Max Planck and the Principle of Human Discovery in Music

by Caroline Hartmann

Great is the trust and confidence of mind wherever order becomes manifest. The cause of this is to be found in the deepest origins of geometry. Even if an order were to be effected by accident, the spirits would fly together into it; therein lies their delight, their life.

—Johannes Kepler, *Harmonia Mundi*, p. 5

July 11—In the midst of the period of discovery of mankind's greatest energy source to date, nuclear fission, the home of the physicist and musician Max Planck (1858-1947), who held the chair of Theoretical Physics at Friedrich Wilhelm University, was a constant meeting spot for music-loving scientists. Many fellow researchers, collaborators of Planck and students, such as Lise Meitner, Otto Hahn, Max von Laue, Arnold Sommerfeld, and Albert Einstein, were often guests. And music played, not by chance, an important role in this creative period of the waning Nineteenth Century!

Planck: Science cannot solve the ultimate mystery of nature.... Music and art are, to an extent, also attempts to solve, or at least express that mystery.

Planck himself was a gifted pianist; he nearly became a musician instead of a physicist, having become closely associated with music while still a schoolboy. As a young student, he frequented many homes where the arts were cultivated; a lot of theater was performed, and Max Planck composed songs, small pieces, and even an operetta for such home performances. Gifted with perfect pitch, he sang soprano in boys' choirs, performing the great oratorios. He was second choirmaster in an academic glee club, and played the organ at church services in the student chapel. He was also conductor of the orchestra club, consisting of both professional artists and amateurs, while he worked to perfect his piano playing.

During his years of study in Berlin, he systematically pursued the piano, and seriously considered whether he ought to move entirely over to music. But he opted for physics, although he studied harmony and counterpoint when he was back in Munich again, with Professor Josef Rheinberger.

Einstein spoke once of Max Planck's "genuine artistic side" and his "artistic need that drove him to creative achievements." In fact, music played an important role in the circle of the Berlin physicist. Planck himself played the piano like a professional, and often, his friend and frequent guest was the great violinist Joseph

Joachim (1831-1907), who was director of the Academic College of Music at the time, and with whom he played Beethoven sonatas. Many other professional musicians admired him for his fine sensitivity to the intentions of the artist and the verve of his accompaniment. With the other physicists such as Einstein and Sommerfeld, but also with his son Erwin as 'cellist, trio or quartet evenings were often organized, where some of his students attended regularly. Reporting about one such music evening at Planck's home, Lise Meitner wrote to Otto Hahn in the Autumn of 1916:

"Yesterday I was with Planck. Two magnificent trios (Schubert and Beethoven) were played. Einstein played the violin, and volunteered, by the way, some of the most deliciously naïve and peculiar political and military views." (L. Meitner to O. Hahn, 16.11.1916, in: Sabine Ernst: *Lise Meitner Otto Hahn Letters from the Years 1912-1924*," Stuttgart, 1992, p. 64).

Otto Hahn, who discovered nuclear fission with Lise Meitner and Fritz Strassmann, had a powerful but untrained tenor voice himself. Through the music scene in Berlin he became acquainted with works of Classical music, and Planck even persuaded him to take singing lessons, as Walther Gerlach and Otto Hahn's grandson Dietrich write in their biography.

Whether it came to designing a difficult experiment, or to Planck's solution, a few years later in 1900, for the radiation law, Planck stuck with a problem, and was not satisfied with half-solutions as were other researchers. This trait was developed and strengthened by his preoccupation with the great works of Bach, Mozart, and Beethoven.

Whence the Power of Classical Music?

It is no coincidence that countless great scientists were also outstanding musicians, and Planck's testimony, as related by his wife's nephew Hans Hartmann in his biography, is of great importance: Planck made music not only for relaxation and recreation, but rather music represented a place in his life where his mind could develop freely! For him, music was not just a matter of feeling, but was also the world of his mind, his creative ideas.

Classical music thus played an important role in this pioneering time. It is not only a universal language that can express more than words; it reaches into the immediate and deepest experiences of the human soul, moving the soul in a creative way. How can one explain this power? Where does this power of music come from? Ludwig van Beethoven once said that "Music is a higher revelation than all wisdom and philosophy."

What is Man? Why does he explore the laws of nature? Why does he dig up old layers of rock in order to explore ancient buildings and tombs? Why does he want to know the history of space, to discover the universe? Just what is this human soul? Plato has Socrates describe the soul in the *Phaedrus* as follows:

> But first of all, let us view the affections and actions of the soul divine and human, and try to ascertain the truth about them. The beginning of our proof is as follows:
>
> Every soul is immortal. For that which is ever moving is immortal; but that which moves something else or is moved by something else, when it ceases to move, ceases to live. Only that which moves itself, since it does not leave itself, never ceases to move, and this is also the source and beginning of motion for all other things which have motion. But the beginning is ungenerated. For everything that is generated must be generated from a beginning, but the beginning is not generated from anything; for if the beginning were generated from anything, it would not be generated from a beginning. And since it is ungenerated, it must be also indestructible; for if the beginning were destroyed, it would never be generated from anything nor anything else from it, since all things must be generated from a beginning. Thus that which moves itself must be the beginning of motion. And this can be neither destroyed nor generated, otherwise all the heavens and all generation must fall in ruin and stop and never again have any source of motion or origin. But since that which is moved by itself has been seen to be immortal, one who says that this self-motion is the essence and the very idea of the soul, will not be disgraced.
>
> *—Loeb translation, 245c-e*

In this creative period in Berlin, Planck and the other physicists around him saw themselves not only as natural scientists but as artists as well. He once said about their calling:

> It is not logic, but the creative imagination which ignites the first flash of insight in the spirit of the

researcher who is advancing into dark regions . . . and without imagination new fruitful ideas do not present themselves. For if, in the midst of the patient, often humble individual work which involves both mind and body, a thought strengthens and uplifts, that is what we physicists work for—not for today, not for momentary success, but, in a manner of speaking, for eternity.

Augustine: The Soul Does Not Want To Squander Itself

For millennia, men have been fascinated by the significant role of music. It bears upon the ancient paradox of what is Man, how body and mind are connected, because since music awakens feelings, but simultaneously works upon the soul and its conscious (and unconscious) thoughts, music is a means for bringing these two worlds together into reciprocal relationship!

Pythagoras was the first to systematically come to grips with this problem. In music one can observe a phenomenon whose basis nobody had previously questioned: There are only a very limited number of musical intervals that the human ear perceives as "beautiful." Pythagoras discerned that this is about proportions, that the human soul must reflect geometric proportions, and he was the first to seek out a cause underlying our capacity to perceive beauty. He made a discovery: the geometric "living" structure of aural space. Through these geometric proportions, he demonstrated why music is the universal language, and why it so profoundly touches the soul and the human creative spirit.

This knowledge made the further development of music in European culture possible for the first time. Pythagoras proved that with music, just as with geometry and astronomy, that human gift may be precisely expressed, which cannot be found by physical or physiological examination: the capacity for creative ideas.

More than 2,000 years after Pythagoras, the astronomer Johannes Kepler turned again to this paradox. On the basis of Pythagoras's discovery, he explored the connectedness of geometric knowledge with the harmonic lawfulness of the structure of the universe, and in the process made a further discovery about the true reasons for music's powerful effect:

> No matter how old the form may be of human singing, which is composed of consonant and melodic intervals, the causes of the intervals were hidden from humans, so that before Pythagoras not one person inquired about them. Now that they are being sought again after 2,000 years, I am, if I am not mistaken, the first to present them in the most accurate detail.
>
> —Johannes Kepler
> *Harmonies of the World*

"St. Augustine in His Study," by Sandro Botticelli (1445-1510).

Eight hundred years after Pythagoras, Aurelius Augustinus of Hippo, later known as St. Augustine (354-430 A.D.) from Thagaste in Numidia, a great admirer of Plato, grappled once again with this question in his writings. He is thus a lone voice against the cultural decay in the time of the collapsing Roman Empire. The musician and the listener must grow beyond the mere recording of musical impressions, and the superficial and sentimental devotion to the sonic, because, according to Augustine, "the soul does not want to squander itself" (Aurelius Augustinus, *De Musica*, Augustine German edition, 1962, p. 12).

The Greek scientist Pythagoras, depicted in a wooden sculpture by Jörg Syrlin, at the Cathedral at Ulm, Germany.

rThe beauty of music is grounded not only in the harmony of the individual tones. The real beauty has a much deeper cause. Nor is it a coincidence, that in the degenerative phases of history, music became increasingly superficial and primitive. For example, at the time of the Peloponnesian War, when the morality of Athens began to regress, and which is often called the "time of the comedies," comic actors appeared everywhere to malign and ridicule the ideas and teachings of Pythagoras, and to mock his remaining followers. Up until the final downfall of Athens, the cult of Dionysus spread its decadence, idleness, and self-indulgence, and the music was for pure pleasure, background music for cultic or military entertainments, or simply intoxicants for ecstasy (*ecstasy* = Greek word for "copping out"). Man was considered a creature of chance. In ancient Rome, St. Augustine had to contend with similar excesses, and in the Nineteenth Century Friedrich Nietzsche revived the cult of Dionysus again, in order to express his own hatred for humans as responsible for their ideas in history.

Today's spiritual degeneration was likewise set into motion for political reasons in 1947 by the Congress for Cultural Freedom, which primarily employed the primitivization of music. It was dubbed "popular music" or pop music, but it uses the same degenerative material as in all the earlier historical phases mentioned above: constant repetitions, unchanging rhythms, especially on pre-Pythagorean (e.g. pentatonic) scale-based tunes. Small wonder that they just "agitate" or "excite" people, whereas the soul and the mind do not respond. This music is not only itself dead, but it systematically kills the human soul and the spirit's yearning for something better! It is as if one were to bring a dead person, by electrical shocks, to make twitching motions, as Edgar Allan Poe describes in his short story "The Facts in the Case of M. Valdemar," but he is not brought back to life. The human mind, however, is alive, and is merely lulled by these primitive tricks into boredom, "switched to economy mode." The longer this continues, the more difficult it will be to reawaken the creative spirit!

It is not a "matter of taste," that what we term Classical music was developed by the Pythagoreans' discovery of the eight-step scale, of the various half-tone steps, and then further by Kepler, until finally after the Thirty Years War, we come to the work of music theorist, composer, and organist Andreas Werckmeister (1645-1706), consciously based on Kepler's work. Werckmeister was working for Dietrich Buxtehude when Johann Sebastian Bach met him while visiting Buxtehude. In his book *Musical Temperament* published 1686 in Frankfurt am Main and Leipzig, he refers to the well-tempering of organs, spinets, and all keyboard instruments, based explicitly on Pythagoras and Johannes Kepler and his idea of *harmonia mundi*.

Classical Music Is Not 'A Matter of Taste'

The development of Classical music is synonymous with exploring the workings of the creative powers of the human mind. It was based on the fact, discovered by Pythagoras, that the human mind perceives a certain number of selected proportions as consonant, which makes all other proportions dissonant. This creates the conditions where polyphonic composition must be based on certain principles! This is absolutely not arbitrary, but is determined by the human mind—or, you can say, the human soul itself! In his investigations into these proportions, Kepler comes to the conclusion that it is the authority of the soul, spiritual knowledge itself, which is linked to the beauty of these laws, and which ultimately recognizes them:

> The activities and movements of the body, where harmonious proportions are imitated, speak for the soul and spirit, in that they indicate the reason why consonances evoke delight. The

judgment of the ancients also does not contradict this. When they define the soul as a movement, as harmony, they did not speak utter nonsense, but rather they have not been properly understood, because often in difficult questions, a mystical sense is veiled under the cover of the word. The philosophy of Timaeus of Locri, where the soul is composed of harmonious proportions . . ., was refuted by Aristotle in the literal sense of the text. But I would say that not all that lies within those lines, is what the text alone says. Indeed, I do not think anyone will deny that the former author, at least in his fundamental thoughts, as I postulate it, holds that it is the soul and spirit of people, by whose judgment or instinct the hearing of the pleasant, i.e. consonant proportions, is distinct from the unpleasant or dissonant. He lays it out carefully on the consideration that the proportions are objects of the Understanding and can be grasped only by the mind, not by the senses, and that it is a function of the mind to distinguish the proportions, i.e. the form, from the thing proportioned, i.e. the matter.

—*Harmonies of the World*, Book III

The frontispiece of the book of organ works written by German music theorist, composer and organist Andreas Werckmeister in the 1690s.

Max Planck was aware of these investigations, as may be seen in his 1894 treatise "Natural Tuning in Modern Vocal Music" (Leipzig, Breitkopf & Härtel). Planck, Einstein, and his contemporaries were aware of this history of Classical music, the discovery of the creative power of the human mind. Therefore, their presentation of music was in many respects more alive with tension than that of the artists of today, despite the ever more perfect technique of the latter's performances! It is perhaps because of the awareness that the continually self-moving soul finds expression not only through sensory things, that it in fact represents the reason for what Man ought to do. As Gauss expressed it:

> There is in this world a pleasure of the mind which satisfies itself in science, and a pleasure of the heart, which lies mainly in the fact that people ease one another's hardships, their lives' burdens. But if this is the task of the Supreme Being, namely to create creatures on isolated orbs and to allow them to exist for 80 or 90 years, just in order to give them that pleasure, that would be a miserable plan indeed.

[The problem would be, as he put it on another occasion, "shabbily solved".]

> Regardless of whether the soul lives for 80 or millions of years, only then to perish, this period is but a reprieve. Finally, it must end. One is therefore forced to the view to which so much attests, even if it is without a rigorous scientific grounding, that in addition to this material world, there still exists another, second, purely spiritual world order, with just as many manifolds as that which we inhabit. In this, you should partake! —Sartorius von Waltershausen, *Remembrances of Gauss*, p. 103)