BOOJUMS ALL THE WAY THROUGH:

Communicating Science in a Prosaic Age

N. DAVID MERMIN
Professor of **Physics**, *Cornel University*

The right of the University of Cambridge to print and sell all manner of books was granted by Henry VIII in 1534. The University has printed and published continuously since 1584.

CAMBRIDGE UNIVERSITY PRESS
Cambridge
New York Port Chester Melbourne Sydney

CONTENTS

II. The quantum theory

III. Relativity

IV. Mathematical musings

They are there for one and only one reason: to relieve the perplexity engendered by the insistence that there are no connections.

Whether or not this is a satisfactory state of affairs is, I suspect, a question better addressed by philosophers than by physicists.

I conclude with the recipe for making the device, which, I emphasize again, can be ignored:

> The device exploits Bohm's version[7] of the Einstein, Podolsky, Rosen experiment. The two particles emerging from the box are spin $\frac{1}{2}$ particles in the singlet state. The two detectors contain Stern–Gerlach magnets, and the three switch positions determine whether the orientations of the magnets are vertical or at $\pm 120°$ to the vertical in the plane perpendicular to the line of flight of the particles. When the switches have the same settings the magnets have the same orientation. One detector flashes red or green according to whether the measured spin is along or opposite to the field; the other uses the opposite color convention. Thus when the same colors flash the measured spin components are different.
>
> It is a well-known elementary result that, when the orientations of the magnets differ by an angle θ, then the probability of spin measurements on each particle yielding opposite values is $\cos^2(\theta/2)$. This probability is unity when $\theta = 0$ (Case a) and $\frac{1}{4}$ when $\theta = \pm 120°$ (Case b).
>
> If the subsidiary detectors verifying the passage of the particles from the box to the magnets are entirely non-magnetic they will not interfere with this behavior.

[7] D. Bohm, *Quantum Theory* (Englewood Cliffs, N.J. Prentice-Hall, 1951), pp. 614–19.

11

Can you help your team tonight by watching on TV? More experimental metaphysics from Einstein, Podolsky, and Rosen

A few years ago I described[1] a simple device that reveals in a very elementary way the extremely perplexing character the data from the Bohm–Einstein–Podolsky–Rosen experiment assumes in the light of the analysis of J. S. Bell. There is a second, closely related form of that *gedanken* demonstration,[2] which I would like to examine for several reasons.

1. It is simpler: there are only two (not three) settings for each switch.
2. The *gedanken* data resemble more closely the data collected in actual realizations of the device.
3. None of the possible switch settings produce the perfect correlations found in the first version of the *gedanken* demonstration, where the lights *always* flash the same color when the switches have the same setting. Since absolutely perfect correlations are never found in the imperfect experiments we contend with in the real world, an argument that eliminates this feature of the ideal *gedanken* data can be applied to real data from real experiments. (If you believe, however, along with virtually all physicists, that the

[1] N. David Mermin, *Journal of Philosophy*, 78,397 (1981), reprinted as the preceeding essay. An only slightly more technical but significantly more graceful version recently appeared in *Physics Today*, April, 1985.

[2] What follows is my attempt to simplify some reformulations of EPR and Bell by Henry Stapp (for example, *Am. J. Phys.* 53,306 (1985)), but the interpretation I give differs from his, and any foolishness in what follows is entirely my own.

quantum thcory gives the correct ideal limiting description of all phenomena to which it can be applied, then this is not so important a consideration.)

4. Because the ideal perfect correlations are absent from this version of the *gedanken* demonstration, one is no longer impelled to assert the existence of impossible instruction sets. To establish that the new data nevertheless remain peculiar, it is necessary to take a different line of attack, which has again intriguing philosophical implications, but of a rather different character.[3]

The modified demonstration

In the modified *gedanken* demonstration there are only two switch settings (1 and 2) at each detector. Otherwise the set-up is unchanged: there are two detectors (A and B) and a source (C), and the result of each run is the flashing of a red or green light. If one had actually built such a device according to the quantum mechanical prescription, it could be transformed to run in this modified mode simply by readjusting the angle through which certain internal parts of each detector turned as the switch settings were changed.[4]

In its new mode of operation, the device produces the following data:

(i) When the experiment is run with both switches set to 2 (22 runs) the lights flash the same color only 15% of the time; in 85% of the 22 runs different colors flash.

[3] There are more orthodox ways of extracting the peculiar character of this data. The route I take here requires fewer formal probabilistic excursions, and leads to a rather different philosophical point, though I suspect a careful analysis of the use of probability distributions in the conventional arguments might uncover something quite similar.

[4] Physicists might note that if setting #1 at detector A corresponds to measuring the vertical spin component, then setting #2 at A measures the component at 90° to the vertical setting #1 at B, 45° to the vertical, and setting #2 at B, −45° to the vertical, all four directions lying in the same plane. (In the earlier version the three switch settings at either detector corresponded to 0°, 120°, and −120°.) The fraction 85% is just $\cos^2(22.5°) = \frac{1}{4}(2+\sqrt{2})$.

(ii) When the experiment is run with any of the other three possible switch settings (11, 12, or 21 runs) then the lights flash the same color 85% of the time; in only 15% of these runs do different colors flash.

As in the earlier version of the *gedanken* experiment, RR and GG are equally likely when the lights do flash the same color, and RG and GR are equally likely when different colors flash. Also as earlier the pattern of colors observed at any single detector is entirely random. There is no way to infer from the data at one detector how the switch was set at the other. Regardless of what is going on at detector B, the data for a great many runs at detector A is simply a random string of R's and G's, that might look like this:

Typical data at detector A

A: R G R R G G R G R R R G G G R G R R R G R G R G . .

The choice of switch settings only affects the *relation* between the colors flashed at *both* detectors. If, for example, the above data had been obtained at detector A when its switch was set to 2, and in all those runs the switch at B had also been set to 2, then, as noted above, the color flashed at B would have agreed with that flashed at A in only 15% of the runs, and the lights flashed at both detectors together might thus have looked like this:[5]

Data from a series of 22 runs

A2: R G R R G G R G R R R G G G R G R R R G R G R G . . .
B2: G R G G G R G R G G R G R R G R G G R R R R G R . . .

Although the list of colors flashed at either detector remains quite random, the color flashed at B is highly (negatively) correlated with the color flashed at A. In the overwhelming majority (85%) of the runs the detectors flash different colors. Only in a few (15%) of the runs do the detectors flash the same color

[5] The numbers after A and B denote the fixed setting of their switches throughout the sequence of runs In contrast to some earlier version of the *gedanken* demonstration, we now try out various fixed switch settings, rather than randomly resetting the switches after each run

On the other hand, for any of the other switch settings {take 21 as an example) the comparative data would have looked something like this:

Data from a series of 21 runs

A2: R G R R G G R G R R R G G G R G R R R G R G R G...

B1: R G R G G G R R R R R G G R G G R R R G G G R G...

Again we have two lists of colors, each entirely random, but they now agree with each other in 85% of the runs, disagreeing in only 15%.

There arc various ways to run the modified *gedanken* demonstration, but let me focus on the following procedure, which it seems to me makes a rather striking contribution to Abner Shimony's field of experimental metaphysics. Suppose we do a long series of runs in each of which both switches are set to 1:

Data from a series of 11 runs

A1: R G G G R G R G R R G R R G R G R R R R G R G G...

B1: R G G R R G G R R R G R R G R G R G R R G G G G...

About 85% of these 11 suns will produce the same colors. and 15%, different. Now because there are no connections of any kind between the detectors at A and B, it seems clear that whatever happens at A cannot in any way depend on how the switch was set at B, and vice-versa. Let us elevate this common sense remark into a principle, which I shall call the Baseball Principle. Before examining the implications of the *gedanken* demonstration for the Baseball Principle, let us discuss it in the context from which its name derives, where it assumes (at least for me) an especially vivid character.

The Baseball Principle

I'm a New York Mets fan, and when they play a crucial game I feel I should watch on television. Why? Not just to find out what's going on. Somewhere deep inside me, I feel that my watching the game makes a difference - that the Mets are more likely to win if I'm following things than if I'm not.. How can I say such a thing? Do I think, for example, that by offering up little prayers at crucial moments I can induce a very gentle divine intervention that will produce the minute change in trajectory of bat or ball that makes the difference between a hit or an out? Of course not! My feeling is completely irrational. If you insisted that I calm down and think about it, I'd have to admit that the outcome of the game doesn't depend in the least on whether I watch it or not. What I do or don't do in Ithaca, New York, can have no effect on what the Mets do or don't do in Flushing, New York. This is the Baseball Principle.

Now a pedant comes along and says, "What do you really mean by that Baseball Principle?' And then, being a pedant, he tells me what I really mean. What I really mean is this: If we examined a great many Mets games and divided them up into those I watched at least part of on TV and those I didn't watch at all, and if my decision to watch or not was entirely independent of anything I knew about the game – made, for example, by tossing a coin - then we would find that the Mets were no more or less successful in those games I watched than in those games I didn't.

Now I reply, "That's very nice, but I mean something much simpler. I mean that in each individual game, it doesn't make any difference whether I watch it or not. Tonight, for example, whatever the Mets do, will be exactly the same, whether or not I end up watching the game."

"C'mon," says the pedant, "that's silly. Either you watch the game or you don't. You can't say that what happens in the game in the case that didn't happen is the same as what happens in the case that did, because there's no way to check. What didn't happen *didn't happen.*"

I say to the pedant: "Who's being silly here? Are you trying to tell me that it *does* make a difference in tonight's game whether I watch it or not?"

"No," says the pedant, "I'm saying that your statement that it doesn't make any difference whether or not you watch an individual game, can only be viewed as a very convenient construct to summarize the more complex statistical statement about correlations between watching and winning over many games. All of its statistical implications are correct, but it has no meaning when applied to an individual game, because there is no way to verify it in the case of the individual game, which you cannot both watch and not watch."

But is it *wrong* to apply the Baseball Principle to an individual game?

The Strong Baseball Principle

Let us call the claim that the Baseball Principle applies to each individual game the Strong Baseball Principle. The Strong Baseball Principle insists that the outcome of any particular game doesn't depend on what I do with my television set – that whatever it is that happens *tonight* in Shea Stadium, will happen in exactly the same way, whether or not I'm watching on TV.

As a rational person, who is not superstitious, and does not believe in telepathy or the efficacy of prayer on the sporting scene, I am convinced of the Strong Baseball Principle. True, there is no way to verify it, since I cannot both watch and not watch tonight's game, and am therefore unable to compare how tlie game goes in both cases to make sure nothing changes. Nevertheless, deep in my heart, I do believe that because there is no mechanism connecting what I do with the TV at home to what happens in Shea Stadium, the outcome of tonight's game genuinely does not depend on whether I watch it or not: The Strong Baseball Principle. Try as you may to persuade me that the Strong Baseball Principle is meaningless, in my heart, I know it's right.

Remarkably, when run in tlie second mode, the *gedanken* demonstration provides us with a case in which if it really does make no differencewhether or not I watch the game, then it is not only meaningless, but demonstrably *wrong* to assert this principle in the individual case. If the Baseball Principle is right for the device, then the Strong Baseball Principle must be wrong, not

merely because it naively compares possibilities only one of which can be realized, but because it is directly contradicted by certain observed facts. Such an experimental refutation of the Strong Baseball Principle would have been impossible before the discovery of the quantum theory; you cannot get into trouble using the Strong Baseball Principle in classical physics, and it can, in fact, be a powerful conceptual tool.[6] I believe that those who take the view that an experimental refutation is of no interest since reasoning from the Strong Baseball Principle was impermissible all along, miss something of central importance for an understanding of the character of quantum phenomena.

The device and the Baseball Principle

We return from ball games to the device. There are no connections between the detectors or between the source and either detector. The Baseball Principle therefore applies, and asserts that what goes on at detector A does not depend on how the switch is set at detector B, and vice-versa. This is readily verified in the statistical sense insisted on by the pedant. Keep the switch at A set to 1. Do a great many runs with the switch at B set to 1. Then, keeping the switch at A at 1, do a second series of runs with the switch at B set to 2. Compare the data at A in the two cases. It will have exactly the same character – namely a featureless sequence of Rs and Gs like the series of heads and tails you get by repeatedly flipping a coin. There is nothing in the outcome at A to distinguish between the runs in which B was set to 1 or to 2.

But what about the Strong Baseball Principle? Given the lack of any connection between the detectors, can we not also assert that what goes on at one detector in any *individual* run of the experiment does not depend on how the switch is set at the other detector'? Granted, there is no way to test this stronger assertion, but surely, for the same reason, there is also no way to refute it. But here, remarkably in my opinion, we have a case in which the

[6] In a deterministic world in which the future can be calculated from present conditions, tlie Strong Baseball Principle can be given an unambiguous meaning.

Strong Baseball Principle is directly contradicted by the data. Consider what happened when the device was run with both switches set to 1:

Actual data from a series of 11 runs

A1: R G G G R G R G R R G R R G R G R R R R G R G G...
B1: R G G R R G G R R R G R R G R G R G R R G G G G...

If there are really no connections between A and B, and no spooky actions at a distance, then what happens at detector A can't depend on how the switch is set at detector B (and vice-versa). The Strong Baseball Principle takes this to mean that in the first run of this sequence (in which both lights flashed R) the light at detector A would have flashed R even if the switch on detector B had been set to 2 instead of 1, and similarly, for every other run in the series, if B had been set to 2 nothing would have changed at A. In no individual run can the outcome at A depend on how the switch was set at B. (Compare this with "In no individual baseball game can the outcome at Shea Stadium depend on how the switch was set on my TV.")

Well if that's so, we can say something about what would have happened if the run had been 12 (A1 and B2) rather than 11 (A1 and B1) – namely the outcomes at A would have been exactly the same as before:[7]

The 11 runs and what the Strong Baseball Principle can say about what would have happened had they been 12 runs

B2: ?...
A1: R G G G R G R G R R G R R G R G R R R R G R G G...

A1: R G G G R G R G R R G R R G R G R R R R G R G G...
B1: R G G R R G G R R R G R R G R G R G R R G G G G...

Note that in this application of the Strong Baseball Principle we

[7] This does not imply determinism – indeed, I'm not convinced that what happens in a baseball game *is* deterministic; it simply says, in the baseball case, that whatever it is that does happen isn't going to depend on what a television set 300 miles away is doing.

make no commitment at all to what colors flashed at B in the case that didn't take place (with the switch at B set to 2) since, after all, that didn't happen. We merely assert that whatever might have taken place at B in that unrealized experiment, nothing would have turned out any differently at A.

We can also say the same thing about what would have happened at B, if we had set the switch differently at A. This gives us one more pair of rows:

The 11 runs and what the Strong Baseball Principle can say about what would have happened had they been 12 runs or what would have happened had they been 21 runs

B2: ?...
A1: R G G G R G R G R R G R R G R G R R R R G R G G...

A1; R G G G R G R G R R G R R G R G R R R R G R G G...
B1: R G G R R G G R R R G R R G R G R G R R G G G G...

B1: R G G R R G G R R R G R R G R G R G R R G G G G...
A2: ?...

Consider now what we have laid out here. The middle two (3rd and 4th) rows show what actually happened: both switches were set to 1, and the first run gave RR, the second, GG, the third GG, the fourth GR, etc. The top two rows (1st and 2nd) express the Strong Baseball Principle in the form that asserts that the outcome of *each individual* run at A does not depend on how the switch is set at B. The bottom two (5th and 6th) express it as an assertion that the outcome of each run at B does not depend on the switch setting at A.

Now what about the question marks? They appear in the top and bottom rows because those rows represent what would have happened at B and A had the switches there been other than what they actually were. Evidently *some* sequence of Rs and Gs would have been produced in either case,[8] but we have no way of telling

[8] At this moment in my talk there were cries of protest from the philosophers in the house. I was told that "If I were hungry I would eat a candy bar" does not imply the proposition "There exists a candy bar which is the one I would eat were I hungry" (the Candy Bar Principle). I affirmed my commitment to the Candy Bar Principle. I

which. Experience with the device, however, tells us some of the features these sequences would have had, if the runs had been 12 or 21 runs rather than the 11 runs that actually took place. An acceptable sequence of Rs and Gs for the first (B2) row, must agree with the sequence of Rs and Gs in the second (A1) row in about 85% of the positions, since that is the way 12 runs always work. Similarly a sequence of Rs and Gs replacing the question marks in the sixth row must agree in about 85% of the positions with the sequence in the fifth row, since that is what always happens in 21 runs. These considerations cut down on the number of ways of replacing question marks with Rs and Gs, but many different possibilities are still allowed.

A final application of the Strong Baseball Principle can be made to restrict these possibilities further. Suppose both switches had been set to 2 rather than 1. We can regard this 22 series of runs either as a modification of a 21 series (modified by changing the switch setting at B without changing anything at A) or as a modified 12 series (in which the switch was changed at A without anything having been done at B). We don't know, of course, what would have happened at B in the hypothetical 12 series (top row of question marks) or at A in the hypothetical 21 series (bottom row of question marks). The Strong Baseball Principle asserts that whatever series of Rs and Gs at A the question marks in the bottom row might stand for in the 21 run, that same series of Rs and Gs would also have happened at A in that series of runs, had the switch at B been set to 2 instead of 1 – i.e. had the runs been 22 runs instead. By the same token, whatever sequence of Rs and Gs the question marks in the top row represented for the results at B in a series of 12 runs, that same sequence would also have described the results at B had the runs been 22 runs.

This last application of the Strong Baseball Principle, by comparing hypothetical cases, has a different character than the

said I wanted to make a rather different point, but I think they all stopped listening then and there. I hope you will not stop reading here and now. If you insist on talking candy, 1 would suggest that a more accurately analogous proposition is "Either there exists a candy bar which is the one I would eat were I hungry or there does not."

first two, which compare a hypothetical case with the real one, and here it might more accurately be termed the Very Strong Baseball Principle. Returning to the sporting analogy, the Very Strong Baseball Principle applies when the game is, in fact, cancelled because of rain. I nevertheless maintain that had the game been played, it would have taken place in exactly the same way, whether or not I watched it. This last assertion, may elicit an even more violent objection from the pedant. Is it really reasonable to insist that something should happen in exactly the same way when conditions change very far away from it, when in actual fact it never happened at all'?

But is it really any more reasonable, I hasten to add, to insist that such an assertion is impermissible? I maintain that if last night's game hadn't been rained out, it would have happened the same way whether or not I had watched it on television. Can you prove me wrong when I say this? Wouldn't most unsuperstitious people regard the proposition as true? Indeed, as uninterestingly true? To be sure, the pedant will translate it into a series of harmless statistical assertions, but is it really wrong to apply it to the individual case as well'? The hallmark of the Strong Baseball Principle at work is that nagging conviction that only a pedant could object. For how can one possibly get into any trouble asserting relations between two things neither of which actually happened?

One can. It is worse than bad form; it is bad physics. For let's try it out. We have to replace the 1st row with some sequence of Rs and Gs and the 6th row with some other such sequence in such a way that the 1st and 2nd rows give the right statistics for 12 runs, the 5th and 6th, for 21 runs, and the 1st and 6th for 22 runs. We do not insist that any particular way of doing this is preferable to or any more deserving of some hypothetical reality than any other, but for the Strong Baseball Principle to survive, some among the various possibilities must be consistent with these statistics.

Now in 22 runs the colors disagree 85% of the time, so whatever goes into the 1st row has to disagree with whatever goes in to the 6th in about 85% of the positions.

On the other hand the set of Rs and Gs in the top row can differ from that in the second row in only about 15% of the positions (since they must have the correlations appropriate to a series of 12 runs). The second row is the same as the third row (by the Strong Baseball Principle). The third row differs from the fourth row in only about 15% of the positions (since they give the data in a 11 run). The fourth row is the same as the fifth row (by the Strong Baseball Principle). And the fifth row can differ from the set of Rs and Gs appearing in the bottom row in only 15% of the positions (since those rows must have the correlations appropriate to a series of 21 runs).

A moment's reflection on the last paragraph is enough to reveal that whatever the sequence of Rs and Gs in the top row, it can differ from whatever sequence is in the bottom row, in at most about 15% + 15% + 15% = 45% of the positions. But according to the next to the last paragraph whatever is in the top row must differ from whatever is in the bottom row in about 85% of the positions. You can't have it both ways. Thus the (Very) Strong Baseball Principle is so restrictive as to rule out *every* possibility for the unrealized switch settings. Far from merely being meaningless nonsense, an application of the Strong Baseball Principle to the *gedanken* denionstration contradicts the observed facts.

In this demolition of the Strong Baseball Principle we did not interpret it as demanding the existence in some cosmic bookkeeping office of a list of data for the unperformed runs. We only took it to require that if the *actual* experiment consists of a long series of 11 runs, then among all the possible sets of data that might have been collected had the experiment instead consisted of 12, 21, or 22 runs, there should be *some* satisfying the condition that run by run what happens at one detector does not depend on how the switch is set at the other. If the Strong Baseball Principle is valid it should be possible to *imagine* sets of B2 and A2 data such that the B2 data produce the right statistics (85% same and 15% different) when combined with the actual A1 data, the A2 data produce the right statistics (85% same and 15% different) when combined with the actual B1 data, and the two sets of imagined data produce the right statistics (15% same and 85% different) for a 22 experiment.[9]

Since it is impossible to imagine *any* such sets of data then the Strong Baseball Principle has to be abandoned not because it is bad form, unjustifiable, or frivolous to argue from what might have happened but didn't, but because there are no conceivable sets of data for the cases that might have happened but didn't, which are consistent with the numerical constraints imposed by the known behavior of the device, when those constraints are further restricted by the Strong Baseball Principle.

This attack is inherently non-classical. If, in the best *gedanken* demonstration I could devise, the 85% and 15% had been replaced by 75% and 25%, then the argument would have collapsed. For instead of the top row being able to differ from the bottom by no more than 15% + 15% + 15% = 45%, which is manifestly less than the required 85%, it would only have been possible to bound the difference by 25% + 25% + 25%. which is just enough to provide the required 75%. Only by exploiting *quantum* correlations can one construct an 85%–15% *gedanken* demonstration. Any model of the device one might devise based on classical physics would necessarily result in 75%–25% or less extreme statistics, and the Strong Baseball Principle would be immune from this kind of refutation by physicists, no matter how dim a view of it philosophers took. I assert this with confidence because classical physics is local and deterministic and in a deterministic world the Strong Baseball Principle makes perfect sense as a manifestation of locality.

Going in the other direction, it is easy to invent fictitious *gedanken* demonstrations that produce data that refute the Strong Baseball Principle even more resoundingly than that of the

[9] In Candy Bar terms, the Strong Baseball Principle does not say that there exists a particular sequence of Rs and Gs which are the colors that would have flashed had a detector been set differently. It only says that among all the mutually exclusive and exhaustive possibilities for such sequences should be *some* that are consistent with the frequencies of flashings characteristic of the four different pairs of switch settings.

device. Consider, for example, a hypothetical device in which 85% and 15% were replaced by 100% and 0%, so that the lights always (not just most of the time) flashed the same color in 11, 12, and 21 runs, and never (not just infrequently) flashed the same colors in 22 runs. Then the argument refuting the Strong Baseball Principle would be even simpler. A 11 run would necessarily result in the same color (say R) at A and B. Suppose instead the switch at A had been set to 2. The Strong Baseball Principle would then assert that R would still have flashed at B, and since the same color always flashes in 12 runs, A would still have flashed R. By the same token B would still have flashed R had its switch been set to 2. Therefore, since the setting of the switch at one detector cannot affect what happens at the other, both would have flashed R if both had been set to 2. But when both are set to 2, both have to flash different colors.

No experiment is known that can provide this more compact refutation. Even quantum miracles can go only so far. The 85%–15% statistics are the most extreme I know how to extract from the quantum theory, and though they are strong enough to demolish the Strong Baseball Principle, the argument we went through is somewhat less direct than that available for the 100%–0% statistics.

It is a characteristic feature of all quantum conundrums that something has to have a non-vanishing probability of happening in two or more mutually exclusive ways for startling behavior to emerge. The viewpoints of quantum and classical physics are distinguished, more than anything else, by the impropriety in quantum physics of reasoning from an exhaustive enumeration of two or more such possibilities in cases that might have happened but didn't. We are startled when such reasoning fails, because as an analytical tool in classical physics and everyday life it is not only harmless but often quite fruitful. The most celebrated of all quantum conundra – how can there be a diffraction pattern when the electron had to go through one slit or the other? – is based on precisely this impropriety. It is just where there is room for some interplay between various unrealized possibilities, that one can

look for the quantum world to perform for us the most magical of its tricks.

Therefore it is wrong to apply to individual runs of the experiment the principle that what happens at A does not depend on how the switch is set at B. Many people want to conclude from this that what happens at A does depend on how the switch is set at B, which is disquieting in view of the absence of any connections between the detectors. The conclusion can be avoided, if one renounces the Strong Baseball Principle, maintaining that indeed what happens at A does not depend on how the switch is set at B, but that this is only to be understood in its statistical sense, and most emphatically cannot be applied to individual runs of the experiment. To me this alternative conclusion is every bit as wonderful as the assertion of mysterious actions at a distance. I find it quite exquisite that, setting quantum metaphysics entirely aside, one can demonstrate directly from the data and the assumption that there are no mysterious actions at a distance, that there is no conceivable way consistently to apply the Baseball Principle to individual events.