in a firm but comfortable chair with the middle finger of his right hand resting on the smooth plastic surface of the transducer. The subject's instructions were to keep his eyes closed and to listen carefully to a tape recording that Clynes had prepared. The tape consisted of a nondescript voice pronouncing the name of a particular emotion, followed by a series of soft clicks at random intervals of three to twelve seconds. As soon as the recorded voice said "anger," the subject was expected to "fantasize" that emotion-i.e., to summon up feelings of anger. Every time he heard a click, he was to try to express anger as precisely as possible by pressing his fingertip on the transducer.

After some thirty clicks, there would be a brief pause, signifying the end of the anger sequence; then the voice would pronounce the word "hate," and the subject was to prepare to respond to the next series of clicks with a finger pressure expressive of that emotion. The tape recording lasted about fifty minutes and took the subject through two complete "sentic cycles." Each cycle literally ran the gamut of emotional expression, from "no emotion" (a cue to press down in a purely mechanical way as if striking a typewriter key) through "anger," "hate," "grief," "love," "sex," "joy," and "reverence." How each subject summoned up these different feelings was his own business. (According to their later reports, most subjects began by imagining themselves in an emotionally charged scene with someone they knew.) The essence of the method was that all the subjects were cued in exactly the same way and were required to express their feelings through a single, standardized outlet.

The transducer that Clynes had rigged up for these experiments was sensitive to pressure in two dimensions-vertical (straight down toward the floor) and horizontal (toward or away from the subject's body). The corresponding electrical signals-which could be immediately displayed as transient traces of light on an oscilloscope-were permanently recorded as two wavy lines of ink on a roll of graph paper. The shape of the "no emotion" response served as a kind of control. For example, every little change in finger pressure during the subject's attempt to express anger showed up as a change in the contour of one line or the other. The resulting shape was assumed to be a "self-portrait" of the brain program for that emotion. (Significantly, responses to emotionally neutral words like "chair" or "table" came out looking like the "no emotion" response.)

To get a clearer picture of how each subject tried to express an emotion such as anger, Clynes used a CAT and averaged fifty successive responses in the anger sequence. The result was a pair of smooth curves showing one person's characteristic ups and downs and ins and outs of finger pressure during the two-second interval after each click. As these curves were analyzed and compared, a definite pattern emerged: Not only did one subject's smoothed-out anger curve look the same from session to session (even when the sessions were held weeks or months apart), but the contours varied very little from subject to subject. And the curves for hate, grief; love, joy, sex, and reverence showed the same kind of stability and consistency. Clynes refers to these curves as "*essentic forms*,"

and he believes that they are the key to man's ability to communicate his feelings precisely to another human being.

Like many scientists, Clynes has a penchant for inventing new words and phrases to explain his experimental data. For instance, he describes an *essentic form* as the spatiotemporal shape of an *acton* whose duration and contour have been modified by an *idiolog* of a particular *sentic state*. He argues that this new vocabulary is needed to embody the new *biocybernetic* view of man -- a systems approach that tries to bridge the gap between the purely "psychic" and the purely "physiologic" aspects of human nature. (An *acton* is defined as a voluntary movement of a limb or muscle, together with the decision or mental command to execute the movement; an *idiolog* is defined as the thought or fantasy of a quality -- such as "red," or "anger" together with the associated chemical and electrical changes in the brain.)

Clynes insists that these concepts are an improvement upon such conventional terms as "gesture" and "idea." For a more precise account of the psychophysiologic reality of the functioning human organism, however, he says we must turn to the language of mathematics. Of all his work so far, Clynes considers his most important achievement to have bow the formulation of a single differential equation that can be used to generate all the empirically determined essentic forms.

Clynes readily admits that his selection of seven primary emotions for the septic cycle was quite arbitrary, He says that other emotional cue words -- "disgust" or "embarrassment," for example -- might have done just as well. Moreover, he explicitly warns that the fantasized emotions cued by the tape must be "differentiated from similar emotions experienced in daily life," but he also points out that most experimental subjects, by their own testimony, during septic cycles have experienced feelings of anger, hate, love, etc., that are very close to the real thing. About a fifth of all subjects have burst into tears during their first attempt to express grief. Many subjects who have gone through more than one session report that they find themselves looking forward to the "love sequence." One psychiatric patient-who was taught in childhood that "nice people" do not get angry -- said that she felt anger for the first time in her adult life, while going through a sentic cycle. [see article #5 for others' experiences].

Even more impressive in some ways, although even harder to account for, is the cumulative, cathartic effect that the entire experience seems to have on some subjects -- an effect that Clynes discovered for himself during his earliest attempts to refine the experimental procedure. Since he had no one else to use as a guinea pig, Clynes would sometimes sit in his laboratory for hours at a time, a fingertip on the transducer, going through septic cycle after sentic cycle. At the end of the day he noticed a curious thing. "Instead of being exhausted, I felt surprisingly refreshed. At first, I thought this was simply due to a feeling of satisfaction at having put in a good day's work. But I soon realized that there was more to it than that. My sense of wellbeing seemed to have something to do with the sentic cycles themselves." The effect generally lasted fm three to twenty-four hours. After an initial period of calmness, Clynes noticed a "marked increase in psychic energy, physical activity, creativity, and spontaneity." He also found

that he needed less sleep and that the sleep he did get was much more restful than usual. Other subjects reported similar experiences.

A few compared the sensation to a marijuana high. Some spoke of feeling pleasantly "drained" and peaceful. Clynes thinks that the general cathartic effect may be related to the old adage about chopping wood to "work off anger" -- except that, "as in a musical, dramatic, or dance performance," it is the "quality of the expressive act, not the quantity of physical energy in it," that discharges the pent-up emotion. As an example of the communicative and cathartic powers of precisely expressed essentic form, Clynes has included in several of his scientific papers a description of an experience he had during an extended visit to Pablo Casals's home in Puerto Rico in the winter of 1966:

The Master was giving cello lessons. On this occasion an outstanding student played the theme from the third movement of the Haydn Cello Concerto, a graceful and joyful theme. Those of us who sat there could not help admiring the grace with which the young master cellist played probably as well as one would hear it anywhere. Casals listened intently. "No, "he said, and waved his hand with his familiar, clear, definite gesture. "That must be graceful!" And then he played the same few bars and it was graceful as if one had never heard grace before -- 100 times more graceful -- so that the cynicism melted in the hearts of the people who sat there and listened. That single phrase penetrated all the defenses, the armor, the hardness of heart which we mostly carry with us, and with its power transformed us into people who were glad to be alive.

What was the power that did this? A slight difference in shape between the phrase as played by the young man and by Casals. A slight difference but an enormous difference in power of communication, evocation, and transformation.

To Clynes, the transcendent quality of such an experience is as valid a subject for scientific inquiry as any other natural phenomenon. "When we hear Casals and we're in ecstasy, is that not a fact?" he asks. Although he was certainly not aware of it until recently, Clynes' entire life seems to have been spent in developing the sensibility and the intellectual tools to come to grips with facts such as these.

Clynes was born in Vienna in 1925 of a well-to-do Jewish family. One of his earliest memories is of crawling around under a grand piano in the living room while his mother sang Schubert lieder. His father was a naval architect and an inventor; among other things, he designed a submarine for underwater exploration in the Adriatic and a coin-operated food and-drink dispenser for an "automat" in Budapest. Clynes' parents moved to the Hungarian capital in 1930 for business reasons; eight years later the entire family -- including Manfred's maternal grandfather, who was also an inventor-emigrated to Australia.

Although he could barely speak English when he stepped off the ship, the young Clynes soon distinguished himself in high school and was admitted to the University of Melbourne at the age of sixteen. On his graduation in 1945, he turned down a good job offer in engineering, entered a national music competition, and won a graduate fellowship

to study piano at Juilliard. After receiving a master's degree from Juilliard, Clynes studied music and taught for several years at the University of Melbourne, and while there he married a former childhood sweetheart in 1951. He later taught music at Princeton University, where he met Albert Einstein. At the same time he was beginning to build an international reputation as a concert pianist.

But Clynes, who had a wife and two children to support in New York City and who was sending money to Australia to assist his relatives there, found that teaching and performing were insufficient for making ends meet. Rather than look around for an "angel" to bankroll his musical career, he decided in 1954 to "make a pact with the devil." He would answer one of the help-wanted ads for engineers in The New York Times, work for three years, save up $20,000, and then return to music full time. His lack of experience notwithstanding, he obtained a job as a computer specialist with Bogue Electric, a company in Paterson, New Jersey, which manufactures electric control systems. His assignment was to operate a new analogue computer that the company had just installed.

"No one there knew anything about computers, including me," Clynes recalls. "I used to go to work with my knees shaking, afraid that they'd find out I was a musician." Within three months, however, Clynes had published a paper on improved methods of control-systems analysis and had worked out a much faster and more efficient way to "stabilize" the electric-control systems that Bogue manufactured.

In spite of his new-found success as an engineer, Clynes hated what he was doing because he felt himself to be "a traitor to music." Then in 1956 he met Dr. Nathan Mine, director of research at Rockland State Hospital, who suggested that Clynes make an effort to apply control-systems analysis to problems in psychiatry. Clynes said that he couldn't see how it was possible to do that, but that he did see a possible application to the study of the homeostatic control mechanisms that regulate heart rate, blood pressure, body temperature, and other internal functions. Although he had never taken a course in physiology, Clynes was soon making significant contributions in this field. (The University of Melbourne later awarded him a D.Sc. on the basis of his published papers.) To facilitate his research, he invented several data processing and recording devices, including the CAT; with the backing of his associates at Rockland State, he formed a company to manufacture his inventions. He later sold the company and his patents to a larger electronics firm, ending up with a handsome paper profit. But by now he was so engrossed in a number of research projects that he found it impossible to simply walk away from his scientific career.

Most of Clynes' research was concerned with the ways in which the structure of our nervous system determines the "structure" of the world we perceive and relate to. In 1961 he published a paper on an experimentally observed phenomenon called unidirectional rate sensitivity which he went on to identify as a basic principle of biologic design. This principle states that, because of inherent physical limitations, there is no way for information about increases and decreases in the rate of change of a stimulus to be transmitted along a single neural channel. As a result, it is only when two separate

channels work in tandem--such as when one kind of receptor senses an increase in temperature and another kind senses a decrease--that we are aware of opposing sensory qualities ("hot" and "cold"). In a single-channel system (touch or smell), the removal of a stimulus conveys no new information; this is presumably why we have no concept of the "opposite" of smell or touch.

Clynes was also interested in the neural representation of perceived color and form. By attaching a ring of electrodes to a subject's scalp, he was able to demonstrate in a series of experiments that the perception of distinctive color patterns and clearly defined shapes is associated with distinctive patterns of electrical activity in the human brain. (In fact, a computer programmed to scan the "evoked potentials" was able to determine, with remarkable accuracy, which particular stimulus pattern out of 100 possible choices the subject had been looking at.) Clynes interpreted these findings as further support for his view that the human nervous system processes the incessant barrage of incoming stimuli according to a limited number of innate organizing principles, or brain programs.

If this level of organization were demonstrable for color and form, Clynes reasoned, there might be other measurable brain programs for other "sensory qualities," including those subtle properties of musical sound for which we have no suitable word in any natural language but which Clynes believed could be precisely delineated if only the right tools were made available. While he was teaching music at Princeton in 1953, he had come across a provocative book by a German musicologist named Gustav Becking Der musikalische Rhythmus als Erkenntnisquelle, published in 1928). According to Becking, when a knowledgeable musician was instructed to "follow" a piece of music with rhythmic movements of his index finger, certain consistent movement shapes appeared, which seemed to be correlated with the music of specific composers. Clynes was intrigued by Becking's attempt to find an objective correlative for what he as a musician had always sensed intuitively: that the "living presence," or personality, of each great composer was somehow embodied in every musical phrase that he wrote. Clynes later had occasion to ask Casals how he went about studying a relatively unfamiliar piece of Beethoven. Casals replied, "Oh, Beethoven is an old friend of mine."

Finally, in the spring of 1967 Clynes decided that he had the tools to put his musical intuition to a rigorous scientific test. The first step was to bring Becking's crude experimental procedure up to date by using a CAT and a pressure transducer. Clynes' idea was to have a musician mentally run through a piece of music, while pressing with one fingertip against the transducer.

Clynes' first subject, naturally enough, was himself. By computing an average of fifty separate "pressure transients" (each lasting about a second), he came up with a smooth curve that graphically represented variations in finger pressure during a typical second of a particular composition. He called this curve the "inner pulse form" of that piece of music. To his delight, every Mozart score that he "recorded" on the pressure-transducer yielded a similar pulse form, one that was quite different from the equally consistent curve for all the Beethoven scores. The inner pulse form for each composer seemed to be independent of standard time signatures or notations for tempo; it remained virtually

unchanged through early and late periods, fast and slow movements, comic and tragic themes. Clynes' experimental procedure was obviously measuring something. But what exactly did those two pulse forms stand for? Did they reveal anything about the music of Mozart and that of Beethoven, or were they simply a reflection of Clynes' subjective attitudes toward those composers? The next step, obviously, was to see whether the experiment could be replicated with other musicians.

The first person who agreed to try his hand at the experiment was the pianist Rudolf Serkin. The experience was nerve-racking, Clynes says, because he felt that he was placing on the line his lifelong belief that sensory qualities have objective reality, that they are not merely "matters of taste." Serkin himself was very cooperative, although he kept trying to tap on the transducer as if it were a piano key, and this made accurate measurement impossible. When he learned to keep his finger in contact with the surface and to modulate the pressure rhythmically while going through a score in his mind, the curves that he produced for the music of Mozart and the music of Beethoven (and of other composers) were very close to the curves that Clynes had already produced. The results obtained with other musicians, including Casals, showed the same close match.

According to Clynes, the consistency of the inner pulse form for a particular composer is not simply the result of tradition or style. "Mozart and Haydn have very different pulse forms," says Clynes. "So have Debussy and Ravel." Clynes himself has difficulty explaining the phenomenon. He speculates that each composer has somehow translated a characteristic brain program into an arrangement of sounds and silences for which the standard musical notation is only a rough approximation. Through some manner not yet understood, the sensitive performer grasps this implicit brain program and is able to re-create it so that the sensitive listener says, "Yes, that is Mozart."

In the winter of 1968 Clynes presented a paper on inner pulse forms to a conference of leading researchers in the biological and information sciences. As he describes it, "the paper was greeted with a substantial amount of laughter and derision." With only a few exceptions, no one seemed to have the slightest idea of what he was talking about. Then someone in the audience asked him, half-facetiously, what practical applications his work might have, and he replied off the top of his head, "I think it can be used to study the language of emotions." Within a few months he had formulated the basic principles of sentics.

Since then Clynes has put himself through literally hundreds of sentic cycles, and his curves for the basic emotions have remained remarkably stable. To prove that this stability was biologically determined, and not the result of cultural conditioning, he made two field trips in the summers of 1969 and 1970 and recorded the sentic expressions of forty different subjects in Mexico, Japan, and Bali. The selection of equivalent cue words for the foreign language tapes presented some problems; for instance, there appeared to be no word for "hate" in the Balinese language and no exact counterpart for the word "joy" in the Spanish spoken by the inhabitants of a tiny village in central Mexico (a location that Clynes chose for the test because it was far removed from most manifestations of the dominant North American culture). Nonetheless, where reasonably

accurate translations were available, it turned out that the essentic forms did not vary any more from culture to culture than they did from person to person within a culture

In the last two years [1970-1971] Clynes has accepted numerous invitations to explain the theory and techniques of sentics to scientific convocations of one kind or another. Last August, for example, he prepared a paper for the Ninth International Conference of Medical and Biological Engineering in Melbourne. In November he spoke at the Fifth World Congress of Psychiatry in Mexico; in December [1971] he chaired a two-day symposium on "Sentics, Brain Function, and Sources of Human Values" at the annual meeting of the American Association for the Advancement of Science in Philadelphia; on May 4 [1972] he was in Dallas to take part in a panel on sentics at the annual meeting of the American Psychiatric Association.

Just before he steps out to a large audience to read a paper or to give a speech, Clynes invariably retires to his hotel room to run through twenty minutes of sentic cycles, using a small tape recorder that he carries in his suitcase. "I used to be very nervous when I stood up to speak," he says. "I find this calms me down without making me less alert."

One point that even his scientific audiences have trouble understanding is that the subjective effects of going through a sentic cycle are entirely independent of the recording of the subject's responses with pressure transducers, computers, polygraphs, and the like. It is true that without this elaborate instrumentation Clynes could never have worked out the method in the first place; but to get the full experience of a sentic cycle, the only apparatus a person needs is a tape recorder with a properly programmed tape, a straight-backed armless chair, and the right kind of surface to press his fingertip against. Surfaces that are too uneven, too sticky, too yielding, or too hard can interfere with concentration and attenuate the effect. Clynes uses a small, hollow, plastic knob that feels "neutral" to the touch and that can be firmly attached with a blob of window putty to any convenient table top of the right height. The most important factor of all is the random spacing of the clicks. If the subject tries to initiate each expressive act on his own--rather than by responding to an unpredictably timed stimulus -- the effect disappears entirely.

Clynes, who has applied for a patent on the method itself, ... set up the American Sentic Association … which provided tapes to qualified researchers and psychotherapists .... Though he has not ruled out the possibility of making the tapes available to the public at large [they are now Available from MicroSound International, Sonoma, CA, 95476], with all profits to go to support further sentic research, he is worried that sentics might become a fad, like alpha-wave conditioning. "For a couple of years," he says, "I was very perturbed about how to introduce this material. I could have gone on 'television -- on one of the talk shows -- and shown how the tapes are used. But I didn't want to cheapen it. On the other hand, I felt bad about holding it back, because I knew that there were people who could have benefited from it immediately. You can understand the heaviness of such a responsibility."

Recently, however, with the upsurge of interest in sentics among his fellow scientists, Clynes says that he feels as if "a great burden has been lifted from my shoulders." The

fourteen papers presented at the [December, 1971] AAAS symposium on sentics dealt with a wide range of possible applications in the fields of psychology, psychiatry, social anthropology, and aesthetics. One paper, by Dr. Alfred French of the Sacramento Medical Center, reported on the use of sentic cycles in the treatment of psychosomatic illness; preliminary findings indicated some success in alleviating anxiety, depression, chronic facial tics, and sleep disturbances. Dr. French is now [1972] experimenting with sentic-cycle therapy for schizophrenics.

There was also much talk at the AAAS symposium about the broader cultural implications of Clynes' work. If the brain programs for all emotions can be expressed through any medium, does this mean that a truly precise "language" of touch can be learned? On a visit to the Esalen Institute, Clynes was impressed by the ability of some instructors to convey complex feelings with a simple caress, and he has suggested that septic cycles can help in "opening up" a person to the possibilities of nonverbal communication. (There is also a danger, he says, that a knowledge of sentics will make it easier for people to "lie" to each other nonverbally, by enabling them consciously to mimic essentic forms in gestures and caresses without any accompanying emotion.)

Another area where Clynes' work might be applied is that of the visual arts. In a number of his published papers Clynes has reproduced a pair of drawings by Picasso -- a Mother and Child, and a piping Pan -- to show how a great artist can intuitively capture the essentic forms of love and sex in a few strokes of his pen. [see figure 3 at the beginning of these papers] Referring to the practice of sentic cycles, he says: "In attempting to obtain pure essentic forms, one is not too far removed from the aspirations of the artist."

Although Clynes' scientific aspirations have not yet been confirmed fully by the scientific community, several speakers at Philadelphia paid him the supreme compliment of using his name as a lower-case technical term, on the order of the watt, the ampere, and the volt. As Dr. French said, for example, "In this paper we will use the term 'clyne' as a verb, meaning 'to carry out the sentic method of Clynes.' A subject may thus be said 'to be clyning' or 'to have been clyned.' We also use the term as a simple noun, as in 'the subject has completed his fourth clyne.'"

Out of modesty, perhaps, Clynes has refrained from adopting this usage.

See figures 1A and !B and 2 at the beginning of these papers.

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Pankseep, J. "Music and brain mechanisms of emotionality"

Clynes, M. "Two principles of (unconscious) musical thought, discovered through computer synthesis"

Music Demonstration: Computer interpretation juxtaposed with artists': Mozart, Bach, Beethoven, and Martino

Commentary by: Abramson, R. M., O. Laske, D. Martino, Denis Vaughan

Session 2:

Minsky, M. "Different kinds of differences"

Repp, B. H. " Analysis, perception, and evaluation of performance micro-structure"Abramson, R. M. "Rhythm, musicality, nuance, and accent in relation to musical meaning" (Discussion)

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AUDIO AND VIDEO TRAINING MATERIALS

Clynes, M. Standard Sentic Cycle audio cassette, 27 mins, with the sequence No Emotion, Anger, Hate, Grief, Love, Sex, Joy, Reverence. Finger rest and illustrated instruction booklet

Clynes, M. Advanced Sentic Cycle audio cassette, 32 mins, with only positive emotions - sequence: No Emotion, Love, Reverence, Bliss, Compassion and Give Blessing with illustrated Instruction booklet. No finger rest is used

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L. von Beethoven Sonata no 32, Op 111 c minor

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