A. C. Macris Consultants

UPDATE

Special Legal Edition

Highlights

What is Human Factors?

In the forty years since its inception, the field of human factors has broadened considerably.
Basically, human factors is a marriage of the principles, utilized in engineering and. psychology. that acknowledge the premise that 'things! do not exist in a vacuum -they are invented by used by and oft times *surrounded* by people. With that in mind, there an rules, laws, standards. etc. that govern a human's safe interaction in the world.
Human factors as a science now allows us to determine what is reasonable performance, and reaction, in relation to:

- health
- safety
- performance
- efficiency
- engineering
- the environment

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Special Edition:
A Winning Edge in product liability and personal injury cases

Big Benefits Gained in Using a Human Factors Expert Witness

by A. C. Macris

I wish I had a nickel for every inquiry that started with "I have a case, and I don't know if Human Factors would be applicable."
That lawyers aren't familiar with the benefits of Human Factors isn't surprising. Human Factors' all encompassing nature can make the definition a bit nebulous. In the broadest of terms: Most interactions a human being has with any place, or thing, is within the spectrum of the discipline. As a crossover discipline between Psychology and Engineering, it is an ideal marriage for the whys and wherefores of people functioning in the real world. A more classical definition of human factors is as follows:
The central focus of human factors relates to the consideration of human being in the design of man-made objects, facilities, and environments, that people "use" in the various aspects of their lives.
The central approach of human factors is the systematic application of relevant information about human characteristics and behavior to the design of man-made objects, facilities, and environments that people use.
Finally the human factors discipline usually is viewed as embracing relevant supportive research that provides some guidelines for the design and related process.'

Now that you have the big picture let's get specific with cases which will demonstrate the above definition, and the resulting benefits.

Most issues fall into one of these five, broad application categories:

1. Instructions and procedures
2. Warnings
3. Task Performance
4. Anthropometrics/Ergonomics
5. Behavioral

The following provides a brief overview and example of each of these categories.

INSTRUCTIONS AND PROCEDURES

Instructions and procedures represent an interaction between human beings and the operation and maintenance of man-made objects. If instructions and procedures are not well written and "human factored" there lies an increased potential for human error. Consequentially, injury to an operator, a maintenance technician or an innocent bystander could result. The case in point:

Truck Wheel case. A wheel became dislodged from a truck in operation. The dislodged wheel rolled away from the truck and fatally struck a young girl, who was on the sidewalk, walking home from school. 'How did the wheel come off?' is the first consideration. A maintenance technician had been working on the truck wheel bearing. The wheel bearing required specialized instruction for proper disassembly and reassembly, and the technician followed the instructions to the best of his ability.

Upon inspection, the guidance provided via the technical manual was inadequate in several ways from a human factors perspective. A warning existed indicating that if the wheel was not properly assembled it could come off during operation. However, the instructions given to ensure that the technician would re-assemble the wheel properly were inconsistent with either the skills or experience level of the technician.

Is this a case of poorly written instructions, or improperly assigned personnel? In most instances, with technical procedures/instructions, the design engineer wrote the maintenance instructions. His orientation is engineering, not maintenance. His training is significantly different than the technician. Beginning to get the disconnect here? They are dealing with the product from opposite ends and different circumstances.

Could this miscommunication in instructions have been prevented? The maintenance instructions, even though the engineer wrote them, should have been verified for technical accuracy, to ensure that the instructions were correct from the technician's perspective. To ensure the instructions are consistent with the pre-defined skill levels of technicians, a technician and a human factors engineer should validate them. The instructions could have been more effective, and could have included a warning, if necessary, that only qualified technicians should work on these wheels. In this way we are minimizing the potential for human error and subsequently the grave consequences.

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WARNINGS

Warnings represent a broad range of human interface issues. These issues include the effectiveness of warnings, whether warnings actually affect behavior, which types of warnings are most effective, with which types of products are warnings most likely to be heeded, etc. As a result, it is very difficult to generalize about warnings; and moreover, each case dealing with warnings usually has a very unique situation. The following, however, apply to all warnings:

1. Warnings must be provided if, without such warnings, the product would be unreasonably dangerous.
2. The ultimate users of the product, or those individuals, who might be expected to be proximate to the use of the product, are the ones to whom the warnings should be directed.
3. To be considered adequate, a warning should catch the attention of a reasonably prudent person on the circumstance of its use, be understandable, and convey a fair indication of the nature and extent of the danger to the individual.

Examples of warning problems (poor warnings, lack of warnings, etc.) are many and diverse. The following situations provide insight into the complexity of the warnings issues and how human factors can assist in sorting them out.

Swimming pool accident. The case here concerned a shallow (4 feet deep) above-ground pool, located on a sloping lawn such that on the high end of the lawn a deck had been built up to the pool's edge. The deck afforded the opportunity for bathers to run and jump into the pool. The accident involved a woman who had considerable experience with swimming and above-ground pools. Throughout the afternoon, she had been jumping into the pool by "flipping" or somersaulting into the water. As long as she completed the somersault, her feet made contact with the bottom of the pool. Her last flip however, was not a complete somersault and her head was the first thing to make contact with the bottom of the pool. This resulted in a spinal injury and paralysis from the neck down.

So who is to blame? Who is liable? The pool did not have "No Diving" signs, or other informational warnings concerning the depth or dangers associated with diving into shallow water. But, considering her familiarity with the pool and proficiency in the water, would the woman have heeded a "No Diving" warning? Furthermore, she was not diving and a "No Diving" warning would not indicate that spinal injury could result. Here's another warning example:

Oil Drum explosion. In this particular community people have old oil drums on their property, for various reasons. In one case, a man was using a cutting torch on a car. When he had completed his cutting, he set the still hot torch down on top of the oil drum. Shortly thereafter, the drum exploded, severely burning the man and throwing him several feet from his original location.

This case has several dynamics. First, there is a warning issue. But there is also an issue of who is responsible, and how did this drum get out of its normal commercial distribution network and into a potential misuse situation. In this case there was a warning on the drum. It was printed in a circular manner on the top of the drum in small print, and did not conform to item three above. The drum had no standard Hazard Communication labeling indicating that it had contained flammable material. The human factors concerns here were many and complex, but fundamentally, the warning was deficient and inadequate, despite all the other human behavior issues.

> ...there are intricate inter-relationships between product design, instructions, and warnings.

TASK PERFORMANCE

This issue involves how users actually interact with products. Here again the spectrum is broad, and ranges from consumer products to industrial equipment. Properly dissecting the problem involves the following:

1. Analyze the tasks involved with a particular piece of equipment and determine if the equipment was adequately designed for the intended tasks,
2. Determine the potential for a user to misuse the equipment, and
3. Determine if the supporting instructions were adequate to provide guidance and problem resolution.

As you can probably determine by now, there are intricate inter-relationships between product design, instructions, and warnings.

Table saw accident. This case involved a man who was a proficient wood worker. He was familiar with power tools and the consequences of their misuse. He was using a popular brand of table saw and on one of his passes with a board he experienced a kickback which in turn caused him to loose the first few fingers of one of his hands.

It turned out that he was using the table saw without the blade guard. His fault, right? He claimed that the guard impeded many of the tasks he routinely performed. This then became a design problem.

The human factors approach taken was to analyze the tasks a person would routinely perform with a table saw. Once the tasks had been determined, a comparison was made between the tasks and the saw's ability to support the task performance. To complete the analysis, a determination was made as to whether the Owner's Manual provided sufficient guidance to resolve the conflicts identified between the tasks required, and the saw's design.

This approach clearly revealed that the guard's design was inadequate, and the Owner's Manual was deficient in its ability to resolve the conflicts. These findings were conclusive enough to result in a settlement for the injured.

ANTHROPOMETRICS / ERGONOMICS

Anthropometry is the technology of measuring various human physical traits, including such factors as size, mobility and strength. Ergonomics, more commonly used in Europe, involves the analysis of problems of people in their various working conditions within their real life situations. In a broader sense, forproduct liability situations we look at the human physical measurements and how products can be better designed to minimize the potential for personal injury. The example discussed below demonstrates this concept and how a simple human factors input at the design phase could have prevented a fatal accident.

Boating accident. A young man accidentally fell off the front of a moving pleasure boat, was subsequently drawn under the boat into the propeller, and killed. This boat had a large forward area, conducive to sun-bathing and a place for riders to enjoy the view and boating experience. Therefore, there was every reason to expect that passengers would want to be there. The young man involved in the accident was lying down, face up, enjoying the ride when the boat encountered a large wake from another vessel. The resulting action caused the man to slide off the deck, and into the water. The boat had a safety hand rail for standing passengers but no lower rail or hand grips on the deck. The distance between the deck and the safety rail was in excess of all but the largest of males in a sun-bathing position. All of these issues are foreseeable. Research and standards exist regarding safety lines and their relationship to anthropometric measurements.

Other complicating issues arose during this case, such as propeller guarding, and other warnings. Again, the human factors expert was able to determine the real issues, utilizing existing research and standards to develop a case for the family of the deceased.

As another note, today you see more and more advertisements stressing that products are designed for the "human race"; evaluated to ensure "oneness with the driver; Fahrvergnügen; "It just feels good!". It is this awareness to the importance of anthropometrics and ergonomics that must be expanded, and used, throughout industry.

BEHAVIORIAL

Behavioral issues were reserved for last, since, it is human behavior that determines how human beings will interact with their environment and the products they use. Unlike anthropometry that is referred to as a science, and can be clearly demonstrated with standards and measurements, behavioral issues are more difficult to deal with. Rigid standards for human behaviors do not exist, but that does not mean product design and the use of warnings are not affected by it. Human factors can aid in predicting behavior, which will determine product or warning design.

Electrical Shock case. There was a large electrical distribution box located near an abandoned factory in a highly vandalized urban area. The box still had "live connection terminals. The access doors were slightly smaller than a refrigerator door. Warnings of under ground cables were present. The handles of the doors had provisions for padlocks, but the locks had been vandalized exposing the potential for access to the live internals of the box. A young boy, while playing hide and seek, went inside the box and was subsequently shocked on one of his hands resulting the loss of the tips of several fingers.

How could anyone do something so stupid as to go inside ANY electrical box? Information exists showing that the utility should have known a child would do just that! Long-standing research concerning the behavior of children and refrigerator accidents demonstrated that children would more than likely seek out hiding places inside of containers, such as refrigerators.

More research indicated that the utility responsible for the box had procedures in place for such situations. They had procedures for installing vandal-proof locks and for routine inspections to ensure safety in the face of vandalism. These procedures were not followed. They also had procedures for warnings and pictographs concerning high voltage boxes. If the procedures and warnings had been fully implemented the potential for the accident would have been radically minimized. And the utility's exposure to litigation would have been significantly reduced.

FINALNOTE

If you come away from this article with a better understanding of Human Factors and the significant role it can play in bringing a valuable, added dimension to a well prepared case, I've done us both a service. We are all going to see a very quick rise in the use of human factors testimony and information in product liability and personal injury cases. The discipline is applicable to a broad spectrum of situations and cases, in ways an attorney may not initially consider.

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