COPY

Haverford College
Haverford, Pa. 19041
September 15, 1970

Mr. Paul Hoch
Berkeley Radiation Laboratory
Berkeley, California

Dear Paul:

I am writing this letter with a feeling of weariness. Not because the topic isn't interesting, not because you haven't opened up an area of investigation that is fertile, but simply because I find that talking to Alvarez (and you too on these issues) is like talking to a stone wall. After all the correspondence on the "jiggle theory", a correspondence that finally ended with Alvarez proving unwilling to answer my criticisms, substituting instead an otiose dissertation on the "philosophy of science," after all this, I find in your report the jiggle theory resurrected in all its glory (with no mention of any of the objections to it that are apparent to both of us) as a buttress for the single-assassin conclusion. So I rather suspect that any criticisms I make of the new Alvarez theory may quickly be relegated to the junk heap. Nevertheless, here are the objections.

At first I thought your theory very nice indeed, and as Sylvia Meagher knows, I was going to write you a simple note of congratulation. But as I thought more about the theory, and enlisted the aid of a trained physicist--Bill Davidon, Chairman of Physics here--the theory became less persuasive. What first set me off was the seemingly innocent remark on page 4 of your paper that such retrograde motion "violated our intuitive notions." I began to ask myself why our intuition would lead us to expect the target to fall away from the rifleman. Surely because we had seen objects do that in the past. Our "intuition" is only short-hand for the correlations we make from experience. But had we only seen solid objects shot in the past, and was this a special case--a container filled with liquid? No. For I myself had shot many times into full tin cans and other liquid containers, and they always fell away from the rifleman. When I looked at your report I saw that in an over-all way this was what you had found: water and gelatin-filled containers were "inconclusive" (what does that mean?), toy rubber balls filled with gelatin tended to go away from the rifle (6), normal melons simply exploded--only melons taped with Scotch tape showed the effect you were looking for. Why? As I began to try to figure out for myself how this could happen, I saw first that the experimental object you chose was quite special, and that in really important ways it differed from a human head.

Perhaps unintentionally, throughout your paper you leave vague the precise nature of the dynamical mechanism involved in producing the retrograde motion. Yet at the beginning of your paper you stress the necessity of identifying this mechanism. As I see it you offer two alternative models for understanding this mechanism:

(1) The "bullet, as it is slowed down, pulls material from the target along with it, at speeds up to that of the bullet." (4) Surely, you must realize that this is simple nonsense. Given this model, as the bullet tears through material, ripping it from the target, it imparts momentum to the target along the line of flight--away from the rifleman. This "pulling" effect (it's your word, not mine) can't possibly produce the retrograde motion because on this model (if you think about it) the momentum transfer to the target is away from the rifleman.

(2) A "high-momentum forward jet"

You say (7) that "we do not now have a detailed explanation of how a bullet interacts with a target to produce a high-momentum forward jet" yet at many points in your article (Cf. especially 18 ff) you imply an explanation--namely, that the impact/transit of the bullet on/through the target (a closed cavity containing a liquid-solid mix) leads to a build-up of pressure in the cavity that vents to atmosphere at first opportunity. Now let's inquire as to how this pressure build-up is brought about. Is it brought about by the transit of the bullet through the cavity? As you know, the answer to this question is found in the relationship of the speed of the bullet in the cavity's medium to the speed of sound in that medium. If the speed of the bullet is greater than the speed of sound in the medium, then there is no shock wave and hence no pressure build-up in the cavity. Would you have any good estimate of the speed of the bullet through JFK's head, or the speed of the bullets you fired through taped melons, or the speed of sound in the interior of a head or in the interior of a melon? I don't, nor would I have any fair estimates what those values would be.

Assuming something that may or may not be true (namely, that the speed of the bullet in the cavity is greater than the speed of sound in the cavity), the pressure build-up within the cavity must be due not to the transit of the bullet through the cavity, but due to its initial impact on the whole container. I visualize it in this way: the projectile strikes the melon splitting its surface and bending the surface inward. This effect instantaneously raises the pressure in the cavity which then vents itself in the easiest way.

If the pressure build-up was caused by impact then I can see at least two different reasons for a human head to behave differently under the same circumstances:

(1) The surface of the melon is porous and flexible; the skull is rigid and dense. If you want to believe the Bethesda autopsy, you have a tiny entrance hole; if you believe the Parkland doctors you've got a massive exit hole--both in the back of the head. Going along with the tiny entrance hole, then the existence of that small hole itself demonstrates that the impact of the bullet did not deform the back of the head, and thus that the impact caused no dramatic pressure rise.

(2) Your melon is a closed container, the head isn't. Pressure build-up in the cranial cavity could be vented down into the neck tissue by the hole through which the spinal column pokes through into the cranial cavity. A marginal difference, I believe, but still a difference.

Completely apart from these considerations, there is one crucial difference between a skull and a melon that makes me smile in amusement at your Warrenesque statement that "a taped melon is not an unreasonable simulation of a person's head." Ask yourself how the momentum of a bullet is transferred to a head. Surely, the main quantity of momentum is transferred as the bullet strikes the surface of the head on entry and exit. The hard bone slows down the bullet, and conversely this impact imparts to the skull a momentum directed along the bullet's flight path. Didn't it ever bother you that the resultant retrograde movement of the head on your theory must come from a momentum factor which is great enough to overcome this forward imparted momentum and then give the head a backward kick? Your figures completely ignore this factor. And didn't it ever bother you that your whole experiment is based upon a target where this forward momentum would, by design, be reduced to a minimum?

What you've done is to design an experiment where all the factors favor an explosive jet and a resultant retrograde motion, and where none of the factors favor the transfer of momentum along the line of flight of the bullet, and hence a forward movement. Our intuitions are right for most cases. What you succeeded in doing was to contrive a special case where these intuitions, and the expectations they give rise to, are violated. It remains to be seen whether the JFK instance is also a special case assimilable to your model. In some cases a piece of metal will fly upward (namely, when a magnet is held above it) but that doesn't mean I should expect this paper clip before me to jump off the desk. I urge you to try further experiments with animal heads and, if possible, with cadavers' skulls. As it stands, both your experimental work and its theoretical underpinning is incomplete and unconvincing.

Other points I won't get into. I'm weary. Why you believe that most of the impact debris went forward eludes me. And I have other difficulties with your interpretation of the evidence surrounding the head shot.

Let me know what you think of the above.

Best wishes,

Josiah Thompson

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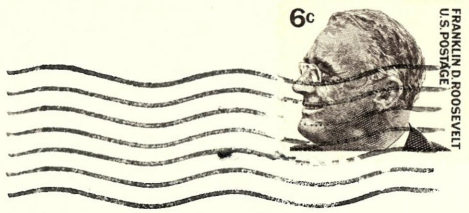

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