



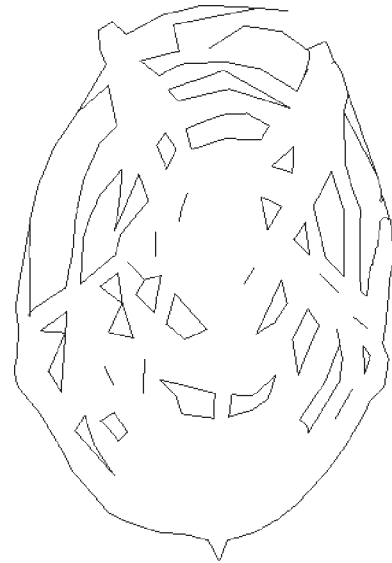
**diamond**

Suzanne van Rest  
[Light]



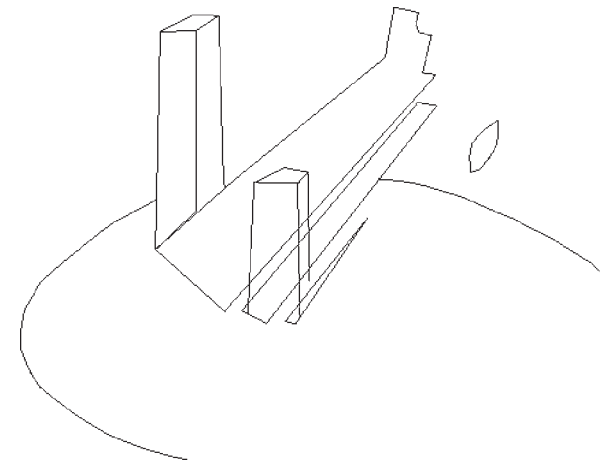
squared sun

Suzanne van Rest  
Grzegorz Dmochowski



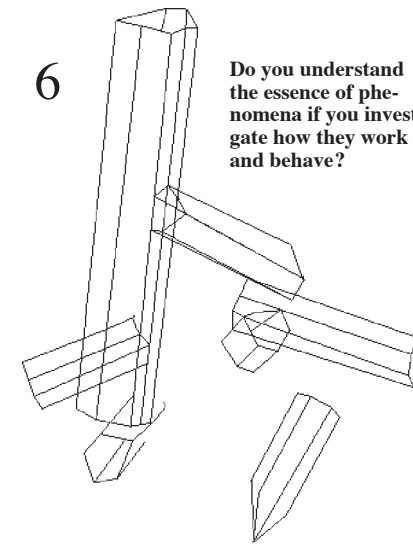
**1** Are we still at the beginning of 'understanding' light or are we getting the grasp of it?

There is still a debate about what the world is really like – is quantum mechanics simply incomplete or are there really 'choices' to be made concerning the particles and wave theories in the world?



**2** [KNOWLEDGE TRANSFER]

Science provides a subjective insight into a limited range of phenomena. Science can only speak about and provide insight into things that are observable.



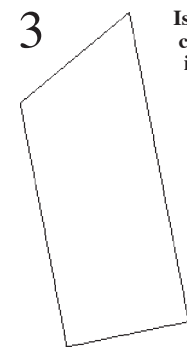
**6** Do you understand the essence of phenomena if you investigate how they work and behave?

Science does not concern itself with the 'essence' or the objective reality of anything.

Some scientist say that there is nothing more to light beyond what we observe and to seek for something more 'absolute' is futile and grossly misunderstands what knowledge is.

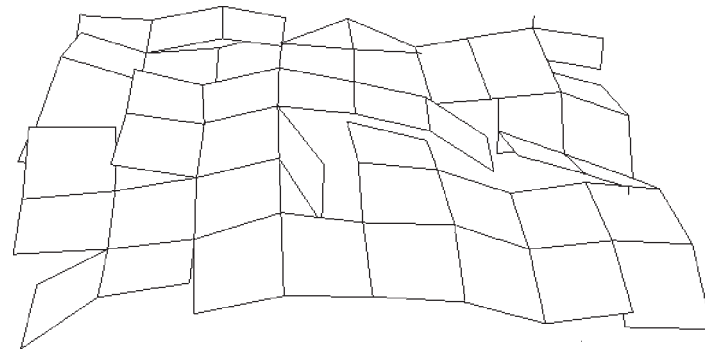
**7** I sometimes think that this idea of 'essence' is a vague, poorly defined and artificial invention of humans. Yet, at other times

it seems so intuitively obvious that things indeed exist *as something*, and inherently have an identity and essence.



**3** Is science looking for a certain 'truth' or is it more interested in the process?

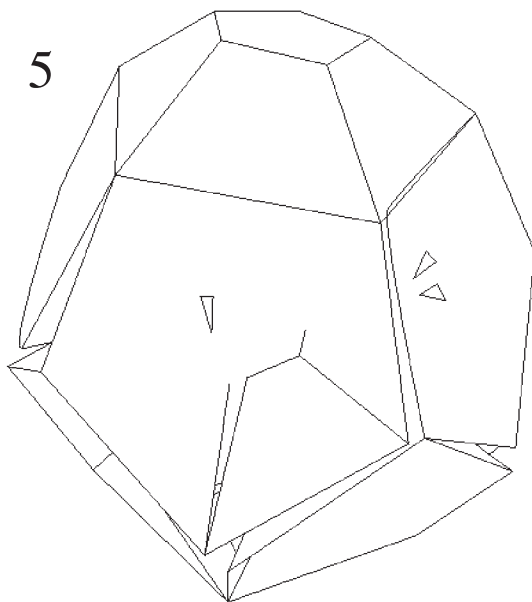
It does not seek the truth. It only seeks a representation of the observable world, which may or may not correspond to reality, whatever that may be.



**4** How is it possible that there are two ways of dealing with light, two ways of dealing with reality?

[Models of science are in their abstraction pure mental works, but at the same time they reflect back at us. They point to important things in our lives, our connection with the unknown.]

In the end, scientists had to deal with the fact that light is neither a particle nor a wave. Whatever it *is*, it behaves as both.

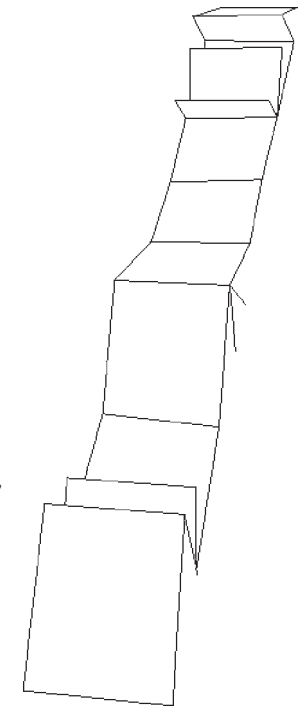


We only know that the model has not been disproven.

**8** How can our body relate to the speed of light?

**9** What do you think about the certain deviation science agreed upon?

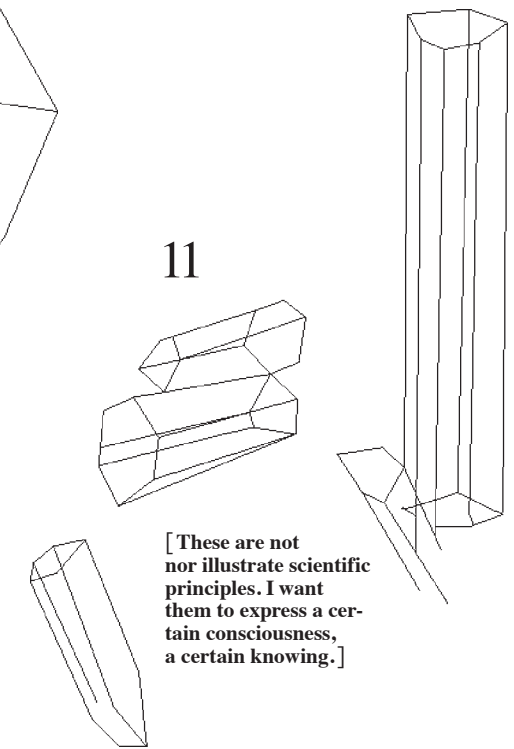
Quantum mechanics, introduced in the beginning of the 20th century, brought with it a new way of looking at the world. It showed that the world may not be the deterministic 'machine' that classical physics described. Rather, there appears to be some uncertainty and unpredictability involved in our observations of the world.



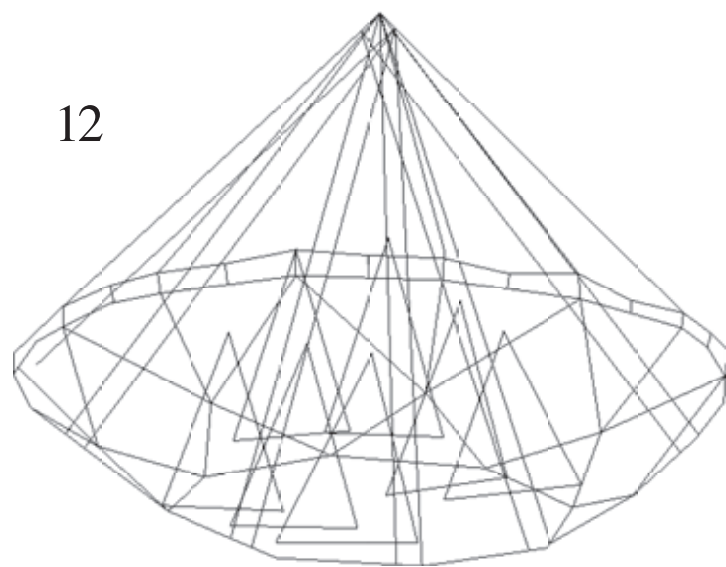
**10** Is it possible, like the string theory tries to combine the relativity theory with the quantum mechanic, that the two ways of dealing with light will be combined?

**11**

[These are not nor illustrate scientific principles. I want them to express a certain consciousness, a certain knowing.]



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**In which way are you involved with light?**

I participate in the scientific study of light. In my work, I make use of light from a laser to study various properties of diamonds and crystals. When a laser light hits the diamond, the diamond emits light of its own. That is, the laser provides an intense stream of light, which carries energy. When this light strikes the diamond, the

diamond will absorb the light and therefore, absorb the energy that this light carries. Once the diamond has absorbed this energy, it can use the energy to create light of its own. That is, the energy that the diamond absorbs from the laser can be released from the diamond in the form of other light. This other light contains information about the diamond itself, which is what we are seeking. Therefore, in order to study the diamond, we study the light that the diamond gives off. This is a

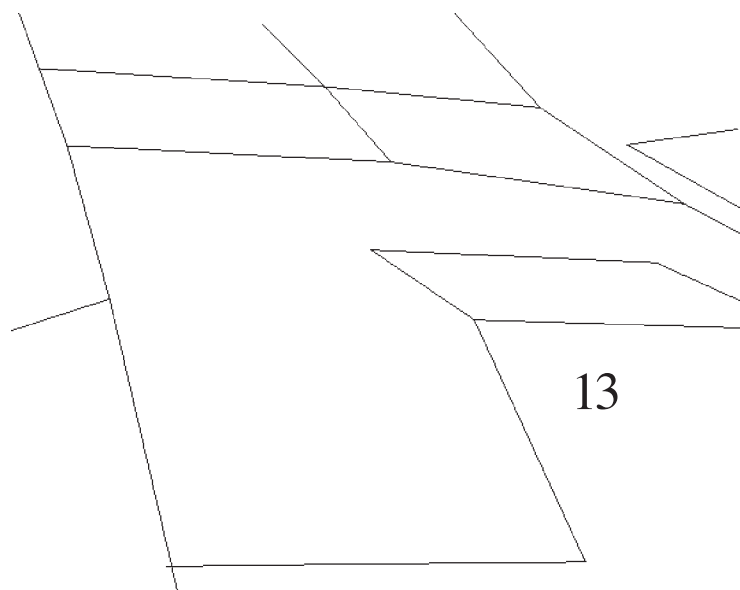
common situation in science, where the scientist will observe one phenomenon directly, which provides information about another, indirect phenomenon. Light consists of particles, which we call photons. Ordinary light from a light bulb is capable of emitting several photons at once, whereas this nitrogen-vacancy defect can only emit one photon of light at a time. Of particular interest to us are diamonds which contain a certain defect in their crystal structure. All crystals are made up of atoms that are arranged in a regularly repeating pattern. In the case of diamonds it is carbon atoms that

appear at regularly spaced intervals. However, there are defects present in every crystal, which interrupt this ordered arrangement. These defects can be of two varieties. They can be either a different type of atom, which replaces a carbon, or they can be simply a missing carbon atom, which leaves behind an empty space. Defects occur naturally and are unavoidable. In diamonds, these defects are tiny but they still account for the different colors of the diamond.

In my case, I am interested in diamonds that have both types of defects, one right beside the other. That is, I study nitrogen-vacancy defects, which consist of a nitrogen atom sitting next to an empty spot. This defect is interesting for many reasons, one of which is its ability to emit one photon of light at a time. As mentioned above, it was discovered that many applications, which require us to transform information that is stored in electrons (like a regular computer) to information that is

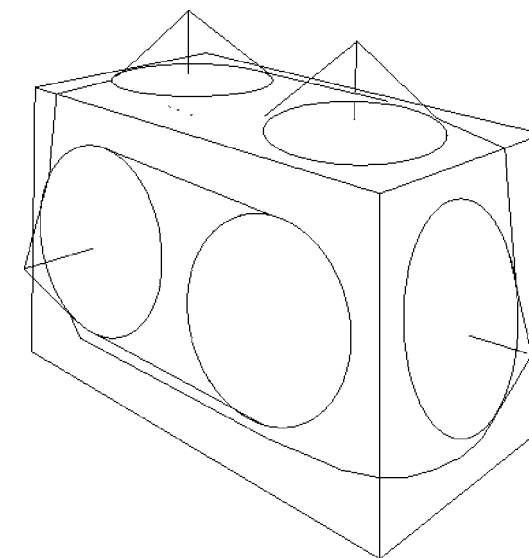
encoded in light. Now, this nitrogen-vacancy defect can exist in two different states. One state emits many photons, one right after the other, whereas the other state does not emit very much light. The defect center can switch between these two states readily. However, we can determine in which state the defect is by simply shining a laser at the diamond. If a lot of light comes out, then we know that the defect is in the first state. If not a lot of light comes out, then we know that it is in the second state. Knowing in which state the defect is, can be used to do more complicated work involving electrons and magnets. For example, we may store information in the defect center and then use the photon that this defect center emits to transfer this information to another location. This process is a crucial step in all information-processing, which occurs in computers.

The understanding of light that I have gained through a scientific study of it has changed the way that I view the world.



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**Do you ever question the structures and models of science, in the end they are all created by humans?**

The (honest) scientist is seeking an ever-increasingly accurate model of what he observes. This model is under constant scrutiny and possible revision, which accounts for the 'ever-increasingly'. The act of 'observation', which is so crucial to science, describes an active process whereby the scientist performs experiments and determines whether the prediction of the model is indeed observed. If the experiment verifies the prediction, then

the model gains some weight. However, if the prediction is not observed, then either the experiment was poorly conducted, or the model is inaccurate. The scientist must then go back and consider the experimental method and the model to see which one to improve. This process repeats until a model has been devised, which accurately explains a variety of phenomena. In the end, the scientist achieves a model of what we observe.

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**In which way is science a creative process?**

There is a step involving creativity, whereby the scientist thinks up different models that fit whatever empirical data they may have.



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Yet *what* light is, we still don't know.

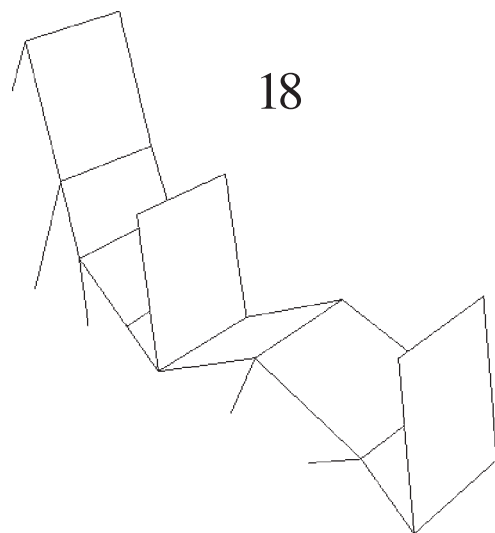


**Where does the light go to, does it travel eternally?**

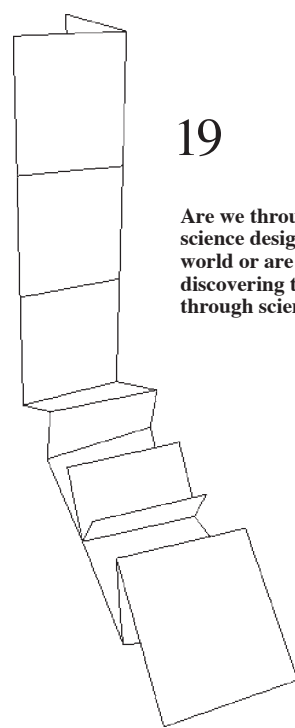
There is even more subtleties involved when considering where light will go if there are several possible routes. Modern quantum theory says that there is no clear answer but only probabilities of where the light will go.

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Are we through science designing the world or are we discovering the world through science?

I believe in a world that exists with or without the presence of humans. That is, I believe in some objective reality that would exist even if humans did not exist to view it subjectively. However, through science we are only discovering models of this objective reality. Moreover, since these models are, to a certain extent, creative creations of ours we are indeed designing our view of the world but we are making sure that it is consistent with the objective world.

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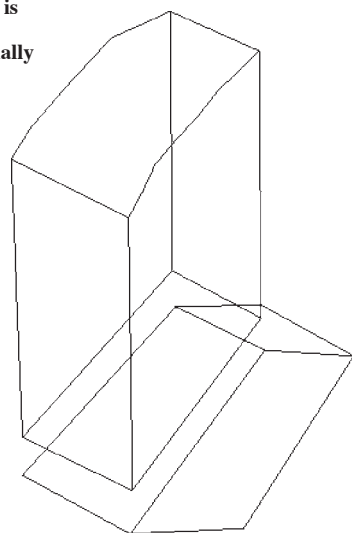
[Knowledge determines what we see and how much we see.]

The blue color of the sky arises because light from the sun, which contains all the different colors, passes through the gases in the atmosphere on its way down to earth. These gases

then scatter (re-direct) blue light in all directions much more than any other color. For this reason, the sky appears blue.

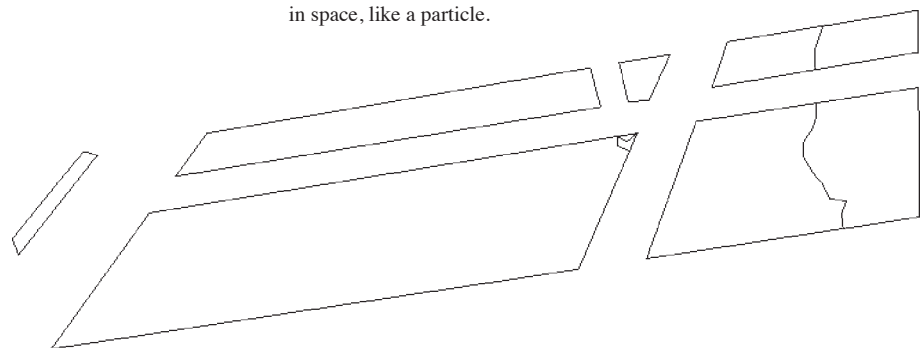
21

[My interest lies in perception – how we see and how we perceive. Light is therefore fundamental and essentially important.]



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In the case of light, the model is that of a photon which has both a wavelength like all waves but also some localization in space, like a particle.



oblong sun

#### Biographies

Grzegorz Dmochowski is born in Gdansk, Poland. He moved to Canada at the age of five, where he did most of his schooling. He graduated from Carleton University in Ottawa for a Bachelor in Engineering Physics. After graduating he moved to Leuven (Belgium), to follow the Erasmus Mundus Nano-science Master Pro-

gram. He is currently writing his thesis in Delft, the Netherlands. In Delft he is involved in a scientific study about the properties of diamonds and crystals. Dmochowski and his colleagues study this through emitting a laser through a diamond or crystal and observe the light that comes out of the diamond or crystal.

Suzanne van Rest is born in Nijmegen, the Netherlands. At the age of eight she moved to Deurne, in the south of the Netherlands. Van Rest graduated in 2007 in the department Fine Arts at AKV St. Joost 's-Hertogenbosch. This publication is a part of the graduating programme of the Dutch Art Institute, Master programme in Research and Practice. For the last year *light* has played an important role in her artwork. Her interest lies in perception – how we see and how we perceive – most importantly on an individual and subjective level.

#### The Publications Project

This booklet is part of a growing collection of artists publications issued by the Dutch Art Institute (DAI), produced in collaboration with the Werkplaats Typografie and edited by artist/curator Delphine Bedel.

The 2009 edition consists of 15 publications by different artists, varying from printed matter, book and artist edition to performance artefact. For each project, the artist teamed up with a graphic designer from Werkplaats Typografie, and invited a guest author to contribute. Over the period of one year, various aspects of publishing – concept, editing and design, production and distribution – were addressed, while the artists were

invited to see the publication as process, as a way of generating work or conversation, rather than just representing it.

The DAI is an MFA program that provides emerging artists with an international platform for exchange, collaboration and dialogue with peers as well as with established practitioners and theoreticians.

Gabriëlle Schleijsen,  
Course director  
DAI / Master Programme ArtEZ, Institute of the Arts

#### Colophon

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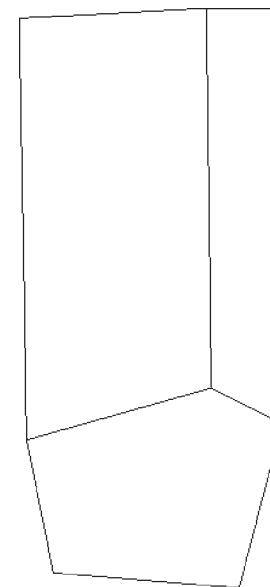
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## 23 Can light inhabit and transfer information?



## 24

[ The sun holds  
very large  
existential questions;  
what is time? ]

Suzanne van Rest  
[ Light ]  
\*\*\*\*\*  
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**(fehlt noch!)**