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Consciousness and Quantum-Mechanical Wavefunctions

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Abstract: I note the similarity of an electron's wavefunction to a human consciousness in three examples: (i) The diffraction of an electron's wavefunction by a double slit into two wavepackets and the reported location of a human consciousness in two separate regions of space; (ii) an electron wavefunction with spin-up and spin-down terms simultaneously and a person undecided on two possible courses of action; and (iii) two electrons' wavefunctions entangled and identical human twins suffering the same pain while separated by thousands of miles. I hypothesize that the electron's wavefunction and the human's consciousness are so similar that the electron's wavefunction is conscious and the human consciousness is a wavefunction. This marries consciousness with quantum mechanics. I suggest an experiment that might be due to a human conscious wavefunction's interacting with an electron's conscious wavefunction, namely, where a human volunteer attempts to mentally flip the spin of a lone electron. I give the details of such an atomic experiment. If successful, this phenomenon could be used to turn human thought into a PowerPoint message, projected onto a screen letter by letter.

Keywords: consciousness, mind-matter interaction, quantum physics, wavefunction.

INTRODUCTION

At a meeting a few years ago when some two dozen of us grantees of the Lifebridge Foundation were gathered for a weekend at the Wainwright House in Rye, NY, one participant spoke of his first case as a young lawyer. Both he and his client went to jail! After he was released, he and his wife began visiting prisons and speaking to groups of incarcerated men. He would explain with large flip charts that no matter how much they had suffered, either through their own actions or those of others, their identities

were intact. They could not be destroyed, even if they were killed! Meanwhile his wife, an aroma therapist, would use a diffuser to vaporize essential oils to enhance mental alertness and calmness, and play baroque music to increase learning and retention. In this way the lawyer and his wife made the meeting room a special place for the prisoners, if only for the moment. Meanwhile the prisoners could muse on the fact that, if their identities were intact, then they could build on them and begin to recover their lives (Groom, submitted).

As a theoretical nuclear physicist, I was struck by the similarity of a human identity that cannot be destroyed to an electron, because an electron cannot be destroyed either.[1]

Actually, when theoretical physicists speak of an elementary particle, they really have a quantum-mechanical wavefunction or wavepacket in mind, not a tiny ball-bearing or b-b. For readers not familiar with wavefunctions, let me give a brief introduction. Imagine a large wave in the ocean, of considerable length and breadth, traveling to the right with velocity *v*. Trace mathematical lines all along the surface of the wave, yielding a sheet of lines undulating up and down. Now take away the water. What is left could be called a wavefunction.

Physicists construct wavefunctions for electrons and other elementary particles using the Schrödinger equation or the Dirac equation to knit the functions from four-dimensional spacetime. I show the side view of a wavefunction in Figure 1. The wavefunction or wavepacket is traveling to the right with speed *v*.

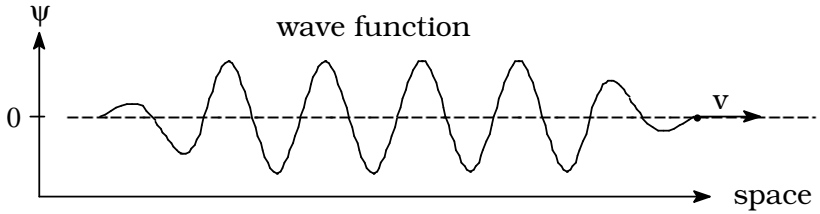

Figure 1. Wavefunction or wave packet of a particle moving to the right with velocity *v*.

[1] The electron normally interacts with other particles by emitting or absorbing a (neutral, massless) photon while remaining an electron. However it can (rarely) turn into a neutrino by absorbing a W^+ boson, and the neutrino can rarely turn back into an electron by emitting the W^+ boson. (The W^+ boson interacts like a photon, except that it is charged and quite heavy.)

How the particle emerges from the wavefunction is an interesting story. Imagine a huge dome of photographic film large enough to cover a football field. Let the playing field underneath be covered with photographic film as well. Now imagine a wavefunction long enough and wide enough to fill the whole inside of the half-dome of undeveloped film. (The wavefunction could be generated by the decay of a very long-lived state of a mercury atom.) Now the wavefunction interacts with the film, but only excites a single silver-halide grain. Quantum mechanics cannot tell us which grain. Nevertheless all of the energy and momentum of the wavefunction is transferred to the grain. We say that a photon carried this energy and momentum and vanished upon giving it to the grain. In an instant, then, the whole football-field sized wavefunction collapses to the size of one grain. The Copenhagen School calls this the collapse of the wavefunction.

Note that a water wave cannot disappear in this way. A water wave has a strong reality; it has too much energy and momentum just to give it to a small spot and disappear. So a quantum mechanical wave is more ephemeral. It is more of an idea than a physical object.

Now return to the large ocean-water wave and imagine that it hits a barrier reef with a couple of gaps, as pictured in Figure 2.

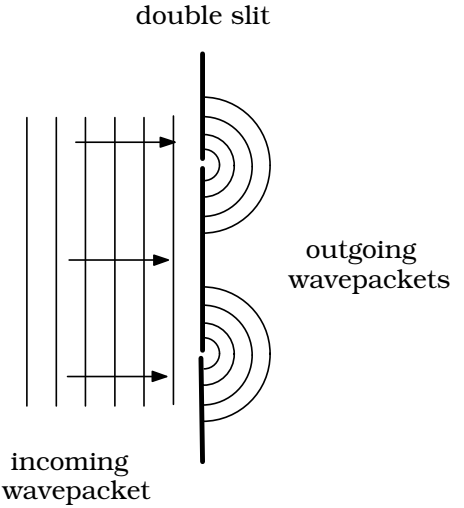

Figure 2. Wavepacket passing through double slit and undergoing diffraction. Two outgoing wavepackets are sketched.

A semi-circular wave emerges from each gap and continues on to the right, along with a broad wave which is reflected from the barrier and moves to the left.

Similarly, a quantum mechanical wavefunction or wavepacket can hit such a barrier and generate semicircular waves moving to the right, along with a wave reflected from the barrier to the left. Let us suppose that this quantum wave represents an electron, and that the electron is in one of the semicircular waves moving to the right. Clearly the *physical* electron cannot be in both waves at once; yet quantum theory permits the electron's *wavefunction* to coexist in these two *physically* incompatible states at once. When the two waves hit detectors, the physical electron will appear in one detector or the other. Quantum mechanics cannot tell us which one.

The human identity or consciousness can sometimes split up too, just like the electron's wavefunction or wavepacket. In her book, *ESP: A Personal Memoir*, the famous English psychic Rosalind Heywood recalls,

> One hot night my husband [a British diplomat] was peacefully sleeping while I wriggled, restless and wide awake, at his side in the great carved bed. At last the excessive peace became unbearable. "I can't stand it," I thought, "I shall wake him up to make love to me".
>
> Before I could carry out this egoistic idea I did something very odd—I split in two. One Me in its pink nightie continued to toss self-centredly against the embroidered pillows, but another, clad in a long, very white, hooded garment, was now standing, calm, immobile and impersonally outward-looking, at the foot of the bed. This White Me seemed just as actual as Pink Me and I was equally conscious in both places at the same time. I vividly remember myself as White Me looking down and observing the carved end of the bed in front of me and also thinking what a silly fool Pink Me looked, tossing in that petulant way against the pillows. "You're behaving disgracefully," said White Me to Pink Me with cold contempt. "Don't be so selfish, you know he's dog tired."
>
> Pink Me was a totally self-regarding little animal . . . and she cared not at all whether her unfortunate husband was tired or not. "I shall do what I like," she retorted furiously, "and you can't stop me, you pious white prig!" She was particularly furious because she knew very well that White Me was the stronger and could stop her.
>
> A moment or two later—I felt no transition—White Me was once more imprisoned with Pink Me in one body, and there they have dwelt as oil and water every since. (Heywood, 1964)

As for the electron, although its wavefunction might be divided into two (or more) packets as in Figure 2, it still stands for just one electron. It is one of the mysteries of quantum mechanics how all of the electron's energy and momentum can be deposited on just one spot upon interacting with a detector, say a photographic emulsion. But the wavefunction represents one electron, and one electron is what you get.

Similarly, even though a human consciousness might be separated into many parts, it still represents just one identity. I find it interesting that Rosalind Heywood's *consciousness* could be in two places at once; certainly her physical body could not. So here her consciousness resembled a wavefunction. If Rosalind Heywood had suddenly been threatened in her extended state, I have little doubt that her divided consciousness would instantly have coalesced to focus on the disturbance.

As another example of a wavefunction's embodying two mutually exclusive physical states at the same time, consider the intrinsic "spinning motion" of an electron. Being a Dirac particle, the electron has intrinsic angular momentum of magnitude $s = \frac{1}{2}\hbar$, where $\hbar$ is Planck's constant divided by 2π.[2] This angular momentum is analogous to the spinning motion of a ball. If the ball is spinning counter-clockwise when viewed from above, then we say that it has spin "up" because the axis about which it is spinning is vertical, and if we held it spinning in our right hand with our fingers lightly curled in the direction of the spin, then our thumb would be pointing up. If it is spinning clockwise, then we say that it has spin "down". Of course usually the electron's axis of spin points neither up nor down, but in some other direction. However another of the curiosities of quantum mechanics is that this spinning motion in an arbitrary direction can nevertheless be represented as a wavefunction ψ consisting of two terms, one standing for spin up and the other for spin down. That is,

$$\psi = a\left|\uparrow\right\rangle + b\left|\downarrow\right\rangle,$$

where $\left|\uparrow\right\rangle$ represents spin up and $\left|\downarrow\right\rangle$ represents spin down; a and b are just complex constants, chosen so that $a^*a + b^*b = 1$, where a^* is the complex conjugate of a, and similarly for b. With appropriate choices of a and b, it turns out that you can point the spin in any direction you like.

[2] [$\hbar$ is also referred to as Dirac's constant.—EDITOR.]

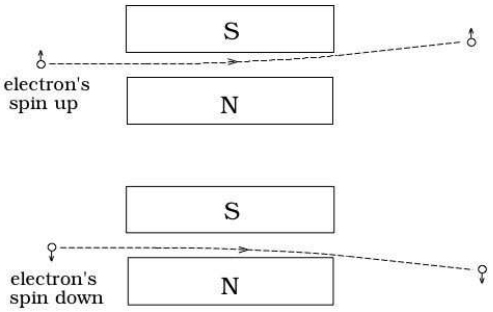

Figure 3. The magnetic field between the pictured North and South magnetic poles is highly divergent, causing a ground-state hydrogen atom with its electron's spin up to be pulled upward, or with its spin down to be pulled downward. This apparatus is called a Stern-Gerlach device, after Stern and Gerlach who first demonstrated it.

The interesting thing is that if the electron's spin is pointing neither up nor down, but oriented in some other direction, then nevertheless a Stern-Gerlach apparatus, as sketched in Figure 3, will deflect the atom only up or down and not somewhere in between. It is as if the electron, when confronted with the magnets, must choose to either be spinning up or spinning down. Mathematically speaking, it must either choose to keep the $a|\uparrow\rangle$ part of its wavefunction, or the $b|\downarrow\rangle$ part. The probability that the electron will be deflected upward is a^*a, and deflected downward is b^*b.

Analogous to the electron-wavefunction's representing two physically incompatible states, the human identity can also entertain two states that are physically incompatible, such as, say, when a person approaching a voting booth has not decided whether to vote for the Republican or the Democratic candidate. Let's give the person a wavefunction:

$$|\text{person}\rangle = a|\text{Democrat}\rangle + b|\text{Republican}\rangle.$$

For example, if $a^*a = 0.30$ and $b^*b = 0.70$, then, prior to voting, the person has a 30% likelihood to vote Democratic and a 70% likelihood to vote Republican. Upon reaching for a voting lever, he or she then decides which lever to pull, and his or her wavefunction collapses to either $a|\text{Democrat}\rangle$ or $b|\text{Republican}\rangle$.

The wavefunctions of electrons or atoms resemble human consciousnesses in even more ways. Theoretically, it is possible to prepare two (ground-state) hydrogen atoms, say A and B, in such a way that the sum of their electrons' spin angular momenta equals zero, even though individually they still have spin angular momentum $s = \frac{1}{2}\hbar$. Their combined state of zero spin is described by the (unnormalized) wavefunction

$$\psi = \left|A\uparrow,\ B\downarrow\right\rangle - \left|A\downarrow,\ B\uparrow\right\rangle,$$

where $\left|A\uparrow,\ B\downarrow\right\rangle$ denotes atom A with its electron's spin pointing up and atom B with its electron's spin pointing down, and $\left|A\downarrow,\ B\uparrow\right\rangle$ denotes atom A with its electron's spin pointing down and atom B with its electron's spin pointing up.

Now within this wavefunction, the terms $\left|A\uparrow,\ B\downarrow\right\rangle$ and $\left|A\downarrow,\ B\uparrow\right\rangle$ are physically incompatible: *physically*, atom A's spin cannot be pointing both up and down at the same time; neither can B's. However, it is possible, in fact common, for *wavefunctions* to contain physically incompatible terms, as we have already seen in the case of a single electron's spin, or the wavepackets emerging from a double slit. The wavefunction is like two blueprints, only one of which is followed when the atoms' wavefunctions are forced to reduce to material atoms.

Let us suppose that atoms A and B proceed in opposite directions until they are a light-year apart. Suddenly atom A reaches a detector (say, a Stern-Gerlach device) and must decide whether to choose spin up or spin down. Suppose it chooses spin up. Then according to most physicists' interpretation of quantum mechanics, this choice cancels the second term in wavefunction ψ, so that atom B's spin must instantly point down. It is as if the atoms were conscious of each other.[3]

Although such interdependence has not been measured for atoms at distances of light-years, it has been measured for pairs of *photons* in laboratories over short distances, and also over several miles (for example, see Gisin, 2001). Indications are that, upon measurement of A's spin, B's spin is indeed determined instantly, or at least after an interval of time

[3] I would like to thank Jerry Franklin (personal communication) for pointing out that a Stern-Gerlach device will not separate a beam of bare electrons according to spin. However, it will separate a beam of neutral atoms according to spin (see Mott & Massey, 1965). This two-atom phenomenon is David Bohm's version of the Einstein-Podolsky-Rosen experiment (Bohm, 1951).

several orders of magnitude less than light would require to carry the message.

In the case of human twins, a similar awareness has been reported. A twin in California filed suit against Pan American World Airways (Pan Am) for pain that she suffered at the instant when her twin sister died in a plane crash at Tenerife in the Canary Islands on March 27, 1977.[4] M. B.'s twin sister, M.F., was one of the 583 people killed in the plane disaster. Consequently, M.B. sued Pan Am, not for the wrongful death of her sister, but for her own injuries, which she sustained because of the "extrasensory empathy" which is common among identical twins. At the moment of the collision, M.B., sitting at her home in Fremont, California, suffered burning sensations in her chest and stomach and a feeling of being split. On February 21, 1980, Federal Court Judge R.W. ruled against M.B., explaining that legally she had to be physically present at the accident to collect damages.

Incidentally, the fact that atoms A and B are apparently in instant communication with each other is a famous aspect of quantum mechanics which Einstein called "Spooky action at a distance". He called the experiment 'spooky' because after atom A 'chooses' to point spin up, quantum mechanics says that atom B must immediately point spin down in less time than a light signal could travel from A to B. This violates a fundamental principle of Einstein's Special Theory of Relativity, not to mention his General Theory of Relativity, which says that information cannot travel faster than the speed of light.

Now, in the case of the human twins, an ordinary light (or radio) signal could have reached M.B. in just 0.05 seconds after the crash, so there is no way to tell if Special or General Relativity was violated when she first felt the alleged pains. However NASA is considering a mission to send men and/or women to Mars, and even when Earth and Mars are closest, it still takes light over four minutes to travel from one planet to the other. Thus it might be possible to test if something happening to one of the astronauts can be perceived by a person on Earth in less than the four minutes. The participants could use synchronized clocks to record the time.

WAVEFUNCTIONS AND CONSCIOUSNESS

In the three analogies described in the previous section, a human consciousness behaved like an electron's wavefunction. Is it possible that

[4] This case was studied as part of a Law School Preparation Program offered by the University of Nevada at Las Vegas in 1998.

the human consciousness *is* a wavefunction in its own right, not just analogous to the wavefunction of an electron? I will consider that possibility in this section. Also, is it possible that an electron's wavefunction is *conscious*, not just analogous to a human consciousness? Let us reconsider the three examples:

1. In the case of the electron's wavepacket transformed into two wavepackets by the double slit, quantum mechanics cannot tell us in which packet the electron will materialize. Perhaps the decision is made by the electron;

2. In the case of the hydrogen atom's entering the Stern-Gerlach apparatus, quantum mechanics cannot tell us whether the atom will be deflected upward or downward. Again, perhaps the decision is made by the electron, whether to choose spin up or spin down, and finally;

3. In the case of the two entangled atoms, quantum mechanics cannot tell us how the second electron knows in which direction its spin should point after the first electron's spin is detected. Perhaps the atoms share a consciousness.

There is no provision for consciousness in present-day quantum mechanics, so I will speculate that in addition to the wavefunction dictated by quantum mechanics, the electron also possesses an elementary consciousness, perhaps two-valued. I will call this generalized wavefunction the *conscious electron wavefunction*.[5]

If the electron's wavefunction embodies some kind of elementary consciousness, then so should the wavefunctions of the other elementary Dirac particles: the mu and the tau (both identical to the electron, except being much heavier), the three neutrinos of very small mass (the one which is paired with the electron, and two others paired with the mu and the tau, respectively), and the six kinds of quarks: up, down, charm, strange, top, and bottom.[6] The wavefunctions of protons and neutrons should also be conscious at an elementary level, as they are composed of the wavefunctions of three quarks each (two ups and a down for the proton,

[5] In this context, the physicists' definition, *wavefunction*, seems like a poor term for the phenomenon. Instead of electron wavefunction, it might be more meaningful to refer to it as the electron's *waveform*, since the wave exists whether or not we choose to parameterize it with a mathematical function.

[6] For a semi-technical presentation of the elementary particles, see my essay Bryan (2000). For examples of technical models set in higher dimensional spacetime, see Bryan (1986, 1998).

one up and two downs for the neutron). Likewise atomic nuclei should have a limited consciousness, as they are made up of protons and neutrons.

Going up the chain, we should find that atoms made of electrons and nuclei also have conscious wavefunctions, as should molecules such as amino acids and DNA. Living cells made up of the foregoing ought also to have conscious wavefunctions.

Farther up the chain are living organs which likewise should have consciousness as part of their (by now enormously complex) wavefunctions. Is there any evidence of consciousness at this level? Recent major organ transplants seem to say Yes. Consider the following heart-transplant case, reported by Pearsall, Schwartz, and Russek (2000) in the *Journal of Near-Death Studies*.

The donor was a 16-month-old boy (Jerry) who drowned in a bathtub. The recipient was a 7-month-old boy (Carter) diagnosed with tetralogy of Fallot, a syndrome involving a hole in the ventricular septum, displacement of the aorta, pulmonary stenosis, and thickening of the right ventricle. The donor's mother, a physician, reported:

> The first thing is that I could more than hear Jerry's heart. I could feel it in me. When Carter first saw me, he ran to me and pushed his nose against me and rubbed and rubbed it. It was just exactly what we did with Jerry. Jerry and Carter's heart are 5 years old now, but Carter's eyes were Jerry's eyes. When he hugged me, I could feel my son. I mean I could feel him, not just symbolically. He was there. I felt his energy.
>
> I'm a doctor. I'm trained to be a keen observer and have always been a natural born skeptic. But this was real. I know people will say that I need to believe my son's spirit is alive, and perhaps I do. But I felt it. My husband and my father felt it. And I swear to you, and you can ask my mother, Carter said the same baby-talk words that Jerry said. Carter is 6, but he was talking Jerry's baby talk and playing with my nose just like Jerry did.
>
> We stayed with the [recipient family] that night. In the middle of the night, Carter came in and asked to sleep with my husband and me. He cuddled up between us exactly like Jerry did, and we began to cry. Carter told us not to cry because Jerry said everything was okay. My husband and I, our parents, and those who really knew Jerry have no doubt. Our son's heart contains much of our son and beats in Carter's chest. On some level, our son is still alive.

The recipient's mother reported:

> I saw Carter go to her [the donor's mother]. He never does that. He is very, very shy, but he went to her just like he used to run to me when he was a baby. When he whispered "It's okay, Mama", I broke down. He called her *Mother*, or maybe it was Jerry's heart talking. And one more thing that got to us. We found out talking to Jerry's mom that Jerry had mild cerebral palsy, mostly on his left side. Carter has stiffness and some shaking on that same side. He never did as a baby and it only showed up after the transplant. The doctors say it's probably something to do with his medical condition, but I really think there's more to it.
>
> One more thing I'd like you to know about. When we went to church together, Carter had never met Jerry's father. We came late and Jerry's dad was sitting with a group of people in the middle of the congregation. Carter let go of my hand and ran right to that man. He climbed on his lap, hugged him, and said "Daddy". We were flabbergasted. How could he have known him? Why did he call him *Dad*? He never did things like that. He would never let go of my hand in church and never run to a stranger. When I asked him why he did it, he said he didn't. He said Jerry did and he went with him.

Pearsall, Schwartz, and Russek report nine other heart-transplant cases in their article which are also compelling. It appears that with each donor's heart comes a consciousness which reflects his or her whole personality, and which becomes entwined with the consciousness of the recipient.

If the heart has a consciousness, and of course the brain has a consciousness, then perhaps the other organs have consciousnesses too. This suggests that there is an *overall* consciousness which coordinates these sub-consciousnesses. Furthermore, as the heart, brain, and the other organs also have *wavefunctions* (as they must, being composed of elementary particles), perhaps there is an overall wavefunction which organizes these sub-wavefunctions. I will make the conjecture that the overall consciousness and the overall wavefunction are but different aspects of a single entity, call it the *conscious human wavefunction*. This conscious wavefunction might be the seat of human consciousness.

Thus consciousness might not be limited to sufficiently complex organisms (like the human brain) but be part of the makeup of *all* matter *going all the way down to the electrons* (and other elementary particles) comprising it. This reminds me of a passage from Jane Roberts' book, *Dreams, Evolution, and Value Fulfillment, Vol. 1* (Roberts, 1986). Seth says,

> Animals also possess independent volition, and while I am emphasizing animals here, the same applies to any creature, large and small: insect, bird, fish, or worm; to plant life, to cells, atoms, or *electrons* [my italics]. They possess free will in relationship to the conditions of their existence.

In a sense, consciousness might be quantized, like electric charge. As an analogy, one can think of a large charged metal sphere with its charge going all the way down to the charges on the individual electrons.

There is considerable anecdotal evidence that the conscious human wavefunction or consciousness can sometimes partially leave the living body. For example, Robert Monroe, a pioneer in the study of consciousness, began to have episodes where his conscious awareness would leave his body and focus somewhere else. At first he was frightened by these so-called out-of-body experiences (OBEs), but in time came to realize that they were not a sign of mental illness but rather of an aspect of normal human consciousness not usually recognized in Western circles.

By the time that he wrote his first book (Monroe, 1971), Monroe could document 589 OBEs that he had had over a period of twelve years. A successful radio executive and producer in the 1940s and 1950s, he went on to found The Monroe Institute in Virginia to help thousands of others learn that they too "are more than their physical bodies".

Countless other reports of OBEs have been published since Monroe's first book. For example, Bruce Moen and William Buhlman have written about their OBEs (Buhlman, 1996; Moen, 1997, 1998, 1999). Also near-death experiences have been reported extensively, as in books by Moody, Sabom, and Ring, where the subjects sometimes go out-of-body as part of the experience (Moody, 1975; Ring, 1980; Sabom, 1982).

An important outcome of these reports is that the human consciousness seems to have the capability to *direct its conscious wavefunction* where it wants it to go. In particular, Monroe found it easier to direct his consciousness to a person rather than a geographical location. For example, on one occasion he went out-of-body to visit R.W., a business-woman he knew quite well. She was on vacation. In this excursion, Monroe also found that he could *affect matter* while in his our-of-body state.

> 8/15/63 Afternoon. . . R.W., a business woman whom I know quite well . . . has been away this week on her vacation up on the New Jersey coast. I do not know exactly where she is vacationing other than that. . . . This afternoon, I . . . decided . . . to make a strong effort to "visit" R.W. wherever she was. . . . I lay down in the bedroom about three in the afternoon, went into a relaxation pattern,

felt the warmth (high order vibrations), then thought heavily of the desire to "go" to R.W.

There was the familiar sensation of movement through a light blue blurred area, then I was in what seemed to be a kitchen. R.W. was seated in a chair to the right. She had a glass in her hand. She was looking to my left, where two girls (about seventeen or eighteen, one blond and one brunette) also were sitting, each with glasses in their hands, drinking something. The three of them were in conversation, but I could not hear what they were saying.

I first approached the two girls, directly in front of them, but I could not attract their attention. I then turned to R.W., and I asked if she knew I was there.

"Oh yes, I know you are here," she replied (mentally, or with that superconscious communication, as she was still in oral conversation with the two girls). I asked if she was sure that she would remember that I had been there.

"Oh, I will definitely remember," the reply came.

I said that this time I was going to make sure that she remembered.

"I will remember, I'm sure I will," R.W. said, still in oral conversation simultaneously.

I stated that I had to be sure she would remember, so I was going to pinch her.

"Oh, you don't need to do that, I'll remember," R.W. said hastily.

I said that I had to be sure, so I reached over and tried to pinch her, gently, I thought. I pinched her in the side, just above the hips and below the rib cage. She let out a good loud "Ow," and I backed up, because I was somewhat surprised. I really hadn't expected to be able actually to pinch her. Satisfied that I had made some impression, at the least, I turned and left, thought of the physical, and was back almost immediately.

Important aftermath: It is Tuesday after the Saturday of the experiment. R.W. returned to work yesterday, and I asked her what she had been doing Saturday afternoon between three and four. . . .

Here is what she reported today: On Saturday between three and four was the only time there was not a crowd of people in the beach cottage where she was staying. For the first time, she was alone with her niece (dark-haired, about eighteen) and the niece's friend (about the same age, blond). They were in the kitchen-dining area of the cottage from about three-fifteen to four, and she was having a drink, and the girls were having Cokes. . . .

> I asked R.W. if she remembered anything else, and she said no. I questioned her more closely, but she could not remember anything more. Finally, in impatience, I asked her if she remembered the pinch. A look of complete astonishment crossed her face.
>
> "Was that you?" She stared at me for a moment, then went to the privacy of my office, turned, and lifted (just slightly!) the edge of her sweater where it joined her skirt on her left side. There were two brown and blue marks at the exactly the spot where I had pinched her.
>
> "I was sitting there, talking to the girls," R.W. said, "when all of a sudden I felt this terrible pinch. I must have jumped a foot. I thought my brother-in-law had come back and sneaked up behind me. I turned around, but there was no one there. I never had any idea it was you! It hurt!"
>
> I apologized for pinching so hard, and she obtained from me a promise that if I tried any such thing again, I would try something other than a pinch that hard.

There is further evidence that the human consciousness can affect matter. Targ and Puthoff (1977) report that the artist Ingo Swann was able to alter the cycling rate of a highly shielded magnetometer in a laboratory at Stanford University. Also Radin (1997) recounts how ten volunteers were able to alter the output of a matrix of random-number generators that he had constructed with the help of collaborators at Contel Technology Center (later merged with GTE).

Just as incredible is the report that Chinese medical doctor and qi-gong master Xin Yan significantly altered the structure of water in sealed tubes while acting some seven kilometers away. (Lu, 1997; Yan et al., 2002). In double-blind tests carried out at the Chemical Analytical Laboratory of Tsinghua University under the supervision of Professors Lu Zuyin, Li Shengping and coworkers, an additional rise stretching from 1000 cm^{-1} to 3000 cm^{-1} appeared in the Raman spectrum of preselected sealed tubes of tap-water while Yan claimed to be acting on them. The spectral intensity peaked some 15 times higher than the usual Raman peak of ordinary water at 3430 cm^{-1} (the O-H stretching mode). The effect gradually disappeared over the space of two hours. No effect was seen in other tubes set aside as controls. Yan is said to have repeated this feat many times, according to Ming Dao (M. Dao, private communication, 2004).[7]

[7] Dr. Dao is currently employed as a physicist in the Department of Materials Science at the Massachusetts Institute of Technology.

It is also remarkable that Robert Monroe could direct his consciousness to R.W. in another state and leave a mark on her body. I estimate that pinching her required his exerting a force of the order of 0.1 lb acting over a distance of at least 2 mm. This equals an amount of energy

$$W = \mathrm{Fd} = (0.5\,\mathrm{N})(0.002\,\mathrm{m}) = 10^{-3}\,\mathrm{J} = 6\cdot 10^{15}\,\mathrm{eV}\,!$$

This ability for some humans to mentally affect living or non-living systems at a distance suggests a physics experiment. If Monroe could, at least once, direct ~6.10×10^{15} eV to pinch a person at a distance, then could a volunteer direct some energy to an electron to reverse its spin in a 50-gauss magnetic field? This would require an energy of just ~6.10×10^{7} eV, or 1/5,000,000 the energy of a single blue photon! That is, some 22 orders of magnitude less energy than Monroe directed to the person.

Still, Monroe was, and Yan is, an exceptional individual. Could an *ordinary* person generate enough PK to flip the electron's spin, even if very little energy were required? With this in mind, I attended a six day-and-night session at The Monroe Institute in 2002 where twenty of us participants were instructed how to bend spoons and forks, greatly accelerate the sprouting of seeds, throw combinations of dice (fives and nines) at a rate far exceeding chance probability, and other skills. To do this, we were trained by two instructors and helped by the Monroe Hemi-Sync binaural audio tapes to achieve a certain meditative state, perhaps the $\theta - \alpha$ 10 Hz brain-wave state noted for restful, creative thinking. With these tapes one hears music in one ear and the same music, 10Hz higher in the other, producing a 10Hz beat frequency in the brain which helps bring about the theta-alpha state (Monroe, 2000).

As it turned out, I did not succeed in bending any flatware or accelerating any seed-sprouting, but I saw sixteen others do it with considerable success, and it made a believer of me. (Later I was told not to feel bad, that physicists do not think that it is possible, so are never any good at it.) But the bottom line was that *some* participants, with very little energy, were molding metal. I tried to bend back a stainless-steel spoon that a student had bent, and after exerting a considerable amount of force, still could barely bend it. Yet I had watched the student bend the spoon, and she had only lightly touched it.

At the end of the 24/6 session, I decided to go ahead with the electron experiment.

THE EXPERIMENT

If someone wants to flip the spin of an electron, then he or she needs to locate the electron and isolate it. Let it be the electron bound to a twice-ionized magnesium ion $^{24}Mg^{++}$ ion, which ion will have tight closed electronic shells like those of a neon atom. Our (valence) electron will then circulate far out from the closed shells, on the atomic scale. Since the (electron + $^{24}Mg^{++}$) composite is still singly charged, it can be held in place by electromagnetic "fingers", in particular, a Paul trap. This device consists of four parallel short metal rods, each about 1.5 cm long, defining a mathematical box of square 0.5 cm^2 cross section and volume ~1cm^3. The bars are divided in thirds, with the end sections kept about 20Volts DC higher than the middle sections. This keeps the Mg^+ ion from escaping out the ends of the trap. Then, to keep the ion from escaping out the sides, 7 MHz, 300Volt AC is applied to the rods, working on the same principle as does an alternating gradient synchrotron. The trap is contained in a vessel at a very high vacuum, about 10^{-11} torr.[8]

If we bathe the ion in a magnetic field and illuminate it with light from a tuneable dye-laser, then when the laser reaches the right frequency, the ion will light up. That is, the valence electron will absorb a laser photon, jump to a higher energy level, then jump back down to the original energy level and emit another photon of the same frequency, but in an arbitrary direction. The electron can do this up to 100,000,000 times per second. This is called laser-induced fluorescence (LIF). The human eye can accept about 10,000 of these photons per second, so one could see this single ion, except that the light is in the near ultra-violet, of wavelength 280nm. So the light is detected by a photo-multiplier tube instead.

Now suppose that an observer, by mental intent, can reverse (or "flip") the spin of the valence electron. This puts the electron in a slightly lower energy-level so that its excursions are no longer tuned to the frequency of the laser. As a result, LIF stops and the ion goes dark.

If the observer is able to flip the electron's spin again, putting it back in the higher energy level, then LIF resumes. By creating suitable long and short intervals of LIF, the observer could send a message in International Morse Code. A computer could take the output of the photo-multiplier tube and indicate the LIF with a lighted dot on the screen. The computer could also be programmed to print out the Morse Code in plain text. In turn, the plain text could be fed into a PowerPoint program and displayed on a large screen. So with his/her mind, the observer could

[8] 1 torr = (1/760) atmospheric pressure.

display, say, the Preamble to the United Nations Charter on the screen, letter by letter.[9]

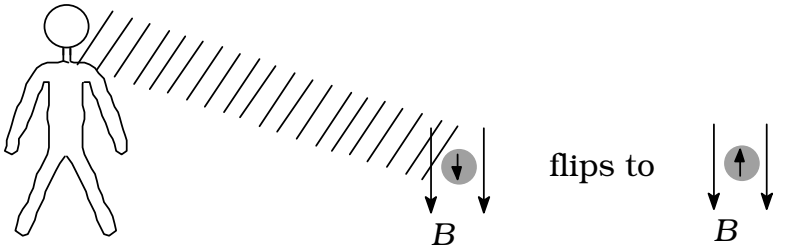

Figure 4. Person by mental intent reverses the spin of an electron immersed in a magnetic field *B*.

But could a volunteer focus his or her conscious wavefunction down to the *size* of a Mg^+ ion? The ion's diameter is about 10^{-9} meters! Here, I will cite the work of Annie Besant and C.W. Leadbeater, a couple who were trained in India in the late-nineteenth century to look at single atoms using their inner senses (Besant & Leadbeater, 1908, 1919, 1951). They surveyed nearly the whole periodic table, drawing highly complex pictures of these atoms' structures. It is interesting that they saw atoms of twice and three times hydrogen's mass. Today we recognize these atoms as deuterium and tritium. The fact that Leadbeater and Besant reported a mass-3 atom by 1919, some years before it was discovered with the mass spectrograph, lends credence to their reports. Stephen Phillips has written two interesting books on Leadbeater and Besant's work, calling their ability to focus on single atoms "micro-psi vision" (Phillips, 1980, 1999). A more concise review of their experiences is also in print (Phillips, 1995).

The world-class remote viewer Joseph McMoneagle also seems to have seen the motion of single atoms or molecules. He has this to say about his out-of-body experiences (McMoneagle, 1993):

1. You arrive at the target just as if you had gone there physically.

2. You know that your consciousness is totally at the target location and where you left your physical body is somewhere else.

[9] For a technical description of the experiment, see Bryan (2006).

3. You see objects and people at the target location, just as if you were seeing them with physical eyes. Both animate as well as inanimate elements are seen with such pristine clarity that you can actually discriminate molecular movement within them. For example, looking at a table is like looking at an energy field in the shape of a table, with billions of component parts or elements contained within the energy field moving or interacting with each other.

4. Seeing into the next room requires having to pass through a wall, which feels something akin to pushing your body through a veil of Jell-O.

I take the reports of Besant and Leadbeater, and McMoneagle to indicate that some individuals, at least, have been able to focus their consciousnesses or conscious wavefunctions down to the size of atoms. And the fluorescing ion in the experiment may well stand out, even if in the ultra-violet. (I have a list of over a dozen people who believe that they have demonstrated psychokinetic ability and would like to try to flip the spin of the electron.)

A possible mechanism for spin-flip is suggested by Figure 5, patterned after a Feynman diagram. Here a portion of the volunteer's conscious human wavefunction travels to the right toward the electron (horizontally on the graph) while moving forward in time (vertically on the graph), emits a field quantum (which moves horizontally to the right on the graph), and recoils slightly to the left as it continues to move forward in time. Meanwhile the electron moves to the left while moving forward in time, and absorbs the field quantum. This flips the electron's spin. The electron then recoils to the right while continuing forward in time.

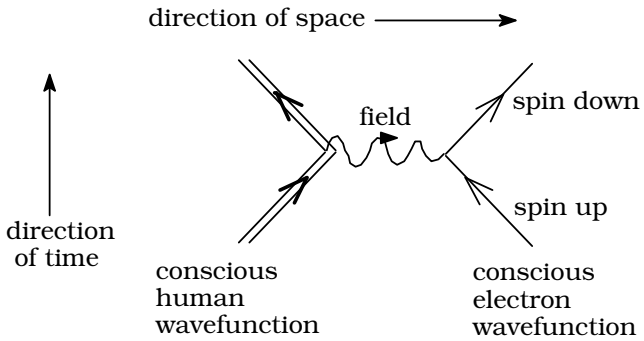

Figure 5. Human directs his/her consciousness toward electron, and reverses its spin by means of a field.

The field quantum in Figure 5 might be a vector boson, similar to the electromagnetic-field quantum. It cannot actually be a photon since the electromagnetic interaction has been ruled out as the mediator in PK phenomena. However the boson might be a quantum of the hypothetical M-field reported by Robert Monroe (1994), or the morphic field conjectured by Rupert Sheldrake (1989), or perhaps "qi" reported by Yan Xin et al. (2002).

SUMMARY AND OUTLOOK

Noting that neither an electron nor a human identity can be destroyed, I observe that these two entities are also similar in that the human consciousness can exhibit some of the features of the electron's wavefunction, such as: (1) diffraction (human consciousness seated in two places at the same time, and an electron's wavefunction separated into two separate wavepackets by a double slit); (2) double-valuedness (human consciousness undecided on which way to vote, and an electron's wavefunction with both spin-up and spin-down components); and (3) entanglement (human consciousnesses of identical twins sharing common sensations even when separated by large distances, and an electron's being instantly aware of a measurement on another, distant electron when the two share a common wavefunction). Thus I speculate that the human's consciousness is also a wavefunction, and that the electron's wavefunction is also conscious.

Along this line of thought, then, I speculate that human consciousness may go all the way down to electron consciousness (and quark consciousness), the same way that the electric charge on a large metal sphere goes all the way down to the electron's charge.

If this be so, then perhaps a human conscious wavefunction can interact with an electron conscious wavefunction. Furthermore, perhaps the human conscious wavefunction can leap across space to interact with the electron conscious wavefunction at a distance, since it is well known that wavefunctions can sometimes be very flighty, jumping great lengths, as in the instant collapse of a photon's wavefunction the size of a football field to a single atom.

Indeed, there have been many anecdotal reports over the years of some persons' being able to affect material objects at a distance. Two reports in recent times are particularly interesting. Robert Monroe reported that he was able to leave a pinch-mark on a person many miles away, and Yan Xin apparently changed the structure of water for two hours from a vantage point about seven kilometers distant. And in my own experience, I have seen students attending a course in PK taught at The Monroe Institute

bend heavy flatware while barely touching it, cause seeds to sprout luxuriously compared to the controls, and perform other paranormal skills.

Therefore I suggest an experiment where a volunteer attempts to mentally flip the spin of an electron in a weak magnetic field, which feat would require far less energy than any reports of psychokinetic action ever reported, to my knowledge. The target electron could be the single valence electron of a magnesium ion confined in a Paul trap. Beaming near ultra-violet laser light tuned to the ion would cause it to fluoresce. If the volunteer could mentally flip the electron's spin, then the ion would cease to fluoresce. If the volunteer could flip it again, then the ion would begin fluorescing again.

If a volunteer could thus turn on and off the laser-induced fluorescence (LIF) of an ion at will, then by producing suitably long and short periods of light, he or she could send a message in International Morse Code, say the Preamble to the United Nations Charter. The UV light could be detected by a photoelectric tube and the signal sent to a computer. The computer could convert the Morse Code to plaintext and print it out. Alternately, it could feed the signal to a PowerPoint program to display the message on a large screen, tracing the message out letter by letter.

If a volunteer could flip the spin of an electron in the lab, then reports by Monroe and others indicate that he or she might also be able to flip the spin from across the street or from across the continent. This would mean that the link between the human and the electron could not be mediated by electromagnetic or gravitational fields, as these fall off as the inverse square of the distance. However quantum-mechanical *wavefunctions* are highly mobile, so I speculate that the volunteer might be able to consciously direct a portion of his or her wavefunction to the electron, however distant it may be, where it would interact with the electron through the exchange of a field. The field might be a Monroe's conjectured M- field, Sheldrake's morphic field, or perhaps the "qi" of qi-gong theory.

Further studies of such a human-electron interaction might enable scientists to replace the human end of the link with purely electronic circuitry. This reminds me of the late-eighteenth century experiments of Volta, who discovered that the muscles of a frog's leg could be activated by electric current. Later, of course, we learned that electricity could excite inanimate devices as well.

Persons who have lost the ability to control their limbs or speech could, in principle, use LIF to speak, write, turn the pages of a book, or move about with the help of appropriate electro-mechanical devices. If a portion of the conjectured human conscious wavefunction survives physical death, then it might also be able to turn LIF on and off, since so

little energy would be required, less than 1/5,000,000 the energy of a single blue photon.

Learning tapes put out by The Monroe Institute indicate that the volunteer attempting to control an apparatus at a distance will have a much better chance if he or she first of all believes that he or she *can* do it. Entering into a meditative state with no cares or external distractions is very helpful. One might listen to the Monroe binaural audio tapes to achieve the $\theta - \alpha$ 10 Hz brain-wave state, which is noted for restful creative thinking (Monroe, 2000). The meditator might imagine that he or she is extending an "energy bar" into a long "tube" that reaches over to the object with which he or she wants to interact. In this meditative state, he or she might ask for insight on how to perform the task, in this case to flip the spin.

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