Journal of Consciousness Studies, **4**, No. 3, 1997, pp. 215–30

ARE PLANTS CONSCIOUS?

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Abstract: Views of 'plant consciousness' in the literature are classified on a scale ranging from descriptions of plant phenomena using consciousness as a metaphor, to explicit statements that plants are conscious beings. The idea of plant consciousness is far from new, but it has received a new impetus from recent claims by psychics to communicate with plants. The literature surveyed is widely scattered and very diverse, but it can teach us much about the views that various segments of society hold on plant consciousness.

Introduction

Are the green things of nature, plants, bushes, ferns, trees, mosses, etc., conscious? Can we even approach this question without knowing what human consciousness is? Although we don't know what human consciousness is, or how it relates to the brain, a common assumption is that brains are necessary for consciousness. Since plants do not have brain tissue, from this viewpoint it is useless to even consider the possibility of plants being conscious.

The article by Cleve Backster (1968) on the 'primary perception ability' of plants, and the best selling book *The Secret Life of Plants*, by Peter Tomkins & Christopher Bird (1974) have stimulated popular reconsideration of plant consciousness. Earlier works had already provoked discussion among scientists, including *Nanna, or The Soul Life of Plants*, by the famous German physician and psycho-physicist Gustav Fechner (1848, reprinted 1921), and work of the Indian Jagadis Chander Bose on plants' sensitivity to injuries (Geddes, 1920; Tompkins & Bird, 1974, pp.95–117). From the 1920's onward, theosophist Geoffrey Hodson (1976; 1994) wrote, lectured and showed paintings of his clairvoyant perceptions of trees and plants.

The idea of plants and trees being more than the mere play of physico-chemical forces did not die with the end of the Middle Ages, when witches and druids had knowledge of the esoteric dimension of plant life (Engel, 1978; Vickery, 1995). Still today — in a world filled with scientific knowledge, where year after year, with no consideration of plant consciousness, plant sciences gain beautiful insights in plants' internal physiology, and crop yields improve as results of fertilizer treatments, weed and pest management, new varieties, mechanization, irrigation and drainage methods — the idea that plants and trees might after all be conscious beings rather than merely living objects is still very widely held. New streams of support are found in New Age literature. Some people claim to have acquired sensitivity on subtle levels, where they can feel plants' and trees' energies. These views have been applied in gardening and agricultural methods, with results convincing them that plant consciousness is a fact.

The purpose of this paper is neither to defend nor to attack such claims, but to analyse the concept of 'plant consciousness' and argue that it ought to be studied seriously. A debate on the subject is worthwhile either way: if plant consciousness were shown to exist, it would profoundly affect all kinds of biological research and agricultural methods, and open a fascinating aspect of nature to the plant sciences; on

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the other hand, if it were shown not to exist, an important step would have been taken towards eradicating an erroneous but still powerful folk-belief.

We should also note that active concern for issues like environmental pollution is often shown by those believing plants to be conscious organisms. Even though this belief might not be based on fact, it remains a strong motivation for such people. In order to understand their response to environmental challenges, it is necessary to understand their beliefs, including their belief in plant consciousness.

Plant consciousness is not taken seriously by mainstream scientists, microbiologists, ecologists, ethnobotanists, or scholars of human and animal consciousness, but it is discussed in a wide variety of sometimes obscure publications, often in superficial or very speculative ways. The present paper is an exploration into this unknown territory of sometimes peculiar, and poorly investigated aspects of plant life — aspects claimed to be pointing towards the fact of plant consciousness, but usually without defining consciousness in general or plant consciousness in particular. Developing such definitions, and making plans for further research, is necessary and will provide material for other papers. The purpose here is the preliminary one of surveying and classifying the various views of plant consciousness.

Method and Material

The relevant literature ranges from highly specific articles on plant and brain biochemistry to New Age literature, from social studies of spirit mediums and witchcraft to parapsychological tests, from Rudolf Steiner's anthroposophical lectures to Rupert Sheldrake's morphic fields. This wealth of material falls broadly into two categories, which we may (without prejudice to their significance and recognizing a certain overlap) label as 'scientific' and 'non-scientific'. The scientific category includes plant sciences, parapsychology, and social sciences. The non-scientific category includes narrations where people believe in or claim to sense the presence of plant and tree spirits, and descriptions of how they work with so called 'nature intelligences'. The former seems to involve a more or less passive awareness, while the latter involves active interaction between man and independent, full bodied natural entities.

Within this twofold division, there is a scale, from the view that 'plants do not have consciousness' on the left extreme, to the view that 'plants are conscious beings' on the right extreme (see Figure 1).

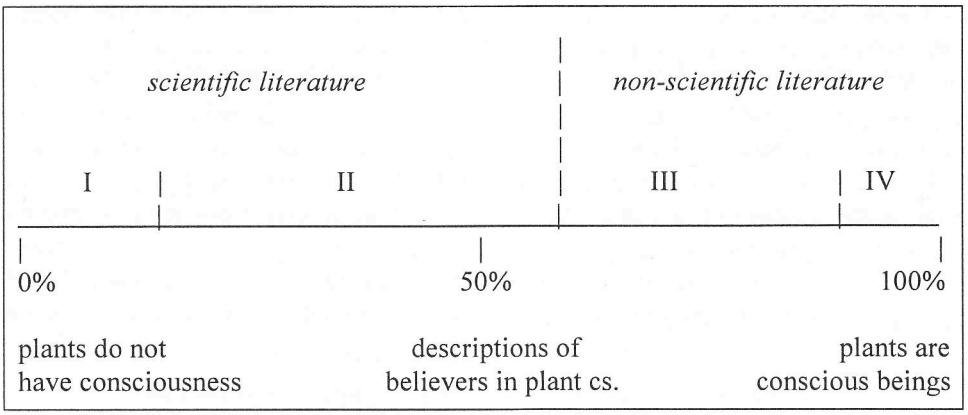

Figure 1. Clusters I to IV on a gradual scale of belief in plant consciousness

In plant sciences, plants are regarded as organisms that interact and adjust to soil types, climate, diseases, and other physiological conditions. They are studied from a biochemical level (DNA-structure), up to a global level (greenhouse effect). A few parapsychologists have investigated whether (human) minds can influence plants. Anthropologists and ethnobotanists have studied indigenous people who believe that certain trees have spirits, or are inhabited by their ancestors. Whether and how such beliefs could be considered factual is never at stake in such studies; instead they ask what these cultures believe, usually imposing pre-given classifications such as 'animistic' and 'primitive'. (Some modern ethnologists instead try to use the methods and classifications of the group being studied, but we do not know of any studies of this kind that have focused on plants.)

The scientific category and its various disciplines spread from the far left on the scale of Figure 1, where plant consciousness is implicitly rejected, to the centre-right, where researchers describe how some people believe everything, including plants and trees, to be conscious. The literature in the non-scientific category ranges from the centre-right to the far right of Figure 1, where experimenters and reporters themselves claim to actively work with nature intelligences.

To simplify our presentation, the texts considered here are grouped into four clusters in a sequence of increasing belief in plant consciousness. A discussion and critique follows the discussion of each cluster.

Classification of Material

Cluster I. *In which plants are assumed not to have consciousness, but are shown to have biological mechanisms which in humans would normally be associated with consciousness.*

Words like 'memorization', 'expression' and 'communication' in article titles like 'Memorization and delayed expression of regulatory messages in plants' (Desbiez *et al.*, 1984) and 'Root communication among desert shrubs' (Mahall & Callaway, 1991) seem to ascribe characteristics to plants which are usually associated with living, conscious beings. In 'Plants bite back: insect-infested hosts starve out unwanted guests, and may even warn their neighbors' (Chen, 1990) the title takes plants as conscious organisms: plants are 'hosts' which 'starve out' 'unwanted guests' and even 'warn their neighbors'.

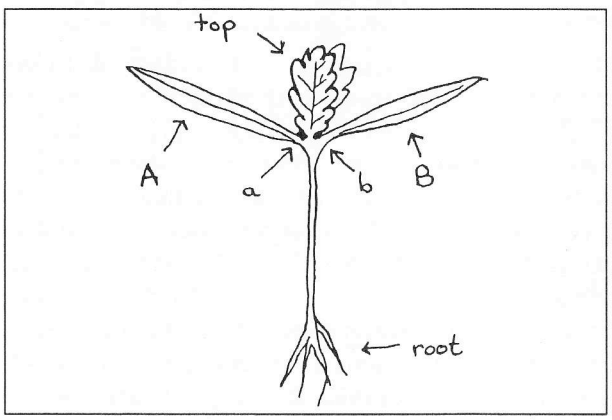

Figure 2. Schematic drawing of *Bidens pilosus* plantlet (from Desbiez *et al.*, 1984).

In cases where cotyledon A has been punctured and both cotyledons and top are cut off after the puncturing, axillary bud *a* develops slower than bud *b*. When the plantlet is not punctured and both cotyledons and top are cut off, the growth rates of bud *a* and *b* are the same.

The first paper (Desbiez *et al.*, 1984) summarizes research done on the plant species *Bidens pilosus* (Figure 2). When one of the first two leaves — cotyledons — of such a plantlet, which basically grows symmetrical, is punctured and shortly afterwards both cotyledons and top are cut off, the plantlet continues to grow asymmetrically; it somehow 'stored the information' that it was punctured, or 're-membered' the injury. How such information is stored is still not well understood.

The second paper (Mahall & Callaway, 1991) gives experimental results on the desert shrubs *Ambrosia dumosa* and *Larrea tridentata.* When these plants are grown in chambers that allow root observation, intra- and inter-plant root communication can be observed. The *Ambrosia* root systems appear capable of detecting and avoiding other *Ambrosia* and *Larrea* root systems, whereas *Larrea* roots inhibit other *Larrea* and *Ambrosia* roots in their vicinity. These results suggest that the plants have a 'capability of self-nonself recognition', but how the roots of an *Ambrosia* plant are able to recognize as different the roots of other plants, even of its own species, is unknown. Also unknown is why *Larrea* roots do not avoid other roots.

Regarding the research by Chen (1990), plants that defend themselves against threatening insects, and send out a warning signal that is picked up by other plants, seem able to exchange information.

Scientists in all fields often use such anthropomorphic language to sharpen intuitions and communicate ideas clearly, safe in the assumption that no one will believe they literally impute consciousness to stars, atoms, computers, etc., because of the widely shared assumptions of science itself. Thus in all areas of biology, the term 'communication' is commonly used in discussing mechanisms of information exchange at the molecular, cellular and organic levels (e.g. Amisino, 1993; Pitts, 1990); the phrase 'signal perception' is used similarly (Weiler, 1989). For example, high light intensities, pollutants, or pathogen attacks may be imposed on plants to examine their 'behaviour' under these 'stress conditions' (e.g. Bowler *et al.*, 1989).

The authors of texts cited in this cluster in no way intend to say that their research proves that plants are conscious. The words in the titles and texts are metaphors for complex plant phenomena that in some ways resemble phenomena in humans. These texts do not support plant consciousness, but rather provide evidence for very sophisticated and still unraveled interactions among plants of the same species, or of different species, or with insects.

Cluster II. *In which it is believed that plants must have 'something' (awareness?) since they respond to mental and paranormal activity of humans.*

Some researchers have claimed experimental results showing that plants that have been prayed for did better than plants that were ignored (Bloksma, 1995; Dossey, 1989; Loehr, 1959; Miller, 1972; Vasse, 1948), and that talking nicely to plants, or abusing them verbally, influences their growth (Loehr, 1959). For instance, tomato plants receiving friendly thoughts or spoken words each day for three to twenty minutes, were reported to produce an average of 23% more tomatoes per plant than those having otherwise identical treatment (Hoffmann, 1992). Paranormal healers, radiating energy directly or indirectly (via water) into seeds treated with a saline solution, are claimed to significantly influence germination and growth of the seeds, in that treated seeds recovered from the saline treatment but untreated seeds developed only slowly, if at all (Saklani, 1988, p. 67; Scofield & Hodges, 1991).

Cleve Backster (1968; Stone, 1989) has connected plants to a polygraph (usually called a lie-detector), an instrument which measures electrical potentials. When people are connected to a polygraph, larger changes in skin potential correspond to personal feelings, such as physical or emotional pain, or arousal by sexual fantasies. Backster noticed similar patterns in plants when a leaf is torn off, or when a plant receives loving thoughts, and interpreted this as showing that plants experience feelings of pain and pleasure. In one experiment, plants also appeared to be aware of brine shrimps being killed in their immediate vicinity (Backster, 1968).

Others who duplicated Backster's experiments did not get the significant, repeatable outcomes that Backster claimed. Even after much trouble was taken to rule out unstable or varying circumstances like room temperature, still no significant correlation was detected between the mental activity of persons (or the death of brine shrimps) and plants' electric leaf potentials (Galston & Slayman, 1981; Horowitz *et al.*, 1975; Kmetz, 1977; Tompkins & Bird, 1974, p. 33).

On the other hand, four years of research convinced Marcel Vogel that factors like atmospheric pressure, temperature, and even fatigue and intrusion of critical personalities, influence plant awareness of, and responses to, thoughts, emotions and actions or other events (see Figure 3). According to Vogel (1974, p. 301), there is 'a precise and important interaction between the experimenter and the plant which is equal in importance to the equipment being used'. He hypothesized that, in human–plant communication, human beings are the active agents, 'sensitizing' or 'charging' the plant to be receptive to thoughts and emotions.

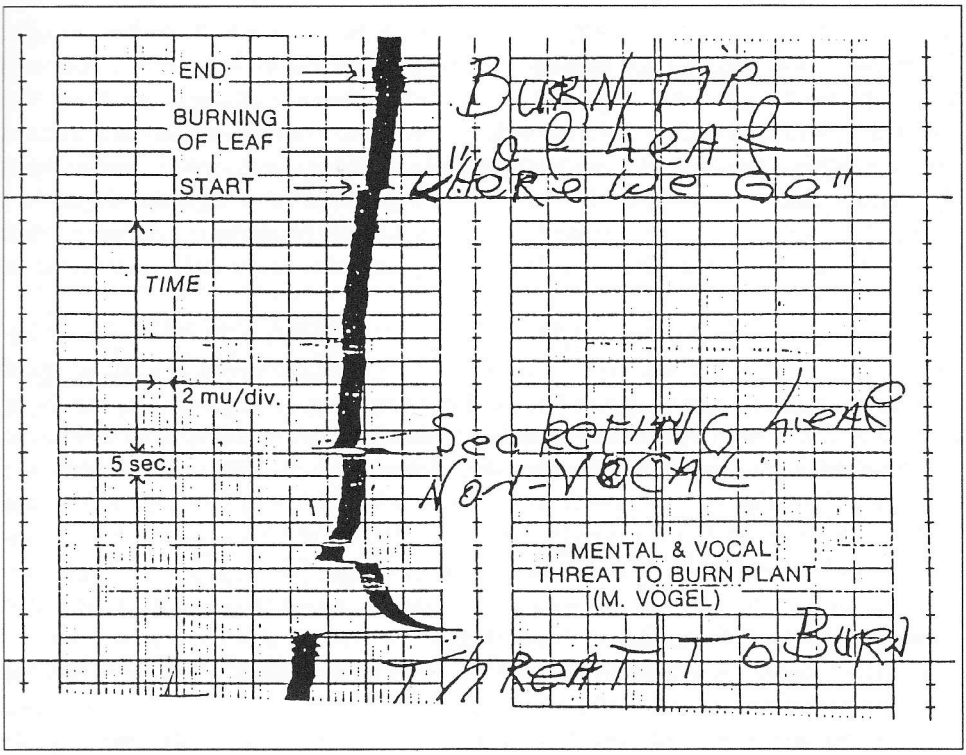

Figure 3. Graph of a split-leaf philodendron connected to a polygraph, when mental and vocal threats were made, and a tip of a leaf was actually burnt (Vogel, 1974, p. 304).

According to Vogel (1974, pp. 297, 299), repeatability is no longer a problem when a link is established between the experimenter and the plant. This is achieved by 'releasing an initial charge of thought energy' to the plant. While 'charging' the plant, the experimenter must quiet her/his conscious mind and body functions, and work in a state as free of emotional disturbance as possible. In this way, the plant gets isolated from secondary influences like light, temperature, atmospheric pressure, and electrical charges in the room. Only when the experimenter has charged the plant, may s/he, or another person, focus her/his mind and cause the plant's response to feelings such as love, anger, excitement, and to issues like the act of damaging or destructing another plant or another life form. The higher the level of emotional control the experimenter can reach, the more precise the experimental results become. Vogel also claimed that distance did not matter to his results. Graphs of plants connected to a polygraph correlate with the experimenter's moods and actions even when they are miles apart. Indifference to distance has also been noticed in prayer experiments (Miller, 1972).

Kirlian photography is sometimes put forward as proof for the effect of radiating energy into a leaf, plant, or water. Named after its discoverer, Semyon D. Kirlian, it is a photographic method that shows a field around the edges of plants, leafs, stones, animals, humans, fingers, etc. (Gmelig Meijling & Gijsen, 1975; Tompkins & Bird, 1974, pp. 215–18; Singer, 1981). There is considerable controversy about what, if anything, is the nature of these fields.

The focus in the texts in this section is whether influences such as prayer, a friendly attitude, and paranormal healing effect plants. Positive results have been reported, and have been challenged, but explanations for the results are thin. At best, similar experiments and explanations in other papers are cited, most often Cleve Backster's article introducing the phrase 'primary perception'. Plants must have something like a primary perception ability, he reasoned, because otherwise how could the graphs of plants' electric potentials vary so much, and in accordance with events happening in their surroundings? But (apart from Marcel Vogel) those who repeated Backster's tests did not get the same results, and so could not verify primary perception in plant life. Not only his results, but also Vogel's explanations are widely questioned in scientific circles.

Moreover, even if 'primary perception' did exist in plants, this would not necessarily prove that plants are conscious. Prayer can be considered a form of mind power, and experiments with mind power have also been conducted with nonliving materials. It has been claimed that some people can move or twist objects without touching them, e.g. paper clips inside glass globes (Hasted, 1981), or influence the outcome of random number generators (Radin & Nelson, 1989). These results are highly controversial, but the conclusion that plants must have something like consciousness because they respond to mind power cannot be supported by such phenomena unless objects like spoons and random number generators are also considered to have that particular 'something'.

A further factor regarding Vogel's work should be considered. Working from the assumption that prayer and healing do not and cannot influence matter, he developed experiments to test whether prayer and healing might work after all. The subjects chosen to test prayer or healing powers were plants, which were assumed to be unconscious, neutral organisms. As a result of his experiments, Vogel not only

became convinced that those powers do exist, but the idea that plants have perceptive ability also began to make sense to him. This in turn modified his research question to 'How can primary perception in plants be made visible in a repeatable experiment?' He then developed a new technique 'to charge a plant with thought energy' in order to isolate it from outer conditions, so that plants' responses could be registered repeatedly. So, not only did the research question itself change, but the theoretical substructure changed in line with it. 'Thought energy' and 'primary perception ability of plants' had become facts. This illustrates how concepts about plants and the nature of reality influence the design of experiments in this area.

It also complicates discussions about Vogel's work, because for someone who is not convinced that prayer and paranormal healing can actually influence (plant) matter, and who believes plants are unaware/unconscious organisms, Vogel's method of charging a plant with 'thought energy' is difficult to accept as a fact. Such a person must first accept the kind of experiments that brought Vogel himself to believe that plants have a primary perception ability and that thought is a force.

Cluster III. *In which it is held that plants do have 'something' (consciousness?) because people actually see, experience or talk with nature spirits.*

Social and anthropological studies have investigated many aspects of (indigenous) knowledge on all continents. The relationship(s) people have with nature, what function(s) certain rituals have, what role shamans fulfil in a community, which animals, trees and plants in particular are believed to be holy or spirited, and so on, are all related to religious beliefs and have an important impact on social structures (e.g. Beattie & Middleton, 1969; Doornewaard, 1992; Elkin, 1994; Ford, 1979; Vitebsky, 1995). That everything on earth might have (something like) 'soul stuff', as is believed in many cultures, is a rather alien concept in current Western society, but it makes sense to some clairvoyants, who often claim to see the auras of humans and animals, and sometimes plants, flowers, and trees (see the pictures in Gmelig Meijling & Gijsen, 1975; Goelitz, 1991; Hodson, 1976; Roads, 1990). Here is a clairvoyant observation of Geoffrey Hodson:

> When examining bulbs growing in bowls, I have seen large numbers of . . . microscopic, etheric creatures moving in and around the growing plants. They are visible at the etheric level as points of light playing around the stem and passing in and out of the bulb. They absorb matter from the surrounding atmosphere, which they deposit on reentering the tissues, and this process goes on continuously until the plant is full-grown. The creatures are entirely self-absorbed and sufficiently self-conscious to experience a dim sense of well-being and even of affection for the plant. When outside of it and absorbing matter, they become enlarged and look like pale violet and lilac-coloured spheres about two inches in diameter. Having expanded to the largest size of which they are capable they return and, as stated above, re-enter the plant, into which they discharge the matter and vital force which they have absorbed (Hodson, 1976, p. 36).

Seeing auras of trees, stones, animals, and etheric life forms like fairies, elves, gnomes and other creatures, as people have seriously reported (Evans-Wentz, 1994; Hawken, 1975; Hodson, 1994; Hommersen, 1993; Van Gelder, 1994), is acknowledged by them to be 'special'. Even more special is having mystical experiences with elements of nature; these experiences always make strong impressions. One such experience is described by Patrice Somé (1994). During the initiation rites of his tribe

in Burkina Faso, Somé was told by his coaches to pick a tree and to look at it until he really saw the tree. It took him many hours before he met and deeply sensed the 'green lady' of his chosen tree, and understood what the elders had meant by 'really seeing' the tree. The tree was not just a tree, it was much more. The 'green lady' was an energy form, a living entity with tremendous strong and overwhelming powers. Never in his life had he felt so deeply loved and cared for.

Mystic encounters with nature are also reported by Michael Roads, an Englishman who for ten years had a farm in Tasmania, and who now gives workshops around the world, and writes about his experiences with nature. In one account, Roads describes his feeling that his consciousness had 'shifted' to being the last English elm on earth (Roads, 1994, pp. 26–48). The experience gave him a perception of 'tree' consciousness as immortal, from which he drew the wider inference that consciousness generally always just 'is', and is not bounded by space and time. Elsewhere Roads (1990, pp. 44–58) tells of finding his consciousness being taken back to his time as a farmer in Tasmania. In the experience, his consciousness had shifted and expanded so that he was both himself (the-farmer-of-before) and also the blackberry vines he was spraying with toxic chemicals. As blackberry, he felt not only that the poison was disturbing his 'blackberry energy', but that all life — including the life of humanity — was affected, because he felt that in reality all is One. After Roads returned to normal consciousness, he felt he understood at a deeper level something that had happened years before. While spraying his blackberry fields, he had succumbed to an overwhelming urge to take a nap, and on waking up — unlike himself — had rolled the hose, climbed on to the tractor, started the engine, driven home, and never sprayed pesticides on blackberries again. Until this mystical experience, he had not understood why his change in behaviour at that time had been so drastic. Now that he had felt the Oneness of all, he did.

Besides seeing and experiencing the etheric and/or mystic aspects of nature, Roads also writes about conversations with nature. During the last 25 years many people have written about their communication with what appear to be personality sources outside their conscious mind. The phenomenon is called 'channelling' (Hastings, 1991; Klimo, 1988). A channeller listens carefully ('tunes into a certain vibration'), and hears what a particular unit of consciousness says, which s/he then speaks out loud, or writes down. It is possible to ask the channelled source questions and have a meaningful conversation.

According to these writers, when nature intelligences are channelled, a whole range of entities can come through, as all elements of nature appear to be available. All plant and animal species, all woods, mountains, caves, rivers and rock formations seem to have a 'soul', a consciousness of their own. Often the unit of consciousness of plant and tree species is called a 'deva', a sanskrit word for 'shining one', used to describe what is understood as an embodiment of creative intelligence that functions in an architectural and organizational kind of mode. A 'nature spirit' too is considered to be an embodiment of creative intelligence, but of another order. Nature spirits are the builders. They shift energy that has been formulated on the devic level to the physical level.

Although it is at this point impossible to judge whether channelled information is pure fiction, or might contain (some) truth, it obviously relates to this paper's subject,

so an example is given. It is an excerpt from the corn deva, as channelled by Robert Shapiro, and shows how this deva sees itself in relation to mankind and earth.

> I am the plant you refer to as corn. I speak to you as the Deva associated with our super-consciousness, the Corn Goddess. I have a very strong spiritual body that not only connects me cosmically to my point of origin but also embraces the earth as a nurturing parent . . .
>
> When I am planted in a field, I choose to feel every row and plant as a unit. Therefore, I do not experience spatial references in the same way as you; I feel myself as the entire field of plants. When an area of corn is accidentally destroyed, some element of protest is expressed from the rest of the corn. Corn shrivels a bit or makes a sound that only the observant farmer notices. I do not shrink out of fear; instead I understand that I am here to sustain you. I am prepared, at any moment, to offer myself in support of my true purpose on this planet . . .
>
> I have a sense of touch similar to that of the human being. I know when I am touched, and I am aware when someone or something is near that is not of my own kind. I have a strong energy field that radiates with an awareness of up to six feet. I have an ability to respond to the change in weather conditions and to the changes from day to night.
>
> Diseases that affect a crop can be assisted through meditation or prayerful communications. Earth must provide nourishment for all, not just a specific few; this is why birds must occasionally invade the crops. They themselves sustain other creatures, even humans. The diseases which wipe out a crop provide for the insect kingdom (Shapiro & Rapkin, 1991, pp. 27–9).

That a shift has been made from believing 'plants are unaware and unconscious organisms' to 'plants are aware and do have consciousness' is obvious in the texts mentioned in this and the following sections. They deal with observations on another level and are paranormal and/or mystical in nature. The nature of reality seems to have an additional, non-physical dimension to it, in which people sense more subtle (spiritual?) energies of nature. This lends it an animistic slant, which may appear fresh and new, but in fact is ancient.

Cluster IV. *In which plants are treated as conscious beings with which man can cooperate.*

In the mid and late 1960's, a family living in a caravan park in Findhorn, a small village on the north-east coast of Scotland, grew some very healthy vegetables and flowers on barren, sandy soil. When forty pound cabbages and broccoli that was nearly too heavy to lift appeared, it became obvious that something extraordinary was going on. The family said the secret of this vital abundance was their cooperation with the nature spirits and devas (Hawken, 1975; Tompkins & Bird, 1974, pp. 372–83). One of the group, Dorothy Maclean (1990) claimed to communicate telepathically with the nature intelligences; she channelled. Whenever there was a problem in the garden she consulted the deva of a particular species or the 'overlighting deva' of the Findhorn garden. These then gave advice. For instance, they would say what kind of treatment would be best for optimal growth. The head of the family, Peter Caddy, the gardener, followed precisely the instructions Maclean received. If plants had to be moved, the deva was informed, so that the plants had time to withdraw energies from their roots. The move thus went more easily for both man (who did not have to pull strongly to get the roots out), and plants (which were less

damaged). It was said that the devas were pleased about the fact they were listened to, and in return thrived in harmony with the family living from the vegetables and fruits that the garden produced.

Through the amazing stories about the tremendous growth and richness of the Findhorn garden, the place attracted many visitors who wanted to see this miracle with their own eyes. A horticultural adviser called. He sampled the soil for analysis, and with some bewilderment — because at first he had advised artificial fertilizers since he thought that Caddy's compost would be inadequate — acknowledged that he had found no deficiencies, not even of trace elements (Tompkins & Bird, 1974, p. 378). An expert on roses tested Caddy by advising him to plant roses that could not possibly grow in Findhorn's climate and soil. Caddy, not knowing he was being tested, did as advised. The next summer, to the expert's amazement, he found 'banks of roses leaning over the roadway' (Hawken, 1975, p. 172).

Stephen Clark (1992) says it is interesting to notice how Caddy, who spent ten to twelve hours a day, seven days a week working in the garden, attributed the garden's success wholly to the help of the nature spirits. Quite striking also is the way that over the years the people of Findhorn turned the story more or less into a myth. When visitors stayed and a community developed, others took over Caddy's gardening activities and the garden lost its abundance. As time went on, the focus of the community simply shifted from growing vegetables to growing a community and growing people. In the minds of the community members this did not mean the garden experiment was over, nor that it failed: the period when the family in Findhorn created its miraculous garden is now considered to have been the seed for the Findhorn community's own later development.

In a way, Machaelle Small Wright (1983, 1990, 1993; see also McGonagle, 1993; Roads, 1987; Young, 1984, pp. 223–66) has continued where Findhorn left off. Wright, inspired by a book about Findhorn, in 1976 began to garden 33 acres in Virginia, USA. From the beginning, she intended to work in cooperation with the nature intelligences. She calls the method she developed 'co-creative gardening', and her garden, Perelandra, has become very beautiful and also a kind of research station where she and nature experiment in partnership. For, in her view, nature must learn ways to get information through to the person asking the questions. Nature just 'knows' how much it needs in nutrients and does not 'think' in amounts of inches or grams. Humans do. So nature has to learn to measure in human quantities. Also, working in partnership with nature does not imply that everything in the garden goes easily and smoothly. As with all partnerships, Wright explains, both must adjust, both must give and take, and get to know each other.

According to Wright's insights, nature always tries to find an optimal balance in the overall energy of the garden and beyond. If the owner says s/he wants carrots, potatoes and gardenias in the garden, nature goes along with those wishes. When asked, the deva(s) can advise otherwise. The advice given is always set against the bigger picture, meaning that the larger context of the area is included, the physical component (the animals, soil, insects) as well as the social component (mankind). In Wright's experience, crops will produce just as much, if not more, compared to current methods which do not cooperate with nature. Nature does not need chemical fertilizers and pesticides. It is not a mistake for mankind to use them, the devas say, because humanity has learned, and is still learning, from this experience.

Two of the three books Wright (1990; 1993) has written about her partnership with nature are handbooks instructing readers how to cooperate with nature intelligences. The key in co-creative gardening is communication. Wright claims to telepathically hear the devas and nature spirits. (In her own opinion she does not channel but 'translates'; she is in full control of her own consciousness, and her physical being is not taken over by nature intelligences.) Furthermore, she relies in her communication on a form of 'kinesiology', muscle testing. She asks nature plain yes/no questions, and sees with a simple muscle test if the answer is yes or no.

The books on working with nature intelligences provide, beyond a new way of gardening, even up to the level of farming, a complete outlook on life itself. Everything on earth, even everything in the cosmos is alive, moving, changing, growing, evolving; everything, in one way or another, is conscious and aware. Nothing of nature has to prove it is conscious, it just is. The devas and nature spirits say through their channels that it is mankind who has decided it is the only true conscious creature on earth. They say that by having done this, humans show they do not understand their own true nature.

The idea of an extra dimension, considered at the end of the previous section, might be rejected for the cases in cluster III. Auras, sensing subtle energies, etc. are not for all to see or feel, and Roads' and Shapiro's channellings might be sheer fantasy, products of their imaginations. Also, the energy fields seen in Kirlian photos — that are often considered to be the aura psychics can see — have been discussed in terms of electrical properties (Singer, 1981). But in the examples of this cluster, anyone can observe the extraordinary richness in the Findhorn garden; and anyone can experience the vital atmosphere at Perelandra. These are plain facts.

Yet when it comes to explaning these facts, opposing views surface. Did Dorothy Maclean, and does Machaelle Small Wright, really work with nature intelligences as they claim? If not, how did they develop their special gardens? A rationalistic sceptic might try to explain these facts within reductionistic a biological/physical/chemical framework: nature intelligences and spiritual dimensions could not be responsible for the facts perceived in Findhorn and Perelandra; the physical circumstances, by sheer coincidence, might have been perfect for nature to develop abundantly. This is possible, but questions remain: Where did Maclean and Wright get their information on planting rhythms, garden layout, maintenance procedures, etc.? Is it only fantasy at work? Does the channelled information stem from the plant kingdom, or is there some undiscovered knowledgable part of the human mind that is perhaps related to having a 'green thumb'? Having a green thumb means having a talent for gardening, but it does not explain anything. Scientists who study channelling cannot say exactly what channelling is, but they do note that the phenomenon can be traced back for centuries (Hastings, 1991; Klimo, 1988; Riordan, 1993). In many cases, so-called chanelled information can be traced to the chaneller's own mind, but Arthur Hastings (1991) and Jon Klimo (1988) are quite certain that not all channelled information can stem from the channeller's own mind.[1]

[1] After this paper was completed, three further books (Bdolak, 1991; Bridges, 1993; Cowan, 1995) which would fall within the third or fourth clusters came to my notice, but there has not yet been time to investigate their claims.

Discussion

Nowadays, it is channelled information, clairvoyant observations and mystical experiences that lead people to belief in plant consciousness. Observations of this kind are not, however, scientific; they are subjective and not repeatable. Science requires observations that are objective and repeatable — by anyone. But this raises a problem in the philosophy of science: Scientific researchers have a highly specialized education, and only those who have had the same training can repeat their experiments. Perhaps, in a similar way, people can be trained to see or feel the more subtle forms of energy. If this is accepted, then it is not sound to argue that clairvoyant observations are subjective and invalid, while laboratory observations are objective and valid.

Noting this philosophical problem, Ray Hyman (1981) still concludes that the results of parapsychological experiments can be dismissed because the experiments do not conform to scientific standards. It seems justifiable to extrapolate his conclusion to the mainly 'one man laboratory' experiments of Cleve Backster and Marcel Vogel, and to the Findhorn and Perelandra cases where definitely no standard scientific research has been conducted. The issue for experiments with prayer and a friendly attitude is, as mentioned already, different. Although it is unexplained why, in some cases at least, plants appear to respond to prayers and friendly words, the fact that plants did so respond would not in any case prove plant consciousness. Ergo, the critical/sceptical approach to plant consciousness appears to win the debate over the believers in nature intelligences (and other forms of plant consciousness).

However, believers in plant consciousness seem not to be bothered by such a defeat. Performing perfectly controlled and repeatable experiments to (dis)prove plant consciousness, even those designed by Vogel, seems pointless from the viewpoints of mystics, neo-animistists, and New Agers. Experiencing a mystical moment of the 'Oneness of All', feeling that reality as a whole is conscious, as testified in many accounts, makes proofs of plant consciousness through scientific experiments seem trivial. The nature of All-consciousness is not to be discovered through experiments where mind and matter, humans and nature are viewed as two different, separate (opposed) things, if — as appears from this perspective — no such separation exists.

On the other hand, to reject science completely, on account of underlying assumptions like its mind/matter duality and repeatability requirements, would be extreme; scientific research is too much a part of our society. Besides, the assumptions of science are already being questioned by scientists themselves (e.g. Berman, 1981; Goguen *et al.*, 1994; Harman, 1988). One part of this trend is Goethian phenomenology, 'a monistic/holistic, appropriately participatory, scientific approach to understanding nature' (Beekman & Van Mansvelt, 1995, p. 6; Kranich, 1993). This method, originally developed by the great German writer Johann W. von Goethe (1749-1832), was given theoretical grounding and further explanation by Rudolf Steiner (1861–1925), and developed considerably further by others later this century. It is characterized by a special attention to the complete process that links the observer to the observed. The observed can only be fully known if the observer is aware of her/his own opinions and values concerning the observed. By really observing nature, a relationship develops between observer and observed, so that the observer becomes aware of dimensions not normally comprehended with the rational mind. From such a stance, nature is experienced more fully than can be described in the natural

sciences, and ultimately, as Steiner has said, 'you may no longer see anything but an expression of the spiritual life lying at the foundation of everything!' (Steiner, 1984, p. 25).

In a way, this Goethian phenomenological approach is similar to techniques of indigenous learning. When the tribal chiefs of Patrice Some (1994) told the initiates to really look at a tree, the initiates could see and sense the spiritual life behind the physical form of a tree; they experienced a depth in nature that is not seen with the five physical senses.

More recent challenges to the foundations of science appear in the work of Rupert Sheldrake (1988) and James Lovelock (1979). The former presents a hypothesis of 'formative causation', postulating that the nature of things, animals, molecules, plants, and human beings, depends on 'morphogenetic fields'. These nonmaterial fields are potential organizing patterns of influence that contain within themselves a memory of their previous physical existence. The process by which the past becomes present within morphic fields is called 'morphic resonance', involving the transmission of 'formative causal influences' through both space and time.

Lovelock considers our planet to be a self regulating organism, called Gaia after the Greek goddess Earth. He postulates that 'the climate and chemical composition of the earth's surface environment is, and has been, actively regulated at a state tolerable for the biota by the biota' (Lovelock, 1991, p. 30). Both hypotheses have aroused many controversies within the scientific community about, among other issues, the testability of the hypotheses. Opposing views about science's basic assumptions often play an important but covert role in these debates. This adds to the complexity of discussing plant consciousness, for the following reason.

People believing in the existence of nature intelligences (the far right of Figure 1), search for scientific ideas that accord with their beliefs, and find them in the ideas of Sheldrake and Lovelock (Altman, 1995, pp. 45–6; Beekman, 1995; Goelitz, 1991; Hommersen, 1993; Kerner & Kerner, 1992; Lindfield, 1986; Stone, 1988). Thus, 'deva' can be substituted for 'morphic field', and viewing the earth as an organism fits with neo-animistic beliefs. People questioning the fundamental assumptions of science (around the middle of Figure 1), bring up Findhorn and Backster to support their critical point of view (Dossey, 1989; O'Leary, 1989; Pedlar, 1979, p.172; Sheldrake, 1991). It seems that everyone has a personal agenda, but all have one common 'opponent', namely that part of science and society that has no place for the belief that plants could be conscious (the far left of Figure 1). Add to this the fact that the plant consciousness issues, especially those in the New Age literature, are not covered in biology and plant sciences, nor in studies of consciousness, and it becomes clear why the subject of this paper is so complicated and sensitive. Much more is involved than just a set of hypotheses and experiments: People's diverse world views (their basic assumptions), the variety in their style and line of argument, the scattered nature of the literature available, all add to the complexity of the task of classifying views of plant consciousness.

Concluding Remarks

The texts discussed here cannot give a decisive answer to the question of plant consciousness. The major input for renewed belief in plant consciousness is now

mainly outside the scope of biologists and plant scientists, and many people take the view of life in which All is conscious to be just as legitimate as the more scientific worldview that at most certain aspects of nature are conscious. It might be fruitful for the different views of plant consciousness to confront each another. Arguments about plant consciousness will not necessarily bring a resolution; they will probably merely reinforce tightly held beliefs about the nature of reality. Even so, open discussions will at least bring such (often implicit) views and beliefs to the surface — itself a valuable process that can sharpen our rational mind — and will let participants experience for themselves the diversity of views that can be held by legitimate members of society.*

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* **Acknowledgement:** I would like to thank Rens Wezelman, Anthony Freeman, Joseph Goguen, and all others who have contributed to this paper through discussions and comments on a previous version.

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Article submitted August 1995, revised April 1996.