that the supersonic transport *will be* and therefore acceptance of such a device is "realistic," and he will ". . . minimize the effect. . ."

Do humans have a choice or not? Why and/or why not should supersonic transports be built? Are there cogent *human* reasons why *any* sonic disturbance from civilian aircraft need ever be tolerated? Aircraft manufacturers, NASA and others take it for granted that this will come to pass, and therefore it is "realistic." Perhaps they are correct.

But where do the criteria of physics, as now practiced, include *any* reference to the *human* condition, that many humans *object* to things that "can startle people and shake buildings?" Does physics have a formula as to how big a minority must be to be protected? Does physics offer any proof that it is *desirable* for some people to startle others?

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Rights of society

The article by Harvey H. Hubbard on sonic booms is interesting. However, I do have reservations about his last paragraph, which is so typical of our attitude toward undesirable man-made environmental changes that I would like to restate it (italics mine):

"Because booms can startle people and shake buildings and their contents, there is serious concern for public acceptance of the sonic boom. As a result, supersonic transport will be limited initially to overwater operations. There are those who would ban the supersonic transport altogether, and a society for this purpose has been formed. Others are taking a more *realistic* approach. Consideration is being given to the development of advanced-design aircraft that would minimize the effects of sonic booms. Backup research is *already* under way."

What is so unrealistic about banning the supersonic transport altogether? Aren't supersonic transports made by human beings to serve other human beings and doesn't society have the right to decide whether it is desirable to have supersonic transports?

And what is so laudable about backup research on sonic booms being "already" under way? I, personally, am looking forward to supersonic travel. However, I would want to insist not only that backup research continue, but that the problem of sonic booms be solved in a socially-acceptable manner before transports are allowed to cross the continents. In fact, I think society has every right to insist that standards for acceptability be developed and framed into legislation before that day.

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SST as pollution

Harvey H. Hubbard comments, "There are those who would ban the supersonic transport altogether . . . Others are taking a more realistic approach." To me, the SST falls in much the same category as pollution: It has the same effect of demeaning the level of life for large masses of the earth's inhabitants. The only reason for its existence is the profit of a very small minority, or perhaps the national prestige. But I am not convinced that either one is worth the cumulative price that will have to be paid by society, and until I am, I must disagree with Hubbard and claim that stopping development of the SST (at least with government funding) is the only realistic approach.

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THE AUTHOR REPLIES: Bailey Smith cites a federal court case in which he was awarded $10 000 for sonic-boom damage and implies that the government made full payment. I have been informed by knowledgeable people that the government has made no cash settlement in this case.

References are made to sonic-boom-induced structural damage, and it is a matter of record that sizeable awards have been made to property owners for alleged damage. Paid damage claims, however, do not constitute scientific evidence of damage. In retrospect it is realized that many of these claims were paid without proper validation. It is also the considered opinion of many reputable engineers that in cases where damage was observed coincident with the occurrence of a boom, the latter was only an extremely small contributing factor.

John H. Wiggins Jr in the June 1967 issue of *Materials and Standards* cites evidence that boom-caused cracking in houses is below the "noise level" generated by natural causes until the nominal overpressures exceed about 10 pounds per square foot. He indicates,

for instance, that temperature and humidity changes cause reversible movements of building materials sufficient to account for observed building cracks. Because the sonic boom is man-made and is readily observed, it is mistakenly blamed for damage that it may be only partly, or not at all, responsible for. Evaluation of claims may, however, be a difficult aspect of any future SST overland operation.

Shurcliff notes that certain persons are particularly sensitive to sonic booms and that intense booms may occasionally be observed. He asks whether the more intense booms would be acceptable to the more vulnerable people. Such a question equally applies to every aspect of modern life. The development of the automobile, for instance, would never have been realized if a small minority had been able to decide its fate. Think of the annoyance and carnage it has caused and yet it is unthinkable that society would do without it. Prototype development of the SST allows for orderly progress of the SST program and extension to overland areas at some future time when and if extension is appropriate.

In response to Dewey's comments, I would like to mention that an extensive study of seismic disturbances induced by sonic booms has been carried out for the National Aeronautical and Space Administration by the Teledyne Corporation, and the results are being published. The main finding was that ground motions could be largely accounted for by effects of an air load traveling over an elastic medium, and that other contributing effects were of secondary importance. Rayleigh waves were observed, and the observers found that their frequencies were related to aircraft speed. They also identified reflections from subsurface layers; these were dependent on the local geological formation. The particular ground velocities observed during the studies were about 1% of those measured during earthquakes for which incipient damage occurred.

The accelerations of figure 11 in my PHYSICS TODAY article were obtained on the second floor of a two-story building and are identifiable with the building structure. Although seismic loadings could conceivably have contributed, we believe that the air loads were dominant. HARVEY H. HUBBARD

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