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General Final Comments

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In this final chapter of the book, some general comments are offered.

The book's main focus is the analysis of injury cases from a HFE perspective. In doing so, the chapter authors use basic HFE methodologies to structure and conduct their investigations. The findings from the analyses reveal considerable consistency in how hazards can discovered and categorized.

The HFE approach focuses on the person–machine interface (interaction) in environments doing tasks. And it incorporates consideration of people's abilities and limitations and how they could affect product use and safety. HFE perspectives can enhance investigations for several reasons; these are discussed in the next paragraphs.

All too often, the product (or task or environment) is considered in isolation without consideration of the human aspects. The concern is at the interface between people and things—their interaction is where the action is. People have differing abilities/limitations; they get fatigued; they get distracted, and so forth. Without consideration of how people work together with things (including products, machines, equipment, environments), intended use and foreseeable misuse (i.e., anticipatable improper use) cannot be determined and protected against (Wogalter, 2019a, Chapter 1, in this volume). Protecting against negative consequences of foreseeable misuse is important because manufacturers have the

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responsibility of selling reasonably safe products. To accomplish this, they need to analyze their product for hazards and control them in one or more ways.

HFE is uniquely concerned with the intersection or interface of people and things (products, environments) doing tasks. HFE professionals have expertise in the study and science of people (as in psychology and other social/behavioral sciences) *and* things (as in engineering, architecture, and other fields). The HFE field arose from applied or problem issues such as poor physical working conditions of employees and aircraft crashes. A main thrust in the early years of HFE was "championing the user" because the design of things did not take into account user experiences pertaining to their performance, comfort and safety. Finding out what users do with products and equipment in the field was not being conducted, and later, if something bad were to happen involving a product (machine, etc.), the operator is invariably blamed and the event commonly labeled as "human error." The operator being wholly at fault is hardly ever true. It, however, is the easiest, quickest conclusion to make, but this simple label does not get to the root cause of the problem. Without the proper investigation, the actual reasons for the failure are not available to learn and use for future benefit. Proper investigation could reduce the injury's likelihood in the future. Frequently, however, the person or operator who made the error was set up by the circumstances that made the error more likely to occur (e.g., Woods, Dekker, Cook, Johannesen, & Sarter, 2010). A whole host of factors can be influential in putting people into position to make an error, such as emphasis on speed (of production), an undermining and discouraging safety culture, poor task design, weak training, etc. There are also aspects such as distraction, fatigue, high mental workload, illness, etc. that could make errors more likely. Even under highly optimal conditions, people are not totally perfect.

Thus, when doing a comprehensive hazard analysis, it should not be expected that humans will always perform faultlessly. It is perilous to expect perfection or to expect that people will always do "as directed." The design of a human-product system should be purposely made so that if an error occurs, it will not result in a disaster. Preferably, products (machines, etc.) should fail in a safe mode. Simple, inadvertent errors leading to severe consequences should be difficult to do and occur very infrequently. The product should be designed to make it easy to do the correct behavior and hard to do the incorrect behavior. Systems need to be resilient such that anticipatable potential mistakes (foreseeable misuses) are prevented by one or several hazard control methods. Should an error occur, the goal of the design is to avoid bad things from happening. Figuring out potential error-prone circumstances and controlling them is complex. This is why studying detailed case studies where injuries or property damage have occurred is worthwhile. Histories of other cases where similar types of errors (not just product specific ones) can be used to predict problems.

People are integral part of product and equipment use. Very few engineered systems lack human beings in them. Anticipation of problems should be broad and deep at the front end of product design and not as an afterthought where the only corrections that are made are to add a line or two to the product manual or package insert sheet. There are many examples of warnings not doing their intended job. Warnings can be a useful method of hazard control but they should be integrated with the design and guarding as an upfront development process—before anyone gets hurt. Some manufacturers require that a HFE review be given in the early product-development stages, purposely trying to avoid being too late to make proper fixes. Safety strategies for the whole lifespan of the product should be considered.

Detailed case studies such as those in this book can provide useful information to help make future injury cases less frequent. Formal analyses expose areas most likely to cause problems so that efforts for risk reduction can be focused toward relevant, targeted correction (rather than wasting time, effort or money on aspects that are less relevant or important).

Forensic

With the term "forensic" in the title, some readers might have expected that the book's focus would concern the expert witness role in litigation. "Forensic" is used in this book to describe the processes involved investigating and explaining the causes of injury events. The book is not about the specific activities and experiences of expert witnessing in legal cases. Tasks and techniques such as drawing up retention contracts, strategies and methods to use in testifying at deposition and/or trial, or other experiences in participating as an expert witness are not covered except very briefly in some case studies. These aspects were purposely deemphasized to focus on HFE analysis of the injury scenario. Some coverage of expert witnessing is expected since the injury scenarios are derived in part from legal cases and the fact that most of the chapter authors actively consult in litigation work. Some authors have participated in hundreds or more personal injury and premises liability cases.

While the case studies are derived from litigation, names, places, and some of the details etc., were changed or combined so as not to reveal private or confidential information. (Any specific details that are similar to actual cases are coincidental.) It is not the intention of this book, or the HFE experts who participated as chapter authors, or the HFE discipline itself, to negative impact any entity.

Chapters 2 and 3 were intended to offer an introduction to hazard analysis and hazard control, and the C-HIP model. Some examples on how these topics relate to the case studies are discussed in the next sections.

Hazard Analysis

Hazard analysis was discussed in Chapter 2. A common theme across many of the case study analyses is that insufficient hazard analyses were done by manufacturers to look for hazards. In several of the case studies, the hazards that befell people were (or should have been) foreseeable had a hazard analysis been carried out by the manufacturer. A few examples illustrate this.

Consider the scenario about the inadvertent respiration of lead dust brought home on clothing from a product used in work (Wogalter & Kalsher, 2019, Chapter 9, this volume). The manufacturer of the product knew there was lead in the product. Indeed, its container label stated that it contained lead and warned not to swallow it but did not warn that after the paste dries that there is a hazard of respiring the resulting dust. A thorough hazard analysis of how the product would be used would have likely picked this up.

Another example in which hazard analysis was either not done or incompletely done was detailed in the chapter on infant sleep positioner (Deppa & Allen, 2019, Chapter 4, this volume). In that case, the entrepreneur/manufacturer was not aware of literature that would have cued potential problems with children's sleep products.

Manufacturers (and importers) typically use third-party testing laboratories as their quality control check. These labs test some aspects such as (or mainly) whether the product as manufactured fulfills pertinent regulations and standards. However, they almost never do testing beyond a defined set of checklist items. They do not check everything pertinent to safety. For example, the third-party testing laboratories may verify that all regulations and standards have been met and that all "required" labels are present, but not whether the labels adequately warn about the product's potential hazards. The manufacturer has to do that assessment or be sure that other entities do it for them.

Hazard analysis is an ongoing process. The emphasis is to look for hazards before the product is released for sale but it is clear in many of cases that problems can become apparent after it is sold and in the hands of consumers and employees. Problems can be found in several ways, such as U.S. CPSC's reporting of injuries and deaths (and other government agencies and organizations), post-sale complaints from users to the company's call center, narrative reviews of the product on the Internet, lawsuits, etc. These reported incidents and near misses can be "early warnings," even if particular events did not result in serious injuries.

Hazard Control

After it is determined that there are potential hazards, manufacturers should try to control them in one or several ways. The basic hazard control hierarchy is to design out or reduce hazards, guard against them, and warn about them in that prioritized order. A few words about each of these strategies in relation to the case studies are given below.

Design

With respect to designing out the hazard, the lead consumption case serves as an example. In that case (Wogalter & Kalsher, 2019, Chapter 9, in this volume), there was an effective substitute for lead that functioned the same as the lead-based product but was less hazardous. The substitute eliminates the mental retardation hazard for children, although the redesigned product is probably not completely hazard free.

Guarding

Guarding can be an effective way to control hazards. One example of the need to guard was shown with the baby seat case study (Mayhorn & Wogalter, 2019, Chapter 6, this volume). Even though the seat retains most babies in place, there is the significant problem that a few babies are able to get out. This problem clearly calls for redesign of the seat and/or the addition of a guard to prevent babies that would otherwise get out from doing so. The most prevalent guard for seating is seat belts. Another example of guarding and seat belts is the case study on rollover protection (ROPS) for residential riding mowers (Lenorovitz, Karnes, & Wogalter, 2019, Chapter 19, in this volume).

Warning

HFE would prefer better designs and guarding to make products safe rather to warn about hazards. Warnings should not be expected to compensate for poor design and guarding. But warnings are an appropriate adjunct to those methods (Lehto & Salvendy, 1995). There were many case studies in which warnings were the main or even sole hazard control method used. Generally, warnings are not the best solution for controlling hazards because they do not do the job as well as the other two methods: designing out the hazard or guarding against it.

Warnings cannot totally prevent all injury events for number of reasons. To be effective, warnings need to influence people, which is not a particularly easy thing to do. It is well known in HFE that it is better and easier to change the product or environment than it is to change the persons involved (e.g., Sanders & McCormick, 1993). As many of the case studies illustrate, the warnings provided were not effective because their design or placement limited perceptual and cognitive processing. In many of the cases, the warnings appear to have been done as an afterthought (after the product had already been designed and built), and where numerous basic HFE warning-design principles were violated. Some of the problems cited were the absence of (in whole or in part): basic information such as the nature of the hazard, instructions on how to avoid the hazard, and the potential injury consequences. In several cases, the manufacturer's warning never reached the end user at risk, or was given in location where it was not likely to be seen. There were also problems of low salience/poor formatting, illegibility, lack of pictorial symbols, non-persuasive expression of language, etc. Not doing a reasonable job at conveying necessary warnings has obvious drawbacks to users and in many instances, to the companies that produced the product.

As mentioned, the basic hazard control hierarchy has three linear, prioritized stages. However, the production of a reasonably safe product usually involves (or at least considers) all of the strategies. The model with feedback loops shown in Figure 2.2 in Chapter 2 (Wogalter, 2019b, this volume) shows some of the complexity that serve to extend the basic hazard-control model. For example, when attempts at warning are not working adequately to control the hazard then there is a need to either make better warnings or to take a step or two back up the hierarchy and reconsider the earlier stages of hazard elimination and guarding. An example of this was given in the baby seat example (Mayhorn & Wogalter, Chapter 6, this volume). Adding another warning was done in the first recall of the product, but this new warning did not (and could not) do a fully adequate job. The follow up course of action (second recall) was not to do another warning but to go back up the hierarchy to a guarding solution with that being the addition of seatbelts.

Even beyond this more complex model in Figure 2.2, other strategies can be considered such as post-sale product recalls, or when nothing works, the complete banning of the product by the U.S. CPSC. In employment situations, additional hazard control methods are available. They can be conducted by supervisors (supervisory or administrative rules) and training. Another point to be made is that manufacturers can make the decision not to sell a product that cannot be controlled by feasible hazard control methods. In other words, a product may not be sellable because it cannot be made reasonably safe leading the responsible, prudent manufacturer not to introduce it into the marketplace or to stop manufacturing it on its own.

C-HIP

In Chapter 3 (Wogalter, 2019c, in this volume), the communication-human information processing (C-HIP) model was described as a way to organize and put structure into the processing of safety communications, such as warnings. C-HIP model can organize and pin point breakdowns in perceptual and cognitive processing. In some cases, a breakdown could occur early on, as for example, the failure to properly deliver a warning. An example is the grill brush case study in Chapter 11 (Wogalter, 2019d) in this volume. The warning was hidden inside a detachable part of the brush. It was not visually exposed, which essentially prevents attention being given to it by the person at risk. Even if the replaceable brush head is detached and the warning is "exposed," the printing might not be noticed because the print is simply molded on (embossed) so it was practically illegible (black on black print) except under specific illumination conditions. Thus, both attention switch and maintenance stages of C-HIP model were violated. A warning more likely to work will be visible on the brush's outer-most exterior surface and have conspicuous, legible print (among other characteristics). In another example, the hazard of a button battery, as a dangerous small part for young children, was not recognized in part because it was hidden inside a remote control unit and there was no warning about the hazard on the product or in the accompanying materials (Miller & Cook, 2019, Chapter 10, in this volume). Another example is the worker who cannot be seen working inside a hopper of a recycling truck by the driver/operator which resulted in severe personal injury when the compactor blade was started (Vigilante, 2019, Chapter 21, in this volume). No warning was effectively presented about the fire hazard of a computer's lithium battery even though a warning could have been deftly presented (Lenorovitz, 2019, Chapter 12, in this volume).

In many of the case studies, the warnings lacked relevant hazard-related information. For example, in the residential zero turn radius (ZTR) riding mower case study (Lenorovitz et al., 2019, Chapter 19 in this volume), the purchaser/operator was not specifically told by the salesperson or by printed on-product or manual warnings) that it was necessary to have ROPS and seatbelts when mowing lawns with virtually any kind of slope. In the furniture tip-over case study (Kalsher & Wogalter, 2019, Chapter 7, in this volume), the caretakers were unaware that big heavy furniture could be tipped over by a small young child. Additionally, in the case study about flammable vapor being ignited by a water heater pilot light (Wogalter, Mayhorn, & Laughery, 2019, Chapter 13, in this volume), the warnings did not provide adequate information to understand that the vapor emitted by the product is heavier than air, and that it could travel substantial distances to an ignition source located elsewhere in a residence. In the aforementioned cases, the information was known within the industry (or was knowable had the manufacturer looked for the information as part of its hazard analysis), but was not provided to consumers.

Beliefs and expectations are based on memory structures built from people's broad experiences and are considered knowledge that is reasonably true. From experience, people expect things to "perform" in certain ways. Consumers' beliefs were violated in a number of the case studies and were most particularly evident in the chapters involving child hazards. Several of these case studies indicated that the caregivers were unaware of the hazard. For example, window blind cords are generally not considered a hazard except for the fact that young children of certain ages could be strangled by them (Pollack-Nelson, 2019, Chapter 5, in this volume). A large, heavy chest of drawers does not appear to be a hazard relative to a small, lightweight child (Kalsher & Wogalter, 2019, Chapter 7, in this volume). In the scissors case study (Vredenburgh, Zackowitz, & Vredenburgh, 2019, Chapter 8, in this volume), colorful, rounded tip scissors sold from a school supply catalog were misrecognized as being appropriate for young children when, in fact, they were particularly sharp. There was also misrecognition of the situation by the driver and pedestrian in the midblock pedestrian crossing case study (Zackowitz, Vredenburgh & Vredenburgh, 2019, Chapter 16, in this volume), in the nighttime pedestrian fatality case study (Mortimer, 2019, Chapter 17 in this volume), or when another vehicle is approaching in the same lane in the opposing direction (Cohen & Cohen, 2019, Chapter 18, in this volume). People have the reasonable expectation that built environments are safe to traverse across (Cohen & LaRue, 2019, Chapter 15, in this volume).

A later stage of the C-HIP model is motivation. Motivation can be defined as differential willingness to take action to do something. The action pertaining to warnings is overt compliance behavior, but it is usually measured indirectly by subjective (e.g., rating) assessments. In general, precaution or compliance is greater if severe injury consequences of permanent injury or death is known or conveyed by a warning compared to less serious injury outcomes.

Infants and young children are particularly vulnerable to injury. Mothers will go to extraordinary lengths to protect their children. This being generally so, caretakers would likely have high willingness to carry out safety related behaviors with respect to children under their care if they are provided adequate safety information. A common statement in warnings for a variety of products is to supervise children. No one can look at his or her child 100% of time, so there likely will be some gray area concerning the extent to which a parent or caretaker supervised a child before the child was injured. However, as was apparent in several injury scenarios, these events can happen very quickly (even with close supervision), with caretakers reporting a disbelief that the child was capable of doing what he or she did. Caretakers may be unaware of hazards because of a breakdown in the stages described in the C-HIP model. The point here is that motivation and willingness to carry out safe behavior is likely to be elevated, at least with the care of children. Frequently, a main problem appears to be a lack of knowledge—that processing never got to the motivation stage. If caretakers had been told about the hazard in effective ways the vast majority would be motivated to take action to reduce the risk.

Human Error

One of the main lessons in product development is: Consider the human. Humans make errors. HFE tries to reduce their frequency and their negative effects. This book analyzes injury events after-the-fact but as many of the case studies indicate there is usually some history of the event (or similar events) having occurred before. Based on those previous instances and the fallibility of humans, future or potential problems can be predicted and hopefully prevented by appropriate hazard control strategies. Post-event injury scenarios should not be forgotten. There are lessons to learn from them. The depth of evidence revealed in legal cases is useful to study because something like them could happen again. Given this, it makes sense to design, guard and warn so that if those events occur again, the outcome is benign and safe, rather than result in severe injury or death. The idea is to add resilience into the system so that if an error is occurs then the consequences are not disastrous.

Marketing

Some of the case studies noted the influence of marketing affecting people's beliefs. Advertising is a massive business in almost every measureable respect. There are many kinds of advertising media including TV, radio, print, web, and product packaging, among others. The goal of advertising is to make impressions on people to influence their beliefs in a direction desired by the advertiser. The impression desired may be to increase the likelihood of purchasing a product or service, for reputation development or maintenance, putting forward a particular perspective, etc. Clearly, advertising is a diverse and complex area. In relation to this book, advertising and marketing intersect with safety beliefs. The goal of creating or maintaining positive beliefs about a product, service, brand, company, or industry can be, and often is, in opposition to the goal of warning about hazards. Advertising makes people feel familiar and comfortable with the products shown, even when we may have never actually tried the product or service. TV advertisements seldom warn about any hazards. In the U.S., the exception is prescription medications as well as financial disclosures (e.g., for loans and brokerages). They may instruct to "use as directed" or to "use responsibly" or some other disclaimer but nothing is usually said about what *not* to do and why. Typically, only positives about the product are given. Repetition can make a formidable and steadfast impression on recipients that the product has benefits with no indication or even suggestion that there might be risks. Indeed the product may have numerous negatives that go unsaid in marketing communications. Advertising communications tend to be very one-sided, giving just part of the story. This means that warnings need to work harder (be more effectively delivered) when people have inaccurate beliefs about safety. If people believe the product is safe, there is no impetus to be particularly cautious such as looking for or reading warnings. This has been called anti-warnings (Egilmann & Bohme, 2006). It means that even stronger, better warnings are needed to overcome incongruous beliefs about a product's risks (and benefits). The danger of an out-of-balance presentation is the reason that the U.S. Food and Drug Administration (FDA) requires that advertisements for prescription drugs provide information on both risks and benefits. The FDA can issue a warning letter to companies that violate that balance or seem deceptive.

These concepts are related to people's expectation that products sold in the U.S. are reasonably safe (Kim, Wogalter, & Taylor, 2011). Many people believe it is more trouble than it is worth to read owner's manuals (Mehlenbacher, Wogalter, & Laughery, 2002; Wogalter & Laughery, 2015; Wogalter, Vigilante, & Baneth, 1998). Supporting people's beliefs and behavior, owner's manuals are typically very poorly designed with respect to warnings presented. For example, important warnings may be buried deep in a manual of many pages of dense text, and may lack adequate content such as nature and seriousness of the hazard. People tend to read the owner's manuals only when problems arise during use or a particular feature is of interest. In the case study about seat recline (Laughery & Wogalter, 2019, Chapter 20, in this volume), it was indicated that few people will likely read the pages of the manual concerning seat belts because many assume they already know what they need to know about seatbelts. Thus, they may never see or read the warnings in the manual about the danger of the passenger seat being reclined while the vehicle is in motion. Prominent and persuasive warnings would be needed to overcome incorrect beliefs.

Thus, a point that cuts across many of the case studies is that warnings need to be considered more seriously than is commonly done. If warnings are being relied on to do the work necessary for effective hazard control, then companies need to consider the factors that influence warning effectiveness, a domain that has been studied extensively in the HFE literature (e.g., Wogalter, 2006). With better warnings, fewer people will get hurt and consequently there will be fewer lawsuits and less personal and financial loss. Similarly, getting a handle on the variables that lead to injury and using the lessons learned can help prevent future injury.

Importers are Manufacturers

U.S. companies that import goods to the U.S. are considered to be the product's manufacturer and this means they have the same responsibilities to the U.S. consumers as if they actually put together or assembled the product (i.e., despite it being made by a different company outside the U.S.). This is important because too frequently the importer does not know or realize that they need to be sure that their product is adequately safe for the U.S. population. For example, warnings printed in poor English (or Spanish), that are disorganized, inconspicuous or even absent when brought into the U.S. are likely to receive scrutiny and criticism if users get hurt in ways pertinent to the warnings. The importer needs to ensure that the product's design, guarding and warning are adequate. It should not be expected that a manufacturing plant in another country would know what U.S. users need and expect; the importer is responsible for that.

Regulations and Standards

The U.S. civil legal system provides an outlet for assigning liability to companies for unreasonably dangerous products. While government regulations and statutes can aid product safety, the process is often slow and cumbersome and may not make a product or environment reasonably safe. The government cannot know everything about every aspect of every product and make regulations for everything. Sometimes industries (e.g., groups of manufacturers) handle the incorporation of some aspects of safety by developing product standards, but the standards are generally voluntary, except when incorporated into law. Like regulations, standards do not cover every aspect that may be important for safety. The standards are the best the standards' committees (mostly industry representatives) can agree upon, and as a result they are always incomplete with respect to safety. Standards are often considered minimums, not a checklist of everything that should be done for user safety.

Manufacturers are usually considered to have superior knowledge of their product relative to other entities, but particularly with respect to consumers. Therefore, manufacturers themselves must consider aspects of their product that are not covered by government regulations and industry standards that affect personal safety. This is why manufacturers who make profits from the sale of their product are supposed to use some time, money and effort to ensure the products that they sell are reasonably safe and to manage risk so as to avoid injuries and property damage. If manufacturers do not do this, they leave open the potential for claims after relevant injury in civil lawsuits after an alleged injury that the product or environment is not reasonably safe even though it may have complied with all regulations and applicable standards.

There are a lot of dynamics of legal cases, some of which are never overtly revealed to the public. Most of these cases are generally resolved out of court by mutual agreement between opposing attorneys (i.e., settled), and the terms are usually not disclosed publicly. Confidential settlements are used as a strategy of risk management—to make it difficult and expensive for another party to bring suit by limiting access to the information and to silence potentially hurtful publicity. Most of the cases described in this book were "settled" before trial. Sometimes, the loss of money and reputation (which could influence sales) is the fastest agent of safety-related change compared to regulations or standards.

Different Analyses

Readers of the case studies might reasonably disagree with the analyses and conclusion that authors have made. People have different philosophies and are attuned to different pieces of evidence. Regardless of whether one is in agreement or disagreement with the authors' analyses in whole and in part, the exercise remains useful as it takes note of some of the factors that may be important in causing injury events. Of course each case is different, and so there may be different facts that are given greater perceived weight than others. It is also important to be reminded that the case studies do not contain all of the evidence that would be presented and available in legal cases due to space constraints and the withholding of private or confidential information.

HFE Professionals Assisting Companies

As products become more complicated, consideration of HFE is important particularly if some kinds of product use and misuse can lead to injuries. Plaintiffs (the injured party) may file a lawsuit against one or more defendants allegedly responsible for those negative consequences. While more industries are considering HFE in their product's design and manufacturing processes, some have not done so. It is not unusual for representatives of product manufacturers (and other entities) in lawsuits to report being unaware of the field of HFE and what it can offer in terms of improving people's interactions with products or environments. Sometimes a HFE expert's report is the first time the manufacturer's designated representative have heard of the field, which is unfortunate and hopefully this will change in the future.

Some companies might hire HFE experts to be on staff and work with the design of products during the development and design stages, and throughout the products' lifespan. Other companies might hire outside consultants to give HFE input on questions and issues that they have. A HFE practitioner hired by a company would preferably like to learn expansive information about a product so as to consider a broad range of different alternatives and make informed recommendations (as e.g., in prioritization of certain warnings over others, see e.g., Vigilante & Wogalter, 1997). Access to and discussions with people designing the product, engineers specifying and producing it, persons writing the documentation and warnings, sales and marketing, and even lawyers, etc. could be information to produce better recommendations by the HFE consultant. It means that the company needs to open up to the HFE person about all of the issues so that appropriate assistance can be given.

The HFE professional can offer a perspective that might not otherwise be heard or known about. Of course, HFE is but one voice of several voices contributing to product development, production, sales, and service. But without an HFE person involved, there is often no one championing the user or doing it adequately.

A common request of an HFE practitioner working with a manufacturer or industry group is: will you make us a better warning for a particular hazard? The request is usually about a specific problem (not about other problems) and it might not be the worst hazard associated with product. Thus the request may be incomplete. At the same time, a HFE should probably not refuse assistance on the grounds that they may not be able to do all the things as perfectly as they would like. For example, consider that just before a product is released, it is found that people are using the product improperly. While the best strategy is to study more about the issue, collect data, etc., there will likely be severe restraints at that point in time. Thus, sometimes the HFE practitioner must do what he or she can, that is, to satisfice, particularly if it would be an uphill and probably unsuccessful battle to try to stop the production of the product at the final stages because of HFE concerns. Hopefully the issues can be fixed subsequently or in a future iteration of the product. To avoid such problems, HFE practitioners would like to offer input at the early design stages to help ensure human-interface success and safety.

HFE References

Lastly, because some readers might like some suggestions on books about HFE, here are several—some are older and some are recent. In alphabetical order, they are: Bridger (2017), Cuevas, Velázquez, and Dattel (2017), Guastello (2013), Lee, Wickens, Liu, and Boyle (2017), Lidwell, Holden, and Butler (2010), Norman, (2013), Proctor and Van Zandt (2008), Reason (1990, 2013), Salvendy (2012), Sanders and McCormick (1993), Stone, Chaparro, Keebler, Chaparro, & McConnell (2017), Tillman, Tillman, Rose, and Woodson (2016), Vicente (2004), Wickens, Hollands, Banbury, and Parasuraman (2012), and Woods et al. (2010). The titles and publishers are listed in the references section below.

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