Forum Drei address

Dear Friends,

It is a great pleasure to be with you today at Forum 3.

I would like to use the time we have together to examine recent developments in physics. Let us begin with the simple question: what is light? If I were to ask each of you to give a reponse, the answers might be:

It is some kind of disturbance in space that travels very fast.

Another might respond: it is an electromagnetic wave.

A third might say: it is a stream of tiny particles called photons.

My guess is that I would also receive from this audience another set of responses. Light is:

An attribute of God.
The Christ.
The body of angels.
Truth, wisdom, life, love...

One can ask this same question of different historical periods and peoples. The earliest response concerning the nature of light that I found is recorded in the Turin papyrus from 1,300 B.C. The Egyptian god Ra is speaking. His words are:

Ich bin der, der seine Augen öffnet, und es wird Licht; wenn sich seine Augen schliessen, senkt sich Dunkelheit herab.

In our imaginations we can stand with the ancient Egyptians in daylight. When we do so we experience with them not only the bright warm rays of the sun. No, these recede into the background, and rather do we feel ourselves to be in the sight of Ra, our highest god. When his eyes open it is day, when they close, it is night. To stand in daylight is to stand in the sight of Ra. Light is God seeing.

Many ancient cultures share this picture of the day as illuminated by the sight of their god: the Persians, Greeks and Egyptians each have myths of this sort.

We, the children of a modern scientific age, tend to think of ourselves bombarded by waves or particles of light emitted by the Sun. By contrast, the Egyptians would have felt, in an entirely naive and natural way, that they stood in the very sight

of their god from sunrise until sunset. Can you imagine yourself as they in the sight of a high god? How does it feel? Compare this to the feeling of standing in a stream of photons.

Which one is true?

In the opening pages of his book Die Rätsel der Philosophie, Rudolf Steiner draws our attention to a thought of Fichte's: "that the philosophy a man chooses depends on the kind of man he is. Animated by this thought, one can examine the attempts that have been made in the course of history to find solutions for the riddles of philosophy. In these attempts one will find the nature of the human being revealed." Thus, by examining our many attempts to solve, for example, the riddle of light--what is its true nature?--we discover a great deal about the development of the human soul from ancient times until our own.

In my book Die gemeinsame Geschichte von Licht und Bewusstsein I try to do just this, to follow human thought concerning the nature of light as a means of tracing the development of the soul, the evolution of human consciousness.

If we follow this beautiful story--which is our story--we find that the deeply spiritual experience of light had by ancient cultures gradually recedes, or becomes codified. In classical Greece the emphasis shifts form the sight of God to the sight of man. Vision is due to a fire in the eye. Empedocles and Plato say it streams out into the world, sunlike, touching the objects of the sense world and so granting us sight. What was once experienced as a cosmic activity is now experienced in its reflected human form. We are reminded of the verse from Goethe's introduction to Zur Farbehlehre:

Wäre nicht das Auge sonnenhaft,
Wie könnten wir das Licht erblicken?
Lebt nicht in uns des Gottes eigne Kraft,
Wie könnt uns Göttliches entzücken?

If we had time we could follow these views from Greece to Rome, the Arab world into Europe during the late Middle Ages, through the scientific revolution and into the modern period. If we did so we would find that with each passing century the experience of light as a moral and spiritual reality became weaker and weaker, and in its place was raised an abstract and increasingly mechanical picture of light. Our view of it as wave or particle is a remnant from the heights of that materialistic and mechanical period of scientific imagination that lasted from Galileo in the early 17th century until the French Revolution at the end of the 18th century. Although the momentum of materialism persists all the way down into our own age, the seeds of its failure already can be seen in the 19th century with the investigation of the new and quite mysterious forces of

electricity and magnetism. And with the dawn of the 20th century we witness a revolution in scientific thinking.

In our remaining time, it is to these more recent developments that I would like to turn. We can recall once again Rudolf Steiner's statement that we can learn much concerning the soul of man in a particular age by looking at the way he seeks to solve the riddles of existence in that age. We can see the most recent developments in science and technology as symptoms of our age, and see through them to new stages of the soul's development. We can also see clearly where pathologies arise in place of healthy developments. They appear like counterfeits of proper achievements.

As the focus for our considerations, instead of light I will consider recent developments in the theory of mind. I will use advances in science that are very recent, namely progress toward are called "quantum computers." At the outset, let me say that I feel that quantum computers offer a counterfeit of what Rudolf Steiner described as "living thinking," a thinking that can be independent of the brain and physical body. But let us approach this conclusion stepwise, by examining the recent furor over quantum mechanics, computers and new theories of the mind.

As with light, our images of the mind itself have shifted over time in keeping with an evolution of soul. Already in antiquity, legends recorded the existence of "brazen heads," intricate mechanisms of bronze that were capable of answering questions. Intelligence itself was imagined as externalized or projected out of the human being and into substance through the craft of the inventor. These legendary devices took on a practical form and were given a clear theoretical foundation only in this century.

Within this view, thinking was represented as a clearly defined sequence of actions. It was felt that our state of mind could be represented by the state of a machine. The simplest possible arrangement of this kind is a string of ones and zeros called bits. The actions of the mind then become actions on the ones and zeros stored in the machine. The content and actions of the mind find, in this way, a representation as the contents and actions of a machine.

Around 1935, the English mathematician Alan Turing formalized this procedure. In the intervening 60 years, it has been implemented in electronic, digital coputers which have become such an important part of modern life. For our purposes, the important point is that an aspect of the human activity of thinking has found external representation. Whether in the form of a mechanical "brazen head" or a modern electronic computer, arrangements of matter or electricity are changed in an orderly way to produce new outcomes. Moreover, at every instant the

state of the machine is unambiguous and we can understand exactly what is happening inside it during its operation.

Proponents of artificial intelligence say that having accomplished this, we have accomplished everything. Human thinking is nothing more than the operation of a Turing machine (or its equivalent) in the nervous system. There may be many parallel devices running semi-independently, but these are details.

Critics of artificial intelligence maintain that while certain aspects of thinking can be represented by the logical operations of a computer, the essential aspect of human thought is missing. This essential aspect of thinking is difficult to articulate, but it has certain features. It is not sequential or logical in the usual sense; it is characterized by unclarity, or perhaps better, a multicentered clarity that is more "organic" in character. We may puzzle on a problem for a long time in this way without success and then suddenly experience a flash of insight. In a moment we have the answer, or at least a guess worth checking. We feel that our creativity or powers of imagination work this way: synthetically, grasping wholes instead of analytically by arranging parts. If asked to analyze this kind of thinking, we might well respond--impossible. One would destry the very object of investigation (imaginative thinking) by approaching it with the tools of conventional analysis.

If we possess the language of Anthroposophy, we might admit that brain- or body-bound thinking can be simulated in electronic brains, but as a spirit being the source of that activity would never be captured. And, in addition, the spirit is not constrained to act in physical bodies alone. Given a suitable spiritual organization it can become active in that spirItual body, free of the brain. We might even say that truly living or imaginative thinking is precisely of this nature. It rises above and out of the physical organism of man to a purely spiritual aspect of our nature characterized by life, light, and an organic holism. This is what we mean in Anthroposophy by moving from conventional consciousness to imaginative consciousness; we move the spiritual activity of thinking from the physical to the etheric body. In doing so, the character of thinking changes entirely: it becomes truly alive.

Rudolf Steiner spoke time and again of our age as one in which the veil between the physical and the etheric, between conventional sense consciousness and imaginative consciousness, is growing thinner and thinner. More and more individuals are experiencing the reality of a life in the living, weaving light-filled region of the etheric. But within the scientific community especially, the language and concepts required for its conscious exploration are missing. If one has an inner experience but lacks the concepts for it, then one either denies

the experience altogether or makes use of concepts that are already available.

Certainly denial has gone on for years, but increasingly individuals are seeking out ways of incorporating all aspects of human consciousness into their scientific worldview.

With recent developments of quantum computers and associated theories of the mind, I believe we are witnessing an attempt to capture "living thinking" or imaginative cognition in an external device. By examining this work a little more closely, we will see just how far developments are likely to succeed and in what ways these efforts will fail--at least from the standpoint of Anthroposophy.

Like the conventional digital computer, the quantum computer makes use of the two logic states--one and zero--but it does so in an entirely novel way. The state of a classical computer is given by the configuration of ones and zeros in its memory, for example: 0110011101... Each "bit" can be either one or zero. By contrast, a bit in a quantum computer can be both one and zero at the same time. Such states are completely characteristic of quantum mechanics and are called superposition states [Überlagerungszustände]. These states are well known from experiments with single electrons in tiny circuits that behave quantum mechanically. Classical switches are either open or closed, off or on, zero or one. Quantum switches can be both, and both in a completely precise way. Viewed from a classical perspective, the state is ambiguous; from a quantum perspective, it is precisely defined.

In addition to each bit being in a quantum superposition state of its own, it is possible to "entangle" the state of each bit with all the others. Consider two bits. The simplest entanglement is for states 10 and 01 to both exist simultaneously. These two ideas--superposition and entanglement--form the heart of quantum mechanics.

Only recently has it been shown that computers that run on these states will have unprecedented power, far in excess of anything presently available. In fact, it appears that problems far beyond the practical reach of even the largest conceivable classical computers should be extremely easy on a quantum computer.

Not only are quantum computers predicted to run unbelievably fast, but they operate according to non-classical laws. This means that if we try to follow their operation by using the kind of thinking familiar to us from working with "brazen heads" or normal electronics, we will fail completely. Normal mechanistic thinking fails us. We thus find ourselves in a situation predicted already in 1958 by Hannah Arendt in her book The Human

Condition, namely, we will have the "know-how" to make devices that we cannot think or understand.

In addition, quantum computers must operate in a world of their own, disconnected from all disturbances and even all observations. If we were to peek in, hoping thereby to discover the quantum computer's internal state, the delicate entanglement of superposed states would instantly collapse into a conventional state with none of the magic of quantum mechanics. A final feature of quantum computation is that the outcome or result is not a definite answer but, in a sense, a set of suggestions which, while likely to yield solutions, must be checked the way we would check an insight or intuition. All this has led certain neuroscientists and philosophers to suggest that the brain itself may be able to support such entangled, quantum superposition states. From a physics standpoint, this is very hard to believe. Normally, such states occur at near absolute zero temperatures or in very isolated systems.

Putting practical matters aside for the moment, however, we see a fascinating attempt to grasp a new concept, to imagine a kind of thinking free of the mechanistic order imposed on it by matter. But instead of rising to living thinking as an inner personal accomplishment, we come to rely on the abstract mathematical formalism of quantum mechanics mastered by experts who then create for us a surrogate. The quantum computer will do our thinking for us, not only the common sort of thinking associated with banking and communication, but even far more subtle kinds of thinking that require a holistic and intuitive approach. It will be only a counterfeit, but one that many will take for the real thing.

In addition to our world of the senses, Rudolf Steiner spoke of both supersensible and subsensible worlds. That realm of the supersensible nearest to us is the etheric, and is increasingly known to us in subtle and sometimes disturbing ways. The subsensible is a kind of mirror image of the supersensible, but instead of being ruled over by high gods, fallen spirits have dominion there. They offer us counterfeits of the supersensible. As the soul evolves from age to age, new potentials arise in us. As I see it, quantum computation offers us an external means of realizing what is or should be an inner soul development, one that leads to living thinking.

What distinguishes quantum computation from the living thinking? Nothing outward. On the surface, it will be a perfect imitation. What is missing will be the moral dimension. Living thinking is not a formal manipulation of abstract objects or relationships, even quantum mechanical ones. Yes, the geometry of space and time may seem holistic in such theories, but they always lack one thing--an interior. In a sense, quantum computers will be hollow.

What exactly do I mean by this? Let me draw on the words of one of Americ'a great writers of the 19th century, Henry David Thoreau. In his journal for Christmas day 1851, he wrote:

> Von einem Standpunkt fünfunddreissig kilometer entfernt sah ich eine karminrote Wolke am Horizont. Du sagst mir, sie sei eine Masse aus Wasserdampf, die nur das Rot reflekiert, aber das trifft nicht den Kern....Was für eine Art von Wissenschaft ist das, die den Verstand bereichert, aber die Phantasie verarmen lässt. Wenn wir alle Dinge nur auf so mechanische Weise wüssten, würden wir dann irgend etwas wirklich wissen?

Thoreau sensed the loss of the moral in the mechanical explanation. We do not have time, but here is where the path through Goethe to Steiner leads. Goethe suggested a way to enhance both the phenomenon and the observer so that insight occurs in the phenomenon itself without a mechanical replacement. Then can the moral dimension of the experience remain intact.

In technology too, when the creations of our hands rise to the artistic, then also is the moral insinuated into matter in a way that is true to the high purposes of evolution.

Both the perception of the moral in the world, and the bringing of it into the world through appropriate and artistic technological innovation--these both require the transformation of the self. As described by Rudolf Steiner and felt by one open to his own inner experience, the organ for living thinking is not made up of quantum switches at a temperature of absolute zero, but rather the real organ is that of the human heart. I do not mean the physical heart but a living, luminous heart whose form is now only barely apparent, but whose "manufacture" rests in our hands. We can form it from out of the substance of our own etheric bodies and send its rays, like the fire in the Greek eye or the sight of Ra, into our dark world.

Having accomplished this, we will feel ourselves alive within a world that is mobile and whole, where we truly weave one into the other, a world of transformation, dissolution and potent living realities. As we near it, we will be afraid. Our fear will urge us to accept the idols and counterfeits of the subsensible. But if we have the courage, and the capacity for moral discernment, then we will not be tempted.

In fact, we may then be able to perform the great act of spiritual irony, we may well find that not only the sting goes out of the beast, but that we may turn the idol on itself. If we can see technology for what it is, and recognize it as a reflection of our own future, then we hold the key for the redemption of any evil it can bring. It is therefore important that parallel with the development of new technologies, such as

quantum computers, that the genuine spiritual accomplishments (of which they are a pale and hollow reflection) are attained. As Rudolf Steiner wrote in his last leading thoughts:

> It is necessary for man, in living inner experience, to come to a spirit-knowledge in which he rises above, into super-nature, as he goes down below nature with his sub-natural, technical occupations. He thereby creates within him the power, not to "go under."

As our entire civilization becomes occupied with technology, whether in industry, home or in recreation, we can remember these words, which enjoin us to walk a path to the supersensible, "in living inner experience." Then will we know Imaginative consciousness firsthand, and feel the moral reality of the sunset in the carmine red of the clouds. Then too will we bring our own light into the darkness, for ultimately the light that rays through the etheric is the Logos that makes all things whole. And it streams from the transfigured human heart.

Arthur Zajonc
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