

Concerning Electricity

Extract from a Lecture by Dr. Rudolf Steiner, Dornach, January 28, 1923

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From stenographic notes unrevised by the lecturer.

The cultural ingredient that now permeates our whole external civilization began to rise to the surface at the turn of the 18th and 19th century. Think of the immense contrast between the present time and that time when a certain physicist prepared a frog's leg which accidentally came into contact with the window ... the frog's leg quivered, and so he discovered electricity! How long ago was that? — Less than 150 years ago, yet electricity is now a cultural ingredient. Indeed, it is far more than this! You see, when the men of my age were young fellows, not one of them dreamt of speaking of the atoms in the sphere of physics otherwise than of tiny, unelastic, or even elastic spheres colliding with one another, and so forth, and then they calculated the results of these collisions. At that time, no one would have dreamt of conceiving the atom without further ado in the way which we conceive of it today: namely, as an electron, as an entity consisting altogether of electricity.

Human thought has spun itself altogether into electricity, and this occurred not so very long ago. Today we speak of the atoms as if they were small suns, centres around which electricity accumulates; we speak of electrons. Thus we suspect electricity everywhere, when we penetrate into the world's mechanism. This is where our civilization so closely connects itself with a definite manner of thinking. If people would not travel on electric tramcars they would not think that the atoms are full of electricity.

If we now observe the connections that existed before the present age of electricity, we may say that they allowed the natural scientist of that time to imagine, at least abstractly, the spiritual in Nature. Although a tiny rest of scholastic realism remained, electricity then began to affect man's nerves, expelling from them everything that tended towards the spiritual.

Things went still further. Even light, the honest light that surges through the world's spaces, was gradually defamed and brought into the ill repute of resembling electricity! When we speak today, as I am speaking now, then the people whose heads are deeply submerged in the electric wave of civilization necessarily believe that this is utter nonsense. But this is only due to the fact that the people whose heads consider such things as nonsense drag themselves along (like dogs whose tongues are hanging out because of the heat) with a load of history, a load of historical concepts on their backs, so that they cannot speak in an unprejudiced way, from out of the immediate present.

You see, when we speak of electricity, we enter a sphere that presents a different aspect to the imaginative vision than that of the other spheres of Nature. So long as man remained within the light, within the world of sound, that is to say, in the spheres of optics and acoustics, it was not necessary to judge morally that which appeared in a stone, a plant, or an animal, either as colours in the sphere of light, or as sound in the world of tones; it was not necessary to judge these things morally, because he

still possessed an echo, weak though it was, of the reality of concepts and ideas. Electricity, however, drove out this echo. And if today we are, on the one hand, unable to discover a reality in the world of moral impulses, we are, on the other hand, even less able to discover a moral essence in that sphere which is now considered to be the most important constituent of Nature.

Today, if we were to ascribe a real power to moral impulses, if we were to say that they contain a force enabling them to become sensory reality in the same way in which a plant's seed becomes sensory reality, we would almost be looked upon as fools. And if someone were to come along today and ascribe moral impulses to the forces of Nature, he would be looked upon as a complete fool! But if you have ever allowed an electric current to pass through your nervous system, so as to experience it consciously with a genuine power of vision, you will realize that electricity in Nature is not merely a current but that electricity in Nature is, at the same time, a moral element. When we enter the sphere of electricity, we penetrate simultaneously into a moral sphere. If you connect your knuckle at any point with a closed current, you will immediately feel that your inner life extends to an inner sphere of your being, where the moral element comes to the surface, so that the electricity pertaining to the human being cannot be sought in any other sphere than that sphere which is also the source of the moral impulses. Those who can experience the whole extent of electricity, experience at the same time the moral element in Nature. Modern physicists have conjured and juggled about with electricity in a strange way, without the least suspicion. They imagine the atom as something electric, and through the general state of consciousness of the present time, they forget that whenever they think of an atom as an electric entity, they must ascribe a moral impulse to this atom, indeed, to every atom. At the same time, they must raise it to the rank of a moral entity. ...But I am not speaking correctly ... for, in reality, when we transform an atom into an electron, we do not transform it into a moral, but into an IMMORAL entity! Electricity contains, to be sure, moral impulses, impulses of Nature, but these impulses are IMMORAL; they are instincts of evil, which must be overcome by the higher world.

The greatest contrast to electricity is LIGHT. If we look upon light as electricity we confuse good and evil. We lose sight of the true conception of evil in the order of Nature, if we do not realize that through the electrification of the atoms we transform them into carriers of evil; we do not only transform them into carriers of death, as explained in my last lecture, but into carriers of evil. When we think of them as atoms, in general, when we imagine matter in the form of atoms, we transform these atoms into carriers of death; but when we electrify matter, Nature is conceived as something evil. For electric atoms are little demons of Evil. This, however, does not tell us much. For it does not express the fact that the modern explanation of Nature set out along a path that really unites it with Evil. Those strange people at the end of the Middle Ages, who were so much afraid of Agrippa von Nettesheim, Trithem of Sponheim, and others, so that they saw them walking about with Faust's malevolent poodle, expressed this very clumsily, but although their thoughts may have been wrong, their feelings were not altogether wrong. For, when we listen to a modern physicist blandly explaining that Nature consists of electrons, we merely listen to him explaining that Nature really consists of little demons of Evil! And if we acknowledge Nature in this form, we raise Evil to the rank of the ruling world-divinity.

As modern men who do not proceed in accordance with old traditional ideas, but in accordance with reality, we would come across the fact that the electric element in Nature is endowed with morality in

the same way in which moral impulses are endowed with life, with a life of Nature, so that, later on, they take on real shape, become a real world. In the same way in which the moral element one day acquires real shape in Nature, so the electric element once contained a moral reality. If we contemplate electricity today, we contemplate the images of a past moral reality that have turned into something evil.

If Anthroposophy were to adopt a fanatic attitude, if Anthroposophy were ascetic, it would thunder against the modern civilization based on electricity. Of course, this would be nonsense, for only world-conceptions that do not reckon with reality can speak in that way. They may say: "Oh, this is ahrimanic! Let us avoid it!" — But this can only be done in an abstract way. For the very people who thunder against Ahriman, and tell us to beware of him, go downstairs after their sectarian meeting and enter an electric tramcar! So that all their thundering against Ahriman, no matter how holy it may sound, is (excuse the trivial expression) simply rubbish. We cannot shut our eyes to the fact that we must live with Ahriman. But we must live with him in the right way, that is to say, we must not allow him to have the upper hand.

The final scene of my first Mystery Play can show you what it means to lack consciousness in certain things. [See The Portal of Initiation] Read this final scene once more, and you will see that it is a different matter whether I lull myself in unconsciousness over a fact, or whether I grasp it consciously. Ahriman and Lucifer have the greatest power over us if we do not know anything about them, so that they can handle us, without our being aware of it. This is expressed in the final scene of my Mystery Play. The ahrimanic electricity can therefore overwhelm civilized man only so long as he blandly and unconsciously electrifies the atoms and thinks that this is quite harmless. But in so doing, he does not realize that he is imagining Nature as a complex of little demons of Evil.

When even the light is conceived of electrically, as has been done in a recent modern theory, then the qualities of Evil are attributed to the divinity of Good. It is really terrifying to see to what a great extent the modern contemplation of Nature has unawares become a "demonology," a worship of demons! We should realize this, for the essential thing is CONSCIOUSNESS: we live in the age of the consciousness-soul.

Atomism and its Refutation

First, we will call to mind the current doctrine of sense impressions, then point to contradictions contained in it, and to a view of the world more compatible with the idealistic understanding.

Current (1890) natural science thinks of the world-space as filled with an infinitely thin substance called ether. This substance consists of infinitely small particles, the ether atoms. This ether does not merely exist where there are no bodies, but also in the pores (pertaining) to bodies. The physicist imagines that each body consists of an infinite number of immeasurable small parts, like atoms. They are not in contact with each other, but they are separated by small interstices. They, in the turn, unite to larger forms, the molecules, which still cannot be discerned by the eye. Only when an infinite number of molecules unite, we get what our senses perceived as bodies.

We will explain this by an example. There is a gas in nature, called hydrogen, and another called oxygen. Hydrogen consists of immeasurable small hydrogen atoms, oxygen of oxygen atoms. The hydrogen atoms are given here as red circlets, the oxygen ones as blue circlets. So, the physicist would imagine a certain quantity of hydrogen, like a figure 1, a quantity of oxygen like figure 2. (See table)

Now we are able, by special processes, not interesting us here, to bring the oxygen in such a relation to the hydrogen that two hydrogen atoms combine with one oxygen atom, so that a composite substance results which we would have to show as indicated in figure 3.

Here, always two hydrogen atoms, together with one oxygen atom form one whole. And this still invisible, small formation, consists of two kinds of atoms, we call a molecule. The substance whose molecule consists of two hydrogen atoms, plus one oxygen atom is water.

It also can happen that a molecule consists of 3, 4, 5 different atoms. So one molecule of alcohol consists of atoms of carbon, hydrogen and oxygen.

But we also see by this that for modern physics each substance (fluid, solid, and gaseous) consists of parts between which there exist empty spaces (pores).

Into these pores, there enter the ether atoms which fill the whole cosmos. So, if we draw the ether atoms as dots, we have to imagine a body like figure 4. (The red and blue circlets are substance atoms, the black dots are ether atoms.)

Now we have to imagine that both the substance-atoms and the ether-atoms are in a state of constant motion. The motion is swinging. We must think that each atom is moving back and forth like the pendulum of a clock.

Now in A (see figure 5) we imagine a body, the molecules of which are in constant motion. This motion is transferred also to the ether-atoms in the pores, and from there, to the ether outside of the body of B, e.g. to C. Let us assume in D a sense-organ e.g. the eye, then, the vibrations of the ether will reach the eye, and through it, the nerve N. There, they hit, and through the nerve-conduit L, they arrive at the brain G. Let us assume for instance that the body A is in such a motion that the molecule swings back and forth 461 billion times a second. Then, each ether-molecule also swings 461 billion times, and hits 461 billion times against the optic nerve (in H). The nerve-conduit L transfers these 461 billion vibrations to the brain, and here, we have a sensation: in this case high red. If there were 760 billion vibrations I could see violet, at 548 billion yellow, etc. To each color sensation there corresponds, in the outside world, a certain motion.

This is even simpler in the case of the sensations of sound. Here also the body-molecules vibrate. The medium transferring this to our ear is not the ether but the air. At 148 vibrations per second we perceive the tone D, at 371 the tone F sharp, etc.

Thus we see to what this whole interpretation leads: whatever we perceive in the world with our senses, colors, tones, etc., is said not to exist in reality, but only to appear in our brain when certain vibratory forms of motion are present in the outer world. If I perceive heat, I do so only because the ether around me is in motion, and because the ether atoms hit against the nerves of my skin; when I sense light, it is because the same ether atoms reach the nerve of my eye, etc.

Therefore, the modern physicist says: in reality, nothing exists except swinging, moving atoms; everything else is merely a creation of my brain, formed by it when it is touched by the movement in the outer world.

I do not have to paint how dismal such a view of the world is. Who would not be filled with the saddest ideas if for example, Hugo Magnus, who is quite caught in that way of thinking, exclaims, “This motion of the ether is the only thing which really and objectively exists of color in creation. Only in the human body, in the brain, these ether movements are transformed into images which we usually call red, green, yellow, etc. According to this, we must say: creation is absolutely colorless ... Only when these (colorless) ether movements are led to the brain by the eye, they are transformed to images which we call color.” (Hugo Magnus, *Farben und Schöpfung*, 8 lectures about the relation of color to man and to nature, Breslau, 1881, p. 16f.)

I am convinced that everyone whose thinking is based on sound ideas, and who has not been subjected from early youth to these strange jumpy thoughts, will consider this state of affairs as simply absurd.

This matter, however, has a much more dubious angle. If there is nothing in the real world except swinging atoms, then there cannot be any true objective ideas and ideals. For when I conceive an idea, I can ask myself, what does it mean outside of my consciousness? — Nothing more than a movement of my brain molecules. Because my brain molecules at that moment swing one way or another, my brain gives me the illusion of some idea. All reality in the world then is considered as movement, everything else is empty fog, result of some movement.

If this way of thinking were correct, then I would have to tell myself: man is nothing more than a mass of swinging molecules. That is the only thing in him that has reality. If I have a great idea and pursue it to its origin, I will find some kind of movement. Let us say I plan a good deed. I only can do that if a mass of molecules in my brain feels like executing a certain movement. In such a case, is there still any value in “good” or “evil”? I can't do anything except what results from the movement of my brain molecules.

From these causes came the pessimism of *delle Grazie*. She says: For what purpose is this illusionary world of ideas and ideals when they are nothing but movements of atoms. And she believes that current science is right. Because she could not transcend science, and could not, as apathetic people do, disregard the misery of this belief; she succumbed to pessimism.

(See Rudolf Steiner and Marie *delle Grazie*, *Nature and Our Ideals*, published by Mercury Press.)

The error underlying the theories of this science is so simple that one cannot understand how the scientific world of today could have succumbed to it.

We can clarify the issue by a simple example. Let us suppose someone sends me a telegram from the place A. When it reaches me, I get nothing but paper and lettering. But if I know how to read, I receive more than merely paper and printed signs, that is, a certain content of thought. Can I say now: I have created this content of thought only in my brain, and paper plus lettering are the only reality? Certainly not. For the content which is now in me is also present in the place A in the same manner. This is the best example one can choose. For in a visible way, nothing at all has come to me from A. Who could maintain that the telegraph wires carry the thought from one place to the other? The same is true about our sense impressions. If a series of ether particles, swinging 589 billion times a second, reach my eye and stimulate the optic nerve, it is true that I have the sensation green. But the ether waves as paper and written symbols for the telegram in the example above are only the carriers of “green”, which is real on the body. The mediator is not the reality of the matter.

As wire and electricity for the telegram, so the swinging ether is here used as mediator. But just because we apprehend “green” by means of the swinging ether, we cannot say: “green” is simply the same as the swinging ether.

This coarse mistaking of the mediator for the content that is carried to us, lies at the root of all current sciences.

We must assume “green” as a quality of bodies. This “green” causes a vibration of 589 billion vibrations per second, this vibration comes to the optic nerve which is so constructed that it knows: when 589 billion vibrations arrive, they can only come from a green surface.

The same holds true for all other mental representations. If I have a thought, an idea, an ideal, it of course must be present in my brain as a reality. That is only possible if the brain particles move in a certain way, for an entity existing in space cannot suffer any changes except by motions. But we would be deadly mistaken about the content of the idea as compared to the way it appears in the body, if we were to say: the motion itself is the idea. No — the motion only provides the possibility for the idea to gain form and spatial existence.

But there is another aspect. For us men, there is nothing [in] which we are completely present as in our ideas, our ideals and mental representations. For them we live, we weave.

When we are alone in the dark, in complete silence, so that we have no sense impressions, — of what are we totally and fully conscious? — Our thoughts and ideas! After these comes everything we can experience through the senses. That is given to me when I open my sense organs to the outer world and keep them receptive. Aside from ideas, ideals and sense impressions, nothing is given to me. Everything else can only be derived as existing and ideas on the basis of our sense impressions.

Can I make such an assumption about moving atoms? If motion occurs, there must be something that moves. By what do I recognize motion? Only by seeing that the bodies change their place in space. But what I see before me are bodies with all qualities of color, etc.

So what does the physicist want to explain? Let us say color. He says: it is motion. What moves? A colorless body. Or, he wants to explain warmth. He again says: it is motion. What moves? A body without warmth. In short: if we explain all qualities of bodies by motion, we finally have to assume that the moving objects have no qualities, as all qualities originate in motion.

To recapitulate. The physicist explains all sense-perceivable, all sense-perceptible qualities by motion. So, what moves cannot yet have qualities. But what has no qualities cannot move at all. Therefore, the atom assumed by physicists is a thing that dissolves into nothing if judged sharply.

So, the whole way of explanation falls. We must ascribe to color, warmth, sounds, etc., the same reality as to motion. With this, we have refuted the physicists, and have proved the objective reality of the world of phenomena and of ideas.

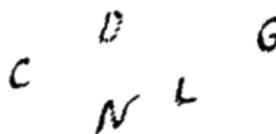


Fig. 1



Fig. 2

Diagrams adapted from originals of Rudolf Steiner

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Dr. Rudolf Steiner's Answers to Six Questions about Some Basic Concepts of Natural Science. (Answered in 1919.)

(The exact questions no longer exist.)

- I. Atoms are to be regarded as ideal contents of space. The contents are the results of force-directions meeting each other — e.g., directions of force.

a b c are active in space, and by their meeting a resultant force is carried which is effective as an atom of tetrahedral character.

Elements are the expression of certain meetings of forces; that they manifest themselves as such is due to the fact that one force, in meeting another, produces a result, while other effects of forces on each other are without result.

Crystals are the result of more complicated meetings of forces, atoms the result of simple meetings.

Amorphic masses result from the neutralization of force-reactions.

- II. Force is the revelation of spirit viewed in a one-sided way. One cannot say that force has an effect on matter, since matter consists merely in the affects of the force-rays when they meet. Never does one form of energy pass over into another one; as little as the activity of one man goes into that of another. What passes over is merely the arithmetical expression of measure. If mechanical energy passes over into warmth the real occurrence is as follows: a certain quantity of this revelation which reveals itself in warmth is stimulated in a spiritual being by a certain quantity of mechanical energy. (This is so in a healthy fashion with Mayer. It was only Helmholtz who botched up this matter.)
- III. Neither sound, nor warmth, nor light, nor electricity are vibrations, just as little as a horse is a sum of gallop-paces. Sound, for instance, is an essential entity, and the effect of this real quality in its passage through the air is vibration. For man as a sensing being, the vibration is motivation to imitate the essential entity in himself; this constitutes the perception of sound. It is similar with others: light, etc.

- IV. Light is that by which it is perceived. (See my introduction to Goethe's Theory of Color.) The vibration is the revelation of light in the ether.

The refraction of light is the result of the effect of a certain force-direction upon the light-direction. Newton's color rings (circles), phenomena of interference, are results of light-radiation (effect of light in the ether), and of the effects of other forces found in the path of light (weakening effects, gradually weakening affects of other forces). The same goes for phenomena of polarisation. One should not seek the polarisation figures in the structure of the essence of the light but in the structure of the medium which places itself in the path of light.

The speed of transmission is the result of a kind of friction of the light against the medium.

- V. Light is not to be considered as a function of electricity, but the latter is to be considered as a kind of corporeal carrier of light.

Electrically charged matter: certain accumulations of force retain those accumulations of force which manifest as electricity.

- VI. Mathematics is the abstracted sum of the forces effective in space. If one says, "Mathematical propositions are valid a priori", this comes from the fact that man exists within the same lines of force as the other beings, and that he can disassociate himself from everything that does not belong to the scheme of space, etc.