Journal of Scientific Exploration, Vol. 13, No. 3, pp. 499–513, 1999 0892-3310/99

Analysis of Technically Inventive Dream-Like Mental Imagery

BRUCE C. TOWE AND CAY RANDALL-MAY

College of Engineering
Arizona State University, Tempe, AZ 85287-6006
email: bruce.towe@asu.edu

Abstract — Analysis of dream-like imagery associated with an altered awareness state reveals the existence of inventive technical ideas embedded within imagined machines and devices. These show an unexpected degree of detail and complexity and suggest a high degree of mental functioning during the altered state. This paper provides two examples of this kind; a photochemical solar energy converter and an envisioned synthetic method of producing a proton-conductive lubricating oil. The basic ideas within these promoted some successful bench-top experiments. The data suggests that a mental process that involves dream-like imagery may be an approach to scientific creativity and invention.

Keywords: mental imagery — creativity — invention — altered states of awareness

Introduction

Scientific inventors have always been dreamers; sometimes in a very literal sense. Nikola Tesla, famous inventor of the polyphase dynamo and high-voltage transformer (Tesla coil), for example, was prone to perceiving his inventions in a dream-like mental vision. Tesla reported that he "saw" his inventions as if they were real on the screen of his mind's eye while in an altered awareness state. He claimed that the power of his imagery was such that he could do "experiments in his mind." He wrote:

> It is absolutely immaterial to me whether I run my turbine in thought or test it in my shop. I even note if it is out of balance. There is no difference whatever, the results are the same. In this way I am able to rapidly develop and perfect a conception without touching anything. When I have gone so far as to embody in the invention every possible improvement I can think of and see no fault anywhere, I put into concrete form this final product of my brain. Invariably the device works as I conceive it should and the experiment comes out exactly as I had planned it. In twenty years there has not been a single exception.[1]

[1]As reported in Harman, W. (1984). *Higher Creativity: Liberating the Unconscious for Breakthrough Insights,* J.P. Tarcher Inc. 1984, where the original reference was cited as Nikola Tesla (1919). My inventions. *Electrical Experimenter.*

In Harman's book, *Higher Creativity* (Harman, 1984), there is a compendium of contributions to science and technology by famous Dreamers of the past. He cites such notables as Nobel Prize winning Neils Bohr for the structure of the atom, Elias Howe the inventor of the sewing machine, and Sir Frederick Banting, who invented the commercial production of insulin. All of these and many others produced their achievements during a dream-like altered awareness state. Indeed, the phrase "dreaming something up" has literally become a common expression in our culture, implying that the process of creation and invention is closely linked to processes involving a non-waking kind of awareness.

Harman points out that a person need not be born with a special ability to enter an altered awareness characterized by dream-like imagery. Methods of evoking altered states leading to imagery are many and varied and can include approaches such as meditation, hypnosis, and even listening to certain kinds of sounds (Atwater, 1996). People from a wide variety of professions have reported experiences with altered states including scientists and inventors (Harman, 1984), law enforcement personnel (Targ, 1985), successful executives (Monroe, 1985), and military professionals (Puthoff, 1996). These reports imply that the ability to see imagery during altered states is not necessarily the daydreaming of an undisciplined mind but rather a common, and maybe even useful human capacity.

As in some dreams, this kind of imagery allows the dreaming observer (the Dreamer) to retain an awareness of the process and products of imagery as they occur. The Dreamer may report the impression of visually "traveling" and that the envisioned things are seemingly not evoked by the conscious use of the imagination but rather appear on their own. The subject matter of imagery is generally under volitional control or can be introduced in response to suggestion.

Our experiments with this kind of imagery have concerned themes of technology such as machines and devices. These topics have been of interest to us because they show imagery that concerns practical things and has considerable detail, complexity, and even an apparent technical sophistication.

Methods

This study started among a social group of university science faculty that had an interest in dream-like mental imagery. During an altered awareness state, one member of the group was found to experience quite vivid mental imagery that could be encouraged towards subjects of choice. When directed towards machines and devices, there was a chance observance that the imagery contained implicit technical ideas embodied in imagined structure and function. This person is the Dreamer of this study and subject for the following experiments.

The subject has a Ph.D. in Entomology and has published in the scientific literature in the area of comparative morphology using arthropods as experi-

mental subjects. The subject also has extensive training and experience in technical illustration, and more recently has been working in the fine arts. A highly visual imagination and intuitive abilities have been present during most of this person's adult life and have been encouraged by a practice of meditation.

The subject uses autosuggestion to relax into a dream-like mental state characterized by highly visual and imaginative imagery. It supports a condition of mental free-association and a feeling of detachment of self from the ongoing parade of imagery seen in the mind's eye. As a result of some practice, the subject is able to maintain a cognitive middle-ground, neither totally submerged in the imagery nor totally awake. This altered state has similarities to lucid dreaming (LaBerge, 1990) where a person becomes aware of a separate but normally subliminal image-making capacity of the mind. The mind is poised in a state of reflective observation where it is possible to verbally describe the content of imagery as it unfolds.

The subject matter of the unfolding of dream-like imageries is largely driven by questions from others present. We have found it particularly effective to use questions to direct the Dreamer's imagination towards specific technological problems like: "Can you envision a device that produces electric power from the sun?" Often several different imageries embodying design approaches will be envisioned over a period of several minutes and the Dreamer will give a preliminary description of each. The questioner selects one and follows with a process that is much like a news interview that encourages the Dreamer to sequentially visualize its parts.

The people providing follow-on questions in this work have been primarily university engineering and science faculty. Verbal interchanges between the Dreamer and the questioner are cooperative. The questioner uses an intellectual and analytical mind to assess the imagery descriptions, ask pertinent questions, and attempts to insure that the interchange stays on topic. The Dreamer plumbs the intuitive, synthetic, and image-making parts of the mind and reports the results without analysis or assigning a meaning. Audio recordings made during the imagery sessions show that the Dreamer is doing most of the talking and that others are not contributing to the content.

We observe that this kind of dream imagery can exhibit an unexpected degree of coherency and realism. Upon analysis, imagined machines and devices are often found consistent with engineering principles and laws of nature and show the existence of technical ideas and strategies embodied in their form and structure. Why this characteristic should be part of altered state imagery is not clear since most people's dreams are not consistent with reality. Indeed, the dreaming mind clearly has the power to imagine anything without the constraints of the real physical world.

The Dreamer usually does not initiate or long-sustain a description of what the questioner may think important in the imagery. The degree of imagery detail is partly up to the person asking the questions and by the extent to which

he continues to pursue the subject matter. A technical background on the part of the questioner is very helpful and may be even essential to helping the Dreamer to focus on important aspects of the imagery. Otherwise there is a tendency for the Dreamer's attention to wander to other things which decorate the inner visual landscape.

Over several sessions it can take many hours to achieve a reasonably complete description of the function and structure of some imagined device. After an imagery session, the waking Dreamer usually reports that the images quickly fade, as in a scarcely remembered nighttime dream, and has difficulty in discussing details or providing any additional information. Even so, we find that objects once envisioned seem to have a fixed "existence" at some level of the mind. The object of imagery often can be later revisited during the altered state. More detail can be envisioned which usually fits perfectly with the original conception. Instances of this have occurred even after months and occasionally years later.

The process of evoking dream-like imagery employs a quiet environment and has ranged from university laboratories to private homes. There is no isolation, Ganzfield settings, or other special props employed. The raw verbal data is thousands of words[2] so we present some quotations from the data but mostly the results are provided in the form of condensed summaries. No additional technical terms or concepts are used in the summaries that do not appear in the raw data. The Dreamer often draws sketches of things envisioned and some of these are included here.

Figure 1a is the Dreamer's sketch of an envisioned solar energy converter. Figure 1b is the sketch redrawn for clarity.

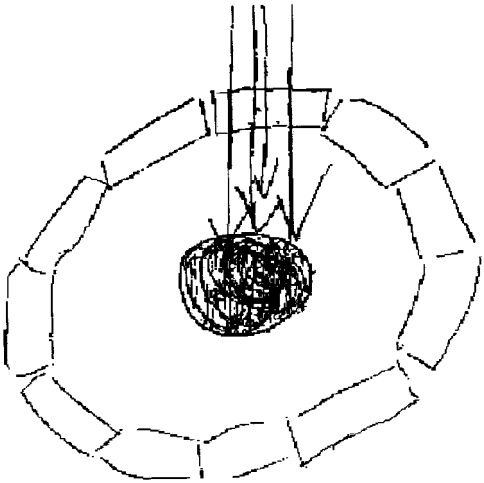
Results

Imagery of A Photoelectrochemical Cell

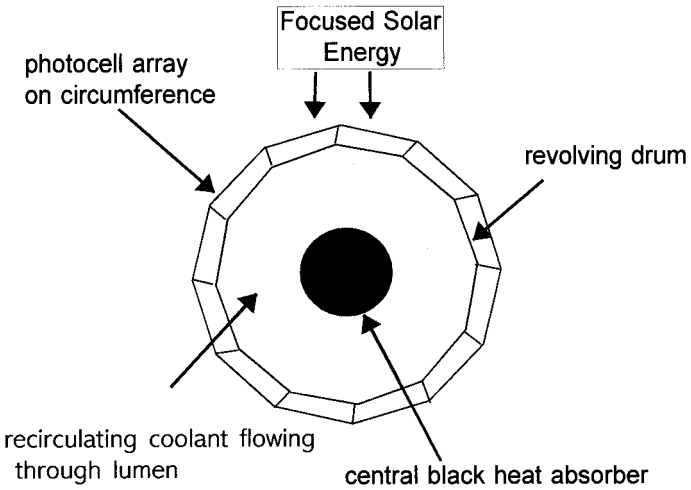
The Dreamer described arrays of individual photochemical cells mounted on a drum that sequentially rotates each one into the focus of a solar concentrator mirror. The device harvests both the heat and light of the sun and so has overall high conversion efficiency. Figure 2 shows one of the photochemical cells. The photovoltaic part is a solar-driven ion pump which uses the interfaces of two different metals, silver and copper, as the electron gating mechanism and a gel electrolyte as the reservoir of electroactive ions. Active cooling of the cells is done through a circulating refrigerant fluid that passes through the central lumen of the rotating support cylinder.

Each cell of the group contains copper and silver halide-based metal rods housed in a clear rectangular box made of quartz containing the gel electrolyte. As each cell is brought into the solar focus, it produces a very high peak current

[2]For scholars interested in more information contact: bruce.towe@asu.edu.

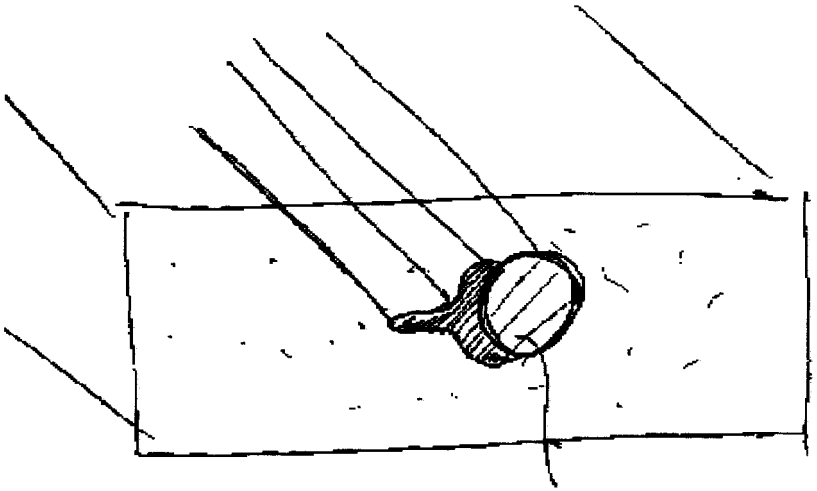


(a)

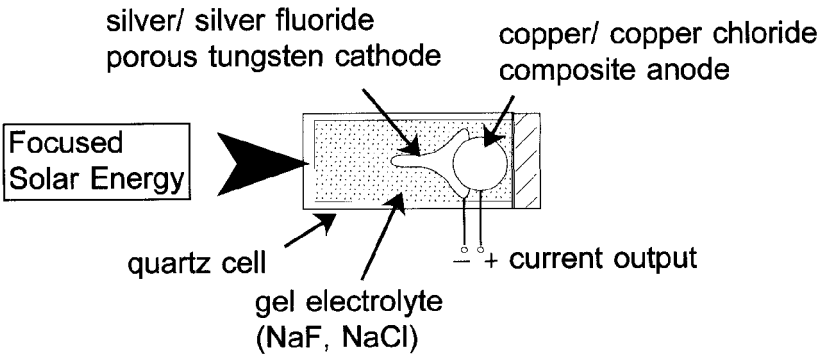


(b)

Fig. 1. (a) Dreamer's sketch of an envisioned solar photovoltaic system. (b) is a redrawn illustration.



(a)



(b)

Fig. 2. (a) Photoelectrochemical cell portion of envisioned system showing the silver flanged electrode (side view) mating with the cylindrical copper-based electrode. (b) is an illustration showing components identified in descriptions.

in the strong illumination but for a relatively short time, on the order of just a few minutes, as electrochemical reactions consume available reactants. As the reaction starts to decline, the next cell moves into place at the solar focus. The illumination of the cells overlaps somewhat to produce a continuum of current flow. Power is withdrawn by metal contacts at the ends of each cell as they pass stationary current collector brushes.

(The sun illuminated electrode contains) ...a silver halide and there is tungsten involved with it. (Tungsten and silver silver-halide powders) are mixed together and extruded under great pressure. The coppery (electrode) is a cupric alloy. They (two electrodes) are lying side by side with one whole long side embracing the other....

This junction of the two electrodes does not result in a short-circuit current flow between them when illuminated, but over a period of time there is a gradual intercalation of the metals at their junction and ultimately the electrodes must be replaced.

The photocathode is not a true alloy but an intimate association of the components; a composite of 70% silver, 20% silver-fluoride and 10% tungsten. The tungsten is chemically unreactive and is used to form a porous matrix that holds infiltrated silver compounds. The anode is mostly copper amalgamated with a small amount of copper chloride.

There is an optically transparent electrolyte gel filling the cell housing. It consists principally of the fluorides and chlorides of silver, sodium, and hydrogen held in loose ionic bonds on the molecular surface of a mucopolysaccaride-based gel matrix. These ions are readily available for photochemical reaction and form a buffer reservoir to insure a saturated electrolyte gel under all operating conditions.

In the presence of light... there is tendency of the silver (electrode) to give up the fluoride and take the chloride preferentially and precipitate out... there is a difference in the stability of silver chloride as opposed to silver fluoride... an unstable balance between the two. (In light)... the fluoride (ion released from silver) tends to copper fluorite.... The copper (fluorite) compound is not a particularly stable one... (in darkness) eventually it dissolves or breaks down... so there is a retreat of the fluoride back into the (silver) metal when the sunlight is not there.... (There is a recharge phase in darkness) for a relatively long period of time... its two fold, a thermal decay as well as an electrical returning to balance.

An Analysis of the Imagery

The description continues into many fine details of the construction and operation of the solar device. It can be seen that the imagery is not the vague and disordered product that most people would associate with dream-like awareness states. Rather there is a detail and coherence to it. However, the sophisticated technical nature of the imagery only really becomes apparent when it is compared to technical books and the scientific literature.

Photoelectrochemistry is an established area of scientific research. Several books written on the subject were used as reference materials in this following analysis (Cardon *et al.,* 1980; Chandra, 1985; Santhanam, 1988). There is also a scientific journal devoted to the subject (*Journal of Solar Energy Materials and Solar Cells,* Elsevier Science Publishers) and there can be found several literature reviews of photoelectrochemical devices of recent interest (see for example, Graetzel, M. & McEnvoy, A. J., 1990; Bolter, 1995). A discussion of the photovoltaic sensitivity of silver halogens can be found in Tan and Trautweiler (1969) and Kosar (1965).

Technical analysis and reverse engineering of the envisioned device shows it consistent with a type of halogen-based electrochemical cell (Cisak & Werblan, 1993). The described chemistry clearly refers to a reversible metathesis reaction known to occur in fused salt systems (Ives & Janz, 1961) of the type:

$$AgF + NaCl \leftrightarrow AgCl + NaF$$

The imagery requires that the reaction be driven to the right upon solar exposure and additionally that the copper chloride anode becomes a copper fluoride. Assuming this, the following reactions are consistent with the imagery, although some liberty has been taken with valence states and in ignoring the possible formation of divalent silver and copper compounds.

$$\text{photocathode:} \quad AgF + NaCl + h\upsilon + \text{heat} \rightarrow AgCl + NaF$$

$$\text{anode:} \quad CuCl + NaF + h\upsilon + \text{heat} \rightarrow CuF + NaCl$$

In darkness these reactions are envisioned to reverse.

Comparisons to the scientific literature shows that aspects of the envisioned cell chemistry as well as parts of the cell structure are firmly based in the photoelectrochemical art. For example:

- Silver halides have a known light sensitivity and their electrode reactions are often reversible (Ives & Janz, 1961). Their employment is consistent with a solar energy cell employing a light–dark cycling strategy.
- The copper chloride anode is similar to a patented kind of high-energy electrode (Bugga, 1990) and so seems well suited to solar voltaic design. Copper chloride/fluoride reactions are light sensitive (Kosar, 1965) and the fluoride is reactive (Cisak & Werblan, 1993) at acidic pH and at elevated temperature and so are reasonable choices for this kind of cell.
- Tungsten porous matrices are resistant to corrosion in a high-temperature chemically reactive environment (Pleskov, 1990) and so a good choice for the infiltrated silver photocathode.
- The copper-silver halide electrodes' intermetallic contact would be called an intercalation junction. Similar ideas, although employed differently, can be found in Pleskov (1990).

Experimental Evaluation

The ideas embodied in the imagery were nearly complete and suggestive of some practical experiments. Not all aspects of the imagery could be easily duplicated, however, such as the intercalation junction and the sophistication of the porous tungsten matrix of the photocathode. Also the Dreamer's notion of the gel electrolyte matrix was complex and in some places not sufficiently specific to allow exact duplication and so the experiment was conducted omitting parts of this electrolyte. With these omissions, the following procedure is consistent with the imagery and tests some of its implicit assumptions:

- Press 0.6 g of 3 μm silver powder together with a dispersed 0.3 g powder of silver fluoride (AgF) into a 1 cm diameter disk at 7500 psi using a pellet press. Drill a small hole in the pellet and epoxy a wire into the hole such that the junction is protected from solution.
- Press 0.8 g of copper powder mixed with 0.1 g of cuprous chloride for the anode. Alternately for the anode, use strips of copper sheet metal 0.5 mm thick by about 1 cm^2. Form a copper chloride coating on them by exposure to a warmed sodium chloride solution.
- Add sodium fluoride to distilled boiling water until saturated. Use hydrofluoric acid to adjust the solution pH to 4.5 and to help dissolve the sodium fluoride. Add sodium chloride till saturated. This is the cell electrolyte.
- Immerse the copper- and silver-based electrodes into a 1.5-cm diameter glass test tube half filled with the electrolyte. Focus sunlight on the silver electrode using an 8-inch Fresnel lens. Connect the electrode wires to a load resistor and monitor the voltage across the load as a function of illumination intensity.

Figure 3 shows the experimental test setup.

Result

When the electrodes were placed into the electrolyte without solar exposure, there was negligible current into a load. When the cell was exposed to concentrated sunlight however, the cell output current rose and it started producing current and power as shown in Figures 4 and 5. The open circuit potential of the cell was measured at 0.55 V that declined to 0.22 V under a 10-Ω load (22 mA). It produced 60 mA at 0.08 V under a 1-Ω load. Some cells using the copper strip electrode produced up to 5 mW of power. Cell open circuit EMF increased to 0.7 V with pH increase toward neutrality and current output decreased. pH values above seven created a dark precipitate and low levels of output current.

In most cells during operation the clear electrolyte turned slightly reddish-yellow upon solar exposure with what was presumed to be excess fluoride in solution since it was clearly emitted by the cathode. In darkness this coloration

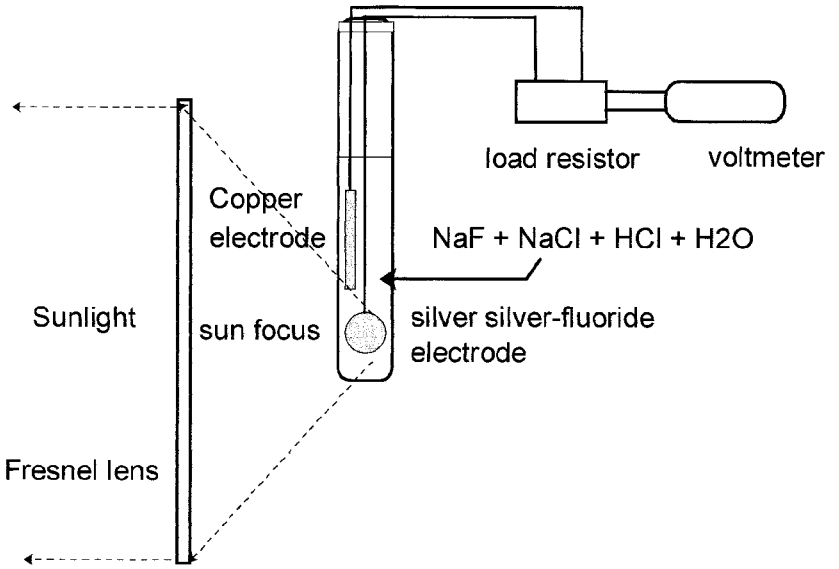


Fig. 3. Experimental test cell that follows the strategy of the dream imagery.

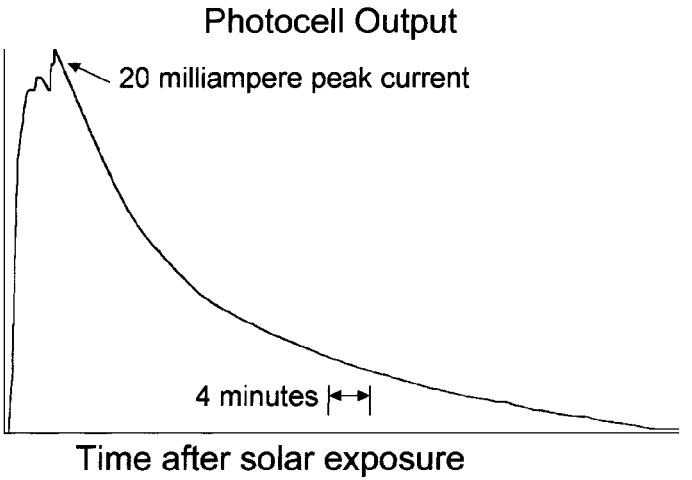


Fig. 4. Cell current rise when introduced into the solar focus. Cell was then shaded (at peak current) producing the decaying current and illustrating the solar-pumped nature of the electrochemical reaction.

disappeared. With current draw, the cathode turned white (likely AgCl) and the anode turned brown (likely CuF). Little or no sustained current flowed when the cell was removed from the sunlight or cooled below about 50°C.

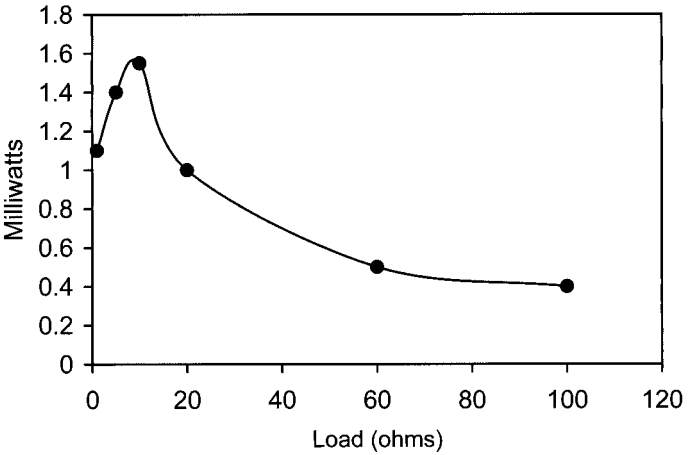


Fig. 5. Power output of the test cell versus load resistance.

With steady illumination, the cell current ultimately declined to 10% of its initial value over ten minutes due to the expected exhaustion of the electrode reactions.

After ten minutes of darkness and re-exposure to the sun, current ramped upward again but to a lower peak current than initially produced. Successive light–dark exposures produced an eventual declining of peak current flow towards zero.

The following experimental consistencies with the dream-imagery were observed:

- when exposed to concentrated sunlight the cell produces significant electric power;
- the cell does not self-discharge and the cell current declines towards zero in darkness.

Experimentally, the cell does remarkably well and appears to support the Dreamer's implicit technical ideas. This is not to say that the imagery is a wholly workable invention; for example, complete reversibility of the chemical reaction was not seen. In fairness however, the muccopolysaccaride basis of the electrolyte as envisioned was not tested and neither was the effect of the intercalation junction. Even so, there appears some likelihood that with the addition of some conventional expertise the device might be made useful. This simple experiment was not an effort to assess the commercial potential of such an approach. Such applications would require a consideration of a host of factors involving its efficiency and the economics of silver-based alloys. None of these issues have been examined in detail, although it might be interesting to do so.

An Electrically Conductive Lubricating Oil

This next example of technical imagery is part of an envisioned complex machine. A component required oil that had the properties of both an electrical conductor as well as a lubricant. The questioner pursued this aspect and asked about its possible manufacture.

(It has) … the mechanical qualities of an oil in addition to the electrolytic properties of an acid or an acidified solution. It is important that the oil itself be ionized so the extra hydrogen ions and sulfate radical are there… so they act as electron carrier…(so the oil) does not dissociate in itself.

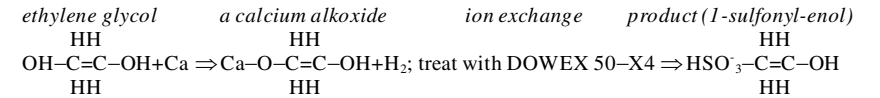
(The precursor is) …a petroleum based… nonflammable… mineral oil …there is a backbone of carbon. (There is) …a several step process that results in an oxygenation. (The precursor) is warmed in a container... a chip…(is added of) calcium.... There is a gas that comes off... hydrogen.... (This intermediate) …is acidified with sulfuric acid by running the heated oil through an …ion exchange resin.... When it is percolated through this it becomes… acidified. (The intermediate) …is white when it goes in and is… a light yellow when it comes out. What happens is that chemically it induces an acidification, as if adding sulfuric acid.... The only functional part is the sulfuric acid.... It is added in such a way that it remains ionic, it is overloading the substance with hydrogen and sulfate ions so that it becomes an oily-greasy electrolyte...

Experimental Procedure

A chemist used this as the basis for a synthetic method of preparing a sulfurous acid-substituted hydrocarbon. The following procedure is consistent with the imagery:

- Add 50 ml of anhydrous ethylene glycol to 1.5 g calcium metal chips under argon and warm to promote the reaction. Hydrogen gas bubbles off and a white precipitate of the alkoxide settles out. Decant the solution and remove any unreacted calcium. Wash the precipitate with acetone or methanol using a filter funnel. Suspend the precipitate in methanol and percolate it through a 20 cm long DOWEX-50 ion exchange column. The milky appearance of the intermediate changes to a pale yellow. Collect the liquid filtrate and fractionally distill off the methanol. Remaining liquid is the product.

Abbreviated Reaction:



This procedure produced a product which:

- is a pale yellow fluid
- has a slippery lubricating quality, somewhat like glycerin;

- has an electrical conductivity of about 3 mS that likely derives from proton (hydrogen ion) exchange between the sulfurous acid groups;
- would be considered an acidic-reacting oil.

The result is consistent with that envisioned. It should be noted however that although the strategy was described by the Dreamer, the chemist added some knowledge of synthetic procedures to produce this result; such as the choice of solvents, the specific type of ion exchange resin, and the use of an inert gas blanket to prevent problems with water vapor contaminants.

Discussion

It is striking that altered state imagery can show such a highly realistic and detailed inner world and can promote a practical result. Indeed, the ideas embedded within the dream imagery appear to contain a highly intellectual product and involve an implicit application of technical knowledge and facts.

In the solar cell example, many of the basic technical facts can be found scattered in the technical literature. Apparently unknown in the literature though is the electrochemical strategy of using a halogen exchange reaction between copper and silver that is driven by light and heat to produce electricity. Extensive searches of the technical literature and computerized databases suggest that this specific chemistry and its application to photovoltaics is an original idea. It is not without basis however, since it appears analogous to the reported thermally reversible chemistry of tin and lead chlorides and fluorides (Lee, 1992) although not in the context of power generation.

Likewise, the conductive oil is of technical interest since there is the clever idea that sulfonating a member of a class of slippery mineral oils renders it electrically conductive without destroying its lubricant quality. Literature searches show that the individual chemical steps and processes used to synthesize the oil are known but have not been assembled in this way before to produce a functional product. Speculatively, these kinds of lubricating electrolytes might be useful in certain commercial applications where there exists a moving or sliding contact that must conduct electricity.

It is notable that the envisioned devices and ideas are not part of the academic research expertise of the immediate group of university science faculty involved in this project. The highly technical nature of the imagery is unusual and raises the question of where the Dreamer-Biologist came into contact with the infrastructure of facts that are correctly employed in the imagery. This is unclear. Although the dreaming subject is a highly educated person, the imagery appears to show employment of technical concepts that would be normally expected to be beyond the subject's expertise. This conundrum is not easily resolved since what things an educated person may know, or may have encountered during an academic career, cannot be independently determined by others or proved with any assurance. This is therefore a difficult line of investigation to pursue in attempting to understand the mental process.

More than facts though, the analysis and literature searches suggest that some imageries are a novel assembly of ideas that are realistic enough that they can achieve a practical result. This leads us to the notion of a process that promotes creativity and invention. Novelty and creative approaches applied to technical subject matter requires the use of special abilities of the human mind that are very much valued by society. These are a much different and perhaps more important aspect of mental functioning than memory.

As seen in this report, the imageries support an inventive collaborative process between the Dreamer and others who have practical and technical skills. This approach to innovation however requires patience, a follow-on scientific expertise, and a tolerance for seemingly odd things that may also appear in the imagery. In this regard, anyone investigating this kind of altered awareness will undoubtedly find that the mental process also easily supports what appears as fanciful imagery. Imageries may also incorporate visions of distant places and times or contain interesting stories and narratives of events transpiring in an envisioned scene. In the instances in this report for example, the photoelectrochemical device was envisioned as part of the power source for a moon colony, and the machine that used the conductive oil was located in an underwater city.

This dichotomy, the capacity to be astute in an inventive technical sense while at the same time decorating the imagery with often interesting settings, has been a continuing and seemingly natural characteristic of the imagery process. Although this combination can be disconcerting, it is certainly not necessary to be discouraged with its presence.

After considerable practice and experimentation, we observe that the imagery process can be quite robust. Several hundred experiments with imagery have been conducted as part of this work and many show results consistent with that seen in this report. As described in the introduction, there are other reports suggesting the existence of an unusual mental performance during altered states of awareness. Unfortunately, serious investigation of imagery of this type by scholars rarely occurs for many reasons including lack of opportunity, limitations on funding, or the need for an extended effort involving a high degree of cooperation with the subjects.

We believe that this is the first in-depth study showing the potential for dream-like altered states to promote an intellectually astute and technically creative product. There are clearly many different questions and issues of human intellectual and intuitive functioning that arise in this kind of work. Our appreciation of the scientific literature is that there exists only a very rudimentary understanding of this kind of imagery.

Lastly, our purpose in this paper is not to propose a specific theory of mental function or to make unsupported speculations. Even so, we believe any evaluation of the data inevitably suggests that dream-like altered state imagery can be a gateway to some remarkable and practical abilities of the mind.

Acknowledgments

We would like to acknowledge the support and contributions of Dr. David Krinsley, as well as the help of other university colleagues over the years, particularly in the analyses of the imageries.

References

Atwater, H. (1996). Accessing anomalous states of consciousness with a binaural beat technology. *Journal of Scientific Exploration,* 11, 3, 263.

Bolton, J. (1995). The photochemical conversion and storage of solar energy: A historical perspective. *Solar Energy Materials and Solar Cells,* 38, 543.

Bugga, R., Distefano, S., Nagasubramanian, G., and Bankston, C. (1990). US patent #4,945,012, Copper Chloride Cathode for a Secondary Battery, July 31.

Cardon, F., Gomes, W. P., and Dekeyser, W., Eds. (1980). Photovoltaic and photoelectrochemical solar energy conversion. *NATO Advanced Study Series,* Vol. 69. New York and London: Plenum Press.

Chandra, S. (1985). *Photoelectrochemical Solar Cells.* New York: Gordon and Breach Science Publishers.

Cisak, A. & Werblan, L . (1993). *High Energy Non-Aqueous Batteries.* New York: Ellis Horwood Inc., pp. 176–177.

Graetzel, M, & McEnvoy, A.J. (1990). Current status of photoelectrochemical solar energy systems. *Energy and the Environment. Into the 90's Proceedings of the 1st World Renewable Energy Congress,* 1, 120.

Harman, W. (1984). *Higher Creativity: Liberating the Unconscious for Breakthrough Insights.* Los Angeles: J.P. Tarcher Inc.

Ives D. & Janz, G. (1961). *Reference Electrodes: Theory and Practice.* Ch. 12, Electrodes in Fused Salt Systems, New York: Academic Press, p. 530.

Kosar, J. (1965). *Light Sensitive Systems: Chemistry and Application of Nonsilver Halide Photographic Processes.* New York: John Wiley, p. 14.

LaBerge, S. (1990). *Lucid Dreaming.* Boston: Hougton Mifflin.

Lee, J. D. (1992). *Concise Inorganic Chemistry,* 4th edition. London: Chapman and Hall, p. 413.

Monroe, R. (1985). *Far Journeys.* Garden City, New York: Doubleday and Co.

Pleskov, Y. V. (1990). *Solar Energy Conversion, A Photoelectrochemical Approach.* Berlin, Germany: Springer-Verlag.

Puthoff, H. E. (1996). CIA-initiated remote viewing program at Stanford Research Institute. *Journal of Scientific Exploration,* 10, 1, 63.

Santhanam, K. S. V. (1988). *Photoelectrochemical Solar Cells.* Amsterdam, New York: Elsevier.

Tan, Y. T. & Trautweiler, F. (1969). Nonlinear photovoltaic effect in silver bromide. *Journal of Applied Physics,* 40, 1, 66.

Targ, R. (1985). *The Mind Race.* Describing police officer Mr. Pat Price. New York: Villard Books.