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# Popper

## The Logic of Scientific Discovery


London and New York

# APPENDIX *xii

## The Experiment of Einstein, Podolsky, and Rosen

### A LETTER FROM ALBERT EINSTEIN, 1935

The letter from Albert Einstein here printed in translation briefly and decisively disposes of my imaginary experiment of section 77 of the book (it also refers to a slightly different version contained in an unpublished paper), and it goes on to describe with admirable clarity the imaginary experiment of Einstein, Podolsky, and Rosen (*Physical Review* **47**, 1935, pp. 777–780; *cf.* my note on p. 232 and section 3 of my appendix *xi).

Between these two points, a few remarks will be found on the relation of theory and experiment in general, and upon the influence of positivistic ideas upon the interpretation of quantum theory.

The two last paragraphs of the letter also deal with a problem discussed in my book (and in my *Postscript*)—the problem of subjective probabilities, and of drawing statistical conclusions from nescience. In this I still disagree with Einstein: I believe that we draw these probabilistic conclusions from conjectures about equidistribution (often very natural conjectures, and for this reason perhaps not always consciously made), and therefore from probabilistic premises.

Einstein's literary executors requested that, if a translation of the

letter were to be published, the original text should be published at the same time. This suggested to me the idea of reproducing Einstein's letter in his own handwriting (see pp. 489–92).

Old Lyme, 11. IX. 35.

Dear Mr. Popper,

I have looked at your paper, and I largely [*weitgehend*] agree.[x] Only I do not believe in the possibility of producing a 'super-pure case' which would allow us to predict position *and* momentum (colour) of a photon with 'inadmissible' precision. The means proposed by you (a screen with a fast shutter in conjunction with a selective set of glass filters) I hold to be ineffective in principle, for the reason that I firmly believe that a filter of this kind would act in such a way as to 'smear' the position, just like a spectroscopic grid.

My argument is as follows. Consider a short light signal (precise position). In order to see more easily the effects of an absorbing filter, I assume that the signal is analysed into a larger number of quasi-monochromatic wave-trains $W_n$. Let the absorbing set of filters cut out all the colours $W_n$ except one, $W_1$. Now this wave-group will have a considerable spatial extension ('smearing' of its position) because it is quasi-monochromatic; and this means that the filter will necessarily 'smear' the position.

Altogether I really do not at all like the now fashionable [*modische*] 'positivistic' tendency of clinging to what is observable. I regard it as trivial that one cannot, in the range of atomic magnitudes, make predictions with any desired degree of precision, and I think (like you, by the way) that theory cannot be fabricated out of the results of observation, but that it can only be invented.

I have no copies here of the paper which I wrote jointly with Mr. Rosen and Mr. Podolski, but I can tell you briefly what it is all about.

The question may be asked whether, from the point of view of today's quantum theory, the statistical character of our experimental

[x] Main point: The $\psi$-function characterizes a statistical aggregate of systems rather than one single system. This is also the result of the considerations expounded below. This view makes it unnecessary to distinguish, more particularly, between "pure" and "non-pure" cases.