HUMAN FACTORS IN LITIGATION

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ABSTRACT

Human factors expert testimony plays an important role in litigation and forensics. This panel presents key issues of human factors litigation of interest to the public, academic, and professional sectors, as well as to present and future lawyers, business people, and consultants.

INTRODUCTION

A wide variety of human factors expert testimony plays an important role in litigation and forensics. Furthermore, human factors and ergonomics forensic consultants and professionals prepare their testimony based on a scientific basis and may be called upon by attorneys for limited, specific opinion or, as is more likely the case, to assist the attorney (and the court) in fully understanding the issue at hand in a broad sense. Although often expensive and seemingly inefficient, the courts provide a "powerful tool to correct the flaws that irresponsible engineering,

management practices, amateur entrepreneurs, or other agencies foist on the using population" (Hornick, 1994).

Forensics experts provide valuable contributions within the justice system and to the society at large. This panel presents perspectives from human factors professionals based on their own experience for better understanding the process involved in presenting clear and useful testimony.

Reference

Hornick, R. J. (1994). Forensics experts fire back (letter; comment). *Ergonomics in design, July,* 4-5.

WHEN TO WARN: LEGAL VERSUS HUMAN FACTORS PERSPECTIVES

Donald P. Horst

One of the frequently litigated areas in which human factors experts can contribute is "failure to warn." However, the scientist and the lawyer view the relevant issues from very different perspectives. These differences can create problems for the human factors professional. Some find the mixture of law and science so awkward that they are unwilling to do legal consulting at all. Those who do work in litigation may find that they have limited credibility in the eyes of their audience – the lawyers, judges, and jurors. In addition, the focus of the legal system on failure to warn may have impacts on the design and use of warnings that the human factors professional may consider undesirable from a safety standpoint.
The contrast between the legal and scientific perspectives is familiar to anyone who has worked in this area. Some differences are listed below, with comments on problems they create for the expert who addresses questions of when to warn.

Goals: the client's best interest versus scientific accuracy

The difference in goals and philosophy between law and science has probably been felt by every human factors professional who has worked in litigation. There may be no more awkward mixture than that of advocacy and impartiality. The human factors expert can fall back on the methodological guidelines of our profession, at least in part. However, our understanding of unintentional experimenter bias may leave us less comfortable than experts in other fields who are less sensitive to such issues. In the laboratory, we go as far as to construct double blind experimental designs to avoid bias, while the forensic consultant, by contrast, has full knowledge of the outcomes desired by the client and a vested interest in pleasing the client. The effects of bias, if any, on expert opinions and on warnings that are currently in use would be difficult to measure, but the solution seems clear – continuing research and initiation of open discussion outside the context of litigation.

Ultimate authority: law versus data

One of the most obvious differences between law and human factors lies in the ultimate authorities to which they appeal. For example, in some states, a "presumption of effectiveness" for warnings is written into the law. The human factors expert may wish to run experiments to examine effectiveness, but the law cannot be changed by facts. In any case, the lawyer may be reluctant to conduct experiments, because he or she does not know the results in advance and fears that the data might provide ammunition for the opposing side. The legal appeal to laws, regulations, and standards affects questions of both when and how to warn. Human factors experts are often asked to refer to warnings guidelines or rules of thumb in assessing whether warnings were *adequate*, even though both research and common experience have demonstrated that the guidelines are neither necessary nor sufficient to insure *effectiveness* of the warnings.

Subject matter: duty versus effects

Even the basic subject matter of the lawyer and the scientist may differ dramatically. The lawyer is concerned with *responsibility* and with the *duties* and *rights* the various parties may have under the law. The human factors expert may be familiar with the law and may have strong personal convictions about these matters, but they are not usually questions that can be addressed experimentally, even in principle. At the same time, the human factors expert may be able to provide information that is relevant to anyone who is addressing the legal questions. The information may take the form of experimental data on the effects of warnings, or survey data bearing on what the public wants or believes. A potential conflict arises when the client asks for an opinion on a subject that human factors does not address directly. How should the human factors expert respond and where should the lines be drawn?

Methodology and procedures

The legal framework defines an adversarial approach to resolving conflicts and differs in principle from the scientific approach that is, ideally, a cooperative approach to reaching consensus. Some examples of methodological conflicts are:
Selective versus comprehensive definition of the problem (*e. g.*, One expert may be asked, "Is it a good warning?" the other, "Did the warnings play any role in the accident?").
Legally defined terms versus operationally defined terms.
A reasonable degree of scientific certainty (*i. e.*, [$p > .50$] versus [$p < .05$]).

The "legal document" model of warnings versus the behavioral impact model

While the plaintiff's lawyer often argues that additional warnings were needed even when the plaintiff was well aware of the hazard, the defense often argues that warnings were provided even when they were limited to obscure statements in documents that the plaintiff never read. Neither argument may make sense to the human factors expert, but there may be no way to reconcile the human factors approach with the lawyers' theories, even when human factors issues are central to the case.

Summary

The differences between legal and human factors perspectives create two interrelated challenges for the human factors expert who addresses failure to warn. One is to convince a skeptical audience that we are scientists with something of value to say. The other is to develop guidelines for when (and how) to warn, based on our own, scientific methods.

RESPONDING TO ADMISSIBILITY CHALLENGES OF ERGONOMICS/HUMAN FACTORS TESTIMONY

Dieter W. Jahns

Motions to exclude expert-witness testimony (aka "*motions in limine"*) are a common tactical strategy in civil cases before both federal and state courts. There is nothing "personal" about them, and they are used against experts in all professional/occupa-tional fields. My presentation will summarize on what basis admissibility challenges are made and how to assist client attorneys to counter such challenges for qualified ergonomists/human factors practitioners. Ergonomic Systems Development (ESD) involves analysis, design, and testing and evaluation to enhance human performance, workload, safety/health, and economic value by means of technological innovations. When accidents happen, (now often renamed "unintended injuries" by public health and safety advocates) the ergonomist is often called upon to investigate and render an expert opinion as to human-factors aspects of accident/injury causation (Jahns, 1990). What an expert can do at trial is governed by a) rules of civil procedure, b) rules of evidence, and c) discretion of the bench. It should be obvious that the expert is involved to educate the trier-of-fact (judge and/or jury) with regard to scientific information which is beyond "common sense" or personal experience in a generic sense. The expert must act in an impartial manner and do nothing that would imply partisanship or interest in the outcome of any case. That is, the expert is there to provide facts, not to usurp the job of the jury which is to evaluate facts relative to legal theories of fault or blame.

Challenges to expert testimony are usually based on a) lack of qualifications by the expert, b) insufficient foundation to render an opinion, and/or c) relevancy of the proposed testimony to the issue at bar. In general, the *motion in limine* will claim that the proposed testimony will "unduly arouse the prejudice or sympathy of the jury", or "create side issues", or will "consume undue amount of time to introduce" or "be cumulative" or (especially for ergonomics/human factors) "invade the province of the jury." While the forensic ergonomist must avoid any behavior that may be construed as the practice of law, the ergonomist and lawyer must integrate their expertise in drafting a memorandum in opposition to the motion to exclude the ergonomist's testimony. The lawyer will focus on legal precedents; the ergonomist will focus on the relevance of his/her education, training, experience, license/certification as they relate to the investigative work that was performed to render expert opinions. Judges are now "the gate keepers" for determining "the line between science and superstition" (Huber, 1990, pg. 113). Therefore, an accomplished forensic ergonomist must know legal theory and legal constraints, know the rules of civil procedure, know the rules of evidence, be prepared to practice in the roles of consultant, analyst, investigator/researcher, report generator, and ethical representative of the profession before the court. An honest, well-researched memorandum (e.g., Quesenberry, 1994) can accomplish a lot

in allowing expert testimony and in keeping ergonomics from being falsely accused of being one of the "junk sciences" (Huber, 1990).

References

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Jahns, E. W. (1990), Forensic human factors: Caveats for the profession. *Human Factors Society Bulletin, 33 (4),* 3-4.
Quesenberry, S., Esquire, (1994) Plaintiff's memorandum in opposition to defendant's motion to exclude Dieter Jahns, Filed October 19, 1994, Superior Court Washington, County of San Juan, Cause #93-2 05157-4, Friday Harbor, WA, pg. 1-8.

USE OF COMPUTER PROGRAMS & GRAPHICS IN ACCIDENT RECONSTRUCTION

David A. Thompson

Introduction

Communicating a physical facility or action to a jury is necessary to describe how or why a specific physical accident happened at that facility or was caused by that action. Often, an expert witness may attempt this with a verbal explanation, possibly using gestures or other body language. However, this approach requires the juror, who generally knows nothing about the actual physical situation, to make a mental transformation from the intellectual description of the witness to a three dimensional one in a clear, reliable manner "on the fly" in order to comprehend what actually existed and occurred. Unless this mental transformation is done in a high fidelity manner, the juror will not have an accurate factual basis on which to base his or her opinion, and justice may not be well served. Obviously, the juror lives in a 3-D world and requires ideas and facts converted to his or her world to fully comprehend.
This communication problem is avoided when direct representations of the three dimensional physical world are used directly in the presentation of the facts of a case, allowing a direct 3-D to 3-D mental transformation by the juror. Models of stairways, power tools, and actual stepladders are very helpful in this regard. Even 2-D diagrams of ladders or stairways, floor plans, or photographs of machines from several angles permit a relatively simple 2-D to 3-D transformation on the part of the juror.

However, how does the human factors professional represent people in such 2-D or 3-D models or diagrams in a meaningful manner that permits reasonable high fidelity accident reconstruction? Is it possible to have both static and dynamic representations of physical situations and behaviors? Is it possible to represent 5th percentile, slender females as well as 95th percentile, heavy males, and at selected points in between? How can the humans being modeled be put in representative postures related to the most probable accident scenarios?

I will present a variety of examples where human mannequins have been used to represent various critical events in accident scenarios. The software used is *Manequin** supplied by the Biomechanics Corporation of America, and supposedly developed for solving selected NASA

personnel space problems. With some effort, it is possible to posture a wire frame mannequin of a human in virtually any posture that the human can reasonably be expected to assume. (Interestingly, since the software mannequin will not assume impossible human postures, it can be used to evaluate the feasibility of questionable human reaches, stretches, twisting, and visual ranges. Movements being evaluated can include all degrees of freedom of which a particular limb is capable.) Movement of the separate body parts, including individual fingers, is possible. In addition, simple drawing tools are available to show the relative relationships of desks, handrails, steps, and other physical features.

Once the mannequin is postured in a particular configuration, it has a 3-D capability and may be viewed from any direction including an isometric view. It is even possible to apply forces to the hands or feet and measure the resulting torques on shoulders and legs. One may also choreograph a crude animation of a brief motion sequence, or display the "normal" cone of vision.

Simple extensions of the mannequin's actions are possible and are helpful to the human factors professional. The body's center of mass can be drawn in to show moments of tipping or bending force when climbing a vertical ladder or reaching inside an automobile trunk. Other forces can also be shown, such as the amount and direction of hand force on handrails, or traction forces during heel strike when walking. Several mannequins of differing size and gender may be shown and manipulated in the same scenario.

The potential user should be warned, however, that significant bugs remain in standard copies of the software, and no upgrades to correct them are planned. Although the software is very useful in selected applications, it can be very frustrating to use in certain object drawing applications. While one can draw objects in 3-D to accompany the mannequins (which are always in 3-D) this can be very tedious and difficult to do without the inclusion of small dimensional errors.

THE HUMAN FACTORS EXPERT IN ROAD USER LITIGATION, OR CONFESSIONS OF A HIGHWAYMAN

Richard A. Olsen

About 400 of my 500 cases over the last 21 years as an expert witness or consultant have been concerned with behaviors of drivers and pedestrians in highway litigation. In this presentation I will discuss a few of the more important issues that have concerned me in this practice. First, what we call ourselves has implications for what we (I) do and for what juries and attorneys think we do. If the word "engineering" is used in a title, does it help or hinder others in understanding? How about the word "psychologist?" And do we help or do we confuse when we testify about "research?" In raising the issue of complex analysis, computer simulation, and statistical testing, do we run the danger of raising costs without clarifying the issues?

Road users, the road environment, and the vehicle's controls and reactions obviously have implication for engineering analysis. Without background in road design, delineation, lighting, signs and markings, vehicle dynamics, and accident reconstruction, the human factors specialist may be reduced to opinions on "human behavior." There are cases that require analysis in areas

of the clinical psychologist, but despite the assumptions of many attorneys and judges, that is not what I, personally, am there for.

Among the problems in the field now becoming known as "ergonomics" is the question of defining and distinguishing the human factors specialist (HF) and the human factors engineer (HFE). In itself, "ergonomist" is not any more understandable than these HF and HFE labels, though it would encompass both. I use "HFE" and "engineering psychologist" in my work, in spite of the latter term's more academic connotations, because I bring engineering training and design experience into the analysis of questions in litigation as well as the HF areas of specialization. This has advantages, but it presents problems of its own. It is essential that each expert witness describe clearly what his or her own qualifications are when opinions are to be given.

In my case, the advantages of the HFE label, including the ability to offer opinions as an accident reconstructionist, can be valuable for at least three reasons. First, the driver is certainly influenced by the design of the entire transportation system, and no analysis is complete without considering technical aspects. Second, the assumption of the psychologist as counselor tends to undercut the quantification and hard science aspects that HFE (or HF) brings to the analysis. Equations, drawings, and tables are not presented for only that reason, but a quantitative approach does bring the full message of the potential of ergonomics in design. The judge, jury, and attorneys usually have respect for algebra, geometry, and statistics in an opinion, especially if the material is presented in a way that allows them to follow the arguments and conclusions, if not all the math. Third, the broadening of investigative coverage often allows one expert to cover the necessary breadth in an economical manner, though I regularly work with a traffic engineer or an accident reconstructionist as well. And yes, cost control and excessive fees are another concern of mine for the future of the expert.

There are also disadvantages to implying one is an engineer *and* a psychologist. The two fields are somewhat complementary, but each is more than enough in itself for a lifetime practice. There is a need to specialize within each field, and when expertise is claimed in both, greater narrowing of knowledge in each field is implied. Many expert witnesses have had to face the questions; "Oh, so you are an expert in everything, is that right?" One answer is, "yes, everything having to do with the driver's motivations and reactions in this situation." That may be the objective of an HF analysis, but seldom can one say "everything" has been explained. Such an answer would soon be put in that category of "things I wish I hadn't said." There are limits to what one person can know, and the litigation process recognizes that. Where the stakes are high, armies of experts will be paraded through the court. Each adds to the picture the attorney is constructing, with overlapping areas to lend emphasis to the extent the court will permit.

But many cases do not have "large" stakes. More often, the action is trying to obtain the limits of one or more insurance policies, totally in the neighborhood of $100,000. One or two experts cover what can be said for each side. An estimate of a speed of impact from damage is appropriate from a HFE/reconstructionist in such cases, rather than from a separate reconstructionist. The accuracy of estimates is usually limited by the lack of details in the information available. It would not make sense to pursue an elaborate computer analysis or reenactment when the outcome depends on which (arbitrary) assumptions are made for the

inputs. Even in bigger cases, the back-of-an-envelope computation will give the same results as a frame-by frame movie analysis if the underlying data are approximate. When you show convincingly that you are working with input values of ±20%, a computer printout to four decimal places fails to impress even the most computer-naive juror.

My experience has led me to start with simplifying assumptions and to offer basic opinions to the extent that the information allows. Because I have written and reviewed papers for, and attended, a number of research organizations and their committees for many years, I am able to stay up on current work fairly well. I seldom do a literature search, as such, but rather pull out a specific paper or reference when it applies to issues in a current case. The issues in much litigation are not complex compared to those in a research setting. Making the issues sound complex, or offering to do "scientific studies" that really do not have sufficient controls to be reliable, adds to the cost without adding to the enlightenment of the jury. The difference between an attempt to explain a concept in court and to snow a jury can be one of degree and conscience. Computer simulation, in my opinion, is especially prone to obfuscation and misuse. I used some of the early reconstruction programs, ca. 1980, but found this rapidly became a specialty in itself. Also, it is important to an ethical practice that the difference be made clear between an observation of driver behavior at a site, for example, and a real analysis of such behavior.

There is room for disagreement in the preceding discussion (for more, see Olsen, 1992). What holds for me and my experience does not necessarily hold for you and yours. An expert witness must consider such distinctions, however, both in preparing a presentation and in the critique of the analysis presented by someone else. That is the intent of this presentation.

Reference

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HUMAN FACTORS ISSUES IN ANALYSIS OF TRAFFIC ACCIDENTS

Kenneth Ziedman

Introduction

Expert testimony relating to human performance and behavior is now commonplace in litigation with traffic accidents. Analysis of individual accidents is challenging in that it forces the expert to apply general human factors knowledge to a specific instance of human/vehicle/roadway interaction and to specify those factors or conditions which are most related to an individual accident. This process is generally conducted in the face of incomplete knowledge of the accident circumstances, including limitations concerning knowledge of the perceptions and responses of involved parties and witnesses. Further, the expert's analysis is conducted and presented in the context of adversarial criminal or civil legal proceedings, the goal of which is to place responsibility for an event. Ideally, the expert's role is one of technical analysis to help

explain human factors aspects of an accident to assist the jurors in an ultimate decision of responsibility.

The focus of this report is on human factors data used or desired by experts in formulating conclusions in litigation. The value of examining such data in the context of forensic analysis is (a) analysis of actual accidents can enrich human factors understanding of the interactions between operator, vehicle and roadway, (b) a potentially useful database of human factors case histories and applications may be buried in legal proceedings, (c) the identification of research needs may arise from limitations experienced by practitioners in forensic analysis, and (d) examination of how human factors data are used in litigation may help to improve the quality of forensic analysis. In addition, the results of the study may be useful in human factors education in providing a group of accident case histories and data applications for a common area of human performance.

This project involved summarization of human factors data used in accident analysis from persons involved as testifying experts. Contributors were asked to provide case reports containing a brief summary of the accident, human factors issues, data used in analysis and any additional data that would have been helpful but was not available, as well as references to human factors data they found useful in accident analysis.

A further purpose of this project was to compile a bibliography of data sources useful for analyzing vehicle and road user performance, with emphasis on sources of quantitative data that can be applied to forensic analysis.

Methodology

A data base of accident descriptions, human factors issues and data limitations was developed based on the 59 case reports submitted by contributors. Accidents were coded according to simple collision-type categories (e.g., vehicle/vehicle, vehicle/pedestrian, etc.). Human factors issue and data limitation categories were defined based primarily on functional performance

areas (e.g., perception/decision/reaction time, visibility and conspicuity, etc.). Summaries of each case report were prepared and entered into the data base in a consistent format. The accident scenarios, human factors issues and data limitations associated with each case report were reviewed, coded and tabulated. Finally, the results were integrated and summarized.

Results and Discussion

The case reports resulted in 201 issue items and 115 data limitation items. The most frequently noted human factors issues were visibility and conspiciuty, decision and cognition, user characteristics and perception/reaction. The most frequently noted data limitation areas were visibility and conspicuity, perception/reaction, workload, and decision and cognition. Specific topics in which additional data would be especially useful in understanding accident causation were: (a)

user performance in complex perception, decision and response situations, (b) driver visual search and attention, and (c) driver interaction with roadways and signing, including effects of expectation and familiarity. Examples of the types of data that contributors felt would be useful for accident analysis will be presented.

The study results are limitated in that traffic accidents that are at issue in litigation are probably not a random sample of all traffic accidents and in that the total number of case reports were fairly small. However, many of the data limitation topics do suggest research areas that could provide useful information for traffic safety decisions. Further, it is likely that failures in user/system interaction that lead to litigation are similar to the failures in accidents that do not result in litigation.
A final issue to be discussed is the manner in which human factors data are usedin forensic analysis and the application of controlled research results to specific accidents.

Reference

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