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Introduction

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When products (equipment or environments) are associated with serious injuries or death, there are extensive costs not only to the individual(s) involved, but also to family, friends, co-workers, employers, and others. The monetary and emotional costs can be substantial. There are costs to society via government agencies that may have to assist in the upkeep of medical and continued life care. There are also costs to manufacturers, importers, distributors, and insurance companies from lawsuits filed in terms of financial penalty, loss of sales, and negative brand perception. The costs can be substantial if it is demonstrated that their product, equipment, or premises caused, aided, or facilitated the injury due to defective design, manufacture, maintenance, or inadequate warnings.

The case studies in this book describe a set of situations (given in illustrative scenarios and background information) in which a person-product or person-environment interaction produced a severe injury or death. Each description is followed by a Human Factors and Ergonomics (HFE) analysis of the event and a discussion of better alternatives and lessons learned.

This is a specialized book as the title indicates: *Forensic Human Factors and Ergonomics: Case Studies and Analyses*. Given its specialization, it seems appropriate to explain the parts of the title to understand its focus. The title combines several components, which are explained in the next three sections.

Forensic Human Factors & Ergonomics: Case Studies and Analyses
M. S. Wogalter (Ed.), Boca Raton, FL: CRC Press/Taylor & Francis Group, © 2019, pp. 3–16.

Human Factors and Ergonomics

The title includes the terms Human Factors and Ergonomics (HFE). "Human Factors" and "Ergonomics" are names, commonly used interchangeably, to describe the field. In Sanders and McCormick's (1993) classic textbook, the field is defined this way (based on Chapanis, 1985):

> *HFE* is a discipline that discovers and applies information about human behavior, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for productive, safe, comfortable, and effective human use.

According to Sanders and McCormick (1993), HFE has two goals:

1. *Functional Effectiveness*: To enhance the effectiveness with which work and other activities are carried out—for example, faster speed, increased productivity, and reduced errors.
2. *Human Welfare*: To enhance desirable human ideals or values—for example, improved safety, increased job satisfaction, reduced fatigue and stress, increased comfort, ease of use, and improved quality of life.

The HFE discipline works to accomplish both of the above objectives.

These are not the only definitions and goals of HFE. Wogalter, Hancock, and Dempsey (1998) analyzed 190 definitions of the HFE area extracted from several common themes of many publication sources. One very short definition is that it concerns the Person–Machine Interface. The term "machine" is generic; it could be substituted for product, equipment, technology, environments, systems, etc. In this book, these terms are frequently used interchangeably. See Figure 1.1 for an illustration of the Person–Machine Interface. Note the counter-clockwise direction of the arrows. The process is a cycle. To demonstrate how it works, start with the top right side of this figure, where stimuli (via various displays) can potentially influence the senses, input of which may then be processed cognitively and lead to a relevant response (via the machine's controls) to influence the internal aspects of machine. This, in turn, causes changes in the machine which is indicated by changes in the displays which may be picked up by the senses and so on, and the cycling continues.

One common example of a person–machine interface is driving a motor vehicle. The displays are visual information through the windshield, the side and rear-view mirrors, gauges on the dashboard, sounds, vibration, etc. Consider this simple scenario. If you see that a speed limit sign that you are passing reads 25 mph (40 km/h) and you notice your speedometer says 42 mph (68 km/h), your mental processes should conclude that you are going too fast and you need to slow down. The appropriate thing to do is to lift your foot off of the accelerator (control) to slow down by coasting or to put your foot on the brake pedal (control) and push to slow down quicker. If the speedometer gives the current speed as 36 mph (58 km/h), your mental processes suggests you should slow down more and may increase pressure on the brake or coast for a while. At some point, you may look at your speedometer and decide that you are going too slow or that the speed crept back up. If so, then the appropriate next step is to use your mental processes to effect adjustments to the brake and accelerator, changing the machine to the desired speed. This cycling is the interaction between people and machines. Historically, when there were problems with this interaction, HFE professionals were asked to fix controls and displays because (a) of poor design, potentially resulting in costly mistakes, or (b) changing the control-display

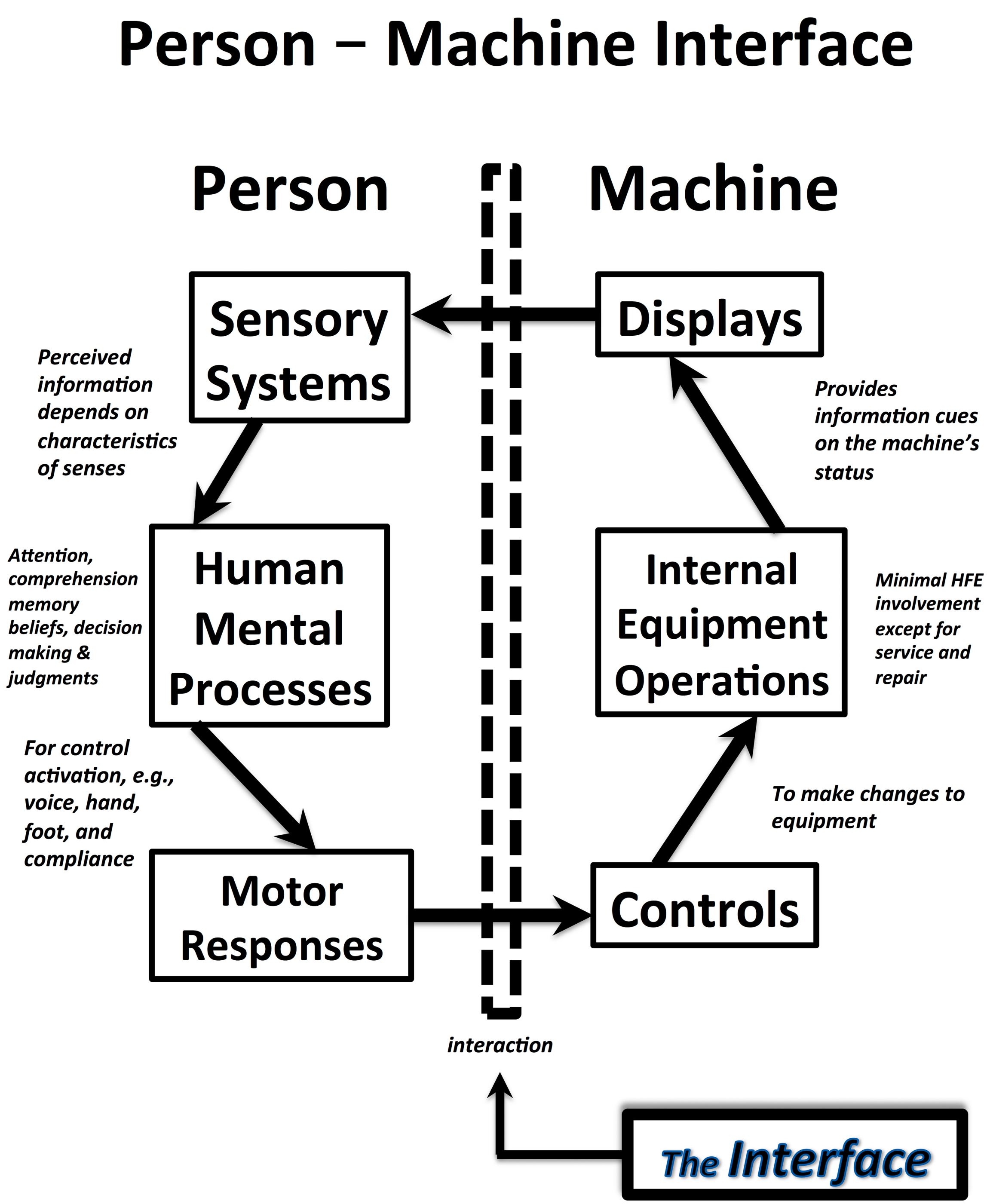

FIGURE 1.1
Person–machine interface.

interface including the warnings and instructions was the only "easy" way to try fix the problem (often because the machine was already built).

Good displays and controls make good use of our abilities can in terms of sensory systems, cognition, judgment, and motor responses and avoids using designs that use our more limited (less good) capabilities. In the modern, fast changing world of technology, HFE professionals have become involved in all aspects of the model shown in Figure 1.1, particularly in the human mental processes area. Thus, it is not surprising that most HFE professionals have backgrounds in psychology and engineering. The fact that they interact with each other is a benefit. The field is frequently described as the emergent combination of psychology and engineering. However, there are numerous other fields represented in the HFE profession, including architecture, law, medicine, and the allied health fields, among others.

HFE is a multi-faceted discipline that concerns the interface between (and interaction of) people and things, with things being products, equipment, machines, tasks, environments, and systems. HFE not only wants to benefit people by utilizing and taking advantage of their amazing abilities, but also tries to avoid tasks that humans are less well equipped to handle (where there are known performance limitations). The goal is to encourage development of systems that are productive, comfortable, and safe.

My own definition or goal of HFE is "to make things better for people," where "things" are represented by almost anything. Most things are ultimately designed for people, so having a good interface can be beneficial for productivity, comfort, and safety. It is particularly critical in piloting passenger aircraft, in controlling a nuclear power plant during an emergency, and in the design of consumer products.

While "Human Factors" and "Ergonomics" are often used interchangeably, there are some subtle connotative differences between them. The subtle difference between the two names is that Human Factors tends to focus on perceptual and cognitive processes ("above the neck"), such as designing tasks to reduce mental workload and errors, whereas "Ergonomics" relates more to physical body and musculoskeletal systems ("below the neck"), such as lifting weight, repetitive motion and cumulative trauma diseases, and workspace design. "Ergon" means work, which, broadly interpreted, is the expenditure of energy to accomplish something. It reflects the idea that humans do tasks usually by interacting with devices or tools (i.e., machines, things, products, etc.). Although ergon is "work" and part of its name, the HFE discipline is not just about tasks done in course of employment, but also involves non-employment activities, such as home and leisure pursuits.

The beginnings of the two parts of HFE can be attributed to concerns in different points of time. Traditional "Human Factors" and its heavier focus on mental activities appears to have taken root during World War II where it became apparent that new machines were being produced, such as fighter aircraft that had so much capability and complexity that even highly-trained pilots had difficulty controlling their aircraft. Some of the best pilots were inadvertently flying their planes into the ground. The ones that survived to talk about their crashes were interviewed about why those crashes occurred. It should be mentioned that prior to this point in time, people could learn to use most any tool or machine that was developed as long as they received adequate training and practice. Limits were reached with this new and developing technology. The pilots interviewed frequently described the controls as being mistakenly selected when it was a control for something else, or a display was obscured or misinterpreted. The controls and displays were even inconsistent between planes of the same type. A control that was thought to be the landing gear was not the landing gear; it was now in another location in the cockpit. Controls were not labeled consistently etc.

During World War II, the U.S. military realized that it was easier and better to design the machine so that it matched people's expectations instead of trying to change people's strongly-held existing beliefs and habits. Poor design forced people to change to fit or try to match the machine's characteristics. The U.S. Air Force (1980) and other military laboratories employed (and drafted) empirical science-based psychologists to study pilots flying in cockpits and used the collected data to redesign controls and displays to ensure pilots could do their tasks with greater accuracy and reliability. Displays, for example, were redesigned for ease of reading and interpreting. As already mentioned, different planes had different locations of controls and displays. In some planes, the landing gear control was placed in one location and another plane of the same type would have it in a different location. Another control-related aspect was also found to be confusing. Prior to the middle of World War II, most control knobs in the cockpit were indistinguishable; many were simply black ball handles, and could only be differentiated by location and labeling in the cockpit. As a result of human factor studies, locations of controls in planes were standardized. To further help differentiate controls, the handles or knobs were made visually and tactually different. The round knobs were replaced by handles with shapes that resembled what the control did. Figure 1.2 shows a set of control shapes that were developed, tested, and standardized by the U.S Air Force's HFE research labs. Note that, for example, the control knob for the landing gear is shaped like a wheel. Specific shapes were also chosen based on whether they could be differentiated by touch alone while wearing heavy gloves. These examples show HFE's roots concerning the interface (and interaction) between people and things.

Traditional "Ergonomics" (using its physical and musculoskeletal connotation) had its beginning a little earlier than Human Factors. Ergonomic needs became apparent in the industrial age when time-and-motion studies were being conducted for the goals of improving physical work efficiency and productivity. According to most accounts, the field of ergonomics began when manufacturers realized that employees had needs beyond simply collecting their pay for doing repetitive, stressful, and injury-prone tasks. Workers were less productive when dissatisfied, uncomfortable, and certainly, if injured. This meant that employers had to consider "human" aspects of tasks and jobs rather than simple productivity measures. This also necessitated ensuring that workers were not injured on the job. Ergonomics played a part in changing the physical nature of tasks so that they meet comfort, health, and safety criteria.

The common goal of both "Human Factors" and "Ergonomics" is to encourage the design of "things" based on characteristics of people—their perceptual, cognitive, and physical abilities and their limitations—so that people can use products productively, comfortably, and safely. The design of things should be based on what we know about human beings, favoring and taking advantage of their tremendous abilities and avoiding their limitations (unless necessary to do so). HFE professionals seek to study, analyze, and offer recommendations on

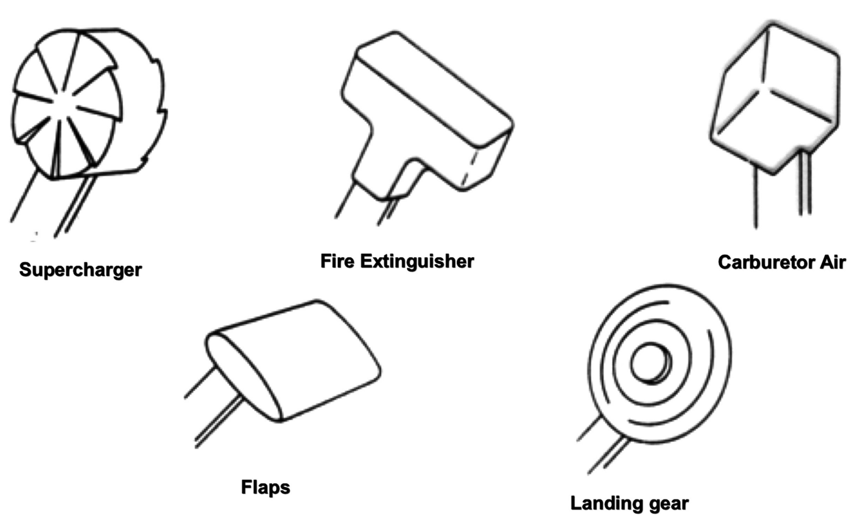

FIGURE 1.2
Shape of control knobs reflecting their purpose.

products, equipment, and environments for industry, government, and other entities. Many are in academia as faculty and students in university settings doing research on these topics.

Safety is a fundamental goal of HFE. Controlling product and environmental hazards is often a mixture of design, guarding, and warning. The best result would be to prevent injury in the first place. Thus, HFE analysis ought to be done (preferably) in advance of the release of a product, that is, at the design phase so that the product is developed with an eye toward eliminating or reducing the likelihood and severity of injuries that might otherwise occur. Of course, and as most HFE professionals would advocate, HFE should be considered in other phases such as during the production and sale of the product. Also, the post-sale is an important period for collecting hazard information on products being used by people in their homes or businesses. In other words, the manufacturer (or other relevant entity) should be concerned with their product from its development to its destruction. This is called product stewardship, a concept that is gaining momentum, especially in the domain of chemical products (See Chapter 2, Wogalter, 2019a, in this volume). Considering the products' life cycle is not a one-time, do it and be done, process. It is an ongoing process since new developments related to the product may occur over time, and where new fixes for old hazards may become apparent, especially given that new technologies are being rapidly introduced.

Over the years, HFE has grown and is now consists of numerous subfields. The main U.S.-based professional and scientific organization for the discipline is the Human Factors and Ergonomics Society (HFES), which has about 20 separate technical groups (TGs) with members who have different research and development (R&D) interests. There are TGs that concern product design, environmental design, safety, occupational, surface transportation, augmented cognition, children's issues, and aging, among others. The TGs have their own scientific/professional sessions at the annual meeting, publish newsletters, and hold business meetings. See HFES.org for a full list of the TGs and descriptions.

Forensic

Another component of the book's title, and its first word, is "Forensic." This term is usually used to describe an *investigation* of something, mainly in the context of a crime or criminal activity, but it can also have a broader meaning by being more generally concerned with aspects of the legal system, which do not necessarily concern a criminal case. It could be a civil case such as product liability or product injury type case.

One active technical group in HFES is the Forensic Professional TG (FPTG). It is concerned with matters related to the interface of HFE professionals and the legal system. On the FPG web site, which is linked to the main HFES website, is a "white paper" that has a useful summary of the field in terms of its professional credentials and research activities relevant for work as consulting and testifying experts in HFE including accreditation of graduate education, board certification, journals, and a listing of some of the businesses government agencies that employ HFE persons. The aforementioned "white paper" is a useful introduction to the HFE discipline for attorneys, judges, and others concerning the scope and qualifications of professionals in the field.

Over the course of several decades, various forensic HFE issues and case studies have been presented at numerous professional/scientific conferences such as the annual HFES meeting, triennial IEA Congress, and other meetings. There have been a few books on the topic of forensic HFE (Noy & Karwowski, 2005; Rudov & Cohen, 2009; Woodson & Cohen, 2005). These books tend to focus on the role and tasks that expert witnesses may carry out. These few forensic-related HFE books are outnumbered by a large number of books published on techniques and methods of expert witnessing in general—across disciplines. There have also been a few books with case studies of HFE material (Casey, 1998, 2006; Cooke & Durso, 2007; Vicente, 2004); however, these excellent books are generally not authored by persons who have participated as expert witnesses. To date, there have been no books containing forensic analysis of injury cases derived from personal experiences as expert witnesses. The chapters have been written by authors personally involved in the course of doing litigation work on one or more cases like the one(s) they describe.

This book's case study collection tells how personal injury cases can be analyzed from an HFE perspective. The authors use techniques and methodologies to break down the cause and effects that led to the injury. An important benefit of using a systematic methodology is that similar techniques and methodologies can be applied to other products, environments, and situations for the purpose of analyzing and potentially correcting person–machine interface problems and hopefully decreasing future injury. Progress towards these goals would benefit performance, comfort, and safety.

Case Studies and Analyses

As the book's subtitle indicates, a number of case studies are presented and analyzed. All of them consider how ordinary persons can be injured from use of products in environments.

The book contains 18 case studies (Chapters 4 through 21). The topics involve a range of products, equipment, technology, tasks, environments, etc. and are adapted from actual events. They represent only a selection of the kinds of areas where HFE considerations could be beneficial for safety. A future volume of this book with different authors will likely have a different set of topics.

The case study chapters are structured in a consistent manner. Most have four major sections. All start with a (a) Scenario, followed by a section with (b) Additional Background Information, then applies a structured (c) HFE analysis to the case, and, lastly, a (d) Discussion/Conclusions section with a short summary and some lessons learned. Each of these four superordinate sections is briefly described below.

Scenario: Each case study starts with an example event, an injury scenario. Chapter authors were given flexibility to tell the story in the scenario in an interesting, engaging way. Many are vivid and impactful, occasionally enlivened by first-person conversations and portraying people engaged in life activities. The intention was to show a "slice of life" occurring prior to an injury event to impart a sense of involvement. It tells about people going about their daily life and then an unexpected and tragic injury event occurs to one or more of the characters.

The lurid scenario also had pedagogic purpose. The intent was to grab readers' attention at the outset of the chapter and get them involved so that generates some desire to find out what the author(s) have to say in their HFE analysis and conclusions.

In most cases, the scenario describes the scene before an injury event, the injury event itself, and the consequences to the individual(s) involved. The scenarios are reflective of real events, but names and places are fictional. Information is disguised to maintain privacy and confidentiality. Any similarity to real cases is coincidental. More about confidentiality is given in a later section.

Additional Background Information: After describing the scenario, most authors include a follow-up section with additional background information. This is a section used to fill out or complete the story provided in the scenario section with relevant background facts about the event, product, injury statistics, etc.

HFE Analysis: The third major section of each case study is a systematic and structured HFE analyses. Across case studies there are several basic and consistent themes.

One theme is the need for manufacturers and other relevant entities to do a hazard analysis and to use appropriate hazard-control methods such as (a) designing out hazards, (b) guarding against hazards, or (c) warning about hazards. These topics are taken up in more detail in the next chapter (Wogalter, 2019a, Chapter 2, in this volume). Several of the case studies give particular examples comporting with this theme.

A second theme is the use of an information processing approach is frequently used to analyze injury events. This approach breaks down components or stages of processing that can either facilitate or inhibit processing. Mostly it is used to analyze whether the warnings involved were adequate. It also provides a foundation to structure a complex sets of the facts that are given in a particular case. The Communication-Human Information Processing Model is described in detail in Chapter 3 (Wogalter, 2019b, in this volume).

Conclusions/Discussion: The last section of each case study gives some final comments, take-away points, and lessons learned. Most chapter authors suggest some potentially better ways of doing things (e.g., using different methods or technologies) to prevent or reduce injury.

Systems Point of View

HFE takes the viewpoint that products cannot be viewed or understood fully or accurately in isolation, independent of people. One example already given in this chapter is the driver-vehicle combination. A driver and a vehicle together can accomplish activities that neither can do alone. Together they are a system with emergent properties from their combination. Another example is a bit more controversial (even to mention) but no side or position is taken on the issue. It relates to guns and people. There is a common saying supported by the National Rifle Association (NRA) and gun rights advocates that "guns don't kill people, people kill people." The HFE discipline would say more specifically that it is the combination of two components that kill people: guns and people. Guns cannot kill people by themselves—it takes people to use them (which is probably what the phrase is supposed to mean). Gun control advocates would emphasize that guns make it easier to kill people. Although people can kill people without guns, the task is harder without guns. If killing is what someone wants to do, then a gun can aid in that task. That task should only be used in very special circumstances. Arguably, it is more accurate to say that bullets kill people. Without bullets, it is much more difficult for a person-gun combination to kill people. Thus, it is the bullet-person interaction that is actually the killer (or even more accurately, it is the gun–person–bullet interaction that does it). The point is that the real action happens with the combination of people and things—not just one or the other.

The reason that products cannot be fully and accurately viewed in isolation, as separate from people, is because virtually all products are installed, used, maintained, etc. by and for people. People are intimately involved, always or almost always, with products, equipment, tasks, etc.

Related to the person–machine interaction is the concept of the systems approach. The system(s) of concern in this book is the combination of people using products to do tasks in environments. The individual parts by themselves or in partial combination may not accomplish as much as what the full system could accomplish. Systems usually have emergent qualities and abilities for which each of the components could not produce alone.

Legal Aspects

Thus far, the description has mainly dealt with what the book is about. The intended focus concerns HFE analyses of injury scenarios. It is worth mentioning what the book is *not* about. It is not about law, legal proceedings, or the tasks and role of the expert witness in the cases. In short, the expert witness role in legal cases is generally not covered here. Tasks and strategies of expert witnesses can be found in other volumes (e.g., Noy & Karwowski, 2005; Woodson & Cohen, 2005), seminars and workshops (e.g., SEAK, Inc.), and in other sources.

There are several reasons for not focusing on expert witnessing. One is that chapter authors do not have much, if any, training in law. Instead, they have training and expertise in HFE (Laughery & Wogalter, 2005). Attorneys' work and role, whether on the plaintiff's side or the defense side, is different from that of the expert witness. Attorneys are supposed to represent their clients as best they can. Expert witnesses are supposed to be experts in their field and be neutral regardless of the side hiring them. The discipline of HFE is grounded on data and principles and employs techniques from science and engineering for testing and assessment. In law, experts and their theories and analysis, are tested through cross-examination by lawyers on the opposite side of legal cases. Law is adversarial and confrontational. Further, the terminology is different between HFE and law, for example, there are substantial differences on what "proof" means. Thus, it was decided that including the chapter authors' personal experiences while working in the role of an expert witness would distract from the main goal of the book, which was to present HFE analyses of injury events.

Thus, the forensic emphasis of the book and the cases studies that comprise most of it derive more from the rubric of *investigation* than of law. The analysis of injury cases from an HFE perspective could serve as a basis for expert witness' opinion, but the book is not about the expert-witnessing role per se.

Another reason for de-coupling expert witness tasks and other legal aspects from the injury scenarios and HFE analyses is that almost all of the authors have had experiences exclusively with the U.S. legal system. As discussed above, the U.S. legal system is complex system and even highly-trained lawyers have trouble interpreting parts of it. Further complexity comes from state governments and local jurisdictions having their own rules, in addition to federal rules. The intention of the book was to be useful for HFE colleagues, students, etc. in other countries who have a different legal system. With respect to these readers, if the U.S. legal system was extensively discussed there would be a lot of irrelevant information to dig through. Instead, it was decided to limit the presentation to the basic crux of HFE experts being concerned with the investigation and analysis of injury events regardless of the legal jurisdiction and rules that might govern a case. The avoidance of heavy legal system referencing and the telling of intricacies of other parts of the expert witness task was intended to make these injury investigations and analyses more approachable to a world-wide audience. It is hoped that international colleagues and others interested in these topics find it valuable.

A tremendous amount of information is generated, produced, and collected in product liability cases. The case study descriptions that are included in this book are limited in the sense that *not* all of the details that could be given are given. Only a portion of what could be described is described. The amount of material produced in product liability cases can be huge. Despite the amount and detail produced in these cases, it is never complete for a variety of reasons, for example, the injured party may have died, the scene and implements were not studied adequately, or preserved during the initial investigation, people's memories are fallible, etc. Thus, there are some gaps in the information collected and produced. Nevertheless, this extensive body of details becomes a useful resource about human behavior in the real world and carries with it different perspectives to give a reasonably good appreciation of what probably happened. This information can be used by the HFE expert to develop an analysis of the causes that likely contributed to the injury event. HFE expert opinions may be offered to a judge and/or jury to assist them in their role of decision maker in understanding the human-related processes for which they may not otherwise be aware or appreciate.

The main reason for presenting HFE analyses of injury cases is that it can help provide insight on ways to enhance safety, performance, and satisfaction in person–machine systems. HFE analysis can be used to potentially foretell problematic aspects so that they can be fixed.

The benefit of considering a range of different types of scenarios is that it may be seen how similar analyses can be applied to circumstances *not* specifically represented by these cases. That is, this volume in aggregate gives some overall guidance on how to organize, plan and strategize their application for other products, environments, and situations.

It is fully acceptable, reasonable and expected that readers may disagree with some or all of the analyses, conclusions, and opinions that one or more of the authors offer. Experts can disagree; hopefully, the higher quality arguments will prevail. The analyses that chapter authors present are not the only analyses that could be produced from the same set of information. People disagree on many things even with considerable experience in a domain based on different experiences and philosophies. Disagreements are not unexpected, particularly given the polarized and adversarial approach with which legal proceedings are conducted. The positive aspect of the disagreements is that they may provide more precise, incisive, and in-depth considerations for future HFE analyses, and if this were to be so, then there would be an advancement toward to the goal of preventing or reducing injury.

Confidentiality and Privacy

At the outset of this book project, chapter authors were cautioned to avoid giving private or confidential information from actual cases. In trying to demonstrate HFE analyses through the use of case studies, the chapter authors were instructed to keep names of the entities confidential. An effort was made to avoid adversely affecting the entities involved (including manufacturers, injured parties, attorneys, and the chapter authors). The intent was not to cause any detriment to individuals, companies, brands, profits, etc. Rather, the main purpose was to give examples of realistic injury cases to illustrate HFE analysis.

As they say on TV and in movies, the names of people, companies, products, and locations have been changed, disguised, or simply left out. The described scenarios are similar to injury events that have happened. Some scenarios are a compilation of several similar cases. Entity names are fictitious. Any resemblance to actual persons, living or dead, or actual events is coincidental.

Beyond the authors' extensive experiences in a particular domain or type of injury cases, specific details about actual cases may be found in public domain publications such as court-filed depositions or trial testimony transcribed by a licensed court reporter. Sometimes, newspaper accounts and filed police or emergency rescue reports can also provide or supplement information. The vast majority of court-filed cases are settled out of court prior to trial and as part of the deal, some details are frequently sealed from view. It is estimated that vast majority of cases filed in court are resolved in pre-trial settlements.

Human Error

In the media, the concept of "human error" is frequently used in significant injury or product damage events to identify the operator of equipment or the victim as the cause, as being responsible for making an error. Most of these case-study chapters show that the victim may ***not*** be the major party to blame. Rather, substantial fault may lie in other entities that failed to make the product or environment reasonably safe. Indeed, the cases in this collection show that it is often fiction to blame the user, and that there is often much more to the story. If the injured party were obviously responsible for their injury, the case would not make it very far. Few plaintiff attorneys would take on a case where the injured party (the client) is mainly to blame. The reason for this is that the plaintiff attorney usually pays "out of pocket" to work the case in hopes of earning compensation (usually 1/3 of the proceeds). In a verdict supporting the defense, plaintiff attorneys (and their clients) usually do not get compensated at all. However, attorneys who do defense work in product or premises liability cases are usually compensated by hourly or salaried wages, which is paid irrespective of a particular case's outcome. The point is that injured parties usually need to have a very good-to-great case that alleges a large amount of fault onto particularly pertinent parties in order to have expectations of financial recovery in a lawsuit. While some people, companies, trade associations, etc. have argued that frivolous lawsuits are "clogging" the U.S. court system, consider the likely source of this information and claim. There are plenty of controls in place to prevent truly frivolous lawsuits from going very far particularly when there is an inadequate case. It is infrequent that frivolous cases make it to trial.

HFE Viewpoint

Earlier in this chapter, the beginnings of the HFE discipline were discussed. In the early days, in both the cockpit and factory, HFE has traditionally and historically championed the user. One of the main goals is injury prevention. With respect to product and premises cases, the natural viewpoint of HFE discipline is more plaintiff oriented than defense oriented because the fundamental principles of the field comport more closely with the user. Most fundamental to the relationship with users is that people have limitations and they make errors. Bad intentions are usually not the root cause of most human error problems. Systems need to be designed to be resilient so that simple foreseeable mistakes do not result in tragedies. A fundamental attribution error, a cognitive-heuristic bias that is well known in psychology, is for observers to blame the recipient of injury rather than blaming the situational aspects that may be the actual and main cause of the negative outcome. When the error happens to oneself, then the attribution pattern is reversed. The point is that it is not unusual for users to be set up to fail by the situation that they are placed in. People have developed assumptions and beliefs from prior experience, and most of those beliefs are adequate to get through life, but sometimes those expectations and beliefs are erroneous. The ones that are not corrected in some way could lead to incorrect judgments and acts. Instead, HFE professionals would like for products and environments be designed to guide people to do the right and safe thing.

Topics

The topics involved in the scenarios can be categorized in a number of ways. One way is the demographics of parties injured. The initial set of case studies concern (or relate to) children and their caretakers, while the later case studies mainly focus on adults and adult-type circumstances such as driving and work.

The heavy focus on children in this volume is reflective of some of the same emphases that the U.S. Consumer Product Safety Commission's (CPSC) has with respect to dangerous products in the U.S. marketplace. Children are particularly vulnerable and as a consequence they are acutely susceptible to injury. The youngest children at risk from a product related injury have not developed adult-level physical and cognitive skills and may not recognize certain hazards. The youngest of children cannot express themselves beyond the general cue of discomfort and pain by crying. With maturational development, children's capabilities change over time, which adds to the difficulty knowing what they are capable of. Caretakers, who are considered responsible for their children's safety, also have varied abilities and limitations as well. Caretakers start out inexperienced in the role, often do not recognize the hazards of products or situations to children, and are under multiple demands. In this sense, the focus on children is also about adults, their caretakers.

In the second half of the book, the topics are mostly relevant to adult activities. Some of them concern work and home activities, whereas others involve transportation-related issues.

For a preliminary idea of the book's topical content, the following list contains chapter numbers, products/situations involved, and a sampling of key words.

Chapter #—Products/Situations—Key words

04-Sleep Positioner—child care, hidden hazard, expectations, suffocation, recall, banning

05-Window Blind Cord—child hazard, hidden hazard, expectation, hanging, strangulation

06-Baby Seat—marketing, expectations, time period of relevance, guarding, no restraint, seat belt, warning

07-Furniture Tip-Over—child hazard, hidden hazard, relevance, affordance, design, guarding, wall attachment, drawers, warning, symbols, pictorials, location

08-Children's Scissors—child hazard, visual cues of appropriateness, rounded tips color, school supply, catalog

09-Lead Consumption—child hazard, investigation, inhalation/consumption, inadequate warning, hazard elimination, substitute design

10-Button Battery—child hazard, small part, child prevention enclosure, guarding

11-Grill Brush—bristle ingestion, food preparation, consumption, visual detection, infection, design, embossed print, warning

12-Lithium Battery—laptop computer, fire, defective part, warning, burns

13-Cement Sealer—chemical solvent, extremely flammable vapor, expectations, warning design, explosion, burns

14-Paint Shredder Machine—two-handed operation, ladder, fall from height, supplemental support, guarding, warning, restraint, employee, employer

15-Pedestrian Trips and Falls—hazards in walkways, built environment, expectation, visual detection, fractures, older adults

16-Mid-Block Pedestrian Crosswalk—fractures, pedestrian in the road, expectation, yielding, attention, distraction, vehicle operation, pedestrian, visibility

17-Nighttime Driving—alcohol, pedestrian, driving task, pedestrian, visual detection, alcohol, expectation, response time

18-Crossing into Oncoming Traffic—lane departure, traffic, two-lane road, unclear decision point, assumption, response time

19-ROPs (Rollover Protective Structure)—residential riding mowers, knowledge, cost, restraint system, crush death broken neck, paralysis, death

20-Reclined Seat—convenience feature, restraint, product testing, inadequate warning

21-Recycling Truck—obscured visibility, optional equipment, task analysis, lockout/tagout, amputation, crush injury

The present chapter serves as an introduction to the book. After this chapter and before the case study chapters, there are two chapters that may assist readers in the HFE analyses given in the case studies. Chapter 2 concerns hazard analysis and the hazard-control hierarchy. Chapter 3 describes the Communication-Human Information Processing (C-HIP) model, which concerns the processes involved in conveying safety information. The last chapter (Chapter 22) summarizes some main take-away points from this collection of case studies.

The reader may be curious about some of the titles of the case-study chapters. They vary from the straight-and-narrow to the slightly outlandish to the outright concealed. The editor encouraged the authors to use an interesting title that would not completely tell what the chapter was about without reading it. The mystery and, sometimes, irony, was done in honor of Steven M. Casey and his captivating, well-written books on HFE issues in everyday life. His two case study books are *Set Phasers on Stun* (1998, Aegean), and *Atomic Café: And Other True Tales of Design, Technology, and Human Error* (2006, Aegean). Casey used oddball names for his chapter titles. To acknowledge his contribution to HFE, this book trends towards using chapter names that are somewhat offbeat as well. Compared to Casey's book, the current book's case studies have a different style–with more structure, detail, analyses, and potential solutions.

This book is intended to promote the use of HFE analysis in applicable situations to predict, prevent, and explain injury scenarios. It is believed that awareness of HFE and what it offers could assist in developing safer products through consideration and use of methods to effectively analyze and control hazards. The methods and lessons learned are generalizable and can be used with other products and situations beyond those used as examples in this book.

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