Science Group of the Anthroposophical Society in Great Britain
Newsletter – September 2005

Contents

Correspondence

I have read the original the lecture that Derek Forman gave at the Science Group's conference in October 2004 at Wynstones. It seems to me to raise some extremely important points and contains the wide sweep of philosophy and science which is so hard to retain in today's world of minute specialisms and intricate detail.

There are two points I would like to pursue, although there are many other important ones.

As Derek sort of points out, in science of the sense-perceptible world we are dealing with a kind of constantly metamorphosing flux of phenomena, all of which are indeed relative to the observer. After all, the sense percepts that I have at 5.30 am on Monday March 14th 2005 are unique to me and will never reoccur. Even if a sprite were sitting on my left shoulder, its percepts would not be the same as mine precisely but relative to its senses. Ditto for the cat on the hearth. By 5.31 the percepts of 5.30 have irrevocably gone; and along with them my percept of myself of 5.30, replaced by my 5.31 percept of myself. Yet we are all sure that there is something as it were 'permanent' within this flux of metamorphosing percepts (to quote Rudolf Steiner in his introductions to Goethe's scientific writings). In fact this is to refer to Cratylus who said 'you can never step into the same stream once' !!! The 'permanent' element is in fact an 'idea', or to translate from Greek 'a vision' or a 'seeing'. What one 'sees' is the 'idea', or to quote Bohm, the 'theory' or 'insight'. One such 'insight' in this case is: that within something like my gas fire, methane is being burnt and releasing a certain number of kilojoules of energy. The relationship of methane to water, carbon dioxide and heat remains 'permanent' and yet the methane of 5.30 is different form that of 5.31. One has to distinguish the idea or 'vision' methane from 'this particular bit of methane'. (These are called secondary and primary substances by Aristotle).

However, it then appears that something only experienced as a vision or insight, (as Bohm calls it in *Wholeness and the Implicate order*), is operating somehow within the sense-perceptible phenomena. It appears that every bit of methane very obediently follows the law laid down for it to combine with oxygen and produce gases and heat as prescribed. But how can this be? *How* can the 5.30 methane 'know' that when met by a flame and oxygen it must burn and become carbon dioxide, water and heat? Ditto the 5.31 methane? Of course, this is a foolish question. But the answer is difficult of access and requires the whole 'change of question' that Bohm alludes to. This is why he makes a lot of the fact that 'wholeness' or the 'formal cause' operates in the world of the senses as a *real* factor. In fact Bohm is far more realist that nominalist. His concept 'wholeness' really means nothing less than that (for example in the case of cells): the cells, in every detail are acting in order to preserve or maintain 'wholeness' or 'integrity' and that the 'wholeness' is more or less observable in the operations of every part of the cell, unless one wilfully refuses to see it; and that in the mineral world 'wholenesses' are also operating. Therefore, two particles do not need to communicate their effects to each other, but both are 'as it were' driven by the *whole* of which they are fragments. He, Bohm, seems to me, to be very close to Steiner's remark in the first Goethe book about the *life* of the mineral world being the 'wholeness of the entire cosmos', i.e. wholeness operates in the entire mineral world but it is possible for parts of this world to fragment and create a temporary smaller wholeness, apparently cut off from the (cosmic) whole. Machines are obviously examples of this. Every bit of a car serves the whole car, but a car is not a cosmic creation!!! When we, unaware or blinded by our education, fail to see that wholeness is an operative factor in systems (something Sheldrake, for example, pointed out in his work with animal groups – I mean, obviously one worker bee does not 'know' what the rest of the hive are doing, nor receives messages, but (like Bohm's particles) is driven by the force of the whole operating in every part), then we look for the 'wholeness' force with our outward eye (which we should see with our inner eye), and then 'see' a kind of shadow being, a sort of dark phantom; a fundamental permanent substratum 'behind' the physical sense-perceptible world, which is in effect the atom. And as Steiner said clearly at the time of the opening of atomic science, 'the atom is really electricity; it is really *thought*'.

In effect, the 'idea' or 'wholeness', seen with sense-perceptible eyes is nothing. It seems to me this clarifies what Steiner meant by calling electricity 'fallen light'; since 'light' is actually invisible; it is in fact 'idea' or 'wholeness'. Maxwell's discoveries surely confirm this.

I feel Derek Forman is too hard on Bohm. Bohm's idea of 'wholeness operating in every part' is, it seems to me, very Goethean indeed; and it seems to me wrong to lump him with, say, Capra and others who see modern western science as another form of eastern mysticism.

Actually, it is very interesting indeed to listen to Bohm and Sheldrake and DNA-discoverer Maurice Wilkins discussing these ideas of insight with Krishnamurti. One is soon disabused of any notions of a sort of return to a primeval unmeasured flux etc. The whole trend of their conversations is about transformation of consciousness: so that insights into wholeness can be made conscious and clear, and quite definitely not vague or dreamy.

As Steiner's *Philosophy of Freedom* says: 'Thinking shows us ourselves both as this particular being, but also reaches out and shows us in our connectedness to everything else'. It separates us and defines us and then re-unites us to the whole. (I think I remember Ron Jarman saying that that was the meaning of 'algebra'. 'The separation and the re-union'. I may be wrong).

Bohm and Krishnamurti wanted this to extend to all our moral life also.

'You are the world and the world is you', said Krishnamurti.

Stephen Moore-Bridger

The Phenomenon of Coloured Shadows

The indication regarding the nature of coloured shadows given by Rudolf Steiner in the *Light-Course* lectures has fascinated me for years now and soon after first reading it I was moved to experimental action. There was an initial discovery stage in early 1997 – learning how to produce the phenomenon in as pure a way as possible, along with becoming acquainted with various research techniques and the many confusing problems associated with the results obtained. In 1999 I returned to the coloured shadows research with a view for it to become the central theme of my doctoral thesis. I had already seen how this phenomenon raises wonder, philosophy and debate – friends in my rented house, art students, university lecturers, members of anthroposophical groups and technicians who work with colour had all been stimulated by encountering the coloured shadows or even photos of the phenomenon. Many more months of experimentation followed – one experiment would point towards an uncertain area or a new question or a new possibility and the idea for the next experiment would arrive. The doctoral research involved at least one year in total of doing experiments every day and at quite a pace – no need to apply for grants, equipment etc. and all the accompanying delays – a year of doing experiments every day and wrestling with the results obtained/myself. The writing of the thesis was somewhat unusual in character – it involved me sitting with a pen and paper, but also involved running upstairs to carry out an experiment to check the words put to paper or to test the comments of other researchers in various published texts. Here is a word of advice to anyone wishing to write about colour phenomena – do the experiments again and again! Remembering specific knowledge of colour phenomena seems to be particularly difficult – I have personally experienced this and seen it revealed many times with others. Hence the need to re-acquaint ourselves regularly with colour phenomena. The science of colour is more like an ability requiring regular practice than an activity of erecting permanent structures.

The adventure with the coloured shadows didn't end with writing a thesis – a whole drama ensued with the examining of the research in the university system. This resulted in experimental research regarding the nature of coloured shadows being examined twice in a *viva voce* situation – once as a study in cultural life in general and once as experimental science, with a year of debate in between. I choose not to recount the details of the debate any further here – the drama was enacted within its appropriate sphere – in the university system.

All of the above activity was stimulated by Goethe's *Theory of Colour* and Steiner's indication about coloured shadows in the *Light-Course* lectures (which can be seen as a renewal of Goethe's *Theory of Colour*). And so to summarise my work in this area from 1997 to 2000: One to two years of doing experiments, thinking about the phenomenon, studying the work of previous researchers, writing about the phenomenon, learning about the technology of colour reproduction (and its relationships to Goethe's *Theory of Colour*), showing the experiments to many people and stimulating much debate, teaching an introduction to Goethe's theory in the university system (probably for the first time in a long time in a UK university), presenting research to other anthroposophists, meeting with the late Hans-Georg Hetzel in Switzerland (who had been working in the same field for many years), learning about Edwin Land's colour researches and experiencing a real drama about research within a university.

To become more specific, it can be asked what role did Steiner's indication play in producing the above events. Could the same cultural activity have been stimulated by exploring Goethe's *Theory of Colour* alone? The answer is, I think, no. The part of Goethe's theory entitled 'Physiological Colours' is now accepted and integrated into the modern science of colour. Recent textbooks often refer to Goethe's coloured shadows researches and his explanation of the phenomenon, but without fully entertaining the whole of the theory. Goethe's researches and classifications of 'subjective' phenomena have been cherrypicked by many modern colour science researchers, whilst Goethe's discussions of 'objective' phenomena have been largely ignored. More important still is the theme which runs through the whole of Goethe's theory – the interrelationships between 'subjective' and 'objective' phenomena. This theme has also been largely ignored or unrecognised.[1]

I realise now that entertaining the possibility that unexpectedly coloured shadows may have a physical reality is a good way to stimulate a reappraisal of Goethe's theory as well as raise many wider issues about the 'subjective' and 'objective'. When laypeople first encounter the coloured shadows, they quickly find the difficult relevant questions about themselves and their relationship to the outer events – creative debate often follows if the debate is not closed down with a simplistic 'fact' statement that the unexpected colour is totally 'subjective'. The coloured shadows help us to think about the relationships of our inner life to the outer world. Steiner's indication re-opened a debate regarding the nature of coloured shadows which had been prematurely closed in the 19th century. I have seen that by seriously entertaining Steiner's indication a great deal of cultural activity has been stimulated. This includes Goethe's *Theory of Colour* being re-presented to many people.

The following section is a direct reply to Ron Jarman's letter in the March 2005 issue of this newsletter.

In para. 1 of Jarman's letter, he refers to the lecture with experiments which I presented in Cornwall in 2000. The lecture began with an historical survey of researches on the nature of coloured shadows, including various versions of viewing tube experiments which produce contradictory results. Jarman's comments do not make it clear that this was part of the presentation.

In the latter part of Para. 1, Jarman refers to coloured shadows experiments he had previously seen utilising light sources such as candles or low wattage electric light bulbs. He then makes the following statements:

> Malin's light sources were very strong in comparison, so that the green shadow … was very bright and clear. It may be that such a brilliant and technologically produced light source is the cause of the errors which Malin may have made.

Four points need to be made here:

1. Two modern slide projectors were utilised for the experiments at that lecture. They are bright and well suited to producing large coloured shadows for showing the phenomenon to groups of people. More recently, I have utilised two old style 500 watt projectors because the lamps employed have better light qualities. I don't apologise for carefully finding ways to present a phenomenon in a pure form.
2. The early researches in this field often utilised candles as light sources. The contradictory results with viewing tubes can be witnessed with very simple coloured shadows experiments involving a candle and daylight as light sources. To facilitate any readers who wish to re-enact these experiments, I published step by step instructions in the September 2003 issue of this newsletter. Jarman does not mention this in his letter.
3. In the experiment Jarman refers to, the unexpectedly coloured shadow was turquoise blue, not green.

4. Jarman does not explicitly state the errors which he suspects (?) when he writes: "It may be that such a brilliant and technologically produced light source is the cause of the errors which Malin may have made." This vagueness denies me the possibility of directly addressing any such implied 'error' and risks implanting doubt in the reader regarding my researches.

In para. 2 of Jarman's letter, he refers to a presentation he made regarding the coloured shadows at a Science Section meeting. He selectively quotes specific comments published in the notes of the 1964 German edition of the *Light-Course* lectures to back his argument that unexpectedly coloured shadows are purely 'subjective' in nature and to back his assertion that Steiner was mistaken in his original indication given during the seventh lecture. In the September 2003 newsletter, I reminded readers that there are currently *four* published editions of the lectures in German, all with notes which relate to this indication. The notes present various recollections from various people which, when seen as a whole, present a picture of debate with opposing viewpoints. The notes do not present a final definitive answer. In Jarman's March 2005 letter, he has quoted comments which suit his own personal view; he also declines to mention the recent researches which were carried out by the late Hans-Georg Hetzel, also described in recent editions. I recommend any interested reader to obtain the notes from all four editions for open-minded consideration (these I am glad to supply on request). Better still than the 'he said, she said' stuff, why not do some actual experiments! This debate has often focused on fragmentary comments quoted out of context, utilised to argue for a specific position. This practice undermines the researches of all the individuals cited. The call is for new research, not to blind faith in acts of artistic selection. I think that other members of the Science Section may support a different view than the one agreed upon at the meeting in Stroud. Will any Science Section members step forward?

In the second part of para. 2 in Jarman's letter, he describes an experiment at the Science Section meeting and observations by Stuart Brown. From the very brief description, it appears to be a synthesis of Count Rumford's and Gustav Fechner's viewing tube experiments,[2] replacing the viewing tube with a concentrated gaze upon one grey shadow. Two points may be of interest here:

1. By willing ourselves to concentrate on seeing only one small area, we avoid seeing the whole picture, if that comment isn't too obvious! Sacrificing the big picture to study only a small part is a re-capitulation of the birth of modern science. However, previous workers have done this well and we are called to see the whole again anew.
2. The reality of the gaze and the power of the gaze has been a recurring theme in the study of vision for many centuries. Many people have the experience of perceiving that someone is staring at them from behind.[3] This common experience points to soul-spiritual realities.[4] I think that Jarman and Brown have proved that their willing and wishing for a certain result can be facilitated by a specific way of looking. This does not prove anything about the nature of coloured shadows, it only proves the power of the gaze. While lecturing to many groups of people and showing them the phenomenon of coloured shadows, I have recognised that the colours can be augmented or diminished by the individuals present, usually unconsciously. If one person has a strongly held view that the unexpected colour is purely an 'illusion' or is purely 'subjective', they can reduce the strength of colour for all present – an individual can will the colour away. Conversely, if, for instance, an artist with a strong inner experience of colour is present, the unexpected colour may be strengthened for all present. (I think this is usually without reference to the 'subjective' – 'objective' questions, it is to do with experiencing colour in an inwardly rich way.) In the above polarity resides questions relating to the activities of our etheric and astral bodies in relation to this phenomenon and its study. Much more research is required in this area. Here are some hypothetical indignant exclamations which may give clues:

   A strong artistic experience of colour producing new physical colour in the outer world – surely that's not science!

   A strong preference for a certain idea expressed in willing a colour away – surely that's not science!

   Perhaps the coloured shadows are prompting us to think carefully about what natural science is and of how it may evolve.

With regard to para. 3, Jarman refers to a question which I raised in the September 2004 newsletter. The question relates to a novel research technique which Jarman described for studying the coloured shadows.[5] This involves viewing the whole image with one eye while the other eye is given an isolated view of one shadow through a tube. This practice is out of line with the whole previous history of using viewing tubes because the idea of the viewing tube is to isolate an area from its surroundings so that any contrast effects are removed. The general technique is to close one eye and use the other eye to look through the tube at one small region of the image. The question simply stated is this: why view the whole image with one eye but restrict the view of the other eye?

In this scenario, the initial reason for utilising a viewing tube seems to be contradicted in the research technique itself. Jarman's reply to this question of why he utilised such a technique is as follows: "The simple answer is that Steiner was called upon to use it and that Malin himself had used it." This is an answer relating to the use of viewing tubes in general. Jarman has not yet answered the question regarding his novel technique.

With regard to para. 4, Jarman mentions previous comments I made of how the viewing tube "tends to lighten and desaturate the colour of any region when we look through it."[6] Jarman agrees that the region is lightened when we look through the tube but then states "…it is not true that the colour of this area is 'desaturated'". Jarman is incorrect here, the attributes of *lightness* and *saturation* – as utilised in colour science – are often interrelated. Here is an example – a projector with a red piece of glass in front of it produces a saturated red on screen. If a second colourless projector is directed to the same screen, the red is likely to be considerably *desaturated* to a pale red or pink. The pale red or pink is also a *lightened* version of the red. Here is another example: a pure violet paint is highly saturated with a low lightness (or brightness). If we begin to mix white paint with it, the basic *hue* (the named colour) remains the same, but the saturation decreases and the lightness increases. The three attributes of *hue*, *saturation* and *lightness* are described separately in colour science but it is well known that a change in one attribute often affects another.

With regard to para. 5, Jarman restates his view that Steiner was incorrect in saying that unexpectedly coloured shadows do have a physical 'objective' presence. I stand by Steiner's original indication – through extensive personal researches and from the researches of others I have seen evidence which supports the view that unexpectedly coloured shadows can exhibit a physical 'objective' reality. However, I think that Steiner's indication should be viewed in the whole context of the *Light-Course* lectures where he criticises rigid classification of phenomena into being either 'subjective' or 'objective'. From

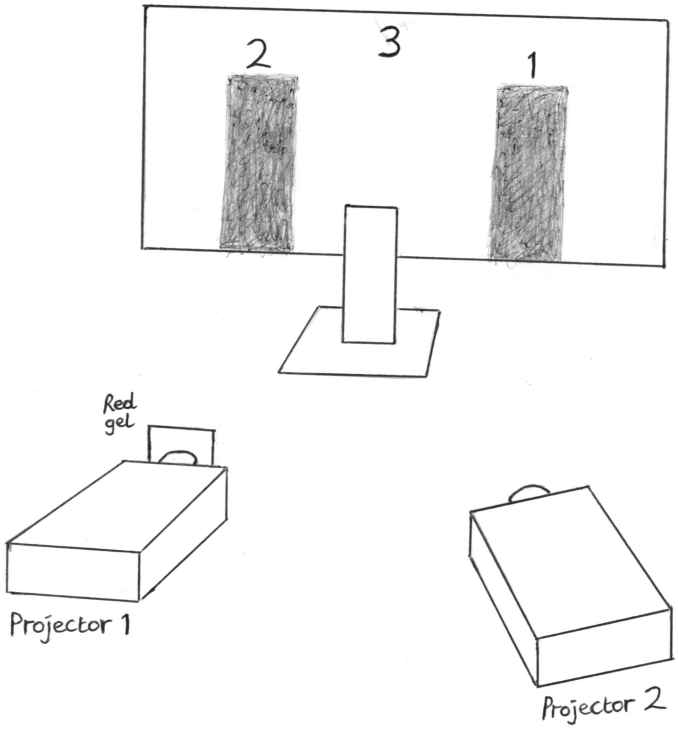
studying Steiner's lectures, Goethe's theory and doing many experiments, I have come to see that Goethe's *Theory of Colour* can help us to recognise dynamic interrelationships between the 'subjective' and 'objective'.[7] I have found that unexpectedly coloured shadows exhibit a dynamic reality which ranges from mostly 'subjective' to partly 'objective', depending on various parameters such as: physical factors, research techniques and the inner life of the researcher studying the phenomenon. I see Steiner's indication as a small correction to Goethe's theory, very much in harmony with Goethe's theory as a whole.

Today, many people are becoming more open to Goethe's *Theory of Colour* in the academic world and in the scientific communities. However, as stated previously (see note 1), there is a danger of Goethe's theory being widely embraced as purely a theory of 'subjective' phenomena. This would undermine one of the central themes of Goethe's theory – the dynamic relations between 'subjective' and 'objective' – a theme which needs to be explored today to move science forward. The development of modern natural science involved keeping 'subjective' and 'objective' completely separate, and for good reasons. However, times have changed, conditions are different and natural science needs to evolve. By seriously entertaining the possibility that unexpectedly coloured shadows exhibit a physical 'objective' presence, many important questions are raised regarding natural science and the human being; eventually it becomes obvious that a Spiritual Science is required to proceed any further. To insist on unexpectedly coloured shadows being neatly boxed as 'subjective' is to deny the existence of a real debate in 19th century science and to ignore the results of various experimental researches. Such a 'closure' would also play into the hands of those who will to prevent Goethe's theory and spiritual science from attaining a wider recognition. This debate about the reality of unexpectedly coloured shadows is a microcosm of many important issues.

The lecture which I presented in Cornwall in 2000 did not end with showing those present the contradictory results obtained with viewing tubes. I went on to discuss Steiner's indication and to show what can happen when this idea – that unexpectedly coloured shadows exhibit a physical presence – is seriously entertained. Some experiments were presented which explore this idea and which attempt to go beyond the use of viewing tube research techniques. Please see the diagram above:

A basic coloured shadows experiment is depicted. Shadow 1 is the unexpectedly coloured shadow, in this case turquoise blue. Shadow 2 is red and region 3 is a pale pink. If a yellow gel is then placed in front of projector 2, the little colour world on screen is transformed: shadow 1 becomes lime green, region 3 becomes yellow-orange and shadow 2 remains red. The obvious explanation for the lime green shadow 1 is that the turquoise blue shadow and the yellow of the gel have interacted to produce a new colour – lime green.[8]

This experiment is very rarely mentioned in the literature of colour science, probably because the results do not correspond to simple explanations of the coloured shadows phenomenon. Most explanations of coloured shadows place emphasis on the region surrounding the shadows (3) as being mainly responsible for stimulating the eyes to produce a complementary colour in shadow 1. So, for example, with a red gel on proj. 1,



region 3 becomes a pale pink which stimulates the eyes to produce the complementary colour, turquoise blue, in shadow 1. However, in this modified version of the experiment, region 3 is yellow-orange (complementary colour is deep blue) and shadow 2 remains red (complementary colour is turquoise blue). Turquoise blue and deep blue do not in any way produce lime green. The conventional explanations break down here and hence the lack of mention of this experiment. Michael Wilson, in his booklet *What is Colour?* (1949) does, to his credit, describe this experiment but I don't think he managed to explain the results adequately utilising conventional ideas.

The turquoise blue shadow and yellow gel appear to be behaving according to the laws of *Subtractive Colour Synthesis* – where layers of transparent colour interact to produce new colours.[9] With a knowledge of subtractive colour synthesis, the next step is obvious – to try placing a magenta gel in front of proj. 2 (instead of a yellow one). When this is done, the result is a purple-violet shadow 1 – the turquoise blue and magenta interact to produce the purple-violet, as predicted by subtractive colour synthesis.

The experiment can be expanded by producing a pink-magenta shadow 1 (with a green gel on proj. 1) which is then modified with cyan and yellow gels on proj. 2. A yellow shadow 1 (produced with an indigo gel on proj. 1) can also be tested with cyan and magenta gels on Proj. 2. In nearly all the variations,[10] new colours are produced according to the laws of subtractive colour synthesis.[11]

I think that this experiment is only comprehensible when we entertain the possibility that unexpectedly coloured shadows have some kind of physical presence. In this situation, the new colours produced can be understood to be due to interactions between the unexpectedly coloured shadow and the gel placed on proj. 2. To insist on the unexpectedly coloured shadow being considered purely 'subjective' leaves researchers scrabbling around for clever explanations which are not convincing. Another possibility for testing the reality of the unexpectedly coloured shadows would be to place pieces of coloured paper inside the shadow to see if any colour changes occur. The answer is yes – place a yellow piece of paper within a turquoise blue unexpectedly coloured shadow and the paper *becomes*

green! The piece of paper can be the whole size of the shadow or only a small part of it, whereby the turquoise blue and the new green can be seen together. Again, conventional explanations appealing to a pure 'subjectivity' of the unexpectedly coloured shadow break down here. Why deny the obvious? The colours interact in a way easily understandable according to the laws of subtractive colour synthesis. A special note is required here. Goethe mentions a very similar experiment in para. 562 of the *Theory of Colour*. It is significant that he places this experiment well away from the main section discussing coloured shadows. I think he knew that this phenomenon jarred strongly with the mainly 'subjective' classification he had given to unexpectedly coloured shadows. Or, perhaps he hoped that by para. 562 the open-minded reader-experimenter would be ready to see dynamic interrelations between 'subjective' and 'objective'!

The experiment with the piece of yellow coloured paper can be extended with cyan and magenta papers and with yellow and pink-magenta unexpectedly coloured shadows, using a similar technique to that employed with the gels. The results are very similar – the coloured paper and the unexpectedly coloured shadow interact to produce a new colour which can be understood in terms of subtractive colour synthesis.[12]

I think that we as human beings are intimately involved in producing unexpectedly coloured shadows through the activity of our physical visual apparatus and the activity of our soul-spiritual members working together. The high fence comes when you entertain the possibility that the unexpected colours may have a physical aspect. At this stage I can offer this possibility for further research – that when our etheric body[13] becomes active in a certain way within the unexpectedly coloured shadow, the colour may attain a physical aspect – i.e. to a certain extent, *part of our etheric body may become physical and coloured.* As Steiner reminded us, when we have a rich inner experience of colour, we feel we are out there in the colours. Previous examples of physical to etheric to physical transformations in cosmic evolution can be found in Steiner's *Occult Science.*[14] To argue that a rich inner experience of colour should not be allowed in colour phenomena experiments is to argue against colour in the world and against new colour being brought into the world. It is true that the phenomenon of coloured shadows calls for a reassessment and renewal of natural science.

Malin J. Starrett

Author's Address: 520 Antrim Road, Glengormley, Newtownabbey, Co. Antrim BT36 5DD, N. Ireland.

Notes

1. Recent books on the science of colour attempt a simplistic reconciliation between Goethe's theory and Newton's theory by granting Goethe the 'subjective' pole and Newton the 'objective'. There is some progress here in that Goethe's theory is being openly credited, but Goethe's theory is about much more than the 'subjective' pole.
2. See article in September 2003 issue of this newsletter.
3. In a Michaelic movement, we should not need to have our backs to the wall in a lecture hall!
4. See, for example, the second lecture of Steiner's *Light-Course* where he describes the relationships that occur between the etheric body, the astral body and the physical organ of the eye.
5. See March 2003 newsletter.
6. See September 2004 newsletter and September 2003 newsletter.
7. See September 2003 newsletter or paras. 368 and 369 in Goethe's theory.
8. The yellow-orange region 3 is due to the red coloured light from proj. 1 additively mixing with the yellow coloured light from proj. 2.
9. Subtractive colour synthesis usually applies to layers of transparent colour interacting e.g. in colour printing.
10. The only exception to the general results is where a yellow shadow 1 is modified by a cyan gel on Proj. 2. In this case, the new colour is a greenish yellow but not a full green.
11. For any readers interested to carry out this experiment, I am glad to supply technical details. The general principles are simple but you need to be able to produce strongly coloured turquoise blue, yellow and pink-magenta unexpectedly coloured shadows. The cyan, yellow and magenta gels need to be of specific hues and less strongly coloured (saturated) than the gels placed on Proj. 1. The experiment requires careful selection of materials and experience of technique. You wouldn't expect a colour printer to use 'any old' cyan, yellow and magenta dyes to produce full colour images!
12. Careful testing of a variety of cyan, yellow and magenta papers is required to see the new colours fully developed.
13. Our astral body is probably involved to some extent in this process as well. How are the beings of the divine hierarchies involved? More research is required here.
14. See Para. 54 (Steiner's original numbering) of the chapter 'Cosmic Evolution and the Human Being' in Steiner's *Occult Science.*

Meetings

Umstülpung & Umstülpungstechnik
(Inversion & Inversion Technology)
5-9 October 2005
Mathematics workshop at the Goetheanum, Dornach Switzerland in cooperation with the Paul Schatz Stiftung and the Gesellschaft für goetheanistische Forschung e.V.
Speakers: Oliver Conradt, Klaus Ernhofer, Peter Gschwind, Uwe Hansen, Tobias Langenscheid, Martin Löschner, Steffan Müller-Stach, Reinhold Salgo, Frank Schaefer-Lorinser, Hellmuth Stachel.
Subjects: Polarity of circling and reflection; oloid geometry; hexagon mechanism; pulsina, oloid technology; ship's propeller; algebraic geometry of the oloid; mathematics of inversion.
For a full programme and booking details (in German) contact: Mathematisch-Astronomisch Sektion am Goetheanum, Tel: +41 61 706 4228; Fax: +41 61 706 4223; Email: mas (at) goetheanum.ch.

UK Group of the Science Section
There will a meeting of the UK group of the Science Section on Saturday 29th October 2005 at Elmfield School, Stourbridge for members of the School of Spiritual Science who are taking responsibility for the scientific work.
For further details, and requests to be added to the Science Section mailing list, please contact Simon Charter, Juniper Cottage, Ludlow Green, Ruscombe, Stroud, Glos GL6 6DQ. Tel: 01453 755614. Email: simon (at) ebbandflow.fslife.co.uk.

The INTERNET and the Path of Higher Knowledge
A Workshop-Conference, Scotland, 10-16 November 2005
Organised by Anthro-Tech Research Institute
The Internet would offer you access to all human knowledge about physical and spiritual existence. It would let you sell your own ideas to the whole world. Is this not the boon for which we have been waiting, the ultimate knowledge-instrument, which will enable every one of us to spread our wings of soul and soar aloft? Gift of the gods or pernicious illusion – one thing is certain: the Internet will sweep away our former ways of life forever.

It is a strange paradox indeed: the Internet is meant to bring all human knowledge within our reach, yet the working of the World Wide Web itself lies beyond our knowing and control. No engineer can visualise the design of its physical compo-

nents; no human mind can compass the intricacies of its software.

In essence the World Wide Web is a gigantic matrix of thoughts in the electrical state – a shadowy world-intellect of unimaginable power. It is conscious but uncaring, insensitive and immoral, devoid of feelings and without reverence for any being higher than itself. It is not a neutral instrument that leaves us free. Its influence on the subconscious mind is very great. Those who unite themselves too closely with the Web will not escape its meshes, even in death.

The aim of our workshop-conference is to bring up into our full consciousness this deeper nature – both physical and spiritual – of the Internet. This esoteric study will include some practical work in digital electronics (no prior knowledge or skills are necessary). We shall examine what it means to develop one's own inner faculties of knowledge, or to rely upon a vast outer web of electricity. And we shall see why these two ways of working cannot be compatible.

Cost: £225.00.

Contact: Philippe Rigal, Anthro-Tech Association, Tobermory, Isle of Mull, PA75 6PH. Fax: 01688 302532 or 01688 302464; Tel: 01688 302532

Courses

Goethean Science Studies: Re-thinking, Re-imagining and Re-creating Our Relation to Nature

A new semester-long course at The Nature Institute: April 2 to June 16, 2006

What would the world look like if we as human beings were able to think like a plant grows? Imagine gaining such flexibility of thought that our ideas were no longer rigid, static and object-like, but grew, transformed, and when necessary, died away. And as with plant form, what if our thoughts revealed the living qualities of the world we inhabit? What a revolution! This is the revolution that the poet and scientist Goethe began with his approach to doing science. It is a way of wakefully entering into the living forces of the world and learning to think and act in harmony with them. This revolution can provide a strong infusion of living thought into our culture.

Out of this concern, we are offering a new practice-based training in a Goethean approach to science. The course will be held in the springtime, allowing the activities to grow out of the genius of place and time: the rapidly and richly unfolding plant life in spring in the Northeast will be a natural focus for our work. The Institute is located in a biodynamically farmed valley in upstate New York with forests, meadows, wetlands, creeks, ponds and many transitional habitats within walking distance.

Core Seminar with Craig Holdrege – Doing Goethean Science: This seminar brings an immersion in the plant world, focusing on the theme 'The Dynamic Plant: Morphology, Metamorphosis and Ecology'. It leads into living thinking and introduces the practice and methodology of Goethean science through hands-on observation and self-reflective thought. There will also be supplemental readings, and the seminar will provide the basis for the individual project.

Individual Project: A key element of learning is individual practice. Each student will choose an area of study (for example, a plant species or family, a species comparison, a habitat study, and so on) in which he or she independently applies the Goethean approach. This project will extend over the length of the course and each student will give a project presentation at the end of the course.

Additional Classes: A seminar in flexible thinking through projective geometry. A seminar on the visual world and the phenomena of light and colour. Drawing and/or painting classes to develop a habit of careful and sensitive observation. Nature field trips. Talks and seminars by guest teachers illustrating the depth and breadth of the Goethean approach.

The two-and-a-half-month course is full-time; classes are held five days per week. Mornings are devoted to seminars and the afternoons to project work, drawing/painting classes, habitat observations, and field trips. The course will be carried by Institute staff, Craig Holdrege and Henrike Holdrege, and guest teachers.

Who is the course for? For people who are deeply interested in nature and motivated to develop a new scientific practice. For example: science teachers, farmers and undergraduate or graduate students looking to instil new life into their discipline and who have the keen desire to learn a rigorous holistic methodology will profit from this course. In the past, both college and graduate students have received credits for attending our education programs, so you should inquire about the possibility of receiving credits for this course.

The course will be carried out with an enrolment of seven or more students; the maximum number of participants is fifteen. We presently envision offering the course every other year.

For more information contact Craig Holdrege, craig (at) natureinstitute.org; 518-672-0116; The Nature Institute, 20 May Hill Road, Ghent, NY 12075; www.natureinstitute.org.

A selection from Schumacher College programme

Roots of learning: science, nature & beauty

Linda Jolly & Solveig Slåttli, October 23-28, 2005. Through art, children can develop a relationship with and understanding of nature that goes beyond the mechanistic teaching methods commonly employed in science or environmental studies. The presenters on this course, with backgrounds in biology and art, will show that "botany can be exciting".

The best foundation for protecting the environment is loving it, and the course will demonstrate how students can be helped to see and appreciate plants in new ways. Goethe's insights into what plants have in common in their growth from seed to plant provide the basis for creative drawing exercises. Direct experience of nature as well as landscape painting will be used to understand individual plants in a wider context.

Linda Jolly has worked as a biology, gardening and agriculture teacher at the Waldorf school in Bergen, Norway since 1979. She runs courses for both teachers and farmers in ecological school gardening and using the farm as a pedagogical resource. Solveig Slåttli has been a class teacher for grades 1-8, as well as drawing and painting teacher for the upper levels since 1978. She runs courses for adults in painting, drawing and nature observation.

This course is only for teachers or others currently working in education.

The science of quality: Leonardo, Goethe and Bateson

Fritjof Capra and Brian Goodwin, with Stephan Harding, April 23-May 12, 2006. Throughout the history of Western science, there has been a tension between mechanism and holism, matter and pattern, quantity and quality. The mechanistic perspective has usually been dominant, but at certain times the holistic, organic perspective also came to the fore. In this course, Fritjof Capra and Brian Goodwin will discuss the work of three scientists who were outstanding representatives of such flowerings of the science of quality: Leonardo da Vinci, Johann Wolfgang von Goethe and Gregory Bateson.

The course will show that although these three geniuses lived in different centuries, they shared a very similar integral

vision of science, art and ethics. Their work is becoming increasingly relevant to our time and can help to build a science of quality for a sustainable future.

Fritjof Capra is a physicist and systems theorist, and founder and president of the Centre for Ecoliteracy. His books include *The Tao of Physics*, *The Web of Life* and most recently *The Science of Leonardo*. Brian Goodwin and Stephan Harding teach on the MSc in Holistic Science at Schumacher College.

The new science at work

Meg Wheatley, June 11-16, 2006. New discoveries in biology, chaos theory and quantum physics can radically alter our understanding of the world and teach us how to live and work together in chaotic times. This course will explore how these insights can lead to new forms of organisation where relationships, participation and cooperation are fundamental, and will look at the implications for management, business, leadership and personal life.

Meg Wheatley is a consultant and speaker, who has worked on management issues with a wide range of companies, governments and agencies in all continents. She is author of *Leadership and the New Science, A Simpler Way* and most recently *Finding our Way: Leadership for an Uncertain Time*.

Nature and consciousness

Christian de Quincey and Arthur Zajonc, June 18-30, 2006. Modern science, particularly physics, is confirming what the mystics and shamans have always known: that there is more to nature than the untrained eye usually sees. Mind and matter are not two separate entities, just as the observer is not independent of the observed. The significance of these insights for our world view and our relationship to the natural world can hardly be overstated. Presenters on this course will explore these issues and reflect on how science, values and spirituality can be integrated.

Christian de Quincey is Professor of Philosophy at John F. Kennedy University and author of *Radical Nature*. Arthur Zajonc is Professor of Physics at Amherst College and author of *Goethe's Way of Science*.

More details: Schumacher College, The Old Postern, Dartington, Totnes, Devon TQ9 6EA, UK. Tel: +44 (0)1803 865934; Fax: +44 (0)1803 866899; Email:
admin (at) schumachercollege.org.uk
Website: http://www.schumachercollege.org.uk

Publications

Archetype

Issue 11, September 2005

Moving pictures: the world of meaning of two meadow butterflies, *Daniel Kuster* and *Johannes Wirz.* Summary: Butterflies are fascinating creatures. Although most of us know little about their biological task in biotopes, they are greatly admired for their obvious contribution to the ensoulment of landscapes. What exactly does this concept mean? In the present study an attempt was made to approach these animals by a variety of methods. In particular, single animal observations of the activities from two species living in extensively used grasslands, the mazarine blue (*Cyaniris semiargus*) and the marbled white (*Melanargia galathea*), were converted into ethochronograms, which allow for a clear distinction between frequent versus rare behaviours and reveal patterns of sequential activities that are species specific, as well as in unison with the particular environments. The results presented provide first steps towards the elucidation of the concept of ensoulment. It will be shown that the elaboration of spaces of soul activity (Seelentätigkeitsräume) by single species reveal their organ-like character and that their subsequent integration contributes to the whole atmosphere of grasslands in a way similar to the way instruments do in an orchestra, each contributing to the whole experience (Gesamterlebnis) of a symphony.

The marbled white butterfly (*Melanagria galathea*) in ecologically different farmland habitats, *Johannes Wirz* and *Daniel Kuster*. Summary: The behaviour of the marbled white butterfly (*Melanagria galathea*) in habitats with distinct ecological qualities and differing patch contexts (wider surroundings) is investigated. Observation of individual butterflies is used as a tool to develop a differentiated view of duration and frequencies of typical activities. Species and sex-specific behaviours can be identified, but in only a few cases do they prove to be independent of habitat-specific qualities. In comparison with the benefits and limitations of qualitative approaches, detailed quantification is justified and reveals unexpected results regarding preference for nectar plants, differences and dynamics of interactions with other insects and the significance of size and geometry of habitats. Some criteria for facilitating the protection and development of populations of the marbled white are presented.

The fortnightly tree-bud rhythms of Lawrence Edwards, *Nick Kollerstrom.* A letter to the editor occasioned by the paper 'Mistletoe berry shapes and the zodiac' by *Stephan Baumgartner, Heidi Flückiger and Hartmut Ramm* published in *Archetype* issue 10, September 2004.

60 pages (approx). A5 format. Price: £4.00 per copy including UK postage (overseas postage: Europe add £0.50, elsewhere add £1.00).

Enquiries and orders to: David Heaf, Hafan, Cae Llwyd, Llanystumdwy, Gwynedd, LL52 0SG, UK. Tel/Fax: +44 (0)1766 523181 Email: 101622.2773 (at) compuserve.com

In Context, The Newsletter of the Nature Institute

No. 13, Spring 2005: As well as short items of news, reviews and comment, the publication carries the following two feature articles: From two cultures to one: on the relation between science and art, *Vladislav Rozentuller & Steve Talbot*; Brain activity and conscious experience, *Siegward-M Elsas.*

Editor: Steve Talbott. Single copies of *In Context* are available free of charge while the supply lasts. Contact details: The Nature Institute, 20 May Hill Road, Ghent, NY 12075. Tel: +1 518 672-0116. Fax: +1 518 672 4270. Email: info (at) nature-institute.org. Web: www.natureinstitute.org.

The Nature Institute's online *NetFuture* newsletter is available at www.netfuture.org.

Elemente der Naturwissenschaft

No. 82, 2005: Zum Begriff der Ich-Zahlen: Warum projektive Geometrie und Clifford-Algebren? *Peter Gschwindt.* Zur Theorie der Farbqualitäten, *Günter Kollerti.* Prismatic colours explained with Goethe's fundamental phenomenon, *Pepe Veugelers*. Der Fruchtzapfen des Nadelbaumes, *Jan Albert Rispens*. Zur Evolution der organismischen Autonomie Teil 2: Vergleich einiger ursprünglicher Metazoen und Diskussion, *Bernd Rosslenbroich.* Ist der Energiesatz wirklich allgemein gültig? *Theo Buergin.* Durchwachsene Körbchen: Eine Erwiderung auf E. M. Kranichs kritische Darstellung, *Jan Albert Rispens*. Ein zweiteiliger Leserbrief, *Nicholas Kollerstrom.*

Editorial board: Johannes Wirz (editor-in-chief), Birgit Althaler (editorial assistant), Haijo Knijpenga, Johannes Kühl, Barbara Schmocker.

Subscription enquiries to: Wochenschrift 'Das Goetheanum', Abo-Service, Postfach, CH-4143 Dornach 1, Switzerland. Email: abo (at) goetheanum.ch. Tel: +41 61 706 4467. Fax: +44 61 706 4465.

Orders for back/single issues to: Naturwissenschaftliche Sektion am Goetheanum, Elemente der Naturwissenschaft, Postfach, CH-4143 Dornach 1, Switzerland. Tel. +41 61 706 4210. Fax +41 61 706 4215.
E-mail: science (at) goetheanum.ch.

Cost: Annual subscription (2 issues, including postage): €20.- / CHF 32.-. Single issues: €12.- / CHF 18.- ISSN 0422-9630.

A list of the contents of all back issues is available at http://www.anth.org.uk/Science/elemindx.htm.

Mathematisch-Physikalisch Korrespondenz

No. 220, Spring 2005: Das Konzept der Information nach Szilard und Unger und die beiden Hauptsätze der Thermnodynamik in der Elementarteilchenforschung, *Reinhard Brandt*. Die Bedeutung der projektiven Metrik für die Form der Maxwellgleichungen, *Peter Gschwind*.

No. 221, Summer 2005: Zum Begriff der Ich-Zahlen: Warum projektive Geometrie und Clifford-Algebren? *Peter Gschwind* (also published in Elemente der Naturwissenschaft 82 – see above). Die Zissoide, *abstracted by Peter Gschwind from the book 'Ausgewählte höhere Kurven', Wiesbaden, 1949, by Hermann Schmidt.*

Subscriptions are SFr 50/€30 per year.

Edited by Prof. Dr. Peter Gschwind, Mathematisch-Physicalisches Institut, Benedikt Hugiweg 18, CH-4143 Dornach, Switzerland. Tel: +41 61 701 5968. Email: p.p.gschwind (at) intergga.ch.

Wasserzeichen

Nr. 22 (2005): Durchströmte Form – Verwandtschaft zum Lebendigen, *Andreas Wilkens.* Ringwirbelexperiment mit wenig Tinte, *Andreas Wilkens.* (Both articles illustrated with flow experiments). In addition to the articles in this in-house magazine, its 50 pages have many shorter contributions including items on the Flow Research Institute's work, conferences and publications. Price €3.00 per issue. Free to sponsors.

Editors, Georg Nitsche & Andreas Wilkens, Institut für Strömungswissenschaften, Stutzhofweg 11, D-79737 Herrischried, Germany, Tel: +49 (0)77 64 9333 0, Fax +49 (0)77 64 9333 22.
Email: sekretariat (at) stroemungsinstitut.de.
Internet: www.stroemungsinstitut.de.

Membership

We welcome Dr Philip Demp (USA) as a new member. The Group has 68 subscribers.

The membership subscription is £5 (UK), £6 (Europe) or £7 (elsewhere). If you received a renewal reminder in March and have not renewed before the next issue goes out, your subscription ends with this issue.

Next Issue

This newsletter is issued to members in March and September each year. Copy for the next issue should reach the editor at the address below by 20th February 2006.

Dr David J. Heaf, Hafan, Cae Llwyd, Llanystumdwy, Cricieth, Gwynedd, LL52 0SG, UK. Tel/Fax: +44 (0)1766 523181. Email: 101622.2773 (at) Compuserve.Com.

Science Group web site: http://www.anth.org.uk/Science