Schrödinger's Cat

[A] puzzle arises if we think about the implications of the two-hole experiment. The standard Copenhagen interpretation of this experiment showed that indeterminacy — Born's waves of probability — meant that we had to renounce the objectivity of the world, the idea that the world exists independent of our observing it. For example, the electron exists as a real particle at a point in space only if we observe it directly. . . .

Schrödinger suggested that we imagine that a cat is sealed in a box along with a weak radioactive source and a detector of radioactive particles. The detector is turned on only once for one minute; let us suppose that the probability that the radioactive source will emit a detectable particle during this minute is one out of two $= \frac{1}{2}$. Quantum theory does not predict the detection of this radioactive event; it only gives the probability as $\frac{1}{2}$. If a particle is detected, a poison gas is released in the box and kills the cat. The well-sealed box is far away on an earth satellite, so we don't know if the cat is alive or dead.

According to the strict Copenhagen interpretation, even after the crucial minute has passed we cannot speak of the cat as in a definite state — alive or dead — because as earthbound people we have not actually observed if the cat is alive or dead. A way of describing the situation

is to assign a probability wave to the physical state of a dead cat and another probability wave to the physical state of the live cat. The cat-in-the-box is then correctly described as a wave superposition state consisting of an equal measure of the wave for the live cat and the wave for the dead cat. This superposition state for the cat in the box is characterized not by actualities but by probabilities — macroscopic quantum weirdness! It is as meaningless to talk about the cat's being alive or dead as it is to talk about which hole the electrons go through in the two-hole experiment [see http://xeny.net/Poetry-FurtherReading]. The statement "The electron goes either through hole 1 or hole 2" is also meaningless. The electron, if you do not observe which hole it goes through, exists in a superposition state of equal measure of a probability wave for going through hole 1 and through hole 2. Maybe you can accept that weirdness for electrons. But here we have the same kind of statement, "The cat either is dead or the cat is alive" for a cat, not an electron. Cats, like electrons, can be in a quantum never-never land.

Now let us suppose that a space shuttle with a group of scientists goes out to examine the contents of the orbiting cat-in-the-box and when they open the box they are greeted with a loud meow — the cat is alive. The

Copenhagen interpretation of this event is that the scientists, by opening the box and performing an observation, have now put the cat into a definite quantum state — the live cat. This is analogous to examining with light beams the location of the electron at hole 1 or hole 2. For the scientists in the space shuttle, the state of the cat is no longer a superposition of waves for live and dead cat. But because their telecommunications system has broken down the scientists back on earth don't yet know if the cat is alive or dead. For these earth-bound scientists, the cat-in-the-box plus the scientists on board the space shuttle who now know the state of the cat are all still in a probability wave superposition state of live cat and dead cat. The quantum never-never land of the superposition state is getting bigger.

Finally, the scientists on board the space shuttle manage to open a communication link to a computer down on earth. They communicate the information that the cat is alive to the computer, and this is stored in its magnetic memory. After the computer receives the information but before its memory is read by the earth-bound scientists, the computer is part of the superposition state for the earth-bound scientists. Finally in reading the computer output the earth-bound scientists reduce the superposition state to a definite one. Then they tell their friends in the next room, and so on. Reality springs into being only when we observe it. Otherwise it exists in a

superposition state like the electron going through the holes. Even the reality of the macroscopic world does not have objectivity until we observe it according to this scenario.

Weird as it seems, this is the standard Copenhagen interpretation of reality. We see that it requires a definite line between the observed and the observer, a split between object and mind. At first this line was between the cat-in-the-box and the space-shuttle scientists. After they opened the box the line moved to between the space-shuttle scientists and the computer, and so on. As information about the state of cat propagated from place to place, so did the objective reality of the live cat. The Copenhagen interpretation demands that a distinction be made between the observer and the observed; it does not say where the line between them is drawn, only that it must be drawn.

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