Review of: "Determining When Schrödinger's Cats Die"

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Potential competing interests: No potential competing interests to declare.

Comment: The author is thanked for an interesting paper. I confess not mastering the fine points of Quantum Mechanics, and my comments are offered from a macroscopic point of view.

Recommendation: The author is encouraged to consider the following:

1. By using the radioactive atoms as the trigger for the demise of the cat[s], the Krechmer defines the decay process. In his scenario the radioactive decay probability is defined as 50% during the first hour, the probability of decay during the second hour will not be 50% as pointed out in the review by Michele Renda. It would take 10 hours to get 99.9% [but still not 100%] of the cats to die. This affects the line shape in Figure 1.
2. Krechmer could have set up the experiment differently to make sure that 50% of the cats died sometime during the 1st hour and the remainder of the cats died during the 2nd hour. One possibility would be a rectangular distribution, but that wouldn't describe a radioactive decay process.
3. Schrodinger's experiment is about what happens to one cat. The Krechmer changed the experiment by introducing many cats. Furthermore, by introducing many cats into the experiment, the author changed the intent of Schrodinger's experiment to the Krechmer's intent of determining when the cats died. This takes the Schrodinger experiment in a new and interesting direction -- the "Krechmer experiment."
4. If we accept the radioactive atom decay as the trigger and the cat's demise as the indicator for the decay event during the 1st hour, by observing the state of many cats at 1 hour, the half-life of the radionuclide [assuming it is a pure radioactive source] could be determined without measuring what happened during the 2nd hour. The relative uncertainty of this measurement will decrease as the number of cats observed increases. Notice that there is a shift from determining when cats die to measuring the half-life of the radionuclide. Why? Because the physics of radioactive decay is much better known than the mechanism of killing cats with cyanide.
5. By reducing the observation time from 1 hour down to 10 minutes, additional data is collected to more quickly determine the half-life of the radionuclide [particularly important if the half-life of the radionuclide is not exactly1hr.] with smaller uncertainty, and also to better understand the process of killing the cats with cyanide.
6. Now that the half-life of the radionuclide is determined to be 1 hr. with a small uncertainty, we are better prepared to determine the rate at which cats die. If an infinite number of experiments were conducted, the relative uncertainty of the half-life should be reduced to near zero. If there are any significant residual uncertainty, it could be related to the experimental design of releasing the cyanide and how it kills cats. It is possible that there is variation in the amount of time it takes for cats to die when exposed to cyanide. These sources of variation could be contributors to the residual

uncertainty, and provide an estimate for the variations due to:

- The lag time between the radioactive atom's decay and the release of the cyanide,
- How long it takes for the gas to reach the cats which could be in different locations in the box,
- How long it takes the concentration of the cyanide to reach critical toxicity, and
- The time of death of the cats due to biological variation.

There may be additional components of uncertainty, not cited here, that could contribute to the residual combined uncertainty.

The Type A uncertainty components could be characterized and quantified by supplemental experiments. And, while some Type B uncertainty components could also be quantified by supplemental experiments, some may be left to estimation from expert experience [including use of rectangular uncertainty distributions].

Regardless, the residual combined uncertainty provides an uncertainty envelope that then can better describe when Krechmer's cats die after the radioactive atoms decay.

7. If the take away message for this paper is that measurements are inextricably accompanied with their uncertainty, it is an important message even for the determination of the life of Krechmer's cats.