Psychic Waves

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Abstract: An analytic theory of psychic phenomena based on a wave formulation of the propagation of information in a neuronal assembly is given. The corresponding psychic wave, which encodes mental information, is derived from a path integral representation of the propagation of that information. A receiver, the psychic who is able to observe the wave emitted by a sender characterizes the theory.

Key words: mental information, path integral, psychic wave, telepathy

1. INTRODUCTION

We develop an analytic theory of psychic observation (measurement), which takes a form based on a wave generated by activity in a neuronal assembly. We show how the propagation of information in a layered network of model neurons generates a path integral representation of that information propagation in the limit as the neuronal density becomes large. Our approach is reminiscent of the path integral formulation of the Schrödinger wave function (probability amplitude) of quantum mechanics (Feynman, Hibbs, 1965). We call the corresponding wave generated by our development a psychic wave function. While the Schrödinger wave is a virtual construct, having no existence in reality, we claim that the psychic wave has a dual real/virtual instantiation. (Throughout, a construct will be given the attribution real if it corresponds directly to a physical object or notion.) For a review of psychic phenomena and associated theories, see Sheldrake, 2003, Broderick, 2007 and Schock, Yonavjak, 2008. Note that the psychic wave is a candidate for generating Sheldrake's morphic field.

In Sect. 2, we develop the path integral representation of the flow of neuronal information and derive the form of the psychic wave. In Sect. 3, we specify a psychic measurement thesis, restricting attention to telepathy (for clarity), leaving applications to other psychic phenomena to future development. Psychic and quantum measurement are compared, and notions regarding causality and reality of the psychic wave are discussed.

2. NEURONAL INFORMATION FLOW AS A PATH INTEGRAL

In Sect. 2.1 we review the basic model of neuronal input-output dynamics (Haykin, 2009). In Sect. 2.2 we adjust that model so that it represents the neuronal activity in nature as the frequency encoding that it in fact is. This is followed by the derivation of a path integral characterization of the flow of information in a feed fprward layered neuronal assembly. Then in Sect. 2.3, using the path integral construct, we derive a wave function (the psychic wave) that characterizes the transmission of neuronal information. (See Miranker, 2005 for an alternative path integral development of the propagation of neuronal information that involves a Lagrangian formulation of recursive neural network dynamics, and that in addition to producing a corresponding wave, specifies a wave equation that could serve as a psychic wave equation.)

2.1 The model neuron

A basic model of neuronal input-output dynamics is specified as follows. Let $w = (w_1,...,w_n)$ be the vector of afferent synaptic weights, and let $v^a = (v_1^a,...,v_n^a)$ be the vector of neuronal inputs. The neuronal activity (total input) u is a weighted sum of the individual synaptic inputs,

$$u = \sum_{k=1}^{n} w_k v_k^a . \tag{2.1}$$

The neuronal output, v^e is a gain function, g of the total input, namely

$$v^e = g(u). \tag{2.2}$$

For clarity we take the gain function to be linear and homogeneous ($g(u) = gu$). Moreover a change of scale allows us to suppress g from our arguments. We shall hereafter also suppress the superscripts a and e, since confusion should not occur.

Now consider a feed forward layered neuronal network. Using the input-output equations, (2.1), (2.2), the output of a neuron in layer N, as it depends on the inputs from N preceding neuronal layers, may be expressed as follows.

$$\sum_{x_{N-1}} \cdots \sum_{x_0} \prod_{k=0}^{N-1} w_{x_{k+1}x_k} v_{x_0} . \tag{2.3}$$

v_{x_0} is the output of neurons in an initial (zeroeth) layer, this being a characterization of the input to the layered network. Note that we use the label x_k for indexing neurons in the k-th layer, $k = 0,1,\ldots,N-1$, so that $w_{x_{k+1}x_k}$ denotes the synaptic weight from neuron x_k to neuron x_{k+1}.

2.2 The neural net generating a path integral approximation

The model of Sect. 2.1 is a simplification of actual neuronal information processing that is in fact frequency encoded. What is customarily called the neuronal activity models the frequency of the actual output. To characterize this aspect, we formally replace the neuronal output in the model by exp(ivt), where v is the output frequency of the action potential of the neuron and t is the time. The neuronal output is then written as

$$\exp i(vt + 2\pi y / \lambda), \tag{2.4}$$

where y is distance along the axon (and associated branching processes) and λ is the signal wavelength (i.e., $2\pi/\lambda$ is the wave number). We now introduce two time scales, $\Delta x/A$ and $(t_{k+1}-t_k)/h$, the first represents the time for the neuron to act on its input, and the second represents the time needed to convey the information between neuronal layers. Then we replace (2.1), (2.2) by the rule (2.5) to represent movement of information from layer k to layer k+1 in the time interval $(t_{k+1}-t_k)$.

$$\exp i v_{x_{k+1}} \frac{t_{k+1}-t_k}{h} = \sum_{x_k} \frac{\Delta x}{A} \exp i w_{x_{k+1}x_k} v_{x_k} \frac{t_{k+1}-t_k}{h}, \quad k=0,\ldots,N-1. \tag{2.5}$$

To compute the output at the final (N-th) layer, set $t_k - t_{k-1} = \Delta t, \forall k$ and consider the following identity.

$$\exp iN\frac{\Delta t}{h} v_{x_N} = \exp i\frac{\Delta t}{h}\sum_{j=1}^{N} v_{x_j} \exp i\frac{\Delta t}{h}\sum_{j=1}^{N}(j-1)\left(v_{x_j}-v_{x_{j-1}}\right). \tag{2.6}$$

Note that v_{x_k} is a function of two variables, $v_{x_k} = v(x_k, t_k)$. Then taking the limit as $N\to\infty$ and $\Delta t\to 0$ while holding $N\Delta t = t$ fixed, we find for the first exponential on the right in (2.6) that

$$\exp i\frac{\Delta t}{h}\sum_{j=1}^{N} v_{x_j} \underset{\Delta t\to 0}{\longrightarrow} \exp\frac{i}{h}\int_0^t v(x,\tau)\,d\tau. \tag{2.7}$$

Using the approximation

$$v_{x_j} - v_{x_{j-1}} = -\left[\left(x_j - x_{j-1}\right)\frac{\partial v_{x_j}}{\partial x} + \Delta t\frac{\partial v_{x_j}}{\partial t}\right] \tag{2.8}$$

in the second exponent on the right in (2.6), we find

$$\exp i\frac{\Delta t}{h}\sum_{j=1}^{N}(j-1)\left(v_{x_j}-v_{x_{j-1}}\right) = \exp\frac{\Delta t}{ih}\sum_{j}(j-1)\left[\left(x_j - x_{j-1}\right)\frac{\partial v_{x_j}}{\partial x} + \Delta t\frac{\partial v_{x_j}}{\partial t}\right] \tag{2.9}$$

$$\underset{\Delta t\to 0}{\longrightarrow}\left\{\exp\frac{1}{ih}\left[\int_0^t(\tau-1)\left(x_j-x_{j-1}\right)\frac{\partial v_{x_j}}{\partial x}\,d\tau + \Delta t\int_0^t(\tau-1)\frac{\partial v_{x_j}}{\partial \tau}\,d\tau\right]\right\}$$

Since $s_j = \left(x_j - x_{j-1}\right)/\Delta t$ is a speed at which neuronal information is propagating, and since such speeds are bounded, then $\left(x_j - x_{j-1}\right) = s_j\Delta t \to 0$. Then the value of the last member of (2.9) is unity, permitting use of (2.7) for the limiting value in (2.6). Then using (2.5), we find

$$\exp i v_{x_N}\frac{t}{h} = \sum_{x_{N-1}}\frac{\Delta x}{A}\cdots\sum_{x_0}\frac{\Delta x}{A}\exp i\left[\sum_{k=1}^{N} w_{x_k x_{k-1}} v_{x_k}\frac{\Delta t}{h}\right]. \tag{2.10}$$

(2.10) is a discrete approximation to a path integral, since it arises by replacing the integrals in the following expression by Riemann sums.

(2.11) $$\int_{-\infty}^{\infty} \cdots \int e^{\frac{i}{h}S} \frac{dx_0}{A} \cdots \frac{dx_{N-1}}{A},$$

where

(2.12) $$S = \int_0^{t} w(x,\tau)v(x,\tau)d\tau.$$

Letting $N \to \infty$, (2.11) defines the following path integral with an appropriate functional measure μ.

(2.13) $$\int_{paths} e^{\frac{i}{h}S} \mu(dx).$$

2.3 Neural network wave function (the psychic wave) $\psi(v,t)$

Let $a = (v_a, t_a)$ and $b = (v_b, t_b)$ denote points between which a trajectory of the neural net dynamics passes (say from a to b as time increases from t_a to t_b). Take $v_0, \ldots, v_N$ to be a uniform partition of $[v_a, v_b]$ with mesh width $\varepsilon = (v_b - v_a)/N$ for some integer $N > 0$. Then for h and $A = A(\varepsilon)$ as suitable constants, define the kernel $K(b;a)$ as follows.

(2.14) $$K(b;a) = \lim_{\varepsilon \to 0} \frac{1}{A} \int_{-\infty}^{\infty} \cdots \int e^{\frac{i}{h}S[b,a]} \frac{dv_0}{A} \cdots \frac{dv_{N-1}}{A},$$

where

(2.15) $$S[b,a] = \int_{t_a}^{t_b} wv d\tau.$$

Suppose the limit in (2.14) exists. Then it defines the following path integral (with an appropriate measure μ).

(2.16) $$\int_{\substack{paths \\ from\ a\ to\ b}} e^{\frac{i}{h}S[b,a]} \mu(dv).$$

Let $\psi(v,t)$ denote the wave function (the psychic wave) of the layered neural network. It is defined by the condition that it has the following property of evolution in time.

(2.17) $$\psi(v,t) = \int_{-\infty}^{\infty} K(v,t;v_0,t_0)\psi(v_0,t_0)dv_0, \quad t > t_0,$$

where K is given by (2.16) and $\psi(v,t_0)$ is a prescribed initial condition (mental state).

3. THE PSYCHIC MEASUREMENT THESIS

We present a psychic measurement thesis, using the psychic wave construct of Sect. 2. For reasons of clarity, attention is restricted to telepathy with applications to other psychic phenomena left to future work. Psychic and quantum measurement are compared, and the causality and reality of the psychic wave is discussed.

Thesis of psychic measurement: We specify a psychic receiver to be a person who has ability that enables detection (measurement or observation, say) of the psychic wave emitted by another person, the sender. Since the psychic wave encodes the information delivered by the relevant neuronal assembly, that is, of information being processed as the mental activity of the sender (see (2.17)), the receiver acquires knowledge of that information. We refer to this acquisition process as psychic (telepathic) measurement.

Comparison of psychic and quantum measurement, causality: In the Copenhagen interpretation of quantum mechanics, the Schrödinger wave function, having no existence in reality, can neither be measured nor observed (Albert, 1992). It is a virtual construct in the sense that no claim is made for it to correspond to literal aspects of physical entities. A quantum measurement is instantiated by a physical act. However except for causing its collapse (a psychic process involving an observer), the act of measurement does not otherwise affect the Schrödinger wave function. Reciprocally, while the Schrödinger wave function encodes all of the possible outcomes of the measurement and can be used for the stochastic prediction of those outcomes, it does not (otherwise) impact the measurement process. By contrast while according to our thesis, the psychic wave changes the mental state of the receiver, an event we liken to an observation or measurement, the wave itself is unaffected by that event. So the causality in quantum and psychic measurement are in opposite directions.

Reality: We need not ask about creating the psychic wave, since that wave is induced by the physical processing that is mental activity. This and the fact that the psychic wave's literal content is what is measured show that the psychic wave is manifest in a dual real/virtual sense. Compare this with the status of the Schrödinger wave function in Bohm's ontological interpretation of quantum mechanics (Bohm, Hiley, 1993).

Open questions: Among the questions generated by the theory are the following.

1. How does the receiver implement the exploitation of the psychic wave? Is there a corresponding physical act as in a quantum measurement? If so, what is the corresponding brain circuitry and activity?
2. Is the particular fragment of information communicated chosen by the sender, the receiver, both, and whichever, how?

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