Site Map: *MAIN* / *A Reader's Journal, Vol. 2* *Webpage* *Printer Ready*

A READER'S JOURNAL

The Light Course, GA# 320
by
Rudolf Steiner

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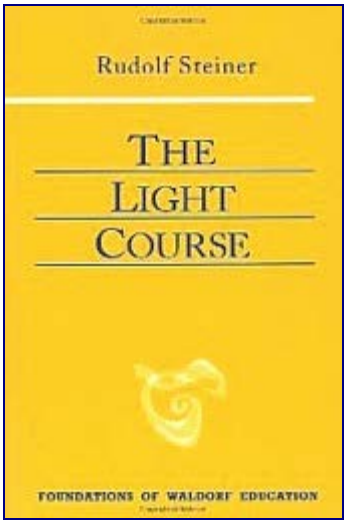


If you are a scientist, you learn from books and from people who learn from books. Goethe learned from his own experience, and Steiner, who edited Goethe's archives, learned from books, learned from Goethe's works, and learned from his own experience . One could almost say that Rudolf Steiner was the only man of the 20th Century who truly understood Goethe's approach to science. To my knowledge Steiner was the only scientist to extend Goethe's works on science and in this Light Course, he teaches his audience as he would expect Waldorf teachers to teach their classes: he introduces a subject, demonstrates through a couple of experiments, asks the class to ponder the experiment, and suggests that they devote their attention to, as Dragnet's Joe Friday would put it, "Just the facts, Ma'am."

Since I am a scientist, in fact, the very type of scientist that Steiner discusses over and over in these lectures, namely, a physicist, I read this entire book avidly and with full concentration. Here was someone demonstrating to me aspects of physical reality that I had ignored for the most part, up until now. That I was systematically trained to ignore these aspects offered me no excuse — I was humbled to see the solid truth in Steiner's arguments and see through the diaphanous veil of truth that I had been taught by textbooks and professors to accept as reality. Rightly understood, the textbook companies and professors should be fired and my university should regret the situation and offer me an apology, just as happened when a sportswriter reported on a baseball game he only watched on TV [August 20, 2003: reported by *Poynteronline, Romenesko*],

> **A Sacramento Bee sportswriter was fired after editors discovered he covered a Giants game by watching it on TV and used old quotes from other media outlets for his game story. "The Bee regrets the situation and apologizes to its readers," writes sports editor.**

One does not promote solid truth by reading textbooks and simply sharing what one found in the textbooks — one must incorporate it into one's own truth. The solid truth I found while reading this book was not Goethe's truth of 1825, not Steiner's truth of 1919, but Bobby Matherne's truth of 2003. I will share with you the path I took to arrive at my truth, but reading this review will likely not suffice to bring you to see your own truth, dear Reader — that will require some serious study on your part, accompanied by a full reading of The Light Course yourself. [Note: to access *The Light Course*, you will have to select *Übersetzungen*, then *Englisch*, then click on title. Also note that the page numbers for the quotes in this review refer to the pages of a book I printed out and do not correspond to any other book's page numbers.]

In the following two passages, Steiner summarizes what the theme of this book is for us:

> **[page 100, 101] What I am trying to present in these lectures is not what you can get from the first text-book you may purchase. Nor is it what you can get by reading Goethe's *Theory of Color*. It is intended to be, what you will find in neither of the two, and what will help you make the spiritual link between them. We are not credulous believers in the Physics of today, nor need we be of Goethe. It was in 1832 that Goethe died. What we are seeking is not a Goetheanism of the year 1832 but one of 1919, — further evolved and developed.**
>
> **page 167] . . . my main purpose in these lectures is to tell you what you will not find in the text-books. The text-book knowledge I may none the less bring forward, is only given as a foundation for the other.**

The Foreword of the book begins with a passage from Steiner's Autobiography that is worth noting here as it applies to the content and thrust of these lectures.

> **[page 9] Those who were striving to transcend the mechanical explanation of the World generally lacked the courage to admit that if we want to overcome the mechanistic system we must also overcome the habits of thought which have led to it. The time was calling, yet called in vain, for a clear recognition of this kind. The orientation of our faculties of knowledge towards the outer senses enables us to penetrate what is mechanical in Nature. This mental tendency has become habitual throughout the second half of the 19th century. If the mechanical aspect of the world no longer satisfied us now, we ought not to expect to reach into higher regions in the identical frame of mind. The outer senses develop and awaken in the human being, so to speak, of their own accord; but on this basis we can only gain insight into the mechanical domain. If we desire to know more than this, we must by dint of our own efforts give to our deeper, latent faculties of knowledge the same development which Nature gives the powers of the senses.**

To use a crude metaphor, if you reach the edge of a cliff, it's time to learn to fly if you wish to proceed. Steiner predicts the day when we will in fact learn to fly — it will come when we learn once more that Matter proceeds from Spirit. The quote is from The Spiritual Guidance of the Individual and Humanity by Rudolf Steiner (1911):

> **In time to come there will be physicists and chemists whose teaching will not be such as now prevails under the influence of the Egypto-Chaldean Spirits that have remained behind, but who will teach that Matter is built up in the way in which the Christ has gradually ordained it. Even into the laws of Chemistry and Physics the Christ will be found. Thus will a spiritual form of Chemistry and Physics come to pass in future.**

What's the problem with physics, chemistry, and every other science as they are taught in universities today? Steiner outlines three things, three processes that scientists follow. One, they classify beings and phenomena in Nature into species and other groupings. Two, they strive to arrive at the causes of things. They begin with what is thought to be known and proceed via experiments to uncover from the unknown the evidence to explain the cause of what was thought to be known. Three, they create "Laws of Nature" to explain the phenomena they observe, such as the falling of a stone. Let's list these three approaches of science and contrast them with the approach of Goethe and Steiner.

> **1. Classify** — Goethe focused on metamorphosis or how nature moved from one sort of thing to another.
>
> **2. Experiments** — Goethe chose to stay in the sphere of what is known.

3. Laws of Nature — instead of laws Goethe applied his thinking to create an archetypal phenomena, the Ur-phenomena, which he used to make the workings of the world transparent and comprehensible.

[page 22] Thus Goethe looks upon the whole of scientific method — so to call it — purely and simply as a means of grouping the phenomena. Staying amid the actual phenomena, he wants to group them in such a way that they themselves express their secrets. He nowhere seeks to recur from the so-called "known" to an "unknown" of any kind. Hence too for Goethe in the last resort there are not what may properly be called "Laws of Nature". He is not looking for such Laws. What he puts down as the quintessence of his researches are simple facts — the fact, for instance, of how light will interact with matter that is in its path. Goethe puts into words how light and matter interact. That is no "law"; it is a pure and simple fact. And upon facts like this he seeks to base his contemplation, his whole outlook upon Nature. What he desires, fundamentally, is a rational description of Nature. Only for him there is a difference between the mere crude description of a phenomenon as it may first present itself, where it is complicated still and untransparent, and the description which emerges when one has sifted it, so that the simple essentials and they alone stand out. This then — the Urphenomenon — is what Goethe takes to be fundamental, in place of the unknown entities or the conceptually defined "Laws" of customary Science.

On the way to studying Nature, Steiner says there are three things scientists typically use: One — number (arithmetic), Two — Geometry, and Three — Kinematics (the science of movement). Each of these three ways of studying Nature involves mental pictures. This is not enough, even for the science of mechanics.

[page 27] Arithmetic, Geometry and Kinematics are not yet Natural Sciences in the proper sense. To reach the first of the Natural Sciences, which is Mechanics, we have to go beyond the life of ideas and mental pictures.

[page 29] We need to be very clear on this point. The truths of arithmetic, geometry and kinematics, — these we undoubtedly determine apart from external Nature. But we must also be clear, to what extent these truths are applicable to that which meets us, in effect, from quite another side — and, to begin with, in mechanics. Not till we get to mechanics, have we the content of what we call "phenomenon of Nature."

In physics I was taught about forces and potentials — how to calculate potentials at any point in a field of centric forces, etc. With some arithmetic, geometry, kinematics it's possible to integrate the potential field and make calculations of what these centric forces would be at any point. I was led to believe that this general approach would work for inorganic and organic material — that organic material containing life could be treated identically to inanimate material. What I didn't know was that inanimate material depends on centric forces whereas life depends on circumferential or cosmic forces. Thus, physics, chemistry and all the related sciences break down when they attempt to apply their methods to life-bearing material — this brings us to the crux of the problem with the sciences that we mentioned earlier.

[page 32] Yet in this way I could never explain any process involving Life. In effect, the forces that are essential to a living thing have no potential; they are not centric forces. If at a given point *d* you tried to trace the physical effects due to the influences of *a, b* and *c*, you would indeed be referring to the effects to centric forces, and you could do so. But if you want to study the effects of Life you can never do this. For these effects, there are no centers such as *a* or *b* or *c*. Here you will only take the right direction with your thinking when you speak thus: Say that at *d* there is something alive. I look for the forces to which the life is subject. I shall not find them in *a*, nor in *b*, nor in *c*, nor when I go still farther out. I only find them when as it were I go to the very ends of the world — and, what is more, to the entire circumference at once. Taking my start from *d*, I should

> **have to go to the outermost ends of the Universe and imagine forces to the working inward from the spherical circumference from all sides, forces which in their interplay unite in *d* . It is the very opposite of the centric forces with their potentials. How to calculate a potential for what works inward from all sides, from the infinitudes of space? In the attempt, I should have to dismember the forces; one total force would have to be divided into ever smaller portions. Then I should get nearer and nearer the edge of the World: — the force would be completely sundered, and so would all my calculation. Here in effect it is not centric forces; it is cosmic, universal forces that are at work. Here, calculation ceases.**

But — you might wish to ask me: "Do you understand how successful physics and the other sciences have been in creating the technology that surrounds us and enhances our lives daily?" And I would have to say, "Yes, this human-made technology has improved our lives. And I agree that these sciences with their centric forces have made this technology possible. But what is true for machines is not true for natural objects outside of human-made machines."

> **[page 33] All that Man makes by way of machines — all that is pieced together by Man from elements supplied by Nature — herein we find the purely centric forces working, working according to their potentials. What is existing in Nature outside us on the other hand — even in inorganic Nature — can never be referred exclusively to centric forces. In Nature there is no such thing; it never works completely in that way: Save in the things made artificially by Man, the workings of centric forces and cosmic are always flowing together in their effects. In the whole realm of so-called Nature there is nothing in the proper sense un-living. The one exception is what Man makes artificially; man-made machines and mechanical devices.**

Steiner tells us that the truth of this was profoundly clear to Goethe.

> **[page 33, 34] In him, it was a Nature-given instinct, and his whole outlook upon Nature was built upon this basis. Herein we have the quintessence of the contrast between Goethe and the modern Scientist as represented by Newton. The scientists of modern time have only looked in one direction, always observing external Nature in such a way as to refer all things to centric forces, — as it were to expunge all that in Nature which cannot be defined in terms of centric forces and their potentials. Goethe could not make do with such an outlook. What was called "Nature" under this influence seemed to him a void abstraction. There is reality for him only where centric forces and peripheric or cosmic forces are alike concerned, — where there is interplay between the two. On this polarity, in the last resort, his Theory of Color is also founded, of which we shall be speaking in more detail in the next few days.**

Here we have Steiner laying out for us his plan for the "Light Course" in which we will be able to see reality demonstrated in the interplay of the centric forces and cosmic forces. We are now over 80 years since Steiner gave these lectures and humankind has learned a lot more about atomic forces, quantum reality, and the nature of light, but the insights that Steiner shares with us in these lectures ring as true today as they did back then to those who will approach them with an open mind, not as a textbook indoctrinated machine, but as a true scientist.

Mass makes itself known by the pressure it exerts. Steiner has us exert pressure on a part of our body and to notice the effect. If we do it long enough and hard enough we lose consciousness. We can write *m* in an equation to represent *mass* and understand the concept as it is applied in kinematical equations, but what does it mean to our human experience?

> **[page 41, 42] Follow the thought a little farther and you will no longer be so remote from understanding what is implied when we write down the *m*. All that is kinematical unites,**

> **as it were, quite neutrally with our consciousness. This is no longer so when we encounter what we have designated *m*. Our consciousness is dimmed at once. If this only happens to a slight extent we can still bear it; if to a great extent, we can bear it no longer. What underlies it is the same in either case. Writing down *m*, we are writing down that in Nature which, if it does unite with our consciousness, eliminates it, — that is to say, puts us partially to sleep. You see then, why it cannot be followed kinematically. All that is kinematical rests in our consciousness quite neutrally. The moment we go beyond this, we come into regions which are opposed to our consciousness and tend to blot it out.**

Mass — we cannot live with it in consciousness, but we cannot live without it. It must be present in us, in the human being, in some part of us that is unconscious. That part is called the Will.

> **[page 42] Nevertheless, although we cannot live with consciousness in all that, for instance, which is implied in the letter *m*, yet with our full human being we do live in it after all. We live in it above all with our Will. And as to how we live in Nature with our Will, — I will now try to illustrate it with an example. Once more I take my start from something you will probably recall from your school-days; I have no doubt you learned it.**

He demonstrates the Archimedes Principle by dipping an object in a tank of water and showing how the weight or pressure exerted by the mass is reduced according to the volume of water displaced. It was this discovery he made while immersing himself into his bath water that led Archimedes to jump from his tub and run naked through the streets of Syracuse crying, "Eureka!" Steiner points out how our brain weighs only 20 grams while living in our skull afloat in its cerebral fluid. Were it not for the fluid reducing the weight of the brain, its mass would force us into unconsciousness. Again, this is not a hypothesis, but an observable fact, as any doctor who has drained the cerebral fluid from a living human's skull can attest.

> **[page 44] While, with some justice we may regard the brain as the instrument of our Intelligence and life of soul — at least, a portion of our life of soul — we must not reckon merely with the ponderable brain. This is not there alone; there is also the buoyancy, by virtue of which the brain is really tending upward, contrary to its own weight. This then is what it signifies. With our Intelligence we live not in forces that pull downward but on the contrary, in forces that pull upward. With our Intelligence, we live in a force of buoyancy.**

While our brain floats, the rest of the body below the brain, except the spinal cord, exerts pressure downward and, as a result, is unconscious — and in those unconscious parts of our lower body lives the Will. Steiner has now given us the background necessary for us to comprehend how the physical and the spiritual work together.

> **[page 45] We have to consider man, not in the abstract manner of today, but so as to bring the spiritual and the physical together. Only the spiritual must now be conceived in so strong and robust a way as to embrace also the knowledge of the physical. In the human being we then see upon the one hand the lightening into Intelligence, brought about by one kind of connection with the material life — connection namely with the buoyancy which is at work there. Whilst on the other hand, where he has to let his Will be absorbed, sucked-up as it were, by the downward pressure, we see men being put to sleep. For the Will works in the sense of this downward pressure. Only a tiny portion of it, amounting to the 20 grams' pressure of which we spoke, manages to filter through to the Intelligence. Hence our intelligence is to some extent permeated by Will. In the main however, what is at work in the Intelligence is the very opposite of ponderable matter. We always tend to go up and out beyond our head when we are thinking.**

Thus we have 20 grams that enters our Will, and with the other 1230 grams we live in our Intelligence. When we tell people to lighten up today, we are saying to them, don't be so ponderable, use your Intelligence. On the contrary when people get depressed, what do they feel like? Heavy. Down. What do they most want to do? Go unconscious, sleep, anything but lighten up. Coincidental or deep insight? You decide.

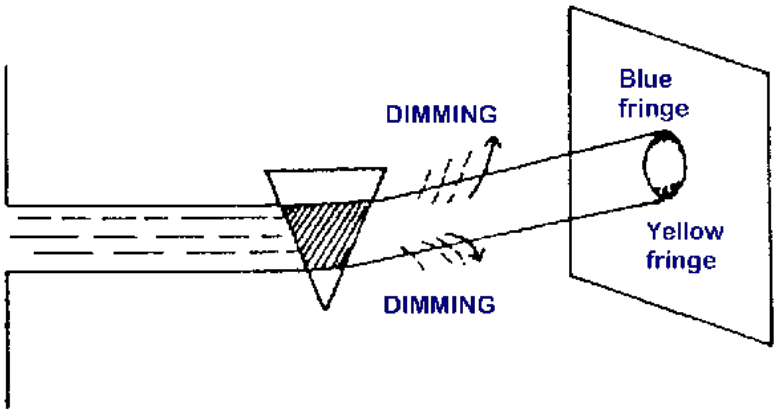
Our etheric body likes to move about — it is constantly in motion — it loves floating, swimming, dancing, ice-skating, flying, etc. In the movie, *Lawrence of Arabia*, there's a scene which illustrates an innate knowledge of the effects of the etheric body's floating about. At one point on the long journey through the desert, Sharif comes up to Lawrence, hits him with his stick to bring him awake, and explains, "You were drifting." "I was thinking," Lawrence replies. "Beware, Lawrence, you were drifting." Lawrence's etheric body was floating around and he was joining it and disconnecting from the reality of the moment, which on a camel in the middle of the desert trek can be fatal.[See ARJ2, page 9 quote: From Mammoths to Mediums.] Because our brain is floating, the etheric body likes to hang with or play in the vicinity of the brain and our brain partakes of the etheric body's intelligence by its propinquity. [See ibid. page 100 quote.] Steiner is revealing to us how the material and the spiritual worlds work together in the human being.

> **[page 46, 47] Now to proceed: what happens through the facts that with our brain — but for the 20 grams into which enters the unconscious Will — we live in the sphere of Intelligence? What happens is that inasmuch as we here make the brain our instrument, for our Intelligence, we are unburdened of down-ward-pulling matter. The latter is well-nigh eliminated, to the extent that 1230 grams' weight is lost. Even to this extent is heavy matter eliminated, and for our brain we are thereby enabled, to a very high degree, to bring our etheric body into play. Unembarrassed by the weight of matter, the etheric body can here do what it wants. In the rest of our body on the other hand, the ether is overwhelmed by the weight of matter. See then this memberment of man. In the part of him which serves Intelligence, you get the ether free, as it were, while for the rest of him you get it bound to the physical matter. Thus in our brain the etheric organism in some sense overwhelms the physical, while for the rest of our body the forces and functionings of the physical organization overwhelm those of the etheric.**

If it is true that we lose consciousness in the presence of mass, it is equally true that we become more conscious or awake in the presence of light. The two synonyms of "light" in English — "lacking mass" and "the medium that provides our sight" — coincidence or deep truth? When we feel heavy with mass in the dark, we become drowsy; when we feel light in the daylight, we become more awake. These are no abstract thoughts of Arithmetic, Geometry, or Kinematics that I am asking you to take on faith — these are readily observable conditions of daily life, of being human.

The next experiment Steiner leads us through upends Newtonian optics and much of the theory I was taught about light in my physics courses. Here's the classic demonstration of the properties of light; it still exists in every physical science textbook extent, to my knowledge: You open a tiny hole in the curtain, allow sunlight to pass through the room and make a tiny bright dot of light on a screen. Now you intersect the beam of light with a prism, point down and an amazing thing happens, which will come as no surprise to you: the dot spreads out into a continuous rainbow of colors, from deep red at the bottom to violet at the top. Sounds familiar, doesn't it? I was told that this shows that light is composed of these seven colors and that the prism has simply "separated" the white light into a spectrum of its "component colors." I put the two words in quotes for the simple reason that no evidence whatsoever was offered to substantiate that light consists of the seven colors other than the prism experiment. But, lacking any alternate explanation for the appearance of the spectrum when the prism was interposed, I accepted the abstract descriptions associated with "separated" and "component colors." Was I not given an alternate explanation because none existed at the time (1958)? No. In fact, Wolfgang von Goethe, the famous German philosopher and poet, had given an alternate explanation over a hundred years prior to 1958. It is this explanation we will encounter next, and my use of the word "explanation" must be now modified to be "description", because,

as you will find, "explanation" — based on abstract thought was not used by Goethe at all. What Goethe used was "description" of the phenomena he explored. And what he described, you can observe directly with your senses without having to manipulate any abstract concepts like "separated" and "component colors." For many of you, I'm sure that will be a relief!



What Goethe begins with is a large circle of light instead of a tiny dot. He describes what he finds, and you can confirm this for yourself, if you wish. The circle of uniform white light is deflected upward and on the screen at the top of the circle is a blue fringe and at the bottom of the circle is a yellow fringe. The two poles of light, if you will, appear at the top and the bottom of the otherwise uniform circle. If you gradually narrow the hole through which the light flows, you will reach the point where the seven color spectrum appears because the colors which first appear only at the top and bottom of the large circle begin to blend in the middle as we make the circle smaller and smaller.

The next step will be a little mind-bending, so I'll warn you in advance. You will notice that in the larger circle of light the colors appear at the interface of light and dark at the top and bottom. Steiner will ask you to treat dimness and darkness as flowing just as you have treated light as flowing to the screen. It is where light and darkness intermix that we will find the phenomena we call color.

> **[page 52, 53] Now in some respect, however little, every material medium is dim. So is this prism here. It always dims the light to some extent. That is to say, with respect to the light that is there within the prism, we are dealing with a light that is somehow dimmed. Here to begin with (pointing to Figure above) we have the light as it shines forth; here on the other hand we have the light that has made its way through the material medium. In here however, inside the prism, we have a working-together of matter and light; a dimming of the light arises here. That the dimming of the light has a real effect, you can tell from the simple fact that when you look into light through a dim or cloudy medium you see something more. The dimming has an effect, — this is perceptible. What is it that comes about by the dimming of the light? We have to do not only with the cone of light that is here bent and deflected, but also with this new factor — the dimming of the light, brought about by matter. We can imagine therefore into this space beyond the prism not only the light is shining, but there shines in, there rays into the light the quality of dimness that is in the prism. How then does it ray in? Naturally it spreads out and extends after the light has gone through the prism. What has been dimmed and darkened, rays into what is light and bright. You need only think of it properly and you will admit: the dimness too is shining up into this region. If what is light is deflected upward, then what is dim is deflected upward too. That is to say, the dimming is deflected upward in the same direction as the light is. The light that is deflected upward has a dimming effect, so to speak, sent after it. Up there, the light cannot spread out unimpaired, but into it the darkening, the dimming effect is sent after. Here then we are dealing with the interaction of two things: the brightly shining light, itself deflected, and then the sending into it of the darkening effect that is poured into this shining light. Only the dimming and darkening effect is here deflected in the same direction as the light is. And now you see the outcome. Here in this upward region the bright light is infused and irradiated with dimness, and by this means the dark or bluish colors are produced.**
>
> **[page 53, 54] How is it then when you look further down? The dimming and darkening**

> **shines downward too, naturally. But you see how it is. Whilst here there is a part of the outraying light where the dimming effect takes the same direction as the light that surges through — so to speak — with its prime force and momentum, here on the other hand the dimming effect that has arisen spreads and shines further, so that there is a space for which the cylinder of light as a whole is still diverted upward, yet at the same time, into the body of light which is thus diverted upward, the dimming and darkening effect rays in. Here is a region where, through the upper parts of the prism, the dimming and darkening goes downward. Here therefore we have a region where the darkening is deflected in the opposite sense, — opposite to the deflection of the light. Up there, the dimming or darkening tends to go into the light; down here, the working of the light is such that the deflection of it works in an opposite direction to the deflection of the dimming, darkening effect. This, then, is the result: — Above, the dimming effect is deflected in the same sense as the light; thus in a way they work together. The dimming and darkening gets into the light like a parasite and mingles with it. Down here on the contrary, the dimming rays back into the light but is overwhelmed and as it were suppressed by the latter. Here therefore, even in the battle between bright and dim — between the lightening and darkening — the light predominates. The consequences of this battle — the consequences of the mutual opposition of the light and dark, and of the dark being irradiated by the light, are in this downward region the red or yellow colors. So therefore we may say: Upward, the darkening runs into the light and there arise the blue shades of color; downward, the light outdoes and overwhelms the darkness and there arise the yellow shades of color.**

This is a bit difficult to follow, so let me jump ahead and give you the Ur-phenomenon which Goethe derived from these experiments and observations of his: "Light through dark — yellow; dark through light — blue." (From page 76). Again one can observe for oneself this Ur-phenomenon. Any cloudless day look up into the sky. We all know from photos of space that space is completely dark. The darkness of space is flowing through a light-filled space during the day and thus we see a blue sky. (Yes, I am aware of the abstract concepts with which physics explains the blueness of the sky.) At sunset, the sky will usually appear yellowish to deep red. What is happening at sunset? The light is flowing through air that has become dark far to the west of where we stand to observe the sun as it sets: light through dark — yellow. There are no abstract concepts involved here that Goethe asks us to swallow whole, but a simple description of something we can each observe and verify for ourselves. Thus the blue fringes at the top of the circle in the diagram above corresponds to a place which dark (dimness) is flowing through light; the yellow fringes where light is flowing through dark (dimness).

Here Steiner gives us a brief summary of what we have seen in the prism experiment and we come to the inescapable conclusion that "colors arise where dark and light work together."

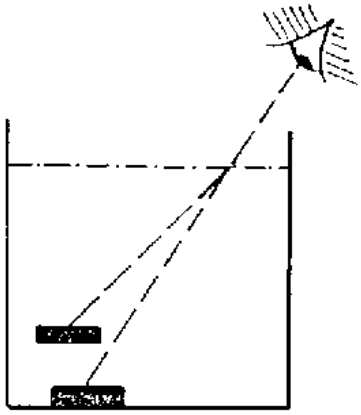
> **[page 54, 55] Thus by adhering to the plain facts and simply taking what is given, purely from what you see you have the possibility of understanding why yellowish colors on the one hand and bluish colors on the other make their appearance. At the same time you see that the material prism plays an essential part in the arising of the colors. For it is through the prism that it happens, namely that on the one hand the dimming is deflected in the same direction as the cone of light, while on the other hand, because the prism lets its darkness ray there too, this that rays on and the light that is deflected cut across each other. For that is how the deflection works down here. Downward, the darkness and the light are interacting in a different way than upward.**

This treatment of color was very difficult for me to follow — it was always like I was walking up a snowy hill and every two steps I took, I slid back a step or so. The pull of the kinematical way of thinking about phenomena kept me back-sliding. You may experience this, also. The problem is that this kinematical tug is not conscious for most of us, up until now. "We had to be carefully taught" as Oscar Hammerstein wrote for a song in *South Pacific*. And having been so taught how to think, it is difficult to think in

another fashion, no matter how much more simpler it would be. It's a slippery slope. Steiner called it a "bitter pill" to take, using a medical metaphor, and spoke particularly to the teachers of small children who have a chance to teach children to observe the world in this simpler fashion, before they learn to add concepts upon concepts to form the massive abstract layer cake of what constitutes science, up until now.

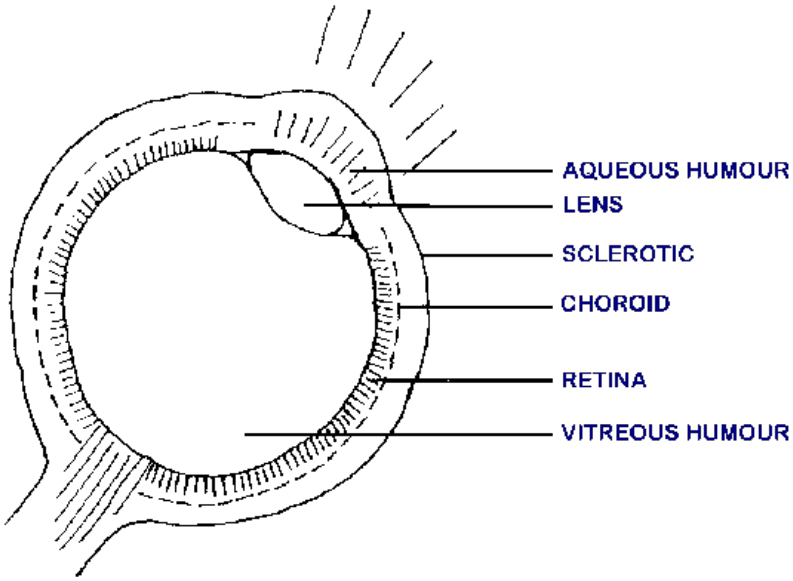
> **[page 57] Now in the first place I really must ask you to swallow the bitter pill (I mean, those of you who found things difficult to understand). Your difficulty lies in the fact that you are always hankering after a phoronomical treatment of light and color. The strange education we are made to undergo instils this mental habit. Thinking of outer Nature, people will restrict themselves to thoughts of a more or less phoronomical character. They will restrict their thoughts to what is arithmetical, spatially formal, and kinematical. Called on to try and think in terms of qualities as you are here, you may well be saying to yourselves: Here we get stuck! You must attribute it to the unnatural direction pursued by Science in modern time. Moreover — I speak especially to Waldorf-School and other teachers — you will yourselves to some extent still have to take the same direction with your pupils. It will not be possible, all at once, to bring the really healthy ideas into a modern school. We must find ways of transition.**

When I worked as a well-surveyor back in the 1960s, a geologist I knew had been flounder fishing at night using a headlight and a pronged gig. He had mistakenly gigged his foot instead of the flounder. His fellow geologists had created a gig with a bend in the shaft to account for the refraction of the water as a joke with a point: to remind him that light bends as it comes out of the water, or so I had been taught to think of the process. Here is the diagram of the refraction of light in water. If you follow the dotted line from the eye to the object underwater, you'll note that the object seems higher than the actual object. This experiment allows Steiner to demonstrate how the eye is an active organism, one which projects and receives information in interaction with the outside world.



This idea of projection by the eye is not new to me. I was brought to understand it when I was working on *The Spizznet File*, a novel about how dolphins communicate with each other and how humans would be able to communicate back and forth with dolphins. If the diagram above was the eye of an archer with her eye on the target and the deflection from actual path was caused by her eyeball being deflected (as happens when one pushes against one's eyeball), the arrow would miss the target, hitting only the upper apparent target. How does the eye get aligned with the real world? I pondered this question for a long time. Suddenly I remembered the story of the guy with the upside-down glasses. He wore them continuously and lived in a world that was upside down. After three weeks, the world flipped over to right side up even with his glasses on. He took off the glasses and the world went upside down again for a time before correcting itself to right side up again. Aha! The man was allowed to manipulate the world and through his manipulations, the brain gradually created an alignment with the real world so that wherever the eye looked, a beam projected out from the eye to the target would hit the target. The eye-brain together create a 3-D holographic image of the outside world and by manipulation of it, align the image with the outside world. I knew at that instant that the eye was an instrument of both input and output of visual information — a receptor as well as a projector. As Steiner says on page 69, "We must be clear that the eye is an active organism."

We are all aware that we have living tissue and dead tissue that comprises our body. Our fingernails, toenails, and hair are examples of dead tissue — tissue that was once living as it grew out from the skin but is no longer living and thus we may cut or



trim these parts of our body for cosmetic purposes without pain. What is not so generally known is that parts of our eyes are living and parts are dead. Look at the diagram of the eye — the aqueous humor and the lens are non-living parts, but as we go back behind the lens, we come to the vitreous humor and then retina which are both living parts of the eye. The farther we go back in the eye, the more alive do we find the components of the eye. In this next passage Steiner obliquely refers to Goethe's famous dictum that the eye is created for the light by the light. It was the presence of light that created the eye in the first place — something that materialistic science has yet to comprehend, in fact, it holds that we only came to see light because the eye was developed by some random evolutionary process.

> **[page 71] In fact the nature of the outer light is here at work, bringing about that transformation whereby the aqueous humor and the lens originate. To this the living being then reacts from within, thrusting outward a more living, a more vital organ, namely the vitreous body. Notably in the eye, formations whose development is stimulated from without, and others stimulated from within, meet one another in a very striking way.**

If this were actually so, we would expect to find some evidence that the eye is part non-living and part living, and Steiner directs us to recall a rather common experience: waking up in the morning.

> **[page 72, 73] During the day when you look at the objects around you — in so far as you have healthy eyes — they will appear to you more or less sharp and clear, or at least so that their sharpness of outline is fully adequate for orientation. But in the morning when you first awaken you sometimes see the outlines of surrounding objects very indistinctly, as if enveloped with a little halo. The rim of a circle for example will be indistinct and nebular when you have just awakened in the morning. What is it due to? It is due to there being two different kinds of things in our eye, namely the vitreous body and the lens. In origin, as we have seen, they are quite different. The lens is formed more from without, the vitreous body more from within. While the lens is rather unalive, the vitreous body is full of vitality. Now in the moment of awakening they are not yet adapted to one-another. The vitreous body still tries to picture the objects to us in the way it can; the lens in the way it can. We have to wait till they are well adapted to each other. You see again how deeply mobile everything organic is. The whole working of it depends on this. First the activity is differentiated into that of the lens and the vitreous body respectively. From what is thus differentiated the activity is thereupon composed and integrated; so then the one has to adapt itself to the other.**

The earliest equation I learned in high school physics was $v = s/t$ where s stands for distance traveled, t stands for time elapsed, and v stands for velocity. This is how I was carefully taught to understand the world through kinematical thinking. All three items, distance, time, and velocity were said to be real values or magnitudes. Not so, says Steiner.

> **[page 96] Of the three magnitudes — velocity, space and time, — velocity is the only one that has reality. What is really there in the world outside us is the velocity; the s and t we only get by splitting up the given totality, the v, into two abstract entities. We only arrive at these on the basis of the velocity, which is really there. This then, to some extent, is our procedure. We see a so-called "body" flowing through space with a certain velocity.**

What he's saying is that space *s* and time *t* are mere abstractions we derived from velocity which is the only reality we can observe. What is the space and time if they're not real?

> **[page 97] The space and time are our own instruments. They are bound to us, — that is the essential thing. Here once again you see the sharp dividing line between what is generally called "subjective" — here, space and time — and the "objective" thing — here, the velocity.**

No one ever explained that to me before. And it makes intimately good sense. Space and time exist inside of us. But this is not to be confused with any abstract Kantian idea of the type so overused by scientists, up until now.

> **[page 98] But that is not what I am saying. I say that in perceiving the reality outside us the — velocity — we make use of space and time for our perception. In effect, space and time are at once in us and outside us. The point is that we unite with space and time, while we do not unite with the velocity. The latter whizzes past us. This is quite different from the Kantian idea.**

The next concept is mind-boggling — something I've learned to expect regularly when I read Steiner's works. We swim in the light with our etheric body and come into a relationship with what light is doing (making fleeting colors, among other things) with our astral body. This is what I perceive that artists do: they come into a relationship with colors through their astral body and communicate that relationship to the world via their art.

> **[page 99] You will never understand what light is without going into these realities. We with our etheric body swim in the light (or, if you will, you may say, in the light-ether; the word does not matter in this connection). . . . In the most manifold ways, colors arise in and about the light; so also they arise, or they subsist, in the so-called bodies. We see the ghostly, spectral colors so to speak, — those that arise and vanish within the light itself. For if I only cast a spectrum here it is indeed like seeing specters; it hovers, fleeting, in space. Such colors therefore we behold, in and about the light.**
>
> **In the light, I said just now, we swim with our etheric body. How then do we relate ourselves to the fleeting colors? We are in them with our astral body; it is none other than this. We are united with the colors with our astral body. You have no alternative, my dear Friends but to realise that when and wheresoever you see colors, with your astrality you are united with them. If you would reach any genuine knowledge you have no alternative, but must say to yourselves: The light remains invisible to us; we swim in it. Here it is as with space and time; we ought not to call them objective, for we ourselves are swimming in them. So too we should regard the light as an element common to us and to the things outside us; whilst in the colors we have to recognize something that can only make its appearance inasmuch as we through our astral body come into relation to what the light is doing there.**

Go back to the experiment with the prism — it is not just the circle of light that is deflected upward, but the dark surrounding the circle is deflected also. Another mind-boggling thing for the carefully educated, even though it is immediately obvious that it is so. We found that the colors appeared on the screen because of the dimmed light [dark] interacted with the light. We found that this flew in the face of

Newton's claim that colors are somehow stored in the light. As a physicist, I was carefully trained to think of dark as the absence of light; I never once thought of the dark as being shifted upward by the prism as a thing in itself, up until now.

> **[page 106, 107] But now, what is this "dark"? You must take the dark seriously, — take it as something real. (The errors that have crept into modern Physics since about the 16th century were only able to creep in because these things were not observed spiritually at the same time. Only the semblance, as appearing to the outer senses, was taken note of; then, to explain this outer semblance, all kinds of theoretical inventions were added to it). You certainly will not deny that when you look at light the light is sometimes more and sometimes less intense. There can be stronger light and less strong. The point is now to understand: How is this light, which may be stronger or weaker related to darkness? The ordinary physicist of today thinks there is stronger light and less strong; he will admit every degree of intensity of light, but he will only admit one darkness — darkness which is simply there when there is no light. There is, as it were, only one way of being black. Yet as untrue as it would be to say that there is only one kind of lightness, just as untrue is it to say that there is only one kind of darkness.**

If we relate light to an asset and dark to a debt, we can understand that we distinguish between degrees of property as well as degrees of debt. Man A can own more property than Man B and Woman A can be deeper in debt than Woman B. To say that there can be distinctions in the amount of property owned, but no distinctions of the amount of debt owed would be folly. Steiner's point is that light and dark are related to each other in the real world exactly as assets and debt are in the economic world.

> **[page 107, 108] When a space is filled with light it is always filled with light of a certain intensity; so likewise, when a space is filled with darkness, it is filled with darkness of a certain intensity. We must proceed from the notion of a merely abstract space to the kind of space that is not abstract but is in some specific way positively filled with light or negatively filled with darkness. Thus we may be confronting a space that is filled with light and we shall call it "qualitatively positive". Or we may be confronting a space that is filled with darkness and we shall judge it "qualitatively negative" with respect to the realm of light. Moreover both to the one and to the other we shall be able to ascribe a certain degree of intensity, a certain strength. Now we may ask: How does the positive filling of space differ for our perception from the negative? As to the positive, we need only remember what it is like when we awaken from sleep and are surrounded by light, — how we unite our subjective experience with the light that floods and surges all around us. We need only compare this sensation with what we feel when surrounded by darkness, and we shall find — I beg you to take note of this very precisely — we shall find that for pure feeling and sensation there is an essential difference between being given up to a light-filled space and to a darkness-filled space. We must approach these things with the help of some comparison. Truly, we may compare the feeling we have, when given up to a light-filled space, with a kind of in-drawing of the light. It is as though our soul, our inner being, were to be sucking the light in. We feel a kind of enrichment when in a light-filled space. We draw the light into ourselves. How is it then with darkness? We have precisely the opposite feeling. We feel the darkness sucking at us. It sucks us out, we have to give away, — we have to give something of ourselves to the darkness. Thus we may say: the effect of light upon us is to communicate, to give; whilst the effect of darkness is to withdraw, to suck at us and take away. So too must we distinguish between the lighter and the darker colors. The light ones have a quality of coming towards us and imparting something to us; the dark colors on the other hand have a quality of drawing on us, sucking at us, making us give of ourselves. So at long last we are led to say: Something in our outer world communicates itself to us when we are under the influence of light; something is taken from us, we are somehow sucked out, when under the influence of darkness.**

Light gives something to us and darkness draws something away. I am reminded of the closing of the movie "Ghost" during which a couple of the bad guys die and immediately dark coalesces from the night and sucks the bad guys away. Shortly afterward, the good guy is given over to the light. The impact of all these revelations by Rudolf Steiner is to usher us into a world which fulfills the promise in the Prefatory Notes of this book, "Even into the laws of Chemistry and Physics the Christ will be found."

Ready for another mind-boggling idea? We humans are filled with warmth. Just as physicists attribute light as being filled with color, they tell us that our bodies are warm as a result of physical and chemical processes that occur within us and make no notice of the difference between how we "feel ourselves within the warmth-condition of our environment and the way we feel ourselves within the light-condition of our environment."

> **[page 110] Physics, since the 16th century, has quite lost hold of this difference. The open-mindedness to distinguish how we join with our environment in the experience of light upon the one hand and warmth upon the other has been completely lost; nay, the deliberate tendency has been, somehow to blur and wipe away such differences as these. Suppose however that you face the difference, quite obviously given in point of fact, between the way we experience and share in the conditions of our environment as regards warmth and light respectively. Then in the last resort you will be bound to recognize that the distinction is: we share in the warmth-conditions of our environment with our physical body and in the light-conditions, as we said just now, with our etheric body.**

But physics has confused or ignored the difference between what we experience with our etheric body and what we experience with our physical body, up until now.

Next Steiner takes up gravity — the force existing between two bodies proportional to the product of their masses and inversely proportional to the square of the distance between them. Note the metaphysical nature of this "force" called gravity. It is an abstract concept and Newton was soundly criticized for postulating it in his time. Since then, we've accepted it as a given, as if the force of gravity were a fact of life anyone can confirm. But it isn't confirmable. One can confirm that an object falls to the ground when released in the air. One can observe the increase of its velocity by 32 feet per every second that it falls, but nowhere can one find the force. It exists in our minds only, not in the world. He gives us a metaphor to demonstrate how silly the idea of the force is. If I move my hand towards my head, do I have to say that there is a force pulling my hand and my head together? One of the things that allows us to identify an abstract concept like "force of gravity" is the possibility of equally valid explanations for the observed phenomena. He offers such an alternate explanation:

> **[page 111] Suppose for example you have two heavenly bodies. You may then say: These two heavenly bodies attract one another, — send some mysterious force out into space and so attract each other. But you need not say this. You can also say: "Here is the one body, here is the other, and here are a lot of other, tiny bodies — particles of ether, it may be — all around and in between the two heavenly bodies. The tiny particles are bombarding the two big ones — bombarding here, there and on all sides; — the ones between, as they fly hither and thither, bombard them too. Now the total area of attack will be bigger outside than in between. In the resultant therefore, there will be less bombardment inside than outside; hence the two bodies will approach each other. They are, in fact, driven towards each other by the difference between the number of impacts they receive in the space between them and outside them."**

One must understand that Rudolf Steiner is a scientist and has the utmost respect for science's achievements, even the most materialistic of the sciences. What he explains for us here are the salient shortcomings which lock science into solely materialistic aspects, and which result in science’s utter disregard for the spiritual aspects of the world. Our hand and our head are not two objects for which we

can postulate some abstract force which causes a mutual attraction between them. Our hand and our head are parts of a unified whole, of a human being, and they both receive directions from the whole as to how and when to move. It is not the equations of Newton that allow us to calculate motions of the planets that Steiner disparages, but rather the prevailing idea of scientists that our Solar System consists of dead rocks held together by some abstract force called gravity. Only when we understand this distinction are we ready to see the bigger picture.

> **[page 113, 114] The implications of this, my dear Friends, are far-reaching. Namely, for every phenomenon, we must examine to what extent it is a reality in, itself, or a mere section of some larger whole. If you consider Sun and Moon, or Sun and Earth, each by itself, you may of course invent and add to them a force of gravity, just as you might invent a force of gravity by means of which my forehead would attract my right hand. But in considering Sun and Earth and Moon thus separately, the things you have in mind are not totalities; they are but parts and members of the whole planetary system. This then is the essential thing; observe to what extent a thing is whole, or but a section of a whole. How many errors arise by considering to be a whole what is in fact only a partial phenomenon within a larger whole! By thus considering only the partial phenomena and then inventing energies to add to these, our scientists have saved themselves the need of contemplating the inherent life of the planetary system. The tendency has been, first to regard as wholes those things in Nature which are only parts, and by mere theories then to construe the effects which arise in fact between them, This therefore, to sum up, is the essential point: For all that meets us in Nature we have to ask: What is the whole to which this thing belongs? Or is it in itself a whole? Even then, in the last resort, we shall find that things are wholes only in certain respects. Even the crystal cube of rock-salt is a totality only in some respect; it too cannot exist save at certain temperatures and under other requisite conditions. Given some other temperature, it could no longer be. Our need is therefore to give up looking at Nature in the fragmentary way which is so prevalent in our time.**

If life has come to seem more and more fragmented in our time, this is one of the reasons why — we have divided living wholes into fragments and applied partial solutions to fragments and in the process fouled up the whole. Pollution is but one salient aspect of this deleterious fragmentary process — there are many more. Examples abound today of scientists analyzing the Earth in a fragmentary manner: global warming, acid rain, holes in the ozone layer, to name only a few. There is no data but contemporary data on these phenomena, so projections for the progress of these phenomena are merely guesses but they are offered as scientific data on which to base economic decisions. On the other hand, if you look at the fields that Steiner innovated, you'll find that a new process, one of treating the whole as a whole, pervades them. Biodynamic farming was his answer to the use of chemical fertilizers that only take care of only one fragment of the entire needs of plant systems. With Biodynamic farming in place of chemical fertilization, we would have no river pollution from excess phosphorus run-off, and people would be eating healthier and more nutritious foods, among other things. What does Biodynamic farming do? It focuses on the inherent life in materials used to fertilize plants and provides more life to sustain healthy growth. On a larger scale, scientists must begin to look at our planetary system as a whole and to see its inherent life. Rightly understood, we are a robust people living on a robust and living planet.

> **[page 114] This then is the essential thing; observe to what extent a thing is whole, or but a section of a whole. How many errors arise by considering to be a whole what is in fact only a partial phenomenon within a larger whole! By thus considering only the partial phenomena and then inventing energies to add to these, our scientists have saved themselves the need of contemplating the inherent life of the planetary system.**

Scientists beginning with Francis Bacon in the 16th Century began to hold a mirror up to Nature, look into the mirror, and say, "See, Nature is all a reflection." They saw Nature as a reflection in their own minds and began to divide up their reflections into fragments and operate on the pieces as if they were separate

from the whole. This worked well for machines and led to the Industrial Revolution. The machines spawned by this approach were part of the living planet and the planet had to endure the excesses produced by the machines.

> **[page 114, 115] Indeed it was only by looking at Nature in this fragmentary way that Science since the 16th century conceived this strange idea of universal, inorganic, lifeless Nature. There is indeed no such thing, just as in this sense there is no such thing as your bony system without your blood. Just as your bony system could only come into being by, as it were, crystallizing out of your living organism as a whole, so too this so-called inorganic Nature cannot exist without the whole of Nature — soul and Spirit-Nature — that underlies it. Lifeless Nature is the bony system, abstracted from Nature as a whole. It is impossible to study it alone, as they began doing ever since the 16th century and as is done in Newtonian Physics to this day.**

When someone orders a drink *neat*, we know that they're saying, "I want it undiluted and pure. No ice or anything else added to it." That's how physicists like their Nature: *neat*. No messy fringes or taints of life mucking about. What they call *neat* is a narrow study of the bony structure of lifeless nature. It is their *metier*. Our modern technology consists of machines made from this bony structure of lifeless Nature. That is good, insofar as it goes, but with the success of their lifeless machines physicists have acquired a *hubris* which encourages them to attempt to explain the entire living Cosmos based on their study of lifeless Nature on Earth. The real Big Bang will come when this lifeless study of Nature blows up in their faces. Rightly understood, scientists who die without uncovering the living Spirit in the Cosmos will become the morons of tomorrow.

> **[page 115] It was the trend of Newtonian Physics to make as neat as possible an extract of this so-called inorganic Nature, treating it then as something self-contained. This "inorganic Nature" only exists however in the machines which we ourselves piece together from the parts of Nature. And here we come to something radically different. What we are wont to call "inorganic" in Nature herself, is placed in the totality of Nature in quite another way. The only really inorganic things are our machines, and even these are only so insofar as they are pieced together from sundry forces of Nature by ourselves. Only the "put-togetherness" of them is inorganic. Whatever else we may call inorganic only exists by abstraction. From this abstraction however present-day Physics has arisen. This Physics is an outcome of abstraction; it thinks that what it has abstracted is the real thing, and on this assumption sets out to explain whatever comes within its purview**.

When I do crossword puzzles I use ink and if my first guess at a word is wrong, it is obvious because I have to write over the previous word. This happens whenever I discover that some word crossing it requires a different word. This has happened over and over again to physicists in the case of light. They began with a wave phenomenon similar to sound. Then they discovered light had a corpuscular nature. Then they moved to transverse waves in an ether. Then they found there was no such ether as they postulated. Like a white mouse running a maze, they keep back tracking trying to find the cheese that exists only in their mental images. In 2003 the search yet goes on and on and on.

> **[page 118, 119] Now think a moment what has happened. The scientists had been assuming that they knew what underlies the phenomena of light and color: namely, undulations in the elastic ether. Now that they learned of the interaction between light and electricity, they feel obliged to regard, what is vibrating there, as electricity raying through space. Mark well what has taken place. First it is light and color which they desire to explain, and they attribute them to the vibrating ether. Ether-vibrations are moving through space. They think they know what light is in reality, — it is vibrations in the elastic ether. Then comes the moment when they have to say: What we regarded as vibrations of the elastic ether are really vibrations of electro-magnetic force. They**

know still better now, what light is, than they did before. It is electro-magnetic streams of force. Only they do not know what these are! Such is the pretty round they have been. First a hypothesis is set up: something belonging to the sense-world is explained by an unknown supersensible, the vibrating ether. Then by and by they are driven to refer this supersensible once more to something of the sense-world, yet at the same time to confess that they do not know what the latter is. It is a highly interesting journey that has here been made; from the hypothetical search for an unknown to the explanation of this unknown by yet another unknown.
The physicist Kirchhoff was rather shattered and more or less admitted: It will be not at all easy for Physics if these more recent phenomena really oblige us no longer to believe in the undulating ether, And when Helmholtz got to know of the phenomenon, he said: Very well, we shall have to regard light as a kind of electro-magnetic radiation. It only means that we shall now have to explain these radiations themselves as vibrations in the elastic ether. In the last resort we shall get back to these, he said.
The essence of the matter is that a genuine phenomenon of undulation — namely the vibrating of the air when we perceive sounds — was transferred by pure analogy into a realm where in point of fact the whole assumption is hypothetical.

We are each as human beings creatures of warmth, air, and light. The light fills our eye, the air fills our lung, and the warmth fills our body. In the next passage the french word *niveau* refers to a level. Steiner uses it to refer to the level at which warmth exists in our body.

[page 131] Thus in effect we have three stages in man's relation to the outer world — I will describe them as the stage of Light, the stage of Warmth, and that of Tone or Sound. There is however a remarkable fact in this connection. Look open-mindedly at your relation to the element of light — your swimming in the element of light — and you will have to admit: It is only with your etheric body that you can live in what is there going on in the outer world. Not so when you are living in the element of warmth. You really live in the warmth-element of your environment with your whole bodily nature. Having thus contemplated how you live in light and warmth, look farther down — think how you live in the element of tone and sound — and you will recognize: Here you yourself are functioning as an airy body. You, as a living organism of air, live in the manifoldly formed and differentiated outer air. It is no longer the ether; it is external physical matter, namely air. Our living in the warmth-element is then a very significant border-line. Our life in the element of warmth is for our consciousness a kind of midway level — a *niveau*. You recognize it very clearly in the simple fact that for pure feeling and sensation you are scarcely able to distinguish outer warmth from inner warmth. Your life in the light-element however lies above this level: —

Light ↑
——————— Warmth ———————
Air ↓ (Sound, Tone)

We experience light and sound in subjective ways as they impinge upon us. If we deal with light and sound as if it lacked an inner life, it would be the same as if I were to deny that you the reader had any inner life as you read these words. This works better when Steiner says it to his live audience.

[page 141] If you deny to light and sound the inner life and being which you experience in a seemingly subjective way, it is precisely as it would be if, having you here before me, I looked on all that is before me as merely part of *my* subjective life, and thus denied to *you* the experience of inner life and being.

And yet this is exactly what happens when a physicist says he wants only to investigate the outwardly spatial processes of sound. This is the way I was taught to talk and to do research. I recognize the earlier physicist-me as the man Steiner is describing below. I have since come to recognize that what goes on inside of me is crucially important to my life as a living human being.

> **[page 141, 142] These are the subject-matter of my researches. These I abstract from the totality; what is qualitative is no concern of mine. A man who speaks like this is at least candid and straightforward, only he must not then go on to say that the one is "objective" and the other "subjective", or that the one is the "effect" of the other. What you experience in your soul, — when I experience it with you it is not the effect upon me of the vibrations of your brain. To see through a thing like that is of untold significance; nothing could be of greater importance for the requirements of the new age, not only in science but in the life of humanity at large.**

I have studied about how in a room full of pendulum clocks the clocks all begin to swing in the same direction over time, how an oyster in Long Island opens and closes in synchrony with the Moon being overhead, how women who live in the same household eventually have their menses come into synchrony, and how when one is listening to a live lecturer, the thoughts of the lecturer flow direct into one's mind independently of the words the lecturer is speaking. This last item was a personal discovery I made while talking to my wife of twenty-five years recently. It came on the heels of many years of the kind of the effects Steiner discusses below:

> **[page 142] Times without number you may have this experience. You are at table with another person and he says something you yourself have just been thinking. You were thinking it but did not say it; he now utters it. It is the sympathetic going-together of events (or complexes of events) in some way attuned to one-another, which is here making itself felt in a highly spiritual realm. We need to recognize the whole range of continuity from the simple resonance of a violin-string which one may still interpret crudely and unspiritually within the sequence of outer material events, to these parallel phenomena which appear so much more spiritual — as when we experience one-another's thoughts.**

At the time I made the discovery that we experience the thoughts of a live lecturer as they speak, I was taking a PhD level course in Education, and I wrote up the experience in my Final Paper which you can read at: http://www.doyletics.com/arj/tandlrvw.htm#live_lecture. I had, prior to that time and since, noted on many occasions that Del or I would begin to say something that the other had been thinking. "It all happens at the time." is one way I came to think about the process. We both think the same thought at the same instant, but one of us gets it out before the other. Connecting that process to a live lecturer is a natural extension of the process of noting that as human beings "we experience one-another's thoughts."

If you read Goethe or Steiner for very long you will find yourself considering how one thing in nature is a metamorphosis of another. This one is mind-boggling: the eye is a metamorphosis of the larynx! Certainly I have heard scientists compare the eye to the ear, since they are both apparently organs for the input of information, one visual and one auditory. Scientists are great at analogies, but neophytes, most of them, at metamorphosis. One would do well to remember that caveat.

> **[page 145] Consider what is left of the eye if I first take away the vitreous body and also the whole or at least part of what is here spread out — the retina. If I were able to remove all this, what would be left would be the ciliary muscle, the lens and the external liquid — the aqueous humor. What kind of organ would that represent? It would be an organ, my dear Friends, which I could never compare with the ear if I were thinking realistically, but only with the larynx. It is not a metamorphosis of the ear; it is a metamorphosis of the larynx. Only to touch upon the coarsest aspect: just as the muscles of the larynx take hold of the vocal chords, widening or narrowing the aperture between**

them, so do the ciliary muscles with the lens. The lens is inherently mobile and they take hold of it.

Okay, the eye *can* be compared to the ear, but only if we deal with the innermost parts of the eye, everything from the lens inward. From the lens outward, the eye has the structure and components analogous to the larynx — it focuses the lens, opens and closes the iris, moves the eyeball around, all in synchronism with the outside world. Just as the larynx shapes sounds based on the input relayed it by the ear which picks up the speaking sounds through the eustachian tube. Just as the larynx is in a tight feedback loop with the sounds picked up by the ear, the outer portions of the eye are in a tight feedback loop with the visual information picked up by the inner portions of the eye.

[page 146] When I am seeing, the same thing happens in my eye as when I hear and speak at the same time.

In Lecture IX, Steiner goes into detail about electricity and its relationship to radioactivity, showing the relationship of beta-rays to electrons, etc. This is an important chapter for those of you not familiar with the phenomena of radiation, but it all comes down to this: electricity is connected with *Will*, just as *mass* is and our connection with electricity we are as unconscious of as we are of *mass*.

[page 166] When in the many complicated ways — which we have only gone through in the barest outline in today's lecture — when in these complicated ways we go down into the realm of electrical phenomena, we are in fact descending into the very same realm into which we must descend whenever we come up against the simple element of mass. What are we doing then when we study electricity and magnetism? We are then studying *matter,* in all reality. It is into matter itself that you are descending when you study electricity and magnetism.

In Lecture X, Steiner devotes some time to discussing cathode rays, but most of the chapter deals with the three aspects of abstract knowledge, arithmetic, geometry, and kinematics and how we apply them to what goes on in the outer world. His point is the difference between these aspects and all the other ideas we use to understand the world.

[page 176, 177] But if we now go further and begin applying to what goes on in the outer world the ideas of "scientific" arithmetic and algebra, geometry and kinematics, then we are doing far more — and something radically different. For we have certainly not gained these ideas from the outer world. We are applying ideas which we have spun out of our own inner life. Where then do these ideas come from? That is the cardinal question. Where do they come from? The truth is, these ideas come not from our intelligence — not from the intelligence which we apply when working up the ideas derived from sense-perception. They come in fact from the intelligent part of our Will. We make them with our Will-system — with the volitional part of our soul.
The difference is indeed immense between all the other ideas in which we live as intelligent beings and on the other hand the geometrical, arithmetical and kinematical ideas.

To summarize what the difference is: all the other ideas we get from directly from our experience of the world; the geometrical, arithmetical and kinematical ideas "rise up from the unconscious part of us, from the Will-part which has its outer organ in the metabolism." Since we are unconscious of our Will and metabolism, we are essentially asleep in this aspect of our existence. I am amazed to discover the truth of my college education at the undergraduate level: I acquired a B. S. in "A Dream of Nature."

[page 178] All this elaboration of the outer world — optical, acoustic and even thermal to some extent (the phenomena of warmth) — by means of geometrical, arithmetical and kinematical thought-forms, is in point of fact a dreaming about Nature. Cool and sober as it may seem, it is a dream — a dreaming while awake. Moreover, until we recognize it

> **for what it is, we shall not know where we are in our Natural Science, so that our Science gives us reality. What people fondly believe to be the most exact of Sciences [Physics], is modern mankind's dream of Nature.**

How can we avoid teaching our children only a "dream of nature"? There are Waldorf and Steiner Schools around the globe inspired by Rudolf Steiner's first school for the children of the workers at the Waldorf-Astoria Cigarette factory. These schools have multiplied in recent years as parents came to understand the importance of their children being raised and educated to see wholes, living wholes, in the outside world, living humans rather than paper doll humans, a science based first upon their own senses, while they are still too young to think in geometrical, arithmetic, and kinematical abstracts. As adults of all ages we can learn to distinguish real data from abstract ideas, but our children need a solid grounding in the real before they are asked to introject our adult fantasies about the world from now on.

> **[page 183] But this at least we can do: we can refrain from bringing into our teaching too many untenable ideas — ideas derived from the belief that the dream-picture which has been made of Nature represents actual reality. If you yourselves are imbued with the kind of scientific spirit with which these lectures — if we may take them as a fair example — have been pervaded, it will assuredly be of service to you in the whole way you speak with the children about natural phenomena.**

To close this series of lectures, I will allow Steiner to exhort us in his inimitable fashion to nurture and treasure the qualitative element in our thinking and especially the thinking of our children:

> **[page 149] You see from this, dear Friends, the fundamentals of a true Physical Science, which we aspire to, are not so easy to conceive. It is by no means enough to entertain a few mathematical notions about wave-movements or oscillations. We must make greater demands on the qualitative element in human thinking. If such demands are unfulfilled, we only get once more the picture of the World which is so worshiped in the Physics of today, and which is to reality as is a tissue-paper effigy to a living man.**
>
> And so it is.