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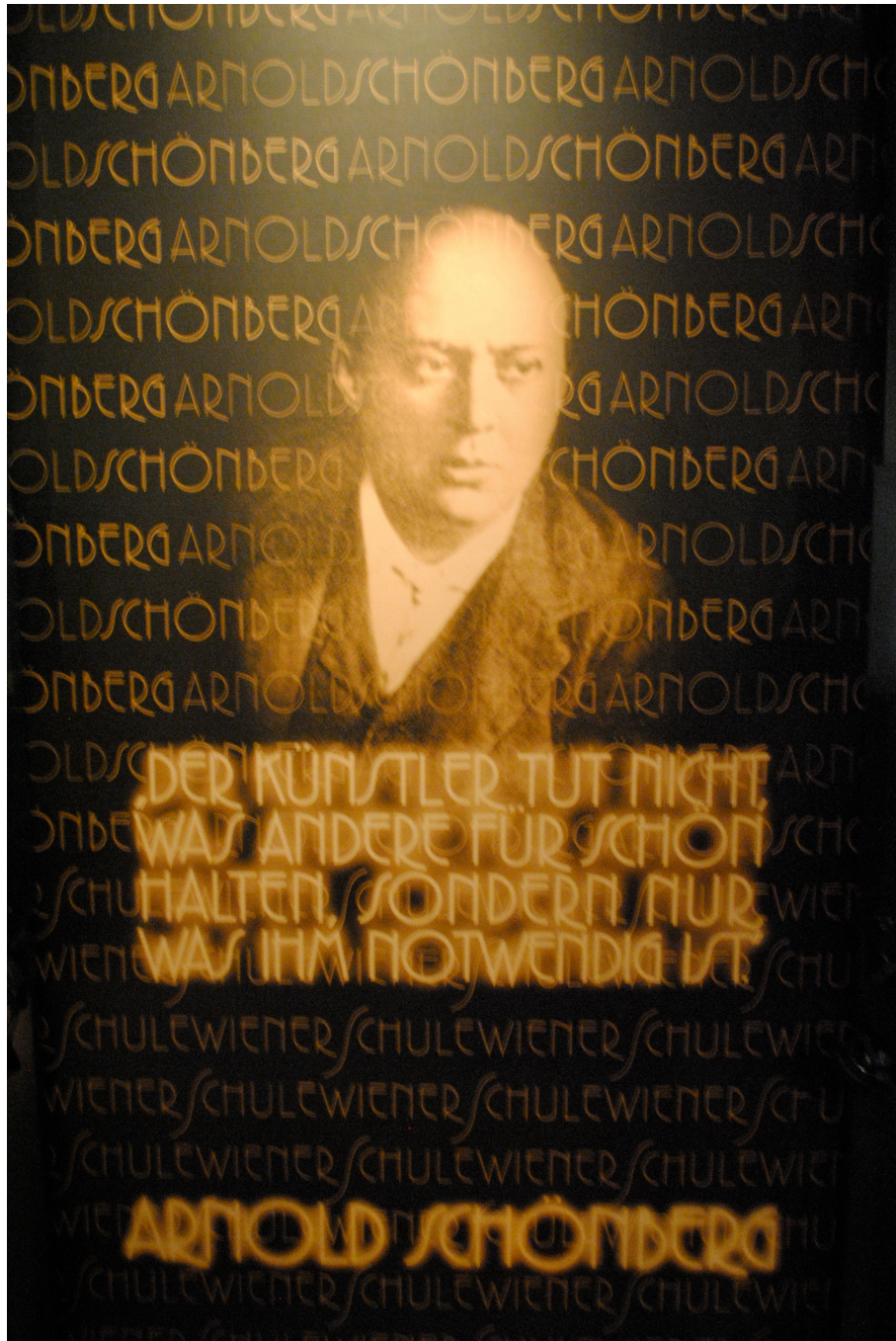
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Was die Welt im Innersten zusammenhält:
Schrödinger's Form, Schoenberg's Idea, and Goethe's *Faust*

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*“The artist does not do what others consider beautiful,
but rather only what is essential to him.”*

Introduction

Johann Wolfgang von Goethe is considered by many to have been the last great polymath in the Western tradition. A literary genius who wrote poems, plays, and prose, Goethe was also a talented diplomat and a gifted linguist; he was an able financier, a competent judge, and an amateur theologian and scientist. In parallel with the title character of his greatest work, *Faust*, Goethe sought to master the myriad aspects of human knowledge and experience. His biography demonstrates his devotion to a life of Faustian striving towards ever-deeper understanding, and his accomplishments reflect the successes he enjoyed along the journey.

The power that infuses Goethe's works, and that grows in these works as their author grew in maturity and wisdom, reflects the writer's immense breadth of knowledge. Allusions to all manner of phenomena and human experiences shoot through Goethe's writings, and verify to the independent reader the veracity of claims of his genius. Given the immense skill with which Goethe forged these disparate interests into literary masterpieces, it is only natural that his works – most prominently among them, *Faust* itself – have been dissected, analyzed, recombined, compared, contrasted, and generally exhausted for nearly two centuries.

Has all that can be said about the great drama, then, truly been said? Naturally, the wise answer is no – a work of such manifest brilliance contains an infinite store of material to study and consider, renewed in the mind of each eager scholar who takes on the challenge. This goal, though, is itself somewhat abstract; scouring *Faust* for new and undiscovered meaning merely for the novelty of finding

it is most often, unfortunately, a relatively fruitless endeavor. Though literary analysis offers myriad opportunities for intellectual engagement with the content and meaning of *Faust*, the relative accessibility of such a method makes its generationally iterative application prone to eventual, inevitable reduplication.

Stepping back from Goethe's text itself, a number of other paradigms through which to engage the work become clear. Drawing inspiration from Goethe's intellectual biography, his writings can be examined not only in the literary sense in which they were primarily written, but also with respect to his constellation of other interests. Taking the process further, the ideas presented and evaluated in *Faust* may be abstracted from the work and viewed in the context of such diverse fields as art and science – realms of inquiry that, while not providing the primary content of the drama, infuse it with the multidimensional intellectual power that so evidently sets it apart in the history of Western literary achievement.

A final step in the process of analysis is both more novel in approach and more uncertain in outcome. After examining *Faust* in a purely literary sense, as well as in the paradigms introduced by fields of academic inquiry seemingly distant from its subject matter, the investigator may finally use *Faust* itself as a focusing lens through which to view and explore other areas of intellectual interest. This role-reversal simultaneously preserves the time-honored fidelity to precise textual analysis with which *Faust* must be addressed, and directly employs the fruits of this analysis in the further exploration of widely divergent subject areas. The entire process seeks to examine a totality of ideas in the same holistic context in which Goethe approached his intellectual world.

Given the diversity of my academic experience, it is this course of study and analysis upon which I have chosen to embark. Through a focused examination of the questions raised in the texts I study, I seek to use *Faust* as both a bridge among the ideas I encounter and as an elegant embodiment, in many cases, of the essential qualities of these ideas. As a student of physics and music, I was drawn to concentrate on the works of twentieth-century pioneers in these fields; through their writings, I seek to discover symmetries in thought and purpose underlying wildly divergent aspects of human inquiry and creation.

Specifically, I am most fundamentally drawn to the conflict central to *Faust*: the strain between the title character's infinite desire to strive ever forward towards deeper and fuller understanding, and the limitations imposed on such striving by his fragile humanity. This drive, I feel, is just the element that propelled groundbreaking physicists and composers to new realms of comprehension and expression, in spite of the great opposition – both personal and societal, micro- and macrocosmic – to the exploration of such discoveries that they faced.

Correspondingly, Faust's compulsion to strive ultimately leads him to sign away his humanity in a pact with Mephistopheles, the devil; in essence, Faust trades his immortal soul for the powers that will (he hopes) allow him to reach the moment of understanding and fulfillment that he so desperately seeks. The symmetry between Faust's bargain, and similar elements in the recent history of physics and musical composition, was the first and most powerful indication of the fruitfulness of a deeper examination of the potential connections of these fields with *Faust*.

At the beginning of the twentieth century, players in a number of key academic disciplines of Western civilization, faced with the looming bounds of convention and human limitation (both physical and mental), leapt boldly over similar “Faustian brinks” into unknowable abysses. The risks of such forays into the unknown were great, but were necessary to push the bounds of knowledge into new realms neither immediately accessible nor comfortable to conventional understanding. In particular, the break in physics between the classical and the newly evolving quantum paradigm, as well as the contemporaneous emergence of atonal composition from historically tonal music theory, give striking demonstrations of pioneers’ willingness to radically depart from the knowable in order to understand that which was previously unknown. In some circumstances, Faustian pacts with a devil of sorts were necessary to make subsequent revelations possible. To this day, human investigators in a myriad of fields struggle with the benefits and costs of such bargains – a resonant testimony to the timelessness of Goethe’s masterpiece, and to the human truths that infuse it.

As Goethe once wrote, “it is not enough to want – one must also do.” Onward, then, to the exposition of the analysis proposed.

Schrödinger: Form

The drive to explore the natural world resides deep in the essence of humanity. This drive has propelled humans out of their native, primitive state; it has led them to more fully tame their environments, to more perfectly construct their realities, and – most significantly – to attempt to understand the true nature of their cosmos, and their place in it. Throughout humanity’s history, the nature of this exploration has evolved considerably. Its most fundamental aim, though, has long remained constant: *daß [wir] erkenne[n], was die Welt Im Innersten zusammenhält* – that we might understand what binds together the world at its heart.¹

Scientific inquiry began as a direct outgrowth of the human capacity to observe and record data about the natural world. The drive to better understand natural phenomena was tightly bound to the desire to achieve better relations with the constellation of deities and supernatural powers seen as responsible for the conditions of daily life; in a tenuous, dangerous world, allying with such powers “beyond nature” was presumably seen as the best way to guarantee conditions amenable to survival and prosperity.²

The earliest records of the great ancient civilizations (Babylonia and Egypt) evidence a rudimentary recognition of the human capacity to push beyond the bounds of the known world. While there is little in the way of arcane theories or formal proofs extant from these cultures, their mathematics demonstrate their

¹ von Goethe, Johann Wolfgang. Faust I & II. Hamburg: Classic Books Publishing, 2008. Lines 382-383.

² “History of Science.” Encyclopædia Britannica. 2010. Encyclopædia Britannica Online. 17 Apr. 2010 *Introduction*.

ability to use (if not to its fullest capacity) the power of abstract thought to better understand and improve the realities of their daily lives.³

The Greeks make the first great cognitive leap from these beginnings, founding and expanding the field of natural philosophy. This area of inquiry combined a quest for deeper understanding of the nature of the cosmos with a study of the importance of such knowledge in the hierarchy of existence, and added a contemplative dimension to the ways in which proto-scientists investigated their world. Though Greek society was still largely governed by traditional beliefs in the supernatural, the mindset of several of its most important philosopher-scientists began shifting towards a worldview in which objective human understanding of nature was at least possible.⁴

This Greek mindset continued to evolve within the Western scientific tradition long after the golden age of Greek civilization itself had faded. It largely fell into abeyance during the Middle Ages, though some of the knowledge and methods that had been acquired were preserved. Science, though, turned its primary focus to alchemy, which, in turn, divided into two branches – “extravert” and “introvert”. Extravert alchemy was more concerned with technological aims (the transmutation of baser metals into gold, for example), while introvert alchemy sought more esoteric ends, like an elixir granting immortality. In both disciplines, though, alchemists combined their knowledge of the natural world and their curiosity

³ *ibid. The Middle East.*

⁴ *ibid. Greek Science.*

regarding it with a deeply-trusted mysticism that they used to explain what they did not yet understand.⁵

Science, in the modern sense, truly began with the advent of the Scientific Revolution in the late sixteenth century. Kepler (a physicist-astronomer) and Vesalius (an anatomist) are usually considered to have “begun” the movement, which continued through the late seventeenth century. These and other scientists made a clean break with a reliance on supernatural or superstitious explanations of natural phenomena; instead, the scientists of this new era placed their trust wholly in empirical observation and in the deductions of their own reason. Using these tools, scientists discovered a way to more purely pursue the drive they felt to explore and understand the natural world.⁶

The Scientific Revolution itself eventually gave way to the Enlightenment, a broader philosophic movement that characterized the eighteenth and early nineteenth centuries with a paramount reliance on reason and logic as the dominant paradigm through which humans came to know their world, and themselves. This phase of development marked the triumph of what are now considered “scientific” methods and faculties over superstition and intuition. Furthermore, given advances in the technologies that allowed scientists to observe their world, a strong belief in a wholly deterministic universe arose. Deistic religio-philosophy argued for the existence of a “divine watchmaker”, who designed the intricate machine of the universe and set it into motion. Man’s goal, as seen by scientists of the time, was to understand the rules and mechanisms governing this fantastically complex machine;

⁵ von Franz, Marie-Louise. Alchemical Active Imagination. Boston: Shambala, 1997.

⁶ “History of Science.” *The Scientific Revolution*.

by doing so, these scientists believed, they could both explain and predict future outcomes and actions based on their knowledge of the preexisting conditions that inevitably and deterministically led to them.⁷

This newfound confidence in the power of man's native abilities to explore and explain the universe manifested itself in tremendous scientific advances throughout the nineteenth century. While Enlightenment thought gave way to Romanticism, and factors beyond logic were elevated in importance in the general mindset, science persisted in its unadulterated devotion to reason and observation. The clarity these methods gave scientists allowed them to explain and codify the rules of motion and electricity, to investigate chemical reactions and the workings of the human body, in a way never before achieved. Knowledge, built from solid principles and constantly retested and challenged, could finally be truly trusted.

By the end of the nineteenth century, much of the natural world had been definitively "explained" by physicists. Though a number of unexplained phenomena remained at the fringes of human experience, it was widely believed that these were merely trivialities — details that would be effortlessly explained by existing theories when subjected to further examination. These nagging questions, though, stubbornly resisted explanation; as a few daring scientists probed them more deeply, they opened doors to realms of understanding not previously conceived.⁸

Most significant, perhaps, to the development of modern physics was the discovery and evolving understanding of quantum mechanics. The field owes its existence to a number of pioneering figures; its foundations developed fairly

⁷ *ibid.* *The Classic Age of Science.*

⁸ *ibid.* *The 20th-Century Revolution.*

quickly, but its postulates (perhaps unusually) took far longer to “interpret”, or understand in a meaningful sense. Indeed, though the *mechanics* of the quantum world are relatively well codified today, true *understanding* of these elegant, impossibly strange mechanisms remains elusive.⁹

In essence, quantum mechanics’ first triumph is physics’ response to Zeno’s ancient paradoxes of motion. These deal with the divisibility of space, and conjure the idea of an “infinite smallness” in distance, time, and every other parameter through which humans interact with and observe the world. Quantum mechanics, as evidenced in its very name, asserts that the universe is comprised of quanta – finite units (be they of time, energy, distance, etc.), beyond which further division is meaningless and unreal.

The assertion of the quantization of nature led to the rapid resolution of a number of the “fringe” problems that had vexed physicists working to perfect their explanation of natural phenomena. As the new theory evolved beyond its infancy, though, the conclusions it necessitated became increasingly bizarre; even as scientists’ abilities to describe their reality improved exponentially, their faculty to analogize these explanations to everyday experience, as they had always done, waned markedly.

First, the nature of matter became increasingly difficult to understand in any intuitive sense. Traditionally, physicists had divided natural phenomena into two broad classes: localized particulate elements, and dispersive wave phenomena. The former category was firmly grounded in intuitive reality; indeed, the Greeks

⁹ Griffiths, David J. Introduction to Quantum Mechanics. Upper Saddle River, NJ: Pearson Prentice Hall, 2005. vii.

themselves proposed that the building blocks of all macroscopically observable objects were “atoms”, indivisible individual particles that aggregated to compose larger constructs. Particulate matter was thought to have definite spatial extent, and beginning with what were then believed to be the most fundamental particulate “building blocks” – protons, neutrons, and electrons – bodies of matter were “built up” according to the standard laws of physics and chemistry.¹⁰

Wave phenomena were slightly less intuitive in application, but by the turn of the twentieth century, the mathematics describing them had been thoroughly explored and used to model significant natural occurrences. Light, for example, was accurately modeled as a traveling wave. More fundamentally, electromagnetic radiation (of which visible light is a subset) was elegantly described in Maxwell’s Equations as a set of travelling, oscillating waves: just as a pulse on a taut rope travels the length of the rope, a disturbance in the electromagnetic field was similarly shown to propagate through the field according to wave mechanics.¹¹

The neat division of natural phenomena into particulate matter and waves allowed an “easy” physical description of reality, consistent with intuition. However, realizations about the implications of quantum physics rapidly eroded the validity of the picture, giving rise to an understanding of nature at once more correct and less clearly comprehensible than its classical predecessor. First, in an attempt to solve one of the “fringe problems” still plaguing the classical model of physics (the issue of blackbody radiation), German physicist Max Planck proposed the concept of the

¹⁰ “Subatomic Particle.” *Encyclopædia Britannica*. 2010. Encyclopædia Britannica Online. 18 Apr. 2010 *The Divisible Atom*.

¹¹ “Electromagnetic Radiation.” *Encyclopædia Britannica*. 2010. Encyclopædia Britannica Online. 18 Apr. 2010

quantization of energy emitted from a radiant source (previously, a purely wave-based phenomenon).¹² Not long thereafter, Einstein postulated, in attempting to solve another “fringe problem” (the photoelectric effect), that light and the rest of electromagnetic radiation are *themselves* quantized, through new elementary particles called photons. This was the first instance in which a wave phenomenon required another mechanism – the particulate photon – to fully explain it. In introducing the concept of the photon, Einstein first breached the formerly impregnable wall dividing wave and particle phenomena.¹³

Einstein’s revelation was compounded several decades later, in 1924, in a proposition of French physicist Louis de Broglie. To better explain the behavior of matter in the new quantum paradigm, de Broglie proposed that *all* matter, in addition to its particulate characteristics, also evidenced wave properties. De Broglie’s idea was validated experimentally, and remains an integral element of our understanding of quantum dynamics. Its implications, though, are astonishing: just as earlier theory asserted that light was not a continuous, homogenous emanation, but also a discrete phenomenon transmitted by particles, de Broglie’s postulate established that everything – protons, neutrons, electrons, people, stars – has wave characteristics that blur the sharp boundaries of their particulate natures.¹⁴

Erwin Schrödinger, an Austrian physicist, played an integral role in developing the mathematical framework scientists needed to deal with de Broglie’s revelation (dubbed wave-particle duality). In formulating his eponymous equation

¹² Abers, Ernest S. Quantum Mechanics. Upper Saddle River, NJ: Pearson Prentice Hall, 2004. 382-383.

¹³ *ibid.* 406.

¹⁴ *ibid.* 21.

in 1926, Schrödinger gave physicists a way to accurately describe quantum states. These states specify the conditions of a system at the most fundamental level, taking into account both wave and particulate properties. In a method analogous to classical physics' prediction of future events based on knowledge of the state of a system (its momentum, energy, etc.) at some specified initial time, the operations that can be performed on a Schrödinger equation allow the quantum physicist to both learn more about the system in question, and to postulate its future behavior.¹⁵ According to the most standard interpretation of the Schrödinger equation, however, the information it gives about the properties of states is not deterministic (as in a purely classical model), but probabilistic; as such, physics had to accept a new indeterminacy, even randomness, as fundamental to the nature of the universe in acquiescing to quantum mechanics.¹⁶

Furthermore, in order to obtain this information, the physicist must observe the system in question. Such observation was, ostensibly, nothing new to a scientist; after all, scientists gather data and draw conclusions by carefully monitoring the behavior of physical phenomena. Einstein's special relativity threw into chaos the previously sacrosanct concept of the ideal, independent frame of reference. Quantum mechanics struck another blow to the concept of observation, and further broke the barrier between scientist and system.

In order for information to be obtained from a physical system, the scientist must measure it in some way – by, for example, shining light on the particles under examination and noting the characteristics of the light returning from the sample to

¹⁵ Griffiths 1-2.

¹⁶ *ibid.* 4-5.

the eye. In everyday experience, such a process would not affect the reality observed (a flashlight illuminating an apple gives information that the apple is red, without causing or altering this redness). In the quantum paradigm, though, the act of observation *itself* influences the reality; such an act is said to “collapse the wavefunction” that describes the system into one of its statistically possible resolutions.¹⁷ An electron before observation, for example, could exist as an uncollapsed wavefunction with a probability of particulate localization at any point within a certain region. Observing the electron allows the scientist to see a particle at a definite position in the region, but the particle was not there (or anywhere specific) before the act of observation; rather, the act itself caused the particle to manifest itself where it did.¹⁸

The practicalities of scientific technique, as well as the realities of quantum mechanical laws, prohibit truly continuous observation of such a system. Accordingly, it is truly impossible to be permanently “vigilant” at the quantum level – the scientist’s back must necessarily be turned on his system at some times. The inability of the physicist to constantly observe a quantum system introduces an entirely new level of uncertainty to his inquiry, and further distorts the classical clarity of the relationship between scientist and system.¹⁹

Erwin Schrödinger was profoundly disturbed by these conclusions, drawn from the theory he helped create. Extensively versed in languages, philosophy (both

¹⁷ *ibid.* 5.

¹⁸ As mentioned above, a consensus in the interpretation and understanding of quantum mechanics has not yet been reached among physicists. The behavior described, however, corresponds to the so-called “Copenhagen interpretation” of quantum mechanics, the dominant understanding in the field today.

¹⁹ *ibid.* 431.

Eastern and Western), and the humanities, Schrödinger recognized the deep impact of these revelations about quantum realities. His writings offer fascinating insight into his views of their implications for human existence and interaction with the universe. It is to these ideas that I now turn.

First, Schrödinger was struck by the effects the loss of the concept of continuous observation had on our understanding, from a philosophical perspective, of what matter is. We naturally trust our senses to establish uniqueness in objects and systems we observe – we recognize and distinguish our relatives, friends, and possessions, even when mixed with groups of similar people or things. This understanding of uniqueness is intuitive, a shared and seemingly innate capacity. Schrödinger, though, questioned the application of this sense at the most fundamental level. In classical theory, scientists should be able to apply the same principle of uniqueness (at least for the purposes of experiment) to any particle under observation; though all electrons “look the same”, in the classical paradigm a physicist would have been able to “watch” one of many, and keep track of it. Given the impossibility of continuous observation discussed above, though, Schrödinger experienced a profound revelation: without the ability to continuously “watch” quantum phenomena, the observer remains forever unsure about the continuity of the reality he seeks to understand. By analogy, attempting to keep track of a particular proton, neutron, or electron among many would be like trying to follow the flight of a particular honeybee in a swarm of visually indistinguishable bees. Such a feat would be conceivable (though very difficult) in the classical sense;

quantum reality, though, dictates that the observer “blink” at regular intervals, making the task of keeping track of the bee truly impossible.²⁰

For Schrödinger, the implications of this revelation were profound. The honeybee, even if its observer blinked and was thus unable to keep track of it, would retain its uniqueness; a more astute and considerate observer, for example, could keep his eyes open and continuously establish the bee’s unique identity (merely by watching it). Schrödinger realized, however, that because quantum mechanics *forbids* such continuous observation, it correspondingly destroys any notion of “quantum uniqueness”. Because of the relationship between the observer and the reality of the system, the observer’s inability to monitor specifics of the system at all times means that these specifics *cannot* be localized and ascribed to single, unique elements of the system. Observing a bee, blinking, and observing a bee again a small distance away from the original bee’s position along its last known trajectory could lead to the reasonable conclusion that the two bees were one and the same – a conclusion that could be verified, in future experiments, by shortening the time of the blink. Schrödinger postulated that because of the necessity of this quantum observational “blink”, verification of quantum uniqueness was impossible. Given this impossibility, Schrödinger asserted, the concept of quantum uniqueness is meaningless to humans, and philosophically invalid. As he writes,

“...and I beg to emphasize this and I beg you to believe it: It is not a question of our being able to ascertain the identity in some instances

²⁰ Schrödinger, Erwin. *Science and Humanism*. Cambridge: University Press, 1951. 120-121.

and not being able to do so in others. It is beyond doubt that the question of 'sameness', of identity, really and truly has no meaning."²¹

His realization of the impossibility of quantum uniqueness left Schrödinger with an even more significant philosophical difficulty: what is the "fundamental concept" by which humans access and relate to the world? The seemingly obvious answer, at first glance, is what Schrödinger termed "substance", or matter: when we recognize or identify objects, people, and places, we connect with their substance (for, it would seem, what other reality could they have beyond their concrete physicality?). To a scientist, the admission of the existence – not to mention the necessity – of a fundamental reality beyond this physicality is, to a degree, anathema; nevertheless, Schrödinger ultimately found it inevitable to assert just such a view. Objects, he claimed, are built up from the same fundamental quantum mechanical building blocks discussed earlier – and could theoretically be deconstructed back into them. As fundamental quantum particles, these building blocks are characterized by the lack of philosophically (and scientifically) valid uniqueness – "The identity of the *material*, if there is any, plays a subordinate role [in determining the individuality of a palpable body]."²² How, then, does this contagion of non-identity not spread to anything constructed from these indistinguishable particles? In other words, how can anything be recognizably or truly unique?

²¹ *ibid.* 121-122.

²² *ibid.* 124.

Form, Schrödinger asserted, was the solution to the dilemma. Echoing a philosophical concept that pervades Western thought (stretching all the way to its ancient advocate, Plato), Schrödinger maintained that form is the element that infuses individuality and uniqueness into an otherwise nondescript and indistinguishable universe:

“The *old* idea about [small organizations of particles] was that *their* individuality was based on the identity of matter in them...The *new* idea is that what is permanent in these ultimate particles or small aggregates is their shape and organization.”²³

To illustrate the point, Schrödinger gives the example of a favorite paperweight in the shape of a Great Dane. He recognizes the paperweight after not seeing it for a number of decades because of its form, not the identity of the particular mass of iron that comprises it – and it is to this form, not this lump of matter, that he attaches personal emotional significance.²⁴ Schrödinger expands the concept by conjuring the image of a childhood home, in which the flowers, the running stream, and the touch of the sun all comprise the consummate impression the place makes on the small boy witnessing it; returning decades later, the now-man is struck by the *sameness* of the place, though the living flowers, the molecules of stream-water and the photons of sunlight retain no definite identity. Indeed, the man’s son, standing beside the same stream in the same light, completes the picture

²³ *ibid.* 124-125.

²⁴ *ibid.* 123.

– the person *himself* is different, but the form remains constant. This, then, completed Schrödinger’s assertion of form, not substance, as the *only* unique constituent of reality:

“...but when you come to [it]...there seems to be no point in thinking of...some material. [There is]...*pure shape*, nothing but shape; what turns up again and again in successive observations is this shape, not individual specks of material.”²⁵

In outlining several selected aspects of Schrödinger’s philosophical positions, I began with those that arose most directly from his work in theoretical quantum physics; I progressed, as he did, to more macroscopic questions that concern some of the issues at the heart of philosophy. I now present what seems to me to be the most fundamental and consequential question Schrödinger asked – indeed, the most important question any scientist can pose: what is the ultimate purpose of human scientific inquiry?

In his writings, Schrödinger first asserts an experiential reality that underpins scientific progress: scientists (and researchers in every field) are somehow naturally driven or compelled to pursue advances in their subjects. The origin of this drive is integrated in human identity; Schrödinger goes on to examine several potential justifications for it. First, he considers the usefulness of scientific progress: science, as he mentions, is often rationalized by the benefits it provides to

²⁵ *ibid.* 125.

human quality of life. Schrödinger ultimately rejects this justification, though, for two reasons. First, not all branches of natural science produce relevant information directly applicable to the improvement of the human condition:

“Take, for instance, seismology. We know enough about earthquakes to know that there is very little chance of foretelling them, in the way of warning people to leave their houses, as we warn trawlers to return when a storm is drawing near. All that seismology could do is to warn prospective settlers of certain danger zones; but those, I am afraid, are mostly known by sad experience without the aid of science.”²⁶

Second, other human activity outside the sciences (economics, sociology, and the like) may produce concrete benefits to quality of life without reliance on the expansion of humanity’s understanding of the natural world. Schrödinger goes on to question whether even those advances by which science ostensibly improves life lead to actual betterment of the consummate human condition. The ease of mechanization and new technology, he writes, often exact a toll in human happiness for all the seeming simplification they bring to everyday life:

²⁶ *ibid.* 106-107

“I consider it extremely doubtful whether the happiness of the human race has been enhanced by the technical and industrial developments that followed in the wake of rapidly progressing natural science.”²⁷

Ultimately, Schrödinger asserts, there is only one justification for scientific inquiry, in concert with all other forms of investigation that humans may accomplish: to answer the question “Who are we?” Each individual is born into a present and an environment; he has neither native nor direct knowledge of the past and future, and can only experience and learn from that which surrounds him at the current time. Each individual – and, by extrapolation, humanity as a whole – desires to know himself. He is endowed with faculties to use in self-exploration, and while a significant degree of this exploration is internal, investigation of everything external to the individual affords greater knowledge and understanding of himself.

Schrödinger further postulates (in part referencing his concept of form) a mysterious unity between the individual and the collective (a unity, incidentally, that he feels is recognized and accessed in the Eastern concept of the Brahman, or universal spirit). Science, Schrödinger believes, is the purest and most fundamental way by which man may come to know and understand his environment, his universe, and all that is external to him. In concert with personal, internal exploration, this inquiry allows man to most truly know who he is:

²⁷ *ibid.* 107.

“Our burning question as to the whence and whither – all we can ourselves observe about it is the present environment. That is why we are eager to find out about it as much as we can. That is science, learning, knowledge, that is the true source of every spiritual endeavor of man...and as we try [to investigate our spatial and temporal surroundings], we delight in it.”²⁸

Schrödinger’s speculations regarding the nature of matter, the fundamentality of form, and the purpose of scientific inquiry elegantly parallel a number of similar concepts raised, in quite a different context, in Goethe’s epic *Faust*. Though Goethe composed his play long before physics’ understanding of quantum realities began to dawn, his work is infused with the same doubt – at times despondent, at others productive – that characterizes both Schrödinger’s musings and his scientific work. In both *Faust* the work and in the eponymous title character, Goethe’s preoccupation with the questions of essence, reality, and purpose is strikingly evident.

Schrödinger’s realization about the absence of true quantum uniqueness led to his insistence on the primacy (even sole importance) of form as the paradigm by which humans may relate to their world. By a very different track, Faust comes to the same realization. Faust did not have the powers of modern physics at his fingertips to inform his perception of the reality of nature; indeed, his entire tragedy rests on the necessity of Mephistopheles’ demonic powers to allow Faust to strive, in

²⁸ *ibid.* 108-109.

his quest for knowledge and understanding, beyond the bounds inscribed by the limits of his mind and the state of technology in his time. The “realities” Faust confronts are fantastic and unbelievable; his unnatural (inhuman) travel through space and time, his changes in appearance and manner, and even the strange, magical events he perceives all seem the stuff of a work of fiction to the reader – as, indeed, they are. These experiences are, however, fundamental to Faust’s development as a character:

*Nur keine Furch, daß ich dies Bündnis breche!
 Das Streben meiner ganzen Kraft
 Ist grade das, was ich verspreche.
 Ich habe mich zu hoch gebläht,
 In deinen Rang gehör ich nur.
 Der große Geist hat mich verschmäht,
 Vor mir verschließt sich die Natur
 Des Denkens Faden ist zerrissen
 Mir ekelt lange vor allem Wissen.
 Laß in den Tiefen der Sinnlichkeit
 Uns glühende Leidenschaften stillen!
 In undurchdrungenen Zauberhüllen
 Sei jedes Wunder gleich bereit!
 Stürzen wir uns in das Rauschen der Zeit,
 Ins Rollen der Begebenheit!
 Da mag denn Schmerz und Genuß,
 Gelingen und Verdruß
 Miteinander wechseln, wie es kann;
 Nur rastlos betätigt sich der Mann.²⁹*

Oh, never fear my promise might be broken!
 My utmost striving’s fullest use
 Is just the part I have bespoken.
 I sought to puff myself too high,
 Your rank is all I may attain.
 The lofty Spirit spurned me, and I pry
 At Nature’s bolted doors in vain.
 The web of thought is all in slashes,
 All knowledge long turned dust and ashes.
 Let in the depths of sensual life
 The blaze of passions be abated!
 May magic shrouds unpenetrated
 With every miracle be rife!
 Let’s hurl ourselves in time’s on-rushing tide,
 Occurrence’s on-rolling stride!
 So may then pleasure and distress,
 Failure and success,
 Follow each other as they please;
 Man’s active only when he’s never at ease.

Furthermore, these experiences parallel the physicist’s perception of realities *just as bizarre and unbelievable* as those in Goethe’s play. In this sense, Faust retains his identity as a character as real and human as any living, breathing person today: the transformation he undergoes and the lessons he learns are possible only through the magic of the devil, but this magic is equaled by the magic – the *true* magic, so distinct from everyday life as to seem impossible – that rests at the heart of the mechanism, governed by and actuated in the laws of physics, that itself both drives

²⁹ *Faust*, lines 1741-1759.

and actuates the universe. Faust himself realizes, at the end of his life, the unity of these twin mysteries, and the capacity humans possess to explore them:

*Tor, wer dorthin die Augen blinzeln richtet,
Sich über Wolken seinesgleichen dichtet!
Er stehe fest und sehe hier sich um;
Dem Tüchtigen ist diese Welt nicht stumm.
Was braucht er in die Ewigkeit zu schweifen!
Was er erkennt, läßt sich ergreifen.³⁰*

A fool who squints beyond with blinking eyes,
Imagining his like above the skies;
Let him stand firm and gaze about alert;
To able man this world is not inert;
What need for him to roam eternities?
What he perceives, [it is] that [that] he may seize.

To come to the same primacy of form in human experience, Goethe could not preempt Schrödinger and walk the path of division of macroscopic objects all the way to their quantum constituents, as these constituents were not yet recognized. He did, however, avail himself of another path in his drama – a path through shape and time. Part I of the work is primarily concerned with the former, though the mutability of matter in shape recurs strongly throughout the entire play. Faust's early alchemical experiments (conjuring the Erdgeist, for example) reference the wider interest of alchemy in converting one substance into another. Though Faust and his contemporaries were unsuccessful in actually accomplishing such transmutation, modern science has made great advances towards its eventual achievement – while lead may still not be easily and practically transformed into gold, the application of our understanding of chemistry and physics brings us ever closer to this goal, and to its more useful counterparts.

Faust's forays into alchemy, however, were futile. His efforts failed in a practical sense, but Goethe, through his description of the Erdgeist's rejection of Faust, evidences a deeper understanding of the situation: not only was the alchemist of the Middle Ages unable to change substance in a physical sense, but substance

³⁰ *Faust*, lines 11443-11448

itself could not change *in a philosophically relevant manner*. Goethe's Erdgeist (literally "earth-spirit", the embodiment of the natural world and the processes that form and govern it) does not criticize Faust's methods or scientific technique. Rather, the spirit mocks Faust for attempting a task beyond meaning to man – an achievement that, whether accomplished or not, would bear within it no deeper significance than physical processes, like the melting of ice or the dissolution of salt in water, that *are* within man's control:

<p><i>Geist:</i> <i>Wo bist du, Faust, des Stimme mir erklang, Der sich an mich mit allen Kräften drang? Bist du es, der, von meinem Hauch umwittert, In allen Lebenslagen zittert, Ein furchtsam weggekrümmter Wurm?</i></p>	<p><i>Spirit:</i> Where is the Faust whose voice rang out to me, Who urged himself on me with utmost energy? Could you be he, who at my wafting breath Is shaken even unto death, Shrinking aside, a fearful writhing worm?</p>
<p><i>Faust:</i> <i>Soll ich dir, Flammenbildung, weichen? Ich bin's, bin Faust, bin deinesgleichen!... Der du die weite Welt umschweifst, Geschäftiger Geist, wie nah fühl ich mich dir!</i></p>	<p><i>Faust:</i> Am I to yield to you, semblance of flame? No, I am Faust, your match, I am the same!... You who bestride the world from end to end, Spirit of deeds, how close I feel to thee!</p>
<p><i>Geist:</i> <i>Du gleichst dem Geist, den du begreifst, Nicht mir!³¹</i></p>	<p><i>Spirit:</i> Close to the wraith you comprehend, Not me!</p>

From a scientific perspective, immutability of substance, or lack thereof, is a matter of chemical reality; Goethe's philosophy asserts, however, that substance *itself* is not fundamental – substance cannot change in a manner *significant to human experience*. From the perspective of philosophy, substance simply *is*, constant and without further meaning.

As Faust progresses through Part I, the most significant occurrence of form as a major plot element arises in Faust's presentation of himself, both physically and in personality, to Gretchen. Transformed through the witch's potion into a younger, handsomer man, Faust woos his eventual lover; later, the spell of the potion gone,

³¹ *Faust*, lines 494-500, 510-513.

Faust returns to her in his native state. At first, Gretchen cannot recognize her formerly youthful-appearing companion; Faust's manner, though, eventually convinces her of his identity. At first, this poses an obvious difficulty: Faust's physical form has changed, yet his essence remains the same, and is recognized by Gretchen. In this context, though, Goethe demonstrates the true unity of his concept of the essential with the parallel idea Schrödinger would subsequently develop. Physical form is indeed fundamental for objects comprised of matter; in animate humans, though, the essential form is manifested not in the physical arrangement of the features and shapes that comprise the body, but in the form of the *soul* – the intangible element that comprises the identity of the individual beyond his physical self. Though Faust's appearance is vastly different when he encounters Gretchen in the dungeon, she recognizes him by the kindness of his manner towards her, and the obvious love he still bears for her. Faust's actions and appearance speak otherwise, but Gretchen recognizes the form of Faust's soul, unchanged:

*Das war des Freundes Stimme!...
 Er rief Gretchen! Er stand auf der Schwelle.
 Mitten durchs Heulen und Klappen der Hölle,
 Durch den grimmigen, teuflischen Hohn
 Erkennt ich den süßen, den liebenden Ton...
 ...es will mir nicht mehr gelingen...
 Und doch bist du's und blickst so gut, so fromm.³²*

That was my dear one calling!...
 He called Gretchen! On the threshold he stood,
 Through the clangor and howl of the Devil's brood,
 Through the sneers, the infernal infuriate drone,
 I knew it, the sweet, the enchanting tone...
 ...it seems I lost the feel of you...
 Yet it is you, as ever kind and dear.

Faust's perception and understanding progress beyond the microcosmic as the play transitions from Part I to Part II. Correspondingly, the paradigm by which Goethe continues to investigate the fundamentality of form shifts from a microcosmic approach through individual human interactions to a macrocosmic time-altering method. Indeed, Part II is, in all respects, an acceleration. Faust's first

³² *Faust*, lines 4461, 4466-4468, 4532, 4535.

foray is in a roughly contemporaneous world, performing a financial task that is novel, but not terribly unusual; as he progresses, though, his travels through time grow more extreme (spanning millennia), and begin to incorporate first pseudohistory, then outright mythology. As financier, general, and husband to Helen, though, Faust remains constant – the form of his soul is unchanged, and his deepest desire to strive ever forward continues to compel him relentlessly. This constancy is reinforced by the prolonged lack of fulfillment of the terms of Faust’s pact with Mephistopheles; even in vastly different places, at vastly different times and engaged in wildly divergent occupations, Faust remains fundamentally unsatisfied:

*[Ich] wandle so den Erdentag entlang;
Wenn Geister spuken, geh’ [ich meinen] Gang,
Im Weiterschreiten find’ [ich] Qual und Glück,
[Ich], unbefriedigt jeden Augenblick!³³*

Let [me] stride on upon this planet’s face,
When spirits haunt, let [me] not change [my] pace,
Find bliss and torment in [my] onward stride,
Aye – every moment unsatisfied.

Time, human creation, and eventually nature fall away as Part II evolves. The seeming impregnability of these barriers – and their resultant permanence and fundamentality – evanesce before the singularity of form taken by Faust’s soul.

Even in the work’s conclusion, Goethe demonstrates his abiding belief in the constancy of soul-form. Faust is redeemed by his desire to do good for others – his striving is unabated, but its object is transferred from seemingly selfish desire for personal growth to a genuine, general concern to better the condition of his fellow men. As Faust ascends through heaven, he *continues* to strive ever upward through the celestial spheres; the consummate bliss and satisfaction of a benevolent eternity manifest themselves not in a cessation of striving, but in a fulfillment of the impulse

³³ *Faust*, lines 11449-11452.

to strive in an environment perfectly attuned to the ideal state of the soul. As the *chorus mysticus*, closing the epic drama, intones in the last words of the play:

*Alles Vergängliche
Ist nur ein Gleichnis;
Das Unzulängliche,
Hier wird's Ereignis;
Das Unbeschreibliche,
Hier ist's getan;
Das Ewig-Weibliche
Zieht uns hinan.*³⁴

All that is changeable
Is but reflected;
The unattainable
Here is effected;
Human discernment
Here is passed by;
The Eternal-Feminine
Draws us on high.

This poignant conclusion elegantly and succinctly demonstrates the surpassing of the inconstancy of changeable matter and shape, and the achievement of the unattainable ideal (on Earth), for which Faust so desperately sought, in the eternal path “on high”, ever upward.

In this respect, Faust is Goethe’s chief embodiment of his concept of the ideal human – the actualization of how everyone should be. As Faust reveals in his great monologue at the beginning of Part I of the work, his goal is to strive to understand the innermost workings of the world; taken as a model, Faust’s preoccupation – an obsession fundamental to his identity – may be mapped to every individual in Goethe’s vision of ideal humanity. Here, then, we see the final evidence of Goethe’s belief in the primacy of soul-form to human existence. The *particular* individual who occupies the form Faust so evidently manifests is essentially irrelevant; what matters, rather, is the *orientation* – the *form* – of the occupying soul towards the striving that Goethe asserts is fundamental to the essence of being human.

In this realization, we come full circle. Just as Goethe evidences a powerful belief in soul-form over the necessity of material or individual personal-substance,

³⁴ *Faust*, lines 12104-12111.

so, too, does Schrödinger assert the fundamentality of form over substance. As Goethe places the purpose underlying human existence about that existence itself, so, too, does Schrödinger reference and elevate to paramount importance the underlying unity of individualities in the cosmic collective.

Finally, given this analysis, the harmony between Schrödinger's purpose of scientific inquiry and Faust's *raison d'être* is evident. Schrödinger, as discussed above, asserts that the most fundamental motivation of scientific exploration (and, indeed, all human activity that seeks to penetrate the mysteries of reality) is so that man may come to know himself better. Faust, too, seeks to truly comprehend and understand the workings of the universe; as evidenced in his pact with Mephistopheles, he binds his entire self to this quest. His motivation in doing so (until the very end of his quest, and life) is not selfless, nor does it have a goal beyond itself (the *use*, for example, of the knowledge won); rather, Faust must probe the mysteries of the universe because *only in doing so may he come to know and understand himself*. Faust is the herald and embodiment of Schrödinger's vision of man, stripped by the power of the devil of all the inconvenient, tangential factors that obscure the reality of his nature. Faust seeks to understand his world, and to ultimately become one with it, in obedience to the drive to know that he *is*. In this unity of purpose, this singularity and naked uniqueness of intent, Goethe's and Schrödinger's philosophies fuse. Whether in fiction or in physics, both men share a vision of the true nature of humanity – and both recognize the common fulfillment, however impossibly distant it may be, of this nature.

Schoenberg: Idea

In the early stages of the Enlightenment, developments in music broadly paralleled advances in Western science. While seen as a vehicle of both artistic and emotional expression, music evolved within the bounds of a relatively formulaic system; compositions of the Classical period, as reflected in the works of such masters as Mozart and Haydn, conformed to an ordered system of stylistic and harmonic development.³⁵ Beginning most prominently with Beethoven, however, Western music began to diverge from this pure, systematic order. In the subsequent Romantic period, emotional expression became the dominant driver of composition. The desire for works that would viscerally transmit such emotion overwhelmed uncompromising allegiance to strict style, and opened musical composition to another dimension of development.³⁶

Throughout the early and middle phases of the Romantic period, harmonic complexity increased without significantly deviating from the grounding sense of tonal fidelity that had governed Western music for centuries. An understanding of the concept of tonality in the Western system is, then, necessary to both grasp the foundational principle of such music, and the ways in which subsequent composers were able to deviate from it.

Essentially, tonality dictates the firm establishment of a harmonic “center” in a piece, as well as the modulation of melody and harmony in relation to this center in established ways. Western composition divides the octave (the continuous range

³⁵ "Western music." Encyclopædia Britannica. 2010. Encyclopædia Britannica Online. 19 Apr. 2010 *The Classical Period*.

³⁶ *ibid.* *The Romantic Period*.

of tones between one tone and another with double, or half, its frequency) into twelve tones; in tonal theory, these pitches are then arranged into sequences of eight (beginning with one note, and ending on its octave). The different frequency relationships among the notes in these eight-note scales establish what are termed musical modes, which are, in turn, used in the methods of harmonic composition.³⁷

A concrete illustration of these concepts in the context of an actual musical instrument may help to clarify them. On a piano, for example, the twelve tones possible in an octave are visibly evident in the keys between any starting key, and the identical key an octave above or below it; there is considered to be a “half-step” between adjacent keys (including both black and white), giving six full steps, or twelve half steps, between the starting note and its octave. Modes, then, are simply codifications of sequences of half steps and full steps, comprising eight notes (including the octave). The Ionian mode is, perhaps, the most familiar to the Western ear; its sequence (using h for half steps and F for full steps) is F-F-h-F-F-F-h, corresponding to the famous “do-re-mi...”, which is, to most people, the most obvious formulation of a musical scale. As is readily apparent, a number of other modes exist in theory; Western music typically recognizes seven of them.³⁸

Within the scales that correspond to modes and their derivatives, different tones are assigned different terms in relation to the first tone of the sequence, known as the tonic or first scale degree. The choice of tonic is fully up to the composer, and is often used to establish a particular mood or quality in a piece; the

³⁷ Kostka, Stefan and Dorothy Payne. Tonal Harmony. New York: McGraw-Hill, 2009. 496-497.

³⁸ *ibid.*

tonic, in turn, sets up the relations among the remaining tones of the scale. The second scale degree – the tone directly “above” the tonic (“re” in the sequence above) – is, fittingly, termed the supertonic; the rest of the scale degrees (third through seventh) are assigned similar names.³⁹ After evolution through various other paradigms of tonality, Western music, in the Classical and Romantic periods, settled on the concept of triadic harmony to dictate tonal structure; this system relies specifically on the relationships between the first (tonic), third (mediant), and fifth (dominant) scale degrees. Combined, these notes comprise a harmonic triad, and the step-relationships between them most fully establish the nature and mood of a musical composition.⁴⁰

In the Ionian mode, for example, there are two full steps between the tonic and the mediant, as well as three full steps and one half step between the tonic and the dominant. This arrangement is termed a major triad, which, in turn, forms the harmonic basis of a “major key” in which a piece may be composed. A key is simply the use of the tones available for composition according to a pre-established set of relationships of all tones to the tonic of the work, often also describable in the language of modes; the “letter name” of the key gives the tonic, and the quality (major or minor) accompanying it references the triadic relationship that forms the core harmonic entity of the tonal sequence upon which the work is built.⁴¹ A piece in C-major, for example, establishes C as the tonic (first scale degree), E as the mediant, and G as the dominant. The key also references C as the harmonic center and focal

³⁹ *ibid.* 17.

⁴⁰ *ibid.* ix-xi, 41.

⁴¹ *ibid.* 8-9, 13-15.

point of the work, around which it unfolds and to which (at least in the music of the Classical and Romantic eras) it ultimately returns.

The careful reader will, however, note some ambiguity in the reliance on a single triad to establish the key of a work. Indeed, this is actually impossible, as a triad simply describes the relationship between three notes (the n , $n+2$, and $n+4$ scale degrees) without necessarily referencing the tonic (harmonic center) of the work. While the sequence C-E-G mentioned above signifies the first (I) triad in the key of C-major (as the C is the tonic), it could just as well represent the third (III) triad in the key of a-minor, where C would be the mediant, E the dominant, and G the subtonic. Though the *triad* retains its harmonic quality (in this case, major) through the relationships of the third and fifth tone to the first, this quality takes on a different meaning in the larger tonal context of the *key*.

To establish the key, the tonic, and the accompanying strong tonal “gravity” that characterizes much of Western music, modulation is necessary. Essentially, this is the use of triads and the more complex harmonies built on them in particular successions to alert the ear to common patterns by which such gravity is actuated.⁴² Certain types of cadences, progressions of two or more (often triadic) chords at the conclusion of a musical phrase or work, provide an especially instructive mechanism through which to examine the nature of this establishment, or confirmation, of tonal gravity.⁴³ For example, the Western ear is most accustomed to hearing a I chord after a V chord (a “perfect authentic cadence”)⁴⁴ at the end of a

⁴² *ibid.* 304.

⁴³ *ibid.* 155.

⁴⁴ *ibid.* 155.

work; by providing this resolution, the composer guarantees near-universal comprehension of his tonal conception of his piece.

The brief overview of tonality above touches on the elements relevant to tonal composition. The choice of the tonic, as well as the numerous scales that are categorized by the pitch relationships between their scale degrees, provide the tonal background on which a piece is composed; the clever employment of sequences of chords, based on the triadic harmonies appropriate to the key already chosen, may strengthen or weaken the listener's perception of the tonal center of the work according to the desire of the composer. Indeed, in countless instances, cadence and chord progression are arranged in ways that invoke an intentional atmosphere of tonal ambiguity. Even in such nebulous works, however, the mechanisms of tonality (albeit somewhat tweaked) continue to operate – and the works in question return, nearly invariantly, to their tonal origins.

Such tonal composition, as mentioned in the introduction to this section, dominated Western music throughout the Classical period and into the Romantic era; indeed, tonal technique is still firmly entrenched as the governing system by which everything from commercial jingles to pop songs is composed. More than anything in musical character, perhaps, tonality seems the quintessential component of Western music. Our intangible desire for music to “go somewhere” originates in our understanding of and appreciation for the triadic relationships among chords built from different scale degrees, and our deep and complex attachments to the different qualities of both notes combined in chords and

sequences of chords themselves significantly impact our emotional and intellectual orientations towards music we perceive. While tempo, dynamics, phrasing, and countless other characteristics of music also contribute to our sense of musical continuity and “fullness”, our overwhelming reliance – especially in “easier” music – on pre-established, time-tested sequences of tonal harmonies often dictates our reactions, both intellectual and visceral, to the music we hear.

In the realm of artistic musical composition, the myriad possibilities of tonality were extensively explored throughout the Romantic era (which stretched, quite roughly, from the 1820s to the 1910s). As composers sought new ways to invoke emotion and elicit strong reactions from listeners, the use of increasingly complex consonances and dissonances within the tonal framework became more and more commonplace; correspondingly, strong fidelity to a clearly established tonal center weakened.⁴⁵ By the end of the period, the full evolution of tonality was considered by some to have been thoroughly exhausted. The works of such composers as Mahler, labyrinthine in their complexity and fearsome in their extremely intricate employment of tonality, represented, to many, the final “flowering” of the potential of tonal composition.⁴⁶ Western music was ripe for a departure from its established structure more radical than any it had yet experienced – a break from tonality itself, the most fundamental, and, though flexible, most immutable element of music to the Western mind.

⁴⁵ “Western Music.” *The Romantic Period*.

⁴⁶ “Gustav Mahler.” *Encyclopædia Britannica*. 2010. Encyclopædia Britannica Online. 19 Apr. 2010

The “abandonment” of tonality did not occur suddenly, nor was experimentation with such new compositional techniques constrained to a single individual or school of thought. Beginning in the early twentieth century, however, and continuing for several decades, one group of composers dominated the drive into the new and unexplored realms beyond strict tonality. The core of this ensemble, termed the Second Viennese School after the city in which its members resided, was comprised of two energetic disciples – Anton Webern and Alban Berg – and their charismatic, enigmatic, and intensely devoted-to-his-art leader, Arnold Schoenberg.⁴⁷ It is to the ideas, both musical and philosophical, of this fascinating character that I now turn.

From the start, Schoenberg was something of an exception in the Viennese music scene. He lacked a formal musical education, but made up in autodidactically acquired expertise what he never achieved through tutelage and instruction. Schoenberg’s early compositions (like, for example, his highly esteemed *Verklärte Nacht*) boldly stretched the bounds of tonal technique. These pieces continued to reside, however, firmly within the realm of tonality; though the Romantic tendency of harmonic ambiguity is quite clearly evident in this and other early works, they retain the modicum of tonal gravity that qualifies them as works within the linear tradition of Western compositional technique.⁴⁸ Beginning in 1908, however, Schoenberg began to experiment with pieces that lacked any reference to tonal key

⁴⁷ Simms, Bryan R. Schoenberg, Berg, and Webern: A Companion to the Second Viennese School. Westport, CT: Greenwood Press, 1999. 1.

⁴⁸ *ibid.* 131-134.

whatsoever – compositions that *had no tonic*, no discernable center to which the music seemed to naturally progress or return.⁴⁹ Though a relatively simple step to take in a practical sense, Schoenberg's conceptual leap was both daring and revolutionary. In a stroke, he abandoned the Western dependence on tonality as a dominating, essential element, and elevated dissonance – the absence of perceptible harmony among tones - to equal status as a legitimate compositional tool. In doing so, Schoenberg earned the title he would later invent (Emancipator of Dissonance)⁵⁰, and profoundly impacted the Western view of musical composition itself.

Schoenberg's early experiments beyond tonality are known today within the framework of "free atonality" – music that lacks a definite tonal center, but that is also constructed without reference to another organizing compositional principle. As his style and understanding continued to develop, however, Schoenberg and his pupils came to codify the principles of dodecaphonic composition, or serialism, for which he is most widely renowned today. In theory (and on paper), serialism is simply another framework by which to organize tones into works of music; in practice, the human reaction to pieces composed according to the technique evidences its radical departure from both the Western concept of music, and, more fundamentally, from the inherent human comprehension of music itself.

As the longer name implies, dodecaphonic composition employs all twelve tones available to the Western composer. Rather than structuring works according

⁴⁹ *ibid.* 130.

⁵⁰ Schoenberg, Arnold. "Opinion or Insight?" Trans. Leo Black. *Style and Idea: Selected Writings of Arnold Schoenberg*. Ed. Leonard Stein. New York: St. Martins Press, 1975. 260.

to modes, scales, and keys in the methods outlined above, serialism seeks to generate music characterized by use of the twelve tones related only with one another – in a sense, democratizing the tones and elevating the importance of their sequencing over their harmonic value.⁵¹ The core element of dodecaphonic composition is the tone row, an ordered set of all twelve tones in a succession established by the composer. According to Schoenberg's postulates, a tone row, once set, must be used in one of four "linear aspects", which may begin, in turn, on any of the twelve tones. In truncated form, the aspects are as follows: the prime aspect is simply the original sequence of tones (for example, C-E-F, in which a major third – two full steps – separates the first two tones, and a minor second – one half step – separated the second two tones). The retrograde aspect is simply the time-inverse of the prime, here yielding F-E-C. The inversion, in contrast, reverses the direction of pitch relationships; our rising major third becomes a falling major third – two full steps downwards – and our rising minor second also transforms into a falling major second. This yields the sequence C-A^b-G. Finally, the last permissible aspect is the retrograde inversion, or the time-reversal of the pitch-direction reversal; this gives G-A^b-C. Once established, tones are sequenced according to these aspects; in combination with the other elements of musical structure (tempo, articulation, dynamics, etc.), in addition to the superposition of other aspects of the established tone row – or, in more complex works, of other tone rows altogether – dodecaphonic works are composed.⁵²

⁵¹ Kostka et al. 552-553.

⁵² *ibid.* 553-558.

Schoenberg employed his dodecaphonic technique extensively throughout his later years, as did many of his pupils. Some of his works achieved limited success, but during his lifetime he never recaptured the adulation and fame he had achieved in his earlier tonal compositions. Primarily, critics accused Schoenberg of being excessively mathematical in his music; formulated as they were along the relatively rigid lines of serialism, Schoenberg's works seemed the pure fruits of a cold intellect, devoid of all spontaneous or intentioned intervention of the heart. As Heinrich Schenker, a Viennese music theorist of the day much admired by Schoenberg himself, described the composer's revolutionary String Quartet No. 1 in D minor:

"A singular, extended desecration. If there are criminals in the world of art, this composer, whether by birth or his own making, would have to be counted among them. Without feeling for tonality, motif, proportion, going on simply threadbare, without any technique and at the same time with a great and constant pretense."⁵³

Schoenberg himself, however, ardently opposed such criticism. He rejected the characterization of his music as "atonal", seeing it, rather, as a direct extension of musical ideals more fundamental than tonality itself that propelled music through a phase of emphasized harmony into one of de-emphasized consonance. In addition, Schoenberg asserted that music without participation of the mind was meaningless,

⁵³ Simms. 135.

and that only a confluence of the efforts of intellect and passion could produce true works of art – as they had in the compositions of his predecessors, and as they did in his own:

“It is not the heart alone which creates all that is beautiful, emotional, pathetic, affectionate, and charming; nor is it the brain alone which is able to produce the well-constructed, the soundly organized, the logical, and the complicated...one might become suspicious of the sincerity of works which incessantly exhibit their heart...whose simplicity is want, meagerness, and dryness; whose sweetness is artificial and whose appeal attains only to the surface of the superficial. Such works only demonstrate the complete absence of a brain and show that this sentimentality has its origin in a very poor heart.”⁵⁴

Schoenberg’s extensive and wonderfully lucid writings give a fascinating glimpse into the philosophies underlying his musical efforts, as well as into his ultimate views on the fundamental importance of both his achievements and others’ perception of them. The development of his thought elegantly mirrors the contemporaneous evolution of his compositional technique, and the conclusions he

⁵⁴ Schoenberg, Arnold. “Heart and Brain in Music.” Trans. Leo Black. Style and Idea: Selected Writings of Arnold Schoenberg. Ed. Leonard Stein. New York: St. Martins Press, 1975. 75-76.

reaches philosophically are reflected in the musical clarity and resolution that characterize his later works.

First, as mentioned above, Schoenberg rejected the notion that his music is merely mechanistic. He describes the division of musical elements prevalent in his day into three main categories: those that listeners believe touch the heart, and originate in the emotions of the composer (like melody); those that are “interesting” in the confluence of heart and mind (like variations in tempo and dynamics); and, finally, those that reside purely in the mind (like counterpoint), that quicken the heartbeat and excite the spirit, but that can only be tolerated if paired with suitably emotional aspects. Schoenberg completely rejects these divisions of the elements of composition:

“...one...misconception is the general belief that the constituent qualities of music belong to two categories as regards their origin: to the heart or to the brain, with the exception of some products in which both might have a word to say...[those who compose using these artificially distinct categories] are not creators who must open the valves in order to relieve the interior pressure of a creation ready to be born. They are merely more or less skilful entertainers.”⁵⁵

In abjuring this superficial categorization of the origins of different facets of compositional technique, Schoenberg both justifies his emancipation of dissonance,

⁵⁵ *ibid.* 54.

and his use of a new technique to structure music according to all those facets outside tonality that are appreciated by the listener while simultaneously broadening the harmonic experience beyond the bounds imposed by a slavish reliance on it as the vector of emotional expression. Such emotion, Schoenberg argues, is most truly transmitted, in a consummately human sense, in an indivisible complex with the intellectual excitations that also characterize works of musical art. Attempting to separate the two is both unnatural, and overly simplistic – and by freeing his compositions of dependence on the traditional roles of different musical elements to produce different effects in the listener, Schoenberg recombines the myriad aspects of meaning that he seeks to infuse into his pieces in ways that deliver them to his audience whole, undissected, and most powerfully and truly human. Thus, to him, dodecaphonic music – if properly executed – is the most honest and perfect way for him to transmit indivisible meaning to the entirety, both emotional and intellectual, of the listener:

“Music without a constant reference to a tonic [is] comprehensible, [can] produce characters and moods, [can] provoke emotions, and [is] not devoid of gaiety or humor...The method of composing with twelve tones substitutes for the order produced by permanent reference to tonal centers an order according to which, every unit of a piece being a derivative of the tonal relations in a basic set of twelve tones, the

'Grundgestalt' [base-form] is coherent because of this permanent reference to the basic set."⁵⁶

Building from these conclusions, Schoenberg asserts that his later works – though superficially radical departures from his earlier, tonal efforts – are actually the natural progression of the same mindset that inspired and drove him from the beginning of his compositional career. In fact, through the concept of the indivisibility of meaning that Schoenberg claims is fundamental to an understanding of his pieces, he holds that dodecaphonic composition itself is the direct linear descendant of the course of Western music throughout its evolution. Rather than a radical break with earlier styles and intentions, Schoenberg sees his later pieces as more ordered, precise, better forms of the music he had tried to compose at the beginning of his career; even though harmonic structure is nearly totally abandoned, the intention of consummate intellectual and emotional expression at the heart of his efforts is more effectively and meaningfully achieved through the vehicle of the emancipation of dissonance. Again, Schoenberg reinforces his ardent belief in both the human validity of his compositional techniques, and in the connections of the works such techniques produce to both the works of the past, and the future:

⁵⁶ Schoenberg, Arnold. "My Evolution." Trans. Leo Black. Style and Idea: Selected Writings of Arnold Schoenberg. Ed. Leonard Stein. New York: St. Martins Press, 1975. 88, 91.

“Let us not forget that I came to this gradually, as a result of a convincing development...according to which the comprehensibility of the dissonance is considered as important as the comprehensibility of the consonance. Thus dissonances need not be a spicy addition to dull sounds. They are natural and logical outgrowths of an organism. And this organism lives as vitally in its phrases, rhythms, motifs, and melodies as ever before.”⁵⁷

Most fundamental to Schoenberg’s philosophy, though, is his concept of the idea. The greatest collection of his writings is titled *Style and Idea*, and the most significant argument within its pages deals neither with the intricacies of dodecaphonic technique, nor the refutation of the countless, relentless critics that dogged him all his life. Rather, Schoenberg seeks to impress upon the reader the fundamental importance of idea to the composer – indeed, in his view, the most important element of and motivator for art itself.

According to Schoenberg, style is simply the individual, personal manifestation that different aspects of life and reality take in a local sense. Style is the actualization of a single identity or concept, with no meaning beyond its temporary and actualized self. To demonstrate the concept, Schoenberg gives the example of a pair of pliers; he marvels at the genius that came up with the tool, and praises the ingenuity of mankind for such a simple but elegant way of solving the obvious problem of the extension of physical dexterity and strength. The pliers,

⁵⁷ *ibid.* 91.

though, are merely the style in Schoenberg's day; as he predicted, other tools came along that perform the tasks made simpler by pliers more quickly and efficiently. Behind both the pliers and their successors, though, resides an unchanging *idea* – the seed of human impetus that germinated deep in the recesses of a brilliant mind, and that provided the principle according to which style molded the actualizations possible in the corresponding time. As Schoenberg asserts,

*“an idea can never perish”*⁵⁸ (italics original)

– and in pursuing the same idea his predecessors in music had pursued, he remains as faithful to the development and realization of the idea of consummate human expression in art as any composer before him:

“...there is produced a state of unrest, of imbalance which grows throughout most of the piece...The method by which balance is restored seems to me the real *idea* of the composition...One thinks only for the sake of one's idea. And thus art can only be created for its own sake. An idea is born; it must be molded, formulated, developed, elaborated, carried through and pursued to its very end.”⁵⁹

⁵⁸ Schoenberg, Arnold. “New Music, Outmoded Music, Style and Idea.” Trans. Leo Black. Style and Idea: Selected Writings of Arnold Schoenberg. Ed. Leonard Stein. New York: St. Martins Press, 1975.

⁵⁹ *ibid.* 123-124.

As was the case with Schrödinger, there exist remarkable parallels between the philosophies evidenced in Goethe's *Faust* and the concepts fundamental to Schoenberg's views that are outlined above. First, Faust's personal evolution throughout Goethe's work exactly mirrors Schoenberg's concept of the indivisibility of the intellectual and emotional aspects of human experience; while Schoenberg addresses the idea in a musical sense, Faust embodies it in a literal manner. Faust's chief difficulty as an academic is precisely the sterility of pure intellect that Schoenberg explicitly rejects; Faust's inability to find consummation in his life prior to the beginning of the drama evidences his tacit experiential agreement with Schoenberg's position:

*Habe nun, ach! Philosophie,
Juristerei und Medizin,
Und leider auch Theologie
Durchaus studiert, mit heißem Bemühn.
Da steh ich nun, ich armer Tor!
Und bin so klug als wie zuvor.⁶⁰*

I have pursued, alas, philosophy,
Jurisprudence, and medicine,
And, help me God, theology,
With fervent zeal through thick and thin.
And here, poor fool, I stand once more,
No wiser than I was before.

In forging a pact with Mephistopheles, Faust seeks to gain the ability to explore other aspects of his human nature and the universe with which he seeks to connect; by continuing to segment and segregate aspects of his experience, however, he continues to prevent himself from achieving the meaningful comprehension of the world and his role in it that he unknowingly seeks. Just as Schoenberg passionately insists on the necessity of the indivisibility of the "humanness" transmitted in his music, so too does Goethe demonstrate – in the ultimate union of the efforts of mind and heart – that true human satisfaction is found only in that which engages and challenges all aspects of the individual as an entire, whole being. Indeed, Faust's

⁶⁰ *Faust*, lines 354-359.

final endeavor (the reclaiming of land from the sea) evidences just such engagement, on both personal and collective levels:

*Die Nacht scheint tiefer tief hereinzudringen,
Allein im Innern leuchtet helles Licht;
Was ich gedacht, ich eil' es zu vollbringen;
Des Herren Wort, es gibt allein Gewicht...
Auf strenges Ordnen, raschen Fleiß
Erfolgt der allerschönste Preis;
Daß sich das größte Werk vollende,
Genügt ein Geist für tausend Hände.⁶¹*

The night, it seems, turns deeper still – but shining,
The light within continues ever bright,
I hasten to fulfill my thought's designing;
The master's word alone imparts his might...
Attendance prompt to orders wise
Achieves the most alluring prize;
To bring to fruit the most exalted plans,
One mind is ample for a thousand hands.

In this respect, Faust's personal evolution throughout the eponymous work exactly parallels Schoenberg's own development of serialism in service to the same goals he asserts that his predecessors had sought. Like Classical composers, Faust at first pursues an understanding of the world – and himself – through traditional courses of study. After these fail, he progresses to more heterodox and exotic methods – alchemy, sorcery, and the like – in an increasingly desperate attempt to achieve his goal, as did the composers of the Romantic era in their successive stretching of the boundaries of musical formalism. Finally, Faust signs a pact with the devil; in so doing, he relinquishes his unity with his humanity (by abjuring its bounds) to fully come to understand and fulfill that same humanity. In the same way, Schoenberg and his disciples renounce the most fundamental element of Western music – *so that they may most truly achieve an expression and transmission of this music's essence*. As Faust progresses throughout Goethe's drama, and learns to better and more successfully integrate emotion, action, time, space, and meaning into the clarifying image of the answer to the questions he pursues, so, too, does Schoenberg's musical evolution – far from being a callous break from the vaunted

⁶¹ *Faust*, lines 11499-11502, 11507-11510.

path of a composer – allow him to approach, in the development of his technique and expression, the human ideal that he, in parallel with Faust, seeks.

Most significantly, though, Schoenberg's fidelity to the concept of the idea as the most fundamental element of human experience and reality reflects Goethe's assertion of the primacy of soul-form, realized, as discussed earlier, in comparison with the works of Schrödinger. Just as Schrödinger divides the world of physical reality into obvious but meaningless substance, and the more subtle form underlying and overlaying it, so, too, does Schoenberg draw clear distinction between style – the transient and temporary actualizations of concepts – and the more fundamental, and unchanging, idea. Indeed, Schrödinger's form and Schoenberg's idea are one and the same; they are the invariant realities, intangible but real – powerfully real – that infuse temporally specific reality with meaning and, in a philosophically relevant sense, with being itself. The form Faust takes at the conclusion of Goethe's work, as explained earlier, elegantly reflects the poet's belief in the significance of the orientation of the soul in direct parallel to Schrödinger's understanding of the primacy of form. Similarly, after an epic drama's worth of changing, unstable styles – of wildly divergent guises, schemes, locations, times, and emotions – the stability and immortality Faust realizes at the moment of both his death and his salvation *are*, in a real sense, a rare glimpse of the naked reality of the idea Schoenberg asserts. In his music, Schoenberg seeks, above all, the transmission to the listener of a message – both intellectual and emotional – that originates within the composer as a whole, complete person. Regardless of the content of the message, it comprises an idea – and, stripped at the end of his life and time on Earth

of the devil's confusing, divisive influence, as well as of his own prevarications, insecurities, and uncertainties, Faust attains the human completeness Schoenberg seeks to convey through his music. In achieving his consummation, Faust is stripped of style; just as he achieves Schrödinger's ideal in the final orientation of his soul, so, too, does he realize Schoenberg's dream of pure and undivided idea, immortal and consummately human:

*Neige, neige,
Du Ohnegleiche,
Du Strahlenreiche,
Dein Antlitz gnädig meinem Glück...
[Du] überwächst uns schon...
Komm! Hebe dich zu höhern Sphären!⁶²*

Incline
Though past comparing
Though radiance bearing,
Thy grace upon my happiness...
[You] already outgrow us...
Come! soar to higher spheres!

As demonstrated, the parallels between Schoenberg's philosophy and Goethe's beliefs are as startling as those proposed between the ideas shared by the poet and Schrödinger. Given the remarkable intermediary — Goethe — that bridges both geniuses' thoughts, I now seek to add a further dimension to my analysis and to more fully examine the "triangular connectedness" of the disparate elements under consideration in light of specific aspects of *Faust* itself.

⁶² *Faust*, lines 12069-12072, 12076, 12094.

Goethe: *Faust*

The symmetries that unexpectedly arise between the philosophies of Schrödinger and Schoenberg through the mediating text of *Faust* draw together ideas that, though originating in vastly different fields of human inquiry, fuse in their transcendence of the human condition. Most significantly, the appearance of the parallel conceptions of Schrödinger's form and Schoenberg's idea, united in their common embodiment in Faust himself, is both startling and deeply meaningful.

This analysis has proceeded by viewing the writings of Schrödinger and Schoenberg, in relation to their respective discoveries and creations in physics and music, through the "focusing lens" of Goethe's *Faust*. Given the scope of the study, though, and the reciprocities in thought and philosophy that it has revealed, it seems only fitting to reconfigure the elements in play – to view Goethe's work, and the ideas within it, through the concepts of the physics Schrödinger worked to understand, and the music Schoenberg sought to create. Furthermore, the timeless themes that pervade *Faust* lend themselves as easily and fruitfully to application to the questions of modern society as they did to the dilemmas of the community in Goethe's day, and as they do to the issues that preoccupied Schrödinger, Schoenberg, and their contemporaries.

The launching point of Goethe's drama is the pact Faust makes with Mephistopheles. As explained earlier, Faust reaches this agreement only after exhausting all human possibilities to explore his world, and to come to a better understanding of it on his own:

*Ich fühl's, vergebens hab ich alle Schätze
Des Menschengenits auf mich herbeigerafft,
Und wenn ich mich am Ende niedersetze,
Quillt innerlich doch keine neue Kraft;
Ich bin nicht um ein Haar breit höher,
Bin dem Unendlichen nicht näher.⁶³*

In vain all treasures of the human mind,
I feel it, have I raked to me; at length,
When I sit down to marshal them, I find
There wells within no fresh resource of strength;
Not by a hairsbreadth am I grown,
No nearer to the limitless unknown.

Faust desires to continue to strive beyond the bounds of his humanity, a desire as fundamental to this humanity as the limitations that constrain its pursuit; it is this tension between diametrically opposed facets of Faust's (and, in Goethe's expanded paradigm, everyone's) being that motivates the drama of the work.

Faust's bargain with the devil is fraught with necessary sacrifice. The pact's expiration occurs at just the moment when Faust ceases to strive and achieves the consummation he seeks; seemingly paradoxically, Faust agrees to a deal that favors him – through his mastery of Mephistopheles – only until he momentarily reaches the goal to which, he hopes, the devil's powers will propel him. At that moment of fulfillment, Faust will not merely experience, then lose, ultimate happiness; in addition, he will be forced to pay his debt to Mephistopheles in reciprocal and eternal slavery, forever aware of the existence of the happiness he once attained, yet never able to reach it again:

*Und Schlag auf Schlag!
Werd ich zum Augenblicke sagen:
Verweile doch! du bist so schön!
Dann magst du mich in Fesseln schlagen,
Dann will ich gern zugrunde gehn!
Dann mag die Totenglocke schallen,
Dann bist du deines Dienstes frei,
Die Uhr mag stehn, der Zeiger fallen,
Es sei die Zeit für mich vorbei!⁶⁴*

And beat for beat!
If the swift moment I entreat:
Tarry a while! You are so fair!
Then forge the shackles to my feet,
Then I will gladly perish there!
Then let them toll the passing-bell,
Then of your servitude be free,
The clock may stop, its hands fall still,
And time be over then for me!

⁶³ *Faust*, 1810-1815.

⁶⁴ *ibid.* 1698-1706.

Willing assent to such an agreement seems foolhardy, and at the early stage of Goethe's work at which the pact is forged, it is precisely that. Faust is in despair; he has just been rejected by the Erdgeist, and has contemplated suicide, as he views himself as both a fraud and a failure. Mephistopheles' powers seduce Faust, offering him a way to explore realms that he perceives but cannot touch in his limited humanity. Faust accepts a temporary grant of these powers – and the terrible cost they bear – out of desperation. In addition, though, Faust truly believes, even as he marks the devil's parchment with his own blood, that his part of the pact will never come due; in his despair, Faust both proposes the potential existence of a state of consummation, and rejects the possibility of reaching it:

*Du hörst ja, von Freud' ist nicht die Rede.
Dem Taumel weih ich mich, dem schmerzlichsten Genuß,
Verliebttem Haß, erquickendem Verdruß...
Und so mein eigen Selbst zu ihrem Selbst erweitern,
Und, wie sie selbst, am End auch ich zerscheitern.⁶⁵*

You heard me, there can be no thought of joy.
Frenzy I choose, most agonizing lust,
Enamored enmity, restorative disgust...
And thus my selfhood to their own distend,
And be, as they are, shattered in the end.

In spite of the circumstances surrounding Faust's acceptance of Mephistopheles' bargain and his mental state while doing so, there exists a deeper and more fundamental explanation of the path Faust chooses. A seeker of knowledge and understanding, as demonstrated in his impassioned cry to "know the world in its heart", Faust's happiness (actual or potential) does not rest in pedestrian pursuits. His obsession lies, rather, in seeking out the unknown – to perceive and to understand what exists simply *because* it exists. This is the motivation of Faust's academic and alchemical pursuits, and the drive in his acquiescence to Mephistopheles' proposal. In defining the end-terms of the

⁶⁵ *ibid.* 1765-1767, 1774-1775.

agreement, then, Faust may be seen to outfox the devil: though a moment of consummation specifically forbidden from lingering more than an instant (and, instead, followed by an eternity of Hell) must seem a deliciously awful fate for Mephistopheles to inflict upon Faust, Faust's *prime motivation* in formulating the contract in such terms may be because his interest is not in *enjoying* consummation, but simply in knowing that it exists. If this is the case, Faust demonstrates a remarkable willingness to sacrifice everything – his humanity, his life, and his immortal soul – in pursuit of the goal of ultimate understanding, rather than eternal bliss.

Faust uses the powers of the devil to their fullest extent in the pursuit of his moment of consummation; in so doing, he moves closer to its achievement, but simultaneously sacrifices more of himself and others along the way. Most significantly, in Part I of the drama, Faust seduces, impregnates, and ultimately destroys Gretchen in a misguided attempt at love and the establishment of a meaningful human relationship. Gretchen is a necessary sacrifice to the achievement of Faust's end – without a true experience of passionate, irrational love, his overly intellectual self would not have the vivifying experience required to achieve an accurate and well-rounded understanding of the possibilities of human interactions:

*Beim Himmel, dieses Kind ist schön
So etwas hab ich nie gesehn...
Wie sie die Augen niederschlägt,
Hat tief sich in mein Herz geprägt;
Wie sie kurz angebunden war,
Das ist nun zum Entzücken gar!⁶⁶*

God, what a lovely child! I swear
I've never seen the like of her...
Her glance's timid downward dart
Is graven deeply in my heart!
But how she was so short with me –
That would be consummate ecstasy!

⁶⁶ *ibid.* 2609-2610, 2615-2618.

Yet Faust's affair with Gretchen, empowered as it is by Mephistopheles' deception and sorcery, bears with it an inevitable cost: by violating nature's order and by altering his physical appearance, as well as by lying to the girl he seeks to impress, initially, in purely lascivious pursuit, Faust breaks the delicate innocence he desires to both enjoy and consume. A relationship that begins in such an illicit manner leads from tainted gifts of jewels to accidental passive murder (in Gretchen's unintentional poisoning of her mother), to accidental active homicide (in Faust's fatal wounding of Gretchen's brother in a duel), to intentional murder (in Gretchen's drowning of the child she had borne illegitimately), and, finally, to Gretchen's self-determined death. Faust gains the experience he seeks, but the process bitterly wounds his heart, and the evils it spawns continue to multiply and grow fouler as he pursues knowledge through powers humans were never meant to wield:

*Laß das Vergangne vergangen sein,
Du bringst mich um...
Der Tag graut...
O wär ich nie geboren!⁶⁷*

Let what is past be past – oh Lord,
You're killing me...
The day shines gray...
O, if only I were never born!

While Faust's goal remains noble, or at least understandable, the methods by which he attains it bear, in their departure from human nature, a terrible cost to humanity itself.

This concept loses a degree of its poignant clarity in Part II of *Faust*, as the title character's journey shifts to a realm of classical allusion and complex metaphors that more properly address the dislocations of the world, and Faust's place in it, as he strives more urgently for stability and belonging: the harder Faust tries to "cement" his happiness in an instant, the more effort is required, in the

⁶⁷ *ibid.* 4518-4519, 4579, 4596.

bending of time, place, and reality, to prolong the illusion of such happiness. Loss, though, dogs Faust regardless of where, when, or how he finds himself. Ultimately, of course, Faust realizes that achievement of *personal* fulfillment is only possible in the sacrifice of such personal ambition to the needs of others; in letting go of his stubbornly held conception of consummation, the path – through striving – by which true consummation *may* be won finally becomes clear:

<p><i>Ja! diesem Sinne bin ich ganz ergeben, Das ist der Weisheit letzter Schluß: Nur der verdient sich Freiheit wie das Leben, Der täglich sie erobern muß. Und so verbringt, umrungen von Gefahr, Hier Kindheit, Mann und Greis sein tüchtig Jahr. Solch ein Gewimmel möcht' ich sehn, Auf freiem Grund mit freiem Volke stehn. Zum Augenblicke dürft' ich sagen: Verweile doch, du bist so schön! Es kann die Spur von meinen Erdetagen Nicht in Äonen untergehn. – Im Vorgefühl von solchem hohen Glück Genieß' ich jetzt den höchsten Augenblick.⁶⁸</i></p>	<p>Yes – this I hold to with devout insistence, Wisdom's last verdict goes to say: He only earns both freedom and existence Who must reconquer them each day. And so, ringed all about by perils, here Youth, manhood, age will spend their strenuous year. Such teeming would I see upon this land, On acres free among free people stand. I might entreat the fleeting minute: Oh tarry yet, thou art so fair! My path on earth, the trace I leave within it Eons untold cannot impair. Foretasting such high happiness to come, I savor now my striving's crown and sum.</p>
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Faust's realization breaks Mephistopheles' pact, and in his ascendance to the soul-orientation, discussed previously, to which all humans should progress, Faust gains the privilege to strive in heavenly community forever. The paradise in which he finds himself is a place actualized only through a humble and introspective realization of its reality and ultimate primacy in eternity.

In more closely examining the path by which Faust reaches the conclusion of both his personal drama and Goethe's literary masterpiece, the question of loss as an inevitable component of human striving distills into three distinct categories; these are reflected in the play itself, and also resonate in human activities in both scientific progress and artistic creation that parallel Faust's own journey. The

⁶⁸ *ibid.* 11573-11586.

devices Goethe uses to weave his story and convey his messages, though not nearly contemporaneous with the world of Schrödinger and Schoenberg, or, indeed, with our own reality, mirror the choices and sacrifices that must be made to forward human achievement in any era.

First, advancement requires sacrifice – more precisely, the destruction or use of some non-renewable resource to fuel it. Building the infrastructure necessary to catapult humanity into the future saps resources from the present, and an overly ambitious effort to strive too quickly beyond current reality risks destroying that reality before its eventual promise can be realized. In *Faust*, as introduced above, Gretchen and her family are the most sympathetic and obvious sacrifices made to Faust's growing awareness and understanding of the totality of his human nature, and of the nature of his world. However, Goethe's most beautiful and elegant formulation of the concept of sacrifice is in his description of the creation, evolution, and ultimate fate of the odd little Homunculus that Faust's assistant Wagner devises in his absence.

The Homunculus is a creature of light and energy; it possesses will, independence, and a fierce desire of its own to strive, but also exists in a manner wholly apart from the standard plane of being in which the other characters in the drama interact. Most obviously, the Homunculus is confined to its test tube – such an arrangement allows it to survive, but completely cuts it off from the reality of the world it perceives. After serving as a guide to Faust through the bizarre and complex Classical Walpurgis Night, the Homunculus, in a moment of inspiration, realizes that its achievement of unity with the world and of true fulfillment are only possible

through its own destruction. To this end, the Homunculus smashes its container (and itself) against the shell-chariot of an ocean goddess of beauty, Galatea; in a flash, the creature unites with the sea and, in its destruction, creates new life.

Goethe's description of the Homunculus' self-sacrifice to achieve a deeper reality is elegantly formulated in alchemical terms; water, air, and fire, though disparate and contradicting natural elements, must conjoin to produce true life. More significantly, however, Goethe subtly implies that the magical element that makes the formula work is *not* merely the union of the physical ingredients necessary to build a physically functional product, but rather an understanding, willing sacrifice that originates in a spirit possessed of full volition:

*"In dieser holden Feuchte
Was ich auch hier beleuchte,
Ist alles reizend schön."...*

*"In this lovely damp,
Whatever lights my lamp
Is sweetly tender."...*

*Homunculus ist es...
Er wird sich zerschellen am glänzenden Thron
Jetzt flammt es, nun blitzt es, ergießet sich schon.⁶⁹*

*Homunculus is it...
He'll crash at her glittering throne and be shattered,
It's flaming, now flashes, already is scattered.*

Only by choosing self-annihilation may the Homunculus simultaneously achieve its own potential; the sacrifice it makes, though total and permanent, demonstrates the utmost importance of the drive to understand that Goethe so highly esteems.

The Homunculus' dilemma is reflected each day in modern science – and, more generally, in society's considerations of how to use the advantages, tools, and powers that science provides. Certain goals of scientific inquiry have very obviously practical implications; often, these are the projects that draw the attention and the support of the public. On the other hand, scientific inquiry that proceeds simply and primarily because of the human desire to *know* occupies a far more remote status in

⁶⁹ *ibid.* 8458-8460, 8469, 8472-8473.

the minds of most individuals today. Such inquiry, paradoxically, is often the line of research that both requires the greatest sacrifices, and yields the fewest immediately practical results. The question of the value of these sacrifices (in money, resources, or even – in the most remote predictions about the Large Hadron Collider – in the end of the world and the human race) continues to test our societies. The question of the true worth of knowledge and understanding, in comparison with the occasionally unimaginable sacrifices needed to achieve them, will certainly continue to vex humanity for years to come. Goethe's answer to the dilemma, at least, is clear: savoring the briefest moment of realization, consummation, and fulfillment is worth the price of existence itself.

The choice of sacrifice, in addition to the inevitability of loss, also leads to a more subtle but related consequence: the loss of the myriad possibilities forsaken in the selection of one over others. By choosing a path, we abjure our right to walk on any of the other competing paths open to us; similarly, the choice of a particular direction or method, though often made for the best of reasons and with the best of intentions, has the necessary corollary of closing off both other, alternate paths visible at the time, and their unforeseeable future branches and outgrowths into new and unexplored territories. Sacrifice is often present, its consequences current and poignantly obvious; the voluntary loss of possibilities that may not yet even exist, in contrast, can vastly improve the future, but at great cost to both what is and what might have been.

In *Faust*, the sacrifices made in many instances involve parallel losses of myriad possibilities long after the pain of present sacrifice fades. Most especially,

the very nature of Faust's striving requires him to continue to give up the security, stability, and even happiness of a prolonged moment of contentedness; choosing to move beyond the natural world and into the fantastic realms of Part II, for example, leads to new and deeper revelations, but also requires the loss of a chance at fulfilled life in the former, more humanly natural world left behind. Perhaps most fittingly, Faust's decision to pursue a relationship with Gretchen, regardless of the costs, sacrifices her and her family in a literal sense. In the figurative, speculative aspect, however, Faust's action also deprives a host of characters their futures; it even robs from Faust himself, for the benefit of present bliss, the promise of potential future fulfillment.

The loss of possibilities in the choice of one path over others, as described and referenced in *Faust*, is an increasingly common element of our decisions in how best to choose amongst the constellation of options modern science presents to us. For centuries, for example, certain physical and personal traits have been considered optimal indicators of future success in children – blond hair, blue eyes, intelligence, wit, and beauty all correlate to more learning, better jobs, and higher earnings throughout life. For the first time in its history, humanity is just beginning to realize the possibility of *choosing* these traits for its children through the marvels of modern genetic engineering. Doing so, in the classical view, seems to involve no obvious sacrifice; the child loses little, for example, by being made to forgo brown hair in deference to blond. More subtly, though, the repeated choice of such seemingly optimal and lossless options reinforces, magnifies, and deepens the collective societal loss of the possibilities that arise from diversity and genetic

variation. Just as Faust's decision in preference of one end – a consummate, immediate romantic relationship with Gretchen – successively destroys the possibilities of more and more ends for others (ultimately, through the loss of several lives and all the attendant possibilities that accompanied them), so, too, does individual disregard for the broader effects of personal use of the advances of science, when unwittingly practiced by most of the populace in willful isolation, lead to a truly catastrophic loss of options for the community and society. Learning from Faust, it is vital to consider not only the present realities of necessary sacrifice in pursuit of knowledge, understanding, and betterment; rather, the future costs in lost possibilities must be extrapolated before a decision is reached, in order to most accurately reflect the true cost of a choice. As Faust realizes and expresses to Mephistopheles while surveying, at the end of his life, the vast domain he has won:

*So sind am härtesten wir gequält,
Im Reichtum fühlend, was uns fehlt.⁷⁰*

Thus we are stretched on cruelest rack,
In riches sensing what we lack.

Finally, there exists one last aspect of the loss that is so bound in Goethe's work to the choices Faust must make. It is the subtlest and most intangible element of loss any advance requires, but also the aspect that may inflict the greatest and most irreversible damage on its subject. Faust begins the work as a superbly educated intellectual; relatively advanced in years, he would certainly not conceive of himself as particularly innocent or inexperienced, and would not see the loss of any remaining innocence he might possess as a significant cost in his quest to strive, know, and understand. Yet this loss of innocence offers the best explanation underlying Faust's transformative path throughout the entirety of Goethe's work –

⁷⁰ *ibid.* 11251-11252.

and, though effecting in Faust the most fundamental and personal changes possible, the loss of his innocence also leads to the most significant conclusions and ultimate understanding he reaches.

Faust is ignorant, in an obvious sense, of most realities beyond the realm of rarified academia at the beginning of Goethe's work. By spending his life in relative solitude, mastering the difficult disciplines of scholarly knowledge, Faust has abjured his chances to explore other aspects of his human world; this both narrows his perception as a consummate human being, and leaves him with a powerful but false sense of "completion". Indeed, Faust's very innocence – his ignorance of what he does not know – is exactly what allows him to suffer from the despair he so painfully feels at the beginning of the drama; only in naively thinking he knows the entire world and remains unsatisfied may Faust inch closer to the brink over which, through his pact with Mephistopheles, he ultimately chooses to cast himself.

Faust's evolution throughout the play, then, can be read in the context of a progressive loss of innocence. Again, the most obvious application of this principle occurs early on, in the parallel foray into sexual experience that Faust and Gretchen pursue together. More subtly, though, Faust's employment of Mephistopheles' powers, especially in Part II, to satisfy his curiosity also successively destroys the magic – and even interest – of whole dimensions of experience that Faust unlocks, exhausts, and casts off, retaining only the "magical detritus" that clings to his increasingly confused, complex world:

*Könnst' ich Magie von meinem Pfad entfernen,
Die Zaubersprüche ganz und gar verlernen,*

Could I but clear my path at every turning
Of spells, all magic utterly unlearning;

⁷¹ *ibid.* 11404-11411.

*Stünd' ich, Natur, vor dir ein Mann allein.
Da wär's der Mühe wert, ein Mensch zu sein.
Das war ich sonst, eh' ich's im Düstern suchte,
Mit Frevelwort mich und die Welt verfluchte.
Nun ist die Luft von solchem Spuk so voll,
Daß niemand weiß, wie er ihn meiden soll.⁷¹*

Were I but Man, with Nature for my frame,
The name of human would be worth the claim.
And such I was, before I fell to searching
The dark, with curses world and self besmirching.
So thick now the air with spook and elf
That no one knows how to extract himself.

The feminine ideal embodied in Helen of Troy through such magic, for example, is viewed worshipfully and reverentially by Faust until she is actualized, and he marries her. Though their relationship seems to be a happy one, its very existence reduces the majestic mythos of Helen herself to a somewhat mundane domesticity, which ultimately fades and ends as Faust moves on to the excitement of the next challenge and experience. In choosing to experience the knowledge of Helen of Troy, then, Faust also chooses to lose the dreams of all she *could* be in order to experience what she *is*.

For Faust, the progressive loss of innocence undeniably leads to happy self-resolution. The ultimate awakening he experiences is his liberation from narcissistic self-interest – and this loss of personal “innocence” in self-obsession – both make the path to true consummation clear, and save Faust’s immortal soul. In the broader societal context, though, loss of innocence is not always nearly so productive; in fact, more commonly than not, a modern loss of innocence is accompanied by a parallel augmentation in general apathy and a palpable loss of meaning in society.

Schoenberg, for example, took a tremendous leap in exposing his public to quite uninnocent new music; he did so not merely in order to shock or titillate, but rather to awaken his listeners to a reality of which they were blissfully unaware. In contrast (and, perhaps, in partial consequence of Schoenberg’s original challenge to the tastes and authority of musical listenership), much of the music produced today

only serves to further cheapen and lessen the power of one of the truest and most fundamental vectors by which humans may relate and communicate. Rather than uniting individuals in a newfound appreciation of collective reality, the narcissism and indulgence of instantaneous personal gratification that pervade much of contemporary culture isolate the individual in a bubble of ignorance and innocence, powerfully contributing to the simultaneous fracturing and snowballing isolationism that plague the modern world.

In contemporary science, too, the loss of innocence that parallels what Faust experiences – in both good and bad respects – is a necessary, though sometimes unfortunate, component of advancement. As discussed above, the need to give up an “innocent” classical worldview, complete with extrapolations from daily life to the smallest and largest aspects of reality, was painful to experience in the early days of the development of concepts of quantum physics (and, as any physics student will readily admit, the pain has never faded). The benefit of the loss, though, is a deeper and more precise understanding of the true workings of nature. Ultimately, then, the message Goethe imparts to us through his work is simple: lose innocence if it is artificial, and only if the cost of what is gained in doing so outweighs the negative consequences. Some innocence is ignorance masked in comfort, and this may be sacrificed without a second thought in pursuit of knowledge and understanding; some, though, serves as a protecting and humbling aspect of personality that may be cast off only with dangerous and regrettable consequences that, in too many cases, cannot be reversed.

Of course, there still exists a wealth of information and of subjects for analysis (and, naturally, of comparisons with science and music) within the text of Goethe's *Faust*. In examining the ways in which issues contained in the work both parallel those addressed by historical and current societies, Goethe's true brilliance shines through once again. The concerns he raises – here, the tripartite concept of loss in sacrifice, in possibility, and in innocence – resonate throughout his work, and in every aspect of contemporary human life. Faust's journey provides a blueprint against which both success and failure may be gauged; by calibrating comparisons to the Faust of the microcosmic, intensely personal Part I, or alternately to the Faust of the macrocosmic, societal Part II, the careful reader may extrapolate a wealth of knowledge and insight into the way Goethe himself viewed the very processes of making decisions, and the deep complexity with which our nature as complicated beings infuses both our choices and their consequences in time and space. In this analysis, as always, *Faust* remains a work of genius; the gaps it bridges across subjects and through communities, and the remarkable timelessness of the experiences and realities it describes, contribute powerfully to the status it enjoys as one of the world's greatest works of literature. *Faust* truly does embody timeless wisdom. It is an exceedingly rare codification of questions and answers that have stood the test and scrutiny of centuries of time and of millions of curious travelers along the paths of life, and none would be wise to ignore the message it bears.

Conclusion

This, then, brings to a close the comparative analysis of the philosophies of Schrödinger, Schoenberg, and *Faust* proposed. As reiterated above, there remain vast realms of inquiry, accessible through the intersections of these fields, that remain unexplored. Given the remarkable symmetries uncovered – most especially, in the confluence of Schrödinger’s form, Schoenberg’s idea, and the ultimate, fulfilled orientation of Faust’s soul – such further inquiry promises to be both fascinating and instructive.

As Goethe, himself both an experienced physical and philosophical traveler, once wrote:

“Man reist nicht um anzukommen, sondern um zu reisen.”

– one does not journey in order to arrive, but rather in order to journey. May the intellectual journey that led to the discovery of this confluence of literature, science, and art, in the shared concept of form-idea, never cease.

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