A Primary Quantum Model of Telepathy

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In this paper, we give a primary quantum theoretical model of telepathy based on the principle of quantum superluminal communication (QSC). Some feasible experimental suggestions are presented. The possible application of telepathy as one kind of new communication means is also discussed.

All historical experience confirms that men might not achieve the possible if they had not, time and time again, reached out for the impossible.

------ Max Weber

1. Introduction

The physical nature of Psi phenomena such as telepathy is an important problem in the life information science. Scientists have confirmed the existence of telepathy phenomena through many strict experiments[1-3]. Then can modern science (e.g. quantum theory) provide a scientific explanation for telepathy phenomena? In this paper, we will seek the possible quantum nature of telepathy from both theoretical and experimental respects, and present a primary quantum model of telepathy phenomena. It will be shown that, according to the principle of quantum superluminal communication (QSC)[4-11], quantum theory can in principle provide a scientific explanation of telepathy phenomena, and some experiments have indicated the validity of this explanation[6]. Furthermore, we will propose a serious of feasible experimental schemes to test the quantum model, and discuss the technical possibility of realizing controllable and applicable human brain communication on the basis of the proposed experimental schemes. Lastly, we give some remarks and expectations about the technical virtue and application foreground of such communication means.

2. The principle of quantum superluminal communication (QSC)

It is well known that even though present quantum theory permits the existence of quantum nonlocality[12-14], it doesn't permit the realization of quantum superluminal communication (QSC) [15-17]. However, when considering the dynamical collapse of wave function and the direct intervention of consciousness of the observer, QSC can be realized in principle[4-11]. Here we will briefly introduce the principle of QSC. The concrete method is via distinguishing the nonorthogonal quantum states.

The states to be distinguished are the following nonorthogonal states ψ_1 and $\psi_1+\psi_2$, where ψ_1 and ψ_2 can trigger the definite perception state χ_1 and χ_2 of the observer, and are the preferred bases during the perception-induced collapse process. We assume that the initial perception state of the observer is χ_0, then after interaction the corresponding entangled state of the whole system is respectively $\psi_1\ \chi_1$ and $\psi_1\ \chi_1 + \psi_2\ \chi_2$ [1]. We assume that the observer satisfies the following "QSC condition", i.e. his perception time for the definite state $\psi_1\ \chi_1$, which is denoted by t_P, is shorter than the dynamical collapse time for the superposition state $\psi_1\ \chi_1 + \psi_2\ \chi_2$, which is denoted by t_C, and that the time difference $\Delta t = t_C - t_P$ is large enough for him to identify [2]. The observer can perceive the measured definite state ψ_1 or his own state χ_1 after the perception time t_P, whereas for the measured superposition state $\psi_1 + \psi_2$, only after the collapse time t_C can the observer perceive the collapse state ψ_1 or ψ_2, or his own corresponding state χ_1 or χ_2. Since the observer can also be conscious of the time difference between t_P and t_C, he can distinguish the measured nonorthogonal states ψ_1 and $\psi_1 + \psi_2$.

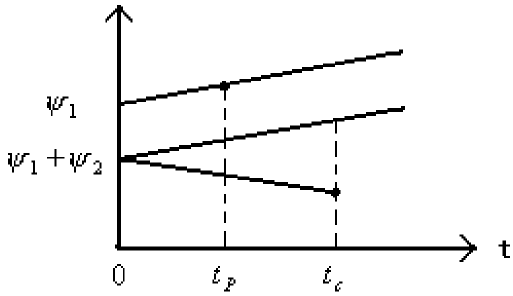

Fig 1. A scheme of QSC principle

It should be stressed that, since the collapse time of a single superposition state is an essentially stochastic variable, which average value is t_C, the "QSC condition" can be in principle satisfied in some collapse events with non-zero probability. For these stochastic collapse processes, the collapse time of the single superposition state is much longer than the (average) collapse time t_C and the perception time t_P.

Once the "QSC condition" is satisfied, and some nonorthogonal quantum states can be distinguished, QSC can be easily realized. In the following, we will briefly introduce a practical

[1] For example, the entangled state can be obtained by inputting the photon in the superposition state to the eyes of the observer.

[2] In real experiments, conscious perception can be more accurately recorded by the EEG recording of the observer, and the "QSC condition" can also be stated using the corresponding EEG recordings.

scheme of achieving QSC based upon the above principle[6-7]. It includes two parts. The first part is how to distinguish the nonorthogonal states. We design a device implementing this function, which is called NSID (Nonorthogonal States Identifying Device). The second part is how to achieve QSC using the hardcore device NSID.

The implementation scheme of NSID is as follows. The particles to be identified are photons, and the conscious being in the device can perceive a single photon[3]. Let the input states of the device be the nonorthogonal states $\psi_A + \psi_B$ or $\psi_A - \psi_B$ and ψ_A or ψ_B. ψ_A is the definite state of photon entering into the perception part of the conscious being from the direction A, which can trigger a definite perception of the conscious being who perceives that the photon arrives from the direction A. ψ_B is the definite state of the photon entering into the perception part of the conscious being from the direction B, which can trigger a definite perception of the conscious being who perceives that the photon arrives from the direction B. $\psi_A + \psi_B$ and $\psi_A - \psi_B$ are the space superposition states of the definite states ψ_A and ψ_B of photon. The conscious being satisfies the "QSC condition", i.e. his perception time t_p for the definite state ψ_A and ψ_B is shorter than the dynamical collapse time t_C of the perceived superposition state $\psi_A + \psi_B$ and $\psi_A - \psi_B$, and the conscious being can be aware of the time difference. When the input state is ψ_A or ψ_B, the conscious being will perceive that the photon arrives from the direction A or B after the perception time t_p, and he assigns '1' as the output of the device[4]. When the input state is $\psi_A + \psi_B$ or $\psi_A - \psi_B$, the conscious being will perceive that the photon arrives from the direction A or B after the collapse time t_C, and he assigns '0' as the output of the device. Thus the device NSID can distinguish the nonorthogonal states $\psi_A + \psi_B$ or $\psi_A - \psi_B$ and ψ_A or ψ_B. NSID can be implemented through the direct use of a conscious being or by an advanced consciousness simulation device in the future.

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[3] In practical situation, a few photons may be needed.

[4] In view of accuracy, a EEG device may be used to record the perception time and produce the output of the device.

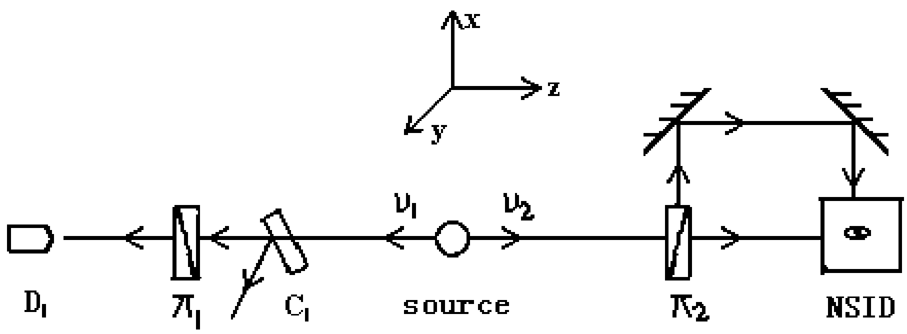

Fig 2. A scheme of QSC experiment

Now we will give the scheme of achieving QSC using the device NSID. In reality, once the nonorthogonal single photon states can be distinguished, achieving QSC will be an easy task, and it may be implemented by means of existing technology. Here we use the EPR polarization correlation pairs of photons as the carriers of information. We encode the outgoing information by operating the polarizer, and decode the incoming information using the device NSID. The experimental setting is shown in the above figure. Pairs of photons, whose frequencies are ν_1 and ν_2, are emitted in the -z direction and +z direction from a source, are then analyzed by a one-channel polarizer π_1 and a two-channel polarizer π_2 respectively. The optical switch C_1 in the left side can be controlled to determine whether or not the photon ν_1 will pass to π_1. The transmission axes of the polarizers are both set in the direction x. The one-channel polarizer π_1 allows only the polarization components of the photon parallel to the transmission axis of the polarizer to be passed, and the two-channel polarizer π_2 allows the polarization components of the photon both parallel to and perpendicular to the transmission axis of the polarizer to be passed. The photon passed and analyzed by the polarizer π_1 is detected by D_1, and the photon analyzed by the two-channel polarizers π_2 is divided into two paths in space, and respectively input to NSID from different directions.

We now explain how QSC can be achieved by means of the above setting. Let the sender operate the optical switch C_1, and have the receiver observe the output of NSID. Suppose the communication rules are stated as follows. The encoding rule for the sender is that not measuring the photon represents sending the code '0', and measuring the photon represents sending the code '1'[5]. The decoding rule for the receiver is that the output of NSID being ‘0’ represents having received the code

[5] In a practical situation, in view of the stochastic property of the collapse time and other possible errors, redundancy coding is required. A single information code should be encoded through the same operation on a small number of photons, not a single photon.

'0', and the output of NSID being ‘1’ represents having received the code '1'.

The communication process can be stated as follows. When the sender wants to send a code '0', he controls the optical switch C_1 to let the photon ν_1 move freely and not be analyzed by the polarizer π_1. Then the state of the photon ν_2 is a superposition state like $\psi_A + \psi_B$ or $\psi_A - \psi_B$ after it passes the polarizer π_2, and the output of NSID is ‘0’. The receiver can decode the sent code as '0'. When the sender wants to send a code '1', he controls the optical switch C_1 to allow the photon ν_1 to be analyzed by the polarizer π_1 and detected by D_1 *before* the photon ν_2 arrives at NSID. Then the state of the photon ν_2 collapses to a definite state like ψ_A or ψ_B, and the output of NSID is ‘1’. The receiver can decode the sent code as '1'. Thus the sender and receiver can achieve QSC using the above setting and communication rules.

3. A telepathy experiment and its possible quantum explanation

Even though some superphysical phenomena may be not real, telepathy does exist. Its usual display is that between the familiar people, say twins, relatives or friends, one can perceive the other's happening, say being sick or being injured etc, at a distance. Many people have this kind of experience. At present, the telepathy phenomena have been confirmed by some strict scientific experiments[1-3], and are being studied by more scientists. One of the most convincing experiments was done in 1994 by Grinberg-Zylberbaum et al[2].

In their experiment, pairs of subjects were first allowed to meditate together, and then put into two semisilent Faraday chambers 14.5m apart. Their EEG activities are registered by two EEG machines. One subject of each pair was stimulated by 100 flashes at random intervals, and each photostimulation resulted in an evoked potentials for the stimulated subject. It is observed that, when the stimulated subject showed distinct evoked potentials, the nonstimulated subject showed "transferred potentials" similar to the evoked potentials in the stimulated subject, at the same time, the subjects both felt their interaction had been successfully completed. Since the subjects were separated by the soundproof faraday chambers, this experiment guarantees that neither sensory signals nor electromagnetic signals is the means of communication, and thus strictly demonstrate the existence of nonlocal correlations between human brains.

In the following, we will analyze the above telepathy experiment in terms of the principle of quantum superluminal communication (QSC)[4-11]. According to the principle of QSC, the proper combination of dynamical collapse of wave function and consciousness of observer will permit the non-electromagnetic superluminal transmission of information. It will be shown that this may provide an possible explanation of the above telepathy experimental results, and indicate that the telepathy process may be realized based on the quantum process in brains.

According to the principle of QSC, for a conscious being the “QSC condition” is that his perception time for the definite state is shorter than the dynamical collapse time of the perceived quantum superposition state, and the time difference is large enough for the conscious being to identify. Now in the above experiment this condition is indeed satisfied as implied by the experiment results. On the one hand, the quantum entanglement state between the subjects A and B in the experiment, which is formed by meditative interaction and can be written as $\chi_1(A)\chi_2(B)+\chi_2(A)\chi_1(B)$, can hold for a long time until the experiment is completed, then there appears the observed similarity between the evoked and transferred potential. This indicates that the dynamical collapse time of the quantum entanglement state is also very long, say several ten minutes. On the other hand, the perception time of the subjects for the definite state is generally of the orders of 0.1s. Thus in the experiment the collapse time of the entanglement state or superposition state is evidently much longer than the perception time of the subject for the definite state, and the time difference is also large enough for the subject to identify, i.e. the "QSC condition" is naturally satisfied in the experiment.

Once the required "QSC condition" is satisfied, realizing QSC and explaining telepathy will be probable. According to the principle of QSC, the subject satisfying the "QSC condition" will possess different perceptions for the superposition state and definite state. As revealed in the experiment, when the subject A is not stimulated and the quantum entanglement state still holds, the subject B will be in a superposition state, and he has no distinct feeling related to the state. Whereas when the subject A is stimulated and the quantum entanglement state collapses, the subject B will be in a definite state, and he does have a distinct feeling that their interaction has been successfully completed. Then QSC can be realized if we encode the different stimulating operations to subject A, and correspondingly decode the codes through the different feelings or EEG activities of subject B. This may also naturally explain the telepathy phenomenon between the subjects.

4. A quantum theoretical model of telepathy process

On the basis of the principle of QSC and the above analyses, we will present a primary theoretical model of telepathy process. In this model, the telepathy process includes three phases.

Phase 1: Form the quantum entanglement state of brains

During this phase, the quantum states of the brains of the telepathy subjects are entangled. Here we give a simple way to entangle the quantum states of brains. Suppose two photons are in the entanglement state $\psi_1\varphi_2+\varphi_1\psi_2$, and they respectively enter the eyes of two subjects A and B whose initial states is respectively $\chi_0(A)$ and $\chi_0(B)$. Then after interaction the entanglement state of these two brains will be formed according to quantum evolution law, which can be written as $\chi_1(A)\chi_2(B)+\chi_2(A)\chi_1(B)$. Here we assume the photons are absorbed in the process. In the above experiment, this step is realized by the meditative interaction between the subjects.

Phase 2: Hold the entanglement state of brains

The formed entanglement state of brains may be some kind of microscopic quantum state, and it can hold for a long time until measurement is made to result in its collapse process. According to the principle of QSC, the holding time should be much longer than the usual perception time of the subjects. It is argued that this condition may be satisfied in some places of the brain[18-21]. In the above experiment, the entanglement state is hold by the subjects feeling each other's presence at a distance.

Phase 3: Collapse the entanglement state of brains

When the entanglement state of brains is collapsed by a certain measurement on one of the subjects, the brain states of both subjects turn to be definite states from entanglement state, and the other subject will perceive the change at a distance. Here the telepathy between the subjects appears.

When in the entanglement state or superposition state such as $\chi_1(A)\chi_2(B)+\chi_2(A)\chi_1(B)$, no definite perception exists, while when the superposition state collapses to a definite state $\chi_1(A)\chi_2(B)$ or $\chi_2(A)\chi_1(B)$, definite perception can appear. In the above experiment, this step is realized by stimulating the subject A with 100 flashes, and when the entanglement state is collapsed by the stimulation, the subjects feel that their interaction has been successfully completed.

It should be stressed that, even though the above quantum model can in principle provide a scientific explanation of telepathy phenomena, there are still two left technical problems. One is to find the position in the brain where the holding time of a quantum superposition state can be much longer than the usual perception time, namely test the existence of "QSC condition" in human brains. The other is to study how the brain generates the high-level telepathy information from the low-level one transmitted through the above QSC means. This closely relates to present neuroscience study. In one word, these problems need to be deeply studied in experiments. In the following, we will further suggest some experimental schemes that may help to solve the problems.

5. Some further experimental schemes

In order to test the existence of "QSC condition" in human brains, and confirm the above primary quantum model of telepathy phenomena, we propose the following experimental schemes.

1. Control experiment

Produce some photons with a certain frequency. Input them to the eyes of the subject. Test and record the perception time of the subject through EEG recording device or his oral description.

2. Quantum perception experiment I

Produce the quantum space superposition state of the photons with the same frequency. Input one branch of the superposition state to the eyes of the subject, and let the other branch freely spread (not input to the measuring device). Test whether the subject perceives the photons during the normal perception time.

3. Quantum perception experiment II

Produce the quantum space superposition state of the photons with the same frequency. Input both branches of the superposition state to the eyes of the subject. Test whether the subject perceives the photons during the normal perception time.

4. Perceptions entanglement experiment I

Produce the quantum space superposition state of the photons with the same frequency. Input the branches of the superposition state to the eyes of two independent subjects respectively. Test whether the subjects perceive the photons during the normal perception time. It is suggested that the subjects are unfamiliar with each other before the experiment, which can be further confirmed by the phase incoherence of their EEG signals.

If the subjects can only perceive the photons after a time interval much longer than their normal perception time in any one of the above experiments, then we will have confirmed the existence of "QSC condition" in human brains. Besides, we suggest the subjects in the above experiments should be composed of three independent groups at least. The subjects in the first group are in normal state. The subjects in the second group are in meditation state. The subjects in the third group are in QiGong state.

5. Perceptions entanglement experiment II

Produce the quantum space superposition state of the photons with the same frequency. Input the branches of the superposition state to the eyes of two independent and isolated subjects respectively. Then Using flashes stimulate one of the subjects at random intervals. Record his evoked potentials and the corresponding transferred potentials of the other subject. Test whether there exists statistical relevance between these two potentials. At the same time, ask the subjects whether they had some kind of perception relating to the stimulations. The existence of this kind of perception will have confirmed the above primary quantum model, and it can be used to realize controllable human brain communication.

This experiment can be taken as the quantum version of Grinberg-Zylberbaum's experiment[2]. The further experimental suggestions are stated as follows:

(1). Complete the experiment at much longer distance, say longer than the bound distance 40km, in which the possible classical signals with light speed can't be used to explain the statistical relevance between the potentials of the subjects. Thus we can strictly confirm that telepathy is one kind of superluminal and non-electromagnetic phenomena, and further confirm the existence of "QSC condition" in human brains.

(2). Replace the flashes with flickering light. Here the evoked potentials of the stimulated subject will contain some measurable frequency information. It is expected that the corresponding transferred potentials of the other subject will contain the same measurable frequency information. Then we can use the transferred frequency information to realize non-electromagnetic and superluminal human brain communication more reliably.

6. Remarks and expectations

If our quantum model of telepathy is confirmed by the experiments, then it can be naturally used as one new kind of quantum superluminal communication (QSC) means. Compared with the conventional wire and wireless communication, such new kind of communication will undoubtedly have more advantages. First, the transfer delay of QSC is irrelevant to the communication distance, and can be zero in principle, thus QSC is the fastest communication means. Secondly, the carriers of information may not pass the space between the sender and receiver for QSC, thus the communication process is not influenced by the in-between environment, and QSC is one kind of complete anti-jamming communication means. Thirdly, since the carriers of information can be only stored in the sender and receiver for QSC, the third party can't eavesdrop the transferred information, thus QSC is the most secret communication means. Lastly, there is no electro-magnetic radiation for QSC, and it is one kind of green communication means.

Certainly, the realization of QSC will undoubtedly require the close combination of biological technology, quantum technology and communication technology. Looking from long views, we should deeply study the perception process (e.g. the perception process about quantum superposition state) of our human brains, and try to find the perception unit in order to achieve practical QSC. On the basis of this study, we may develop the more advanced perception stimulation technology, and integrate the perception function in a tiny biological chip. This will help to develop the genuine QSC products.

It may be forecasted that QSC will become the main communication means in the near future. Space will no longer be the obstacle of communication, and people can have real-time talks between any faraway distances. At the same time, QSC will be one kind of completely anti-jamming, secret and green communication means. These are not just dreams, and science may take us walk into such miraculous QSC times in twenty or thirty years. Let's try hard and expect it together!

References

[1] T.D.Duane and T. Behrendt, Science 150, (1965)367.
[2]J.Grinberg-Zylberbaum, D.Dalaflor, L.Attie and A.Goswami, Physics Essays 7, (1994)422
[3] L. J. Standish et al, Plenary talk in Quantum Mind 2003 Conference, Tucson, 2003.3
[4] E.J.Squires, Phys.Lett.A 163, (1992) 356-358
[5] Gao Shan, Quantum-Mind Digest, #2000-10, (2000)
[6] Gao Shan, *Quantum Motion and Superluminal Communication*, (Beijing, Chinese B&T Publishing House, 2000)
[7] Gao Shan, Patent of Quantum Superluminal Communication, CN 1316836A, Gazette of Invention Patent, Vol.17, No.41, p.122 (2000)
[8] Gao Shan, Research Briefing On Electro-Magnetic Wave Velocity, No.1, 2001
[9] Gao Shan, The Noetic Journal, Vol.3, No.3, July, 2002
[10] Gao Shan, NeuroQuantology, Vol.1, No.1, (2003) p.4-9.
[11] Gao Shan, Short talk in Quantum Mind 2003 Conference, Tucson, 2003.3
[12] A.Einstein, B.Podolsky, and N.Rosen, Physical Review. 47, (1935) 777-780
[13] J.S.Bell,Physics 1, (1964)195
[14] A.Aspect, J.Dalibard and G.Roger, Phys.Rev.Lett 49, (1982) 1804
[15] W.K.Wootters and W.H.Zurek, Nature 299, (1982) 802
[16] P .H.Eberhard, Nuovo Cimento B, 46, (1978) 392
[17] G.C.Ghiradi, A.Rimini, and T.Weber, Letters Nuovo Cimento. 27, (1980) 293
[18] S.R.Hameroff and R.Penrose, Orchestrated reduction of quantum coherence in brain microtubules: A model for consciousness. In: Toward a Science of Consciousness: The First Tucson Discussions and Debates, S.R. Hameroff, A. Kaszniak and A.C. Scott, eds. (MIT Press, Cambridge, 1996)
[19] S. R. Hameroff and R.Penrose, Conscious events as orchestrated space-time selections, Journal of Consciousness Studies, 3(1) (1996), p.36-53.
[20] S. R. Hameroff, Quantum computation in brain microtubules? The Penrose-Hameroff "Orch OR" model of consciousness, Philosophical Transactions Royal Society London (A) 356 (1998), p.1869-1896.
[21] S. Hagan, S. R. Hameroff, and J. A. Tuszynski, Quantum computation in brain microtubules: Decoherence and biological feasibility, Phys. Rev. D, 65(2002), p.061901.