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Nancy Heneson

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### *Live Animals in Car Crash Studies*

On Sunday, 14 January 1980, an article appeared in *The (London) Observer* describing the use of human corpses and live primates, pigs and bears in simulated car crashes by the French Organisme nationale de la sécurité routière (ONSER). Three photographs accompanied the article: two depicting human cadavers attached to various devices used to mimic the events of a road accident, and a third showing a clothed, anesthetized bear arranged on a car seat in an upright sitting position with its jaws tied together and a safety belt strapped across its chest.

Approximately one month later, French Transportation Minister Joel Le Theule provisionally suspended all experiments at ONSER involving live animals. A decision on whether to lift the ban or keep it permanently in force is expected to be made in a few months when a parliamentary report on the experiments is issued.

To say that one article in the British press was responsible for this action by the French government would be an oversimplification. However, the *Observer* piece did serve to activate protest and pressure by directing public attention to a topic which has been ripe for investigation on both

scientific and ethical grounds. In fact, this was not the first time that the use of live animals in car crash testing captured public interest. In 1978, a great deal of furor arose over experiments which were being conducted by the University of Michigan Highway Safety Research Institute (HSRI). Funded by the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA), the HSRI project included a phase in which baboons were to be subjected to terminal "impact sled tests" (simulated car crashes) to measure thoracic injury-response. Local press coverage emphasized the "animal cruelty" aspect of the controversial experiments, but more knowledgeable objections from humane organizations centered on the validity of the baboon and other animals as models for human response; the ramifications of continued importation for research of baboons and other primates; the inconsistency of a moral position which damns the use of human cadavers but accepts the infliction of fatal injury on healthy animals; and the necessity of the experiments themselves.

Researchers performed one test with one baboon and then announced that further tests were unnecessary in light of the data already supplied. Although there was no official acknowledgement of the influence of the coalition of citizens and animal welfare groups known as the Committee to Save the Baboon Seven, Fund for Animals representative Carolyn Smith told *The Michigan Daily* (7 February 1978): "I have a feeling that if there weren't a Committee to Save the Baboon Seven, there would be six more baboons on the sleds." *Postscript: The remaining six baboons became part of a terminal experiment on hypertension sponsored by the National Academy of Science and the National Institutes of Health.*

Are the recent events in France and the earlier cessation of live ani-

mal crash studies at the University of Michigan simply expressions of governmental and professional anxiety over the bad publicity that can be generated by well-meaning but uninformed humanitarians? The answer is clearly no. Real scientific and ethical ponderables surround this type of research. Yet at the same time, people want the assurance that the cars they drive are engineered for maximum safety. These wishes are translated into government mandates and in the ensuing effort to develop safety standards, it is inevitable that some research will be poorly conceived and/or designed. However, when animal life and, indeed, taxpayer money are involved, there must be a scientifically and ethically acceptable rationale for the research *concept* as well as for the individual experiment tailored to a particular end.

The scientific rationale for using live animals in car crash studies proceeds from the argument that comparative biomedical and biomechanical data are needed to develop an instrumented dummy, or anthropomorphic test device, which will provide reliable, reproducible information for designing safe cars. The animal studies are thus not really ends in themselves, *i.e.*, they do not supply data which can be readily applied to real situations. Instead, they contribute to a pool of information which is supposed to lead to the perfecting of an experimental subject (the instrumented dummy) which will eventually render the further use of live animals unnecessary.

One might ask at this point why human cadavers do not provide the best data for developing an anthropomorphic test device. The considered expert opinion is that a cadaver cannot equal the response of living tissue. A live, morphologically similar animal will more closely resemble the biomechanics, in terms of tissue injury, of a live human response than will the deteriorated, inert and

skeletally weak human corpse. There are also practical considerations involved in using cadavers. For example, the Department of Transportation (DOT) has a mandate to sponsor research on safety standards for children. For obvious reasons, child cadavers are extremely difficult to obtain.

Animals, although preferable to cadavers from the point of view of living versus dead tissues, are variable, and the results they yield are often unreproducible. Also, granted that broad morphological similarities exist between humans and certain other animals, *e.g.*, the thoracic regions of a human and a bear, some scientists feel that the differences are basic enough to negate the usefulness of live animal tissue injury data. Dr. Murray Mackay, head of the accident research unit at Birmingham University (UK), told *The Observer*: "My own view is that [the ONSER animal studies] are of marginal importance. ...there is not a very precise correlation (between humans and animals) because of basic anatomical differences." Even researchers who are engaged in car crash testing with live animals point out the problem of extrapolating from their subjects to humans because of structural differences. In a paper entitled "Head Impact Response Comparisons of Human Surrogates" which was presented at the 23rd Stapp Car Crash Conference (October 17-19, 1979, San Diego, CA) and published by the Society of Automotive Engineers (Warrendale, PA), researchers from HSRI stated: "Experimental impact testing of animals, in particular primates, provides basic neurophysiological information related to neuropathology. However, although the primate geometry is most similar to man's, it is significantly different in anatomic soft tissue distribution and skull morphology. This can present severe problems when scaling the test results to human levels. Ultimately these differences lead to complica-

tions in the very complex phenomena of head injury" (p. 500).

That particular research project was funded privately by the Motor Vehicles Manufacturers Association. At present, public funding in the U.S. of car crash experiments using live animals appears to be limited to one contract awarded by DOT to the Southwest Research Institute (San Antonio, TX). The name of the research project is "Crash Injury Susceptibility of Children Compared to Child Surrogates," and its long range goal is to develop a 15 kg, 3 year old "advanced child test device," or child crash dummy. The estimated cost of the project is \$602,203. The child surrogates mentioned in the title of the experiment are pigs. According to a statement to DOT from Southwest Research Institute Biomechanics dated 21 December 1979, a live animal surrogate was chosen because a) commercially available child dummies are still too crude; b) availability problems aside, child cadavers have limited application to living tissue response; c) insufficient data exists for computer modeling; and d) field accident data is not very useful because preimpact conditions are unknown.

The memo goes on to mention a table prepared by Southwest for an auto industry sponsor which compared anatomical measurements of a pig, baboon, child cadaver and child dummy. DOT officials refused to release this document when a Freedom of Information request was made because of a claim by Southwest that public access to such information would harm their future business relations with industry. One of the nine exemptions permitted under the Freedom of Information Act applies to "trade secrets and commercial or financial information" which a private citizen or corporation gives to the government with the expectation of confidentiality. The courts have interpreted this to mean that information is to be considered "confidential"

only if disclosure would impair the government's ability to gather information in the future, or (as DOT has agreed to maintain in this case) be likely to cause substantial harm to the concerned party's competitive position. However, in order to stand up to legal scrutiny, DOT would have to *prove* rather than merely state that disclosure of the data table would "substantially harm" Southwest's future chances for bids with industry. Legalities aside, Southwest is not improving public relations by making it difficult to obtain information of considerable public value and in the process raising the suspicions of animal welfare and consumer groups.

The DOT study was motivated in large part by the results of another study using live pigs conducted by Southwest under General Motors (GM) sponsorship. The research was interpreted as showing that an out-of-position child could be severely injured by an inflating air bag during a crash and, therefore, air bags themselves presented a danger unless the child was seated normally at the time of impact. As a result, DOT is now funding Southwest to conduct sled tests using pigs so that the government can make an independent assessment of the findings of the GM-sponsored research. No one can dispute the importance of determining whether GM uncovered some definite and serious defects in the air bag, or were merely reluctant to install the devices, which are much more expensive than passive restraints such as seat belts. However, a source within DOT indicated that a soon to be published DOT semiannual report contained the following statement: "It is important to note that none of the child injuries theorized by GM have been observed in the real world crashes of cars with air bags, and that GM does not know the degree to which the animals it used in its tests are accurate surrogates for small children in its tests [*sic*]." The report also

states that other auto companies did use child dummies in the developmental testing of air bag systems.

The French government took action in response to public protest over a sector of research for which it was providing funds. The DOT, it seems, wants to avert this kind of situation by building into the bureaucracy a body which would function similar to an NIH peer review committee. The Biomechanics Advisory Committee, chaired by neurosurgeon Ayub K. Ommaya, has thus been set up to oversee DOT-funded research in car crash safety. Still, scientific peer review tends to concentrate on research design and may not always include an examination of the ethics or even the overall utility of a project. One would be hard pressed to find a researcher in the field of biomechanics who would deny that the development of safety standards for road vehicles is a complex and often inexact process. Given the nature of the task, is the use of live animals providing a significant enough advancement of knowledge to justify their sacrifice? If their use is of marginal value, as some have maintained, why continue to employ them in research which saps the taxpayers' money and returns no tangible human benefits and absolutely no benefits for the animal? It can of course be argued that in science there are no guarantees, and that just because the "perfect dummy" may never be invented, that is no reason to stop trying. Yet can it not be argued with equal force that to place the bulk of public faith in the development of a safer (but never fail-safe) machine may be a misappropriation of energy needed to solve what is fundamentally a human and not a mechanical problem?

Crash safety testing is meant to be preventive research in the sense that it seeks to gather information on car crash injuries with the ultimate goal of preventing those injuries. There is, however, a more basic prob-

lem to be considered, namely, the causes of road accidents themselves. At the 1979 Stapp Car Crash Conference (noted above), R.W. Smith presented a paper entitled "The Response of Unembalmed Cadaveric and Living Cerebral Vessels to Graded Injury—A Pilot Study" which described an experiment in which a 10 gram weight was dropped from various heights onto the exposed brain of a dog in order to measure the response of living cerebral vessels. Experiments such as these are of highly doubtful application to the biomechanical responses of humans in car crash situations. As the experimenter admits: "[The] relationship between trauma caused by a weight falling directly on exposed brain and that resulting from a blow delivered to the surface of the intact skull remains to be demonstrated. It is not even certain that cerebral cortical contusion can be reproducibly caused by an external blow in a dog" (p. 559). Beyond this, they (and better conceived live animal crash tests as well) add nothing to our knowledge of why people speed, drive drunk and refuse to wear seat belts. Obviously it is naive to assert that the psychological elements which contribute to the occurrence of road accidents can be completely researched, thoroughly understood and totally controlled. Biomechanical research aimed at injury prevention is as necessary as psychological and sociological research into the human factor in auto crashes. As to whether live animals should be or even have to be used in such research, one *New Scientist* columnist offered the following sardonic answer (85:544, 1980): "The animals are anesthetized and they don't know what is happening to them. So that makes it all right. I mean, aren't human beings the lords of all the Earth? Any treatment of animals is justified if it helps us to dash about in cars and pile them up with less risk of damage to ourselves."

Nancy Heneson