

the orientation of the physicists produced, the geographical concentration of physicists, and the wages of physicists are strongly (I say overwhelmingly) influenced by government

policy. If there ever was an academic isolation of physicists, it is not so now. To take position on public issues is not a matter of choice, it is essential to our being physicists.

HERBERT L. FOX
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The world "out there"

R. Bruce Lindsay's article on "Arbitrariness in Physics" argues that the physicist has only two alternatives: Either he views science as the progressive discovery of "absolute truth" about a world "out there," or he must give up the realist position of a structured external world and view science not as discovery but as the free creation of ways of ordering our subjective experience. Surely this dichotomy is an enormous oversimplification and a crude caricature of the realist position.

The view of all modern realists—I cite Bertrand Russell and Albert Einstein as typical—is that there is indeed a world "out there," a world that is mathematically structured, but we know its structure vaguely and only in part. That science provides only probable truth, subject to endless revision, is taken for granted by all contemporary realists, scientists or philosophers, but that in no way entails abandoning the conviction that there is a world outside human experience and that science is providing us with constantly improving knowledge of that world's structure.

I am sure that Lindsay would not wish to maintain that the moon did not revolve around the earth until a creature evolved on the planet capable of observing it; yet that is the kind of nonsense that is implied by his subjective, naïvely pragmatic way of talking about the scientific process.

MARTIN GARDNER
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Indubitable determinism

When reading R. Bruce Lindsay's interesting paper on "Arbitrariness in Physics" (PHYSICS TODAY, December, page 23), I was struck by the following paradox: Lindsay, as a physicist, would never say that things in a physical system "just happen"—freely, arbitrarily. He would apply the concept of causality and show how a given event is caused by another event that preceded it in time, and so on down the line. Yet when it comes

to psychology, he uses the terms "free choice" and "free use of preference," as though these choices had come into full bloom within the mind with no causal predecessors.

On the other hand, Sigmund Freud, who in the public eye is usually associated with the psychology of the irrational, was actually the most dyed-in-the-wool determinist when it came to thought processes. His basic premise was: There are no accidents in the mind. And so if scientist A comes up with a bold and original idea, it may be arbitrary as far as physics is concerned, but the psychoanalyst would put A on a couch and trace back the psychological determinants of this idea to their origin. The logic may be unconscious and unphysical; it may be unrecognizable as formal logic; it may have dream-like distortions and displacements, but one way or another the origin of the idea will be found.

In other words, a new idea or way of looking at things may be free and arbitrary within the framework of physics, but it is not free in the context of the scientist's past experience and overall style of life.

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Through an ion darkly

It appears to me that Werner Brandt's conference report, "Ion Implantation Creates New Electronic Properties" (PHYSICS TODAY, November, page 115) presents too dark a picture of this burgeoning soon-to-be-technological area.

His unqualified "... In practice perplexing difficulties arise ..." is unduly pessimistic when in fact implantation phenomena are fairly well understood. The associated phenomenon meriting this tag is the accompanying secondary electron emission which, it is granted, has many perplexing aspects, none of which are difficult to minimize in effect. Range-energy effects, annealing effects and electrical behavior of implanted species have been detailed experimentally



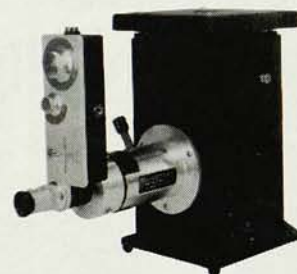
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