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- 1) To provide a forum for the free-thinking communication among all those interested in physics, mathematics, logic, philosophy, science and mathematics education, heuristics, cognetics, artificial intelligence, and other closely related fields.
- 2) To publish essays, expository articles, and research articles on these subjects.
- 3) To promote the awareness of and further interest in the philosophical foundations of science and mathematics, and to promote the establishment of a modern inquiry of Natural Philosophy.
- 4) To investigate and define the purpose, scope, and methodology of modern science.

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ARTICLES:

2 **How did you know to do that?**

*Patrick Reany.....*This article expands the examples of virtual emplace-
ment with topics from analysis, linear algebra, algebra, and linear pro-
gramming.

8 **The irascible Ignaz Semmelweis**

*Patrick Reany.....*There is much be learned about the incorrect way to
change the Establishment from careful study of the life work of this savior
of mothers.

13 **The legacy of Nikola Tesla**

*Thomas Kelley.....*Telsa is every bit as unconventional as his scientific and
occult followers claim. We will see how he integrated his occult views
directly into his technology to attempt to give birth to a new age of free
and unlimited energy for everyone's personal use.

How did you know to do that?

by Patrick Reany

Typically, students are taught that all they need do to be a good problem solver is to learn how to apply book methods to certain classes of problem. It's almost a mean joke played on them by their teachers and text authors who teach this. Those students who haven't become completely discouraged or intimidated usually get around to asking the teacher after a trivial but nonintuitive step is presented: "How did you know to do that?" Rarely is a good answer given, for to do so would require the teacher to understand to role of formal cognetics in teaching.

Cognetics is the study of the way that humans are efficient at learning. I have written often on the need for teachers to learn how the good mathematicians think so that we lessers can follow them part way along their trails by copying their techniques. There isn't a single chess master today that hasn't done the same. Realizing this, then, why is it considered such a strange concept to do the same in science and math?

Before going on, we need to have some definitions ready for use: A *mathematical expression* (ME) is a combination of numbers and symbols without any *relational operators*, which are any of the objects $\{<, >, \leq, =, \geq\}$. A *mathematical sentence* (MS) is the assertion that two expressions (namely that LHS and RHS) are actually related by the relational operator that connects them.

The present paper is a return to the concept of virtual emplacement (VE):

- I) changing the form of an ME without changing its value
- II) changing the form of an MS without changing the statement's RO
- III) changing the form of an MS with one RO to an MS with another RO
- IV) using a step in a proof that is either a do/undo operation or else introducing something that seems to have more content than the steps prior to it can justify

Please understand that I recognize the limitations of the definitions of these types of VEs. I'm not satisfied with any of them. I think it fair to point out, though, that my uneasiness has nothing to do with the subjective nature of the definitions per se, but it is hard to capture a subjective aspect of mathematics in a precise way.

Let's look at some examples. *Identities* are born from Type I VEs, such as $a = a + b - b = (a + b) - b$. Representative of a Type II VE is: if $a = b$ then $a + c = b + c$. For Type III VEs we have: c is a positive number and $a + c = b$ iff $a < b$ (or in other words a "is less than" b).

We begin our examples with a Type III VE from operations research, which is concerned with optimizing use of limited or expensive resources. Often in this research one encounters constraints in the form: $\sum_{j=1}^n a_{ij}ROb_i$ with $b_i \geq 0$. Now, the preferred RO is equality. For example, the inequality $x_1 + 3x_2 + 117x_3 \leq 500$ becomes $x_1 + 3x_2 + 117x_3 + x_4 = 500$. We call x_4 a “slack” variable. The interested student can pursue this farther on his or her own from here. (the conversion of inequaltites to equalities by using slack variables is the Next Best Thing to have equalites to start with.)

Our next example comes from the study of continued fractions (CFs). In computer computations with transcendental reals, such as π , e , and $\sqrt{2}$, we need to find an optimal way to represent approximations of these numbers by fractions. Now we can just take the number’s decimal representation and truncate it at whatever decimal point we want, but there is a better way.

Using virtual emplacement, recursion, simple algebra we can produce a CF representation as follows: Take the transcendental as a sum of its integer and decimal parts. Then repeatedly “rewrite the current decimal part as unity over the decimal’s multiplicative inverse, producing a denominator with a number having both integer and decimal parts itself” until you have the desired accuracy of representation. Let’s try this out on the number π .

$$\begin{aligned}
 3.14159265\dots &= 3 + .14159265\dots \\
 &= 3 + \frac{1}{(.14159265\dots)^{-1}} \\
 &= 3 + \frac{1}{7.062513305\dots} \\
 &= 3 + \frac{1}{7 + \frac{1}{(.062513305\dots)^{-1}}} \\
 &= 3 + \frac{1}{7 + \frac{1}{15+.9965944\dots}} \\
 &\approx 3 + \frac{1}{7 + \frac{1}{16}} \\
 &= \frac{355}{113}
 \end{aligned}$$

Thus, every real can be given the alternative representation as a CF by

$$r = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\dots}}}$$

or alternatively as the series $\{a_0, a_1, a_2, \dots\}$.

Now we take an example from simple algebra that I overlooked before. When students are taught how to divide one polynomial by another, they usually have no problem using the algorithm for something like $(x^2 + 3x + 2)/(x + 1)$. They simply start with

$$x + 1 \overline{)x^2 + 3x + 2}$$

and procede easily. But give them something like $(x^2 + 2)/(x + 1)$ and they can get confused. Telling the student to put in the linear term virtually to start with

$$x + 1 \overline{)x^2 + 0x + 2}$$

is fine as far as it goes, but algebra is the ideal place to begin the systematic teaching of the concept of virtual emplacement and this is a good example with which to emphasize it.

Our next examples come from Donald E. Knuth's nonstandard approach to notating summations in analysis. His program is to recast the summations over subsets of integers to as large a subset of integers as possible, even over all integers if possible.

For example,

$$\sum_{k=2}^{n-1} k(k-1)(n-k) = \sum_{k=0}^{n-1} k(k-1)(n-k) \tag{1}$$

the added terms being identically zero.

Now we seek a formal method to move from a finite sum to an infinite sum. To do this we introduce the notations: 1) $P(k)$ to be a truth-valued function on the integers which is true when k is in the domain and false otherwise, 2) $\sum_{P(k)}$ to be the sum over the set of k such that $P(k)$ is true, and 3) the symbol \sum_k means the summation over all integers, indexed by the variable k . Our last notation to introduce is the so-called "Iverson" factor defined as follows. Let $[P(k)]$ be the boolean-valued function (i.e., takes values of 1 or 0) such that

$$[P(k)] = \begin{cases} 1 & \text{for } P(k) \text{ true,} \\ 0 & \text{for } P(k) \text{ false.} \end{cases}$$

With that done we can use virtual emplacement to add in all integers not originally defined as in the domain by

$$\sum_{P(k)} f(k) = \sum_k^{\text{VE}} f(k)[P(k)] \tag{2}$$

Let us choose some k' such that $P(k')$ is false (i.e., k' is not in the original set of domain integers) then $[P(k')] = 0$ and, as consequence, $f(k')[P(k')] = 0$; the term is added in virtually into the RHS of (2).

The great advantage to Iverson factors is that they can be factored or fused according to the rules of boolean algebra.

To factor Iverson factors we have the rule:

$$(P(j, k) \text{ iff } R(j, k) \text{ and } Q(j, k)) \text{ iff } [P(j, k)] = [R(j, k)][Q(j, k)]$$

Knuth gave this neat example:

Problem: Show that

$$\sum_{j=1}^n \sum_{k=1}^j f(j, k) = \sum_{k=1}^n \sum_{j=k}^n f(j, k) \quad (3)$$

To prove this we shall make use of the boxed theorem, giving

$$\begin{aligned} \sum_j \sum_k f(j, k)[1 \leq j \leq n][1 \leq k \leq j] &= \sum_j \sum_k f(j, k)[1 \leq k \leq j \leq n] \\ &= \sum_k \sum_j f(j, k)[1 \leq k \leq n][k \leq j \leq n] \end{aligned} \quad (4)$$

For our next couple theorems we adopt the convention that $\binom{n}{k} = 0$ when $k < 0$ or $k > n$. Thus

$$\sum_{k=0}^n \binom{n}{k} f(k) = \sum_k \binom{n}{k} f(k)[0 \leq k \leq n] = \sum_k \binom{n}{k} f(k) \quad (5)$$

Next we have a problem that every mathematician should know how to solve. Given that the exponential function is given by the power series

$$e^x = \sum_k \frac{x^k}{k!} [k \geq 0],$$

show that $e^x e^y = e^{x+y}$.

Proof:

$$\begin{aligned}
 e^x e^y &= \sum_{m=0}^{\infty} \sum_{n=0}^{\infty} \frac{x^m}{m!} \frac{y^n}{n!} \\
 &= \sum_{m,n} \frac{x^m}{m!} \frac{y^n}{n!} [m \geq 0][n \geq 0] \\
 &= \lim_{i \rightarrow \infty} \sum_{m,n} \frac{x^m}{m!} \frac{y^n}{n!} [m \geq 0][n \geq 0][m+n \leq i] \\
 &= \lim_{i \rightarrow \infty} \sum_j \sum_{m,n} \frac{x^m}{m!} \frac{y^n}{n!} [m \geq 0][n \geq 0][m+n=j][0 \leq j \leq i] \\
 &= \lim_{i \rightarrow \infty} \sum_j \frac{1}{j!} \sum_n x^{j-n} \frac{j!}{(j-n)!n!} y^n [0 \leq n \leq j][0 \leq j \leq i] \\
 &= \lim_{i \rightarrow \infty} \sum_j \frac{1}{j!} \left[\sum_n x^{j-n} y^n \binom{j}{n} [0 \leq n \leq j] \right] [0 \leq j \leq i] \\
 &= \sum_j \frac{[x+y]^j}{j!} [j \geq 0] \\
 &= e^{x+y}
 \end{aligned}$$

Let's prove another neat theorem:

$$\sum_j \binom{n}{n} \binom{m}{k-j} [j \leq k] = \binom{n+m}{k} \tag{6}$$

Proof:

From the binomial theorem we have

$$(1+x)^n = \sum_k \binom{n}{k} x^k \tag{7}$$

which can be considered a legitimate Maclaurin series. We can now prove (6) by comparing the l th coefficients on both sides of the Maclaurin series of

$$(1+x)^{n+m} = (1+x)^n (1+x)^m \tag{8}$$

Expanding the LHS of (8) gives

$$(1+x)^{n+m} = \sum_l \binom{n+m}{l} x^l \tag{9}$$

Expanding the LHS of (8) gives

$$\begin{aligned}
 (1+x)^n(1+x)^m &= \left[\sum_j \binom{m}{j} x^j \right] \left[\sum_k \binom{n}{k} x^k \right] \\
 &= \sum_l \left[\sum_r \binom{m}{r} \binom{n}{l-r} \right] x^l
 \end{aligned}
 \tag{10}$$

From which (6) follows immediately. We have used the fact that the l th coefficient of the Maclaurin series of the product of the two Maclaurin series $\sum_i a_i x^i$ and $\sum_j b_j x^j$ is

$$\sum_r a_r b_{l-r} [0 \leq r \leq l].$$

And now, just for fun, we introduce complexity built out of absolutely nothing:

$$0 = (1-1)^{2k+1} = \sum_{i=0}^{2k+1} \binom{2k+1}{i} (-1)^i.$$

We come now to the fourth and last Type of VE defined so far—that of putting steps in a logical proof. This analysis is directly applicable to symbolic logic, to argumentation, and to the reasoning behind mathematical proof. However, I must of necessity assume that the reader has some knowledge of symbolic logic. Consider the following “proof” (it’s not a real proof of anything) to demonstrate Type IV VEs:

1	A	Given
2	$A \wedge (B \vee \sim B)$	Conjunction with tautology
3	$(A \wedge B) \vee (A \wedge \sim B)$	Distributive
4	C	Given
5	$C \vee D$	Addition
6	$E \wedge F$	Given
7	E	Simplification
8	$G \vee H$	Given
9	$\sim \sim (G \vee H)$	Double Negation
10	$\sim (\sim G \wedge \sim H)$	DeMorgan’s Theorem

Steps 1–3, 4–5, 6–7, and 8–10 are four groups that are each independent of the others. I dare not say that these are the only VEs in symbolic logic, but I can say that the conceptual difficulty of virtual emplacement has not escaped the attention of prominent authors. One such is Howard Kahane* who tells of how difficult it is to get student to use *Addition* even after he proves it’s a

* H.Kahane. 1969 [1973]. *Logic and Philosophy*, 2ed. Wadsworth Publishing Co., Inc. Belmont, California.

valid technique (p.57): “Even after proving that Addition is a valid argument form, students are reluctant to use it, because they believe that somehow it is ‘cheating’ to be able to ‘add’ letters to a line simply at will.” But this is, after all, part of the great magic and wonder of mathematics. Long before I read this text, I discovered the rule of magic *If you want something somewhere, stick it there*—the magic of virtual emplacement.

The irascible Ignaz Semmelweis

by Patrick Reany

Introduction:

This short biography of the Hungarian physician, Ignaz Semmelweis, is designed to encourage those scientists, mathematicians, and physicians who find themselves struggling against the Establishment to change the system for the better. It’s just too bad that often a maverick who finds his methods obviously superior to those of his peers cannot find encouragement from them. Often it lies to the Great Balance of history to decide merit. Until then, the just shall live by faith.

I found few sources for this biography. My first exposure to Semmelweis was from that ever-inspiring march of documentaries from PBS. This article, however, relies mostly on one book: *Men Against Death*, Paul de Kruif, (Harcourt, Brace & World, Inc., New York, 1932 [1960]).

Ignaz Semmelweis was a Hungarian-born physician who began his career in the First Maternity Division of the Obstetric ward of the Vienna General Hospital, in 1846. At that time little was known scientifically about the causes of most diseases. Any researcher attempting to investigate a disease found himself up against not only apathy from his peers but also up against strongly held age-old myths about the nature of the causes of diseases.

Some of these myths are so patently absurd by today’s science that it seems hard to believe that they could be so heartily embraced and defended by the physicians of those days, especially in the face of strongly contradictory evidence. When strong evidence is ignored, I must assume it’s due to all the wrong reasons. What makes the case of Semmelweis so interesting is that he never devised a good theory to replace the old myths; notwithstanding, he still did completely debunk the myths by supplying incontrovertible statistical evidence. It’s a lesson to keep in mind even for today.

One such disease, which flourished by the insincere ignorance of physicians, was puerperal, or childbed fever. It was not uncommon in those days for this disease to kill three out of every ten mothers who delivered in a hospital. Few

doctors seemed to care why. One did, however, our Semmelweis. The prevailing belief on the cause of childbed fever at the time was miasma, a pervasive atmospheric emanation that spread infection to people. One gets the impression that this miasma is so devoid of rational properties as to be (conveniently) outside the domain of scientific investigation. No wonder Semmelweis was so upset about it.

For those unfortunate mothers who contracted the disease, most would soon die from it. It first appeared two days after delivery, evidenced by a fever. By the third day an agonizing visceral pain set in. The patient was constantly thirsty and growing ever weaker. On the fourth day blue-violet spots would appear on the hands and feet, indicating that the horror would soon be over. Semmelweis agonized with each of these dying mothers for two years straight. It must have been quite emotionally debilitating to this medical saint of the Maternity ward.

Semmelweis was young and impetuous, too ready to question authority, too ready to challenge them head-on, too. He was considered uncouth by his seniors, and nearly illiterate by all. But he had an unending passion to relieve the suffering and deaths caused by childbed fever. Unfortunately for Semmelweis and for mothers, he was born at a time of indifference to ending childbed fever. His peers called themselves physicians but cared little to relieve the horrors of disease. They called themselves scientists but had all the gumption and curiosity of a gorged sloth.

For whatever reason Semmelweis's boss, Professor Klein, bought into the myth of miasma, even when Semmelweis finally disproved it conclusively. Klein's maternity ward had two divisions: The infamous First Division had five times the death rate from childbed fever than the Second Division. Klein seemed not to care why. Semmelweis did, though, because so many mothers were dying. In 1846, for example, the First Division had 451 mothers die from childbed fever. To Semmelweis the discrepancy was a "lucky" break by offering a way to discern the correct variables responsible for difference, and he was right.

His compassion was of the highest nobleness, but his means to confront the situation was less admirable. He openly mocked and challenged Klein, and he did this unfailingly even though it would never lead to Klein change his mind. All of Semmelweis's recriminations were of less value than a month's worth of carefully documented statistics on the cases of childbed fever from both divisions. But I found no evidence that Semmelweis made any such attempt to collect data. It's human nature to build up a psychological wall of defence against emotional recriminations. The defendant just cavalierly relegates the accuser to the realm of hotheads and wierdos. It only seems to slow down the process of instituting a new view and a new procedure. I don't fault Semmelweis. I just affirm that must learn what not to do by being mindful of his mistake.

Then in quick succession, Semmelweis was fired and rehired again. Not long after returning to the ward, a tragedy for one of his fellow physicians,

Kolletschka, triggered the beginning of the end to the mystery of childbed fever. Poor Kolletschka died of childbed fever himself after being accidentally wounded by the scalpel of a clumsy student while they were performing an autopsy. It was obvious to Semmelweis: the scalpel carried cadaver poison which infected poor Kolletschka; it was not any miasma.

The next couple deductions were both irresistible and mortifying for Semmelweis. The First Division was attended by physicians and medical students, who routinely performed uterine examinations and deliveries immediately after performing autopsies and without careful washing of their hands and instruments. The second Division was attended mostly by midwives who did little intrusive examinations of the uterus. Thus, the doctors were guilty of transferring the infection from the cadavers to the mothers. The students were guilty. Semmelweis himself was guilty. This realization must have gvanized Semmelweis like an epiphany. What price knowledge.

With a definite plan in hand Semmelweis needed no longer just attack his boss, Klein. He could now go to war against childbed fever. Semmelweis ordered the entire staff of the First Division to carefully wash their hands in chlorine water before examining or delivering on the ward. This simple prerequisite, so common and second nature to us today, was considered a silly and foolish waste of time. Perhaps at first that's to be expected. But physicians and students continued to resist this simple procedure even long after it showed incredible results.

The results were indeed incredible. The death rate plummeted from 18% in April to 1% in June. Soon Semmelweis realized that their hands and instrument must be thoroughly cleaned before examining every patient, not just upon entering the ward. One would think that Semmelweis would have been made a hero, but it didn't happen. It's true that he had results, but he didn't have ongoing data to support his contentions. It's true that he had a theory of how the infecting agent entered the body, but he still had no theory of the true nature of the agent itself.

Perhaps you ask what difference that makes, anyway. Isn't it obvious that his procedure helps to prevent the infection? I have no good answer for you. I can't understand it either. But history is replete with such examples of educated people holding out against clear evidence. I offered to you a psychological-sociological theory to account for it but it still doesn't make sense to me, even though I firmly believe the explanation. Why couldn't the other physicians of that day just admit, like Semmelweis himself had done, that they were guilty and then put it behind them, resolving to change their procedures in accordance with the new evidence? Semmelweis did. Why couldn't the others. How many times over the past 25 years, during my studies in science, I have queried myself rhetorically, "Why couldn't they have just kept an open mind?"

One important fact to be learned from Semmelweis's experience in attempting to champion his cause is that a scientist must often be all things to all people to win over some. It is not a matter of actual compromise that I'm sug-

gesting, but a matter of playing the game by the rules, of keeping a cool head, of being patient, of foregoing useless recriminations, of accepting conventional channels of communication. This latter rule was outside Semmelweis's personality scope it seems. He preferred polemics and recriminations against specific physicians, and then wondered why they wouldn't turn around and admit that he was right. Would you have, if he called you a murderer?

Semmelweis was not interested in rational conversion of his opponents. He distained writing formal papers for journals. It was perhaps this last failing, together with his lack of systematic data available to publish, that slowed down the acceptance of his theory of preventing childbed fever. Perhaps he had hated writing as a youth and never got over it. But now he had a reason to get over it, but he didn't. Surely there was ample cause for him to bury his hatred of formal writing, buckle down and learn how to do it to further the cause.

In 1848, Klein, exhausted from Semmelweis's constant attack's, had Semmelweis transferred to a teaching position. Semmelweis couldn't stand this, so he moved back to Budapest, his birth city. A month after Semmelweis left the ward twenty mothers died of childbed fever. Klein could have cared less.

Semmelweis took an unpaid job at the St. Rochus Hospital in Budapest. He again turned on the old charmless haranging of the staff to absolute cleanliness. It paid off, though. Only eight deaths in a thousand dues to childbed fever over the next six years that Semmelweis was there.

In 1861, Semmelweis finally wrote his long-overdue quasi-scientific paper that reviled the community of obstetricians all over Europe. The paper was titled "Aetiology, Concept and Prophylaxis of Childbed Fever." de Kruif had this to say about it: "No wilder, more repetitious, more jumbled, more wordy, yet no more exact, more classical, and surely no more heart-rending human scientific work has ever been written. The obstetrical excellencies read this terrific document in stunned silence. It was too devastating for any answer."

A charge too devastating for any answer is the method of an inquisitor about to extinguish the life of the accused, but it's not the right method to engender a thoughtful curiosity that might lead men to change their ways. Semmelweis was right at heart, but wrong at method. The obstetric community *could* not answer him, so they ignored him, predictably. That only served to enflame Semmelweis's rhetoric against them. He wrote open letters to specific physicians and accused them of being murderers. "The murder must stop" was his battle cry. Sound familiar? If he had only cut them some slack. Toned down the rhetoric, left them some measure of dignity, maybe many more would have changed their ways.

His campaign of ranting must have had some positive effect. Afterall, there were younger doctors coming onto the scene with some exposure to the germ theory of disease and to the methods of preventing infection. But this budding new science made its way into medical prophylaxis because of dedicated, hard-working microb hunters who kept accurate records and published restrained

Arizona Journal Of Natural Philosophy

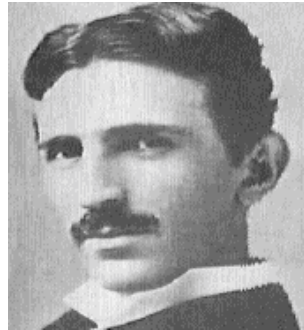
articles in respectable journals or monographs. So Semmelweis made a lasting positive contribution in spite of his methods. Pasteur would do similarly a few years later.

After this point in his life Semmelweis started to go mad from a disease that would later be determined to have caused severe degeneration of his brain and spinal cord. By the summer of 1865 things were so bad for Semmelweis that he was taken to a public insane asylum by one of his friends. And there, on August 17, he died, ironically, of blood poisoning, apparently from a self-inflicted accidental knife wound during his last surgery in Budapest. Even in his own death Semmelweis gave evidence that the theory of miasma was chimerical nonsense.

ESSAYS:

The legacy of Nikola Tesla

Thomas Kelley



Forward

Tesla Coil Demonstration:
Sahuaro High School, Tucson, Arizona.
April, 1974:

Inside the auditorium there are nearly 400 science students seated in attendance, while a crew of five assistants help me present a series of technical demonstrations with a six-foot 1.5KW Tesla Coil. At this point in the lecture, the students are murmuring to each other, talking, socializing, raucously enjoying a break from the regular class monotony. My assistants wire the energy storage banks to the primaries, while I prepare to open the rotary gap. After placing the microphone down, ending my unsuccessful attempt to enlighten my audience on the events about to occur, I step onto the insulated platform, and take my position at the static gap.

The teenage audience is only marginally attentive. I point to an assistant off stage, who then closes the primary power knife-switches, sending a 150amp surge into the high-voltage transformer and then into the energy storage banks. Everyone in the auditorium suddenly feels an incredible hum. The platform I'm standing on vibrates. With calculated sensitivity I proceed to open the static gap. As it opens with a loud sparking noise, we are graced with a display of brilliant light. At a certain point as I turn the static gap open, the power breaks and transfers to the rotary gap. A deafening roar erupts, and a brilliant cascade of light harshly illuminates the stage, casting strong shadows across the auditorium hall. The intensity of the light is too painful to look at directly. I let the demonstration run for about 30 seconds, then I close the static gap. My assistant pulls the primary power knife-switches. Despite the ringing in my ears, I can hear total silence in the auditorium. My audience is transfixed, and for the remainder of the lecture I will have their undivided attention....

Introduction

The purpose of this paper is to delineate the influence of Tesla's philosophical and religious beliefs on his goals and methods of producing virtually free and

unlimited energy for all mankind, and then to relate his work to the diverse literature that has developed around him and his work since his death. First, I characterized three principal chronological phases of his life (See AJNP 1987). Second, I will establish by historical evaluation what I assert to be the two principal lines of his legacy. The first line of his legacy is the techno-religious investigators that use Tesla to justify their own radical or at least fringe beliefs. The second line of Tesla's legacy that I have defined contains the gamut of technologies that he left us; this aspect of Tesla's legacy will be analyzed in a future paper. The analysis that follows will characterize several features of the first line of his legacy. It seems that the Tesla mythos is both self-regenerating and growing. Throughout his private and public life Tesla encourages the development of this legacy.

An analysis of Tesla suggests trying to compare him to a wide variety of philosophical viewpoints, seeking a best fit. Yet, the principal difficulty in analyzing Tesla's eclectic philosophy is that he had drawn on so many diverse philosophies that it has something for everybody. An analysis of the literature surrounding Tesla reveals a large body of techno-cultural writing, a significant percentage of which appeals to a pseudoscientific subculture. This subculture has various labels, some of which may reasonably identify these people. Some of the labels include: New Age, New Science, Occultism, Mysticism, Futurist, Pop-Culture and Pseudoscientific. However one defines this writing culture, Tesla's writings and utterances are given a preeminent place, usually offering authoritative justification for an author's beliefs. See Figure 1 to survey several major lines of Tesla's legacy.

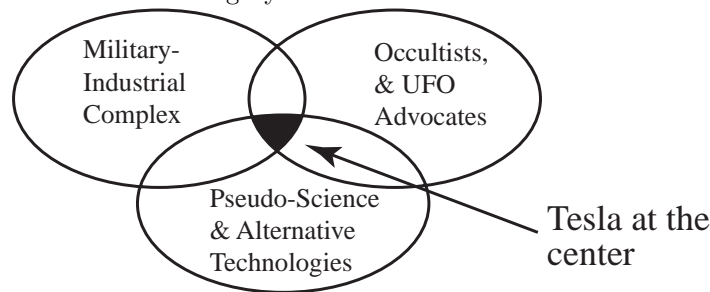


FIGURE 1. Relationship of Tesla to three trajectories of his legacy.

A historical review will lay a foundation Tesla's life and legacy. It will show that the impact of Tesla on the entire spectrum of this literature cannot have had any other possible consequence than that which has taken place. The academic framework for this assertion is derived from the communications theories of Neil Postman. As to the body of literature itself, a rhetorical criticism would seem to yield the most balanced survey of both the content

and the external influences. Therefore, both the rhetorical and the sociological framework for this analysis will be derived from Jacques Vallee's 1979 book, *Messengers of Deception*.

Brief Biographical Background

An understanding of the life and legacy of Nikola Tesla must include a survey of the region of the world that Tesla grew-up in—that region encompassed by modern-day Yugoslavia. Tesla, the Serbo-Croatian genius of the modern electric world, is an enigmatic figure in the history of technology. Even his peers recognised that his larger-than-life presence set him on the same plane as Charles Steinmetz or Albert Einstein.

Born in 1856, in Smiljan, in the Lika province of Croatia, to the family of a Serbian Orthodox Christian minister, Tesla was raised in a family rich in traditional and scholarly discourse. His mother, Dulca, was illiterate, yet she had an amazing retention for poetry and folklore. Tesla apparently inherited this gift. But in contradistinction to his intellectual leanings, the middle-class tradition dictated that Tesla take a career in the military, clergy, or in farming. His father followed tradition and became a minister. This brought young Nikola into a realm of considerable intellectual stimulation and diversity. Initially, Nikola followed his father's plans for a career in the clergy, bringing him access to literature well beyond the reach of most other Croatian boys. Nikola always had an obsessive interest in reading. For example, if he read one work by a particular author, he read all of the author's works obtainable. Additionally, the great confluence of languages and cultures in Croatia taught the young Nikola at least eight languages that he could speak, read and write at a scholarly level. Following his epiphanal vision about generating hydroelectric power at Niagara Falls at age sixteen, he almost exclusively wrote in English. Tesla was well educated in the strong cultural-mythic-intellectualism of his heritage, and in the current theories of physics. He strove throughout his career to meld the two systems of thought together into something beneficial for all mankind. The basis of this passion he explained in sociological terms by Cheney: "Ethnic traditions are often most tenaciously observed by transplanted minorities and the Teslas were no exception" (Cheney, 6, 1981). In other words, Tesla never let his heritage be replaced by materialistic-positivistic philosophies.

Consider several assertions made about Tesla: Tesla has often been hailed as the greatest inventor the world has ever known. Tesla was a studious poet of his own culture. He successfully melded the eastern mysticisms with modern applied high-technologies (e.g., energy resonance theories with spiritualism). He conversed on a scholarly level with religious leaders (Christian, Hindu, Buddhist, Theosophist, Spiritist, et al). He became the icon for the unification of Yugoslavia by all competing factions. His views on women made him the champion of pagan feminists. While Tesla and Thomas Alva Edison supported a lifelong loathing of each other, they were united in their mortal

fear of J.P. Morgan's personal secretary, Charles A. Coffin (the consequence of which greatly influenced the resulting pseudoscientific subculture). Additionally, Tesla is credited with inventing the modern electric power grid, wireless power transmission, radio, television, X radiation, modern rare-gas lighting, anti-gravity engines, Star-Wars death rays, atom smashers, and virtually everything else technological, except the digital computer.

Tesla's Formative Science-Philosophy and Its Consequence

Throughout his career Tesla held fast to the scientific positivism of his early training. His adherence to a strong personal positive philosophy of science brought along the conceptual baggage of such ideas as the luminiferous ether, which is a belief he held until his dying day—despite the general abandonment of the ether concept by physicists in favor of relativistic theories. Even more damaging to his career, his stalwart rejection of transverse electromagnetic radiation theory and his promotion of so-called “scalar electromagnetic” theory was seen to be obsolete, if not unquestionably ludicrous. An examination of how Tesla's philosophical beliefs influenced his scientific beliefs yields insight into his scientific legacy: the positivists that founded the military-industrial complex, and the pseudoscientists in their own subculture—a source of the new “alternative” sciences. Tesla not only contributed considerable writings that promote this literary consequence, but he also stood by mute while a large number of occultists, eastern mystics, spiritualists and opportunists laid claim to his influence and used him liberally to justify their own viewpoints and theories.

Tesla believed that humans are essentially automatons, subject to the most analytical and predictive behavioral sciences. He wrote, “While I have failed to obtain any evidence in support of the contentions of psychologists and spiritualists, I have proved to my complete satisfaction the automatism of life, not only through continuous observations of individual actions, but even more conclusively through certain generalizations” (Tesla, p. 105, 1919).

A Positivist's Career

Publicly, Tesla's belief in technology, materialism, and social behavior should have aligned him perfectly with the scientific and engineering communities in this country during the 1890s. At one time he was even titular head of that American community. His golden hour was his overwhelming victory in what is called the “War of the Currents,” the battle between the engineers that supported alternating current (AC) and the engineers who supported direct current (DC) for the transmission of electrical power. It was Westinghouse verses General Electric, Tesla verses Edison, Westinghouse versus J.P. Morgan. It culminated in a contest over who would succeed in harnessing the Niagara Falls to produce electric power for Buffalo, New York. Using Tesla's

AC patents, Westinghouse von the Niagara falls contracts. By 1893, AC was clearly champion over DC. Tesla became an international celebrity achieving superstar status. The American Institute of Electrical Engineers (AIEE) invited him to speak in 1893, where he gave them a presentation of AC technology that attracted a legion of engineers.

As the figurehead of the AIEE, Tesla could have promoted the logical positivist agenda in America. Yet, it was not to be. For Tesla was a victim of the same Social-Darwinism that was prevalent in this country, which he had used so well to win the War of the Currents. For even though Edison was forced to buy licensing rights from Tesla to produce AC, Tesla's influence was fading because of his humanitarian and odd philosophical views. Even though he won a major technological war, in the larger picture, the big players such as J.P. Morgan were still dominant. Tesla was in such a socially connected sphere and enjoyed such familiarity with the media, that he failed to recognize that he had been cast adrift by the financial power brokers and engineering communities that publicly supported him. A major feature of this separation between Tesla and the proto-military-industrial complex, despite Tesla's genuine belief that he was entirely in accord with that power agenda, was a perception by the powers that were, that Tesla was occultic, superstitious, and a pseudoscientist himself. In this respect, Tesla was his own worst enemy.

The Legacy of Tesla

Tesla was quite familiar with a wide variety of religious teachings. As mentioned above, he was a member of a clerical, scholarly family. He grew up in a region crossed with Christian Orthodoxy, Roman Catholicism, Protestantism, Islam, Islamic tradition, and from the far east, Hinduism, Buddhism, and various eastern mysticisms. It is largely from this discursive culture that Tesla sought to combine his philosophy with his technology. Unfortunately for Tesla, the pragmatic American industrial complex was not prepared to promote his fanciful conclusions. For example, "He believed his own mechanistic concept of life to be 'one with the teachings of Buddha and the Sermon on the Mount'" (Cheney, p. 244, 1981). One may cite hundreds of quoted statements of Tesla that describe a techno-religious monism in some future utopian society. One of the chief factors against Tesla achieving successful financial backing to give everyone free and unlimited power was the complete lack of profit motive. Why invent if the result is not profitable?

References

Cheney, M. 1981. *Tesla: Man out of Time*. Reprint. New York: Dell Publishing Co. 1983.