Schrodinger's cat

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Sincere apologies if this has appeared before: my newsgroup connection has been faulty, and I have not been able to access the group since my original posting. If anyone has responded, I would be grateful if they could copy their response, either to the group or by email.

My knowledge of quantum theory is close to zero, but I am interested in it, and some of its consequences. This post is an invitation for correction as much as anything.

The particular issue is the collapse of the wave function, or the state vector, according to choice. My understanding is that the wave−particle duality can be resolved by considering the wave as the probability distribution of the positions of the particle. When the position becomes known, the wave "collapses" in the sense that it is no longer required.

The difficulty with this is the question: known to whom? I have read a book in which the author laboured to suggest that this collapse, the transition from possibility to certainty, could only happen in the presence of consciousness.

Now I am delighted to find that Karl Popper produced an argument against this proposition which I find compelling and relatively accessible. I would be interested to know whether it is well−known, and how well regarded.

Popper prefers propensities to probabilities, and that appeals to me, as an ex−marketing man. We used to describe consumers as having a propensity to buy brands in a market, ranging from 1 if they only ever bought one brand, down to 0 if they would not buy that particular brand whatever the circumstances. Given these propensities, a consumer going into a store would buy the product at the top of their list, given that it was on display, at an acceptable price, and that a brand for which they had a lower propensity was not better priced or promoted.

Popper's argument is spelt out is his "quantum theory and the schism in physics" which I will greatly shorten here, whilst hoping to preserve the essence. He pictures a series of time−slices in which all the information in the universe is captured on a piece of film. Bear with this, the point will become clearer. He also refers to the wave−function

as the wave packet.

"Let e be the event whose presence or absence we wish to predict, and
let s1, s2 ... be classical film strips attached to later and later
time−slices. Let
pred (e, s1)
be a prediction with respect to e in the light of the appropriate still
of film strip s1. We shall then find that pred (e, s1) and pred (e, s2)
do not, in general, agree, and that the latter will generally be
preferable as a predictor to the former.

The transition from pred (e, s1) to pred (e, s2) corresponds exactly to
the transition from the probability statement p (e, s1) to p (e, s2)
where p (a,b) denotes the probability of a given the information b. But
the transition from p(e,s1) to p(e,s2) is, as we have seen, precisely
what quantum theorists have described as a "reduction of the wave
packet". They have suggested that this reduction of the wave packet is
connected with, or dependent on, a) the measuring experiment by which we
obtain new information s2 and b) the realization or actualization of
what was, so far, only potential. (Heisenberg's transition from the
possible to the actual). These two points a) and b) are often combined
in the suggestion c) that it is only under the stimulus of our own
interference with the physical system, only owing to our measuring
experiment, that the transition from the possible to the actual takes
place. In our picture, in contrast, the transition from the possible to
the actual takes place whenever a new state of the world emerges;
whenever a new time−slice is actualized or realised, whether observed,
or measured, or not. (In fact, observations and measurements are so
extremely rare that almost all realizations of potentialities happen
independent of them.)

As long as anything happens, as long as there is any change, it will
always consist in the actualization of certain potentialities. Thus a
new filmstrip, (and with it a new opportunity for a reduction of the
wave packet) appears: whenever any interaction takes place. Whether or
not we know or observe the new state s2, and whether or not we replace
pred (e, s1) by pred (e, s2) in our attempts to predict e, is completely
incidental, and does not in any way bring about the actualization of
potentialities.

The world changes without reference to us

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Of course, some changes are due to our own experiments, and these are
both practically and theoretically important to us. But it looks to me
very much like a symptom of either myopia or megalomania to allow one's
view of the world, or of science, to be dominated, or even coloured, by
the disturbances created by one's own experiments. Transitions from the
potential to the actual and quantum interactions were going on before
anybody interfered with anything, and they will continue going on long

after we have left off interfering."

Comments welcome.
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ralph
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