

A NOTE ON THE EVALUATION OF WARNINGS

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I acted as scientific consultant to the manufacturer's attorneys in a recent case involving two deaths by carbon monoxide poisoning. The complaint against the defendant manufacturer was the use of an "inadequate warning" on a gas heater. The issue arose in the following way. A young married couple, educated professionals, were driving in a rural area in the late afternoon. A deer ran out before their car and was killed by the collision. The car was damaged; both driver and passenger were upset and elected to spend the night in a local motel.

The weather was cool. The heating system in the cabin was a freestanding gas heater connected by a slightly rising pipe to a wall outlet. The heater was lit, whether by the travelers or the motel owner is not known, and the travelers remained in the room over night. In the morning they were found dead of carbon monoxide poisoning.

The facts are as follows. The heater was a replacement for the heater which had been in the cabin before and which had failed. That original heater had been a closed cycle unit: one in which both the combustion air and the exhaust were isolated from the air in the room and connected by a double pipe to an outlet in the wall with two ports one an annulus around the other. In service the heater drew air through the annulus port, combined it with gas in the combustion chamber and exhausted through the inner port.

The replacement heater was of the open cycle type. It drew its combustion air from the heated room, and exhausted it through a port to the outside. In such heaters, there is, of necessity, a connection between the combustion chamber and the room. In this particular one, there was also, and by design, a connection between the exhaust pathway and the room arranged so as to permit room air to join the exhaust gases.

The replacement heater was a used unit about 10 years old. It had been given to the motel owner by a friend when the original heater failed. The replacement had been installed by the motel owner about 14 months before the accident. The proprietor had had to plug the unwanted openings when he connected the 'new' heater to the old exhaust port in the wall. On an earlier occasion a traveler staying overnight had been somewhat ill the following morning and had attributed the illness to "food poisoning." No other incidents in the 14 months had been reported.

The exhaust pipe did rise; the port in the wall was about 6 inches above the exhaust port on the rear of the heater. The heater was about 4 feet from the wall so that there was an average rise of 1 inch in 8. This is within AGA and ANSI standards.

A metal warning label was riveted on the rear of the heater near the exhaust port. On the label was the following message:

THIS APPLIANCE
MUST BE CONNECTED
TO A FLUE

The warning probably met the standards of the time when the heater was designed but was strongly criticized by a human factors consultant engaged by the plaintiffs. It clearly was not up to modern standards.

The families of the dead couple sued the owner of the motel, the gas company, the state of Montana (because of its responsibility for the inspection and licensing of accommodations) and the manufacturer of the heater. I was retained by the manufacturer's attorneys.

The legend "This unit must be connected to a flue" was specifically criticized as not being understandable to a significant part of the user population. In particular testimony was presented from a number of depositions of persons knowledgeable in the design and use of gas-fired heaters. Some were engineers; some had practical experience with such heaters. All were asked, among other things, what they understood a 'flue' to be. The answers were varied and a large fraction were wrong, even from some of the engineers.

The plaintiff's consultant drew the reasonable conclusion that a user of average intelligence and education would have difficulty in understanding the instruction and that the warning was therefore inadequate. The plaintiff then claimed that the inadequate warning was the proximal cause of the deaths; and that had the warning been correctly designed and had there been a permanently attached instruction book, the deaths would not have occurred.

Although the depositions clearly showed that people, by and large, cannot say what a 'flue' is, that did not demonstrate that people would not connect the heater to a flue properly. I first did a small field study in a rural area in New York, of the same general type as that in Montana where the accident occurred. People on the sidewalks of a small village, men and women between the ages of 20 and 60, were asked to say what a 'flue' was. Very much like the engineers and mechanics, they generated a wide range of answers, the majority of which were wrong compared with dictionary definitions. (The American College Dictionary defines flue as: "1. the smoke passage in a chimney. 2. any duct or passage for air, gases, or the

like.") The evidence of the depositions was thus confirmed by the field study.

I then did a second study. Persons in a rural area of New York state were shown a sketch of a heater, with its warning label, in a room as shown in Figure I below.

insert Figure I about here

and were asked to sketch on the page how they would connect the heater. Of the 25 persons who participated 24 drew a correct vertical flue or a connection to a vertical chimney (The added lines in Figure I are typical). The one who did not was characterized by the field interviewer as being negative and noncooperative in manner. All 25 were asked why they would do what they had drawn. Of the 25 people 22 said that there would be fumes, 2 cited safety hazards, the last said that fire would occur. Of a further group of 6 motel managers in the same area, all said that there would be toxic or explosive fumes. All sketched a correct installation into a chimney.

It was now clear that in this forested rural area, people were well aware of how to connect a gas heater even if they could not define a flue. The drawing study was then repeated in the Montana area where the incident had occurred and included a sample of motel owners. Two groups of 25 people in Montana were interviewed with the same drawing but for the second group there was no warning sign of any kind. They were asked merely to show how they would connect the heater. The former group yielded the same results as had been found in New York. Of the latter only 23 out of 25 drew a correct connection.

The high level of correct behavior even in the absence of a warning or instruction of any kind leads to the conclusion that any effort to test an experimental warning would have been frustrated by the fact that there was essentially no room for improvement: almost everyone, 92%, did it properly without any instruction; 96% did it properly with an instruction which did not meet standards. Since the existing warning was almost totally unnecessary, and had an effect as great, given the vagaries of subjects, as any warning could have no matter how well designed, the parties settled the case pretty much on the defendant's terms.

It is my considered opinion that, where possible, direct tests should be used instead of theory-based expert opinion. Empirical data on what people would do is more important, with respect to the adequacy of warnings, than theoretical predictions.

Further, a failure of people to define words or paraphrase sentences correctly does not demonstrate that they cannot understand how to use the things to which the words refer.

Finally, it is important to assess the "common knowledge base" about the product and process at issue. I have never seen a bread knife with a warning on the blade saying:

DO NOT CUT BREAD WITH THUMB
BETWEEN LOAF AND BLADE

nor have I ever heard of a lawsuit stemming from an injury in that situation. If the public does know how to do things, an inadequate or absent warning does not necessarily imply negligence nor does it necessarily have a causal relationship to an accident.