The Product Safety Engineering Newsletter

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President's Message

Hello Product Safety Engineering Society Members,

Welcome to the 4th year of the Product Safety Engineering Society. It appears that PSES is here to stay. The society appears now to be financially viable. The IEEE has restructured its infrastructure charges to the individual Societies. The new model is much better for the PSES financially. We just need to get the word out to let people with product safety engineering interests know that we exist and to join the society!

Henry Benitez

The PSES Board of Directors met last month in Los Angeles. We brainstormed ideas to increase membership, provide more technical activities, increase the size and breadth of our conferences and to plant the seeds for a full fledged PSES peer reviewed technical journal. We are always open to ideas from our membership to know what you want from your society. The PSES is still in a formative stage and may be more easily molded than well established societies. So please provide input to myself or any of your PSES Board Directors.

The board is currently planning for future conference locations. Longmont, Colorado has been selected for October 22-23, 2007. Austin, Texas will be the venue for 2008. We are looking to fill several more years out. We are also entertaining the idea for conferences

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The
Product Safety Engineering Newsletter

Newsletter Committee

IEEE PSES Officers

IEEE PSES Web Sites

http://www.ieee-pses.org/
http://www.ieee-pses.org/symposium/
http://www.ieeecommunities.org/emc-pstc
http://www.ieee-pses.org/emc-pstc.html
http://www.ieee-pses.org/newsletters.html
http://www.ieee-pses.org/pses.html

outside the United States as well for 2007 or beyond. It is preferred that a host chapter be available to help support such events although not absolutely necessary. If anyone is interested in helping to host a conference in their geographic location anywhere in the world, please let us know and we can discuss the possibilities.

Enjoy the newsletter and consider contributing articles yourself for publication in your areas of interest.

Sincerely,

Henry Benitez
IEEE Product Safety Engineering Society
h.benitez@ieee.org

Tip: ***Best way to get your boss to approve your trip to the 2007 Symposium on Compliance Engineering is to submit a paper that gets accepted for the symposium!***

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People Looking To Start Chapters

Want to start a chapter? Send your contact information to Stefan Mozar and it will be included in the chapter news. If you haave chapter updates please send them to Stefan Mozar as well at s.mozar@ieee.org.

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Technically Speaking

Technically Speaking
by Richard Nute
February, 2007

A colleague asked a question regarding a power supply unit (PSU) compliant with EN 60950-1 (for instance a Class I ATX PSU). He asked:

Looking through an ATX PSU report and also EN 60950-1 there is a requirement for the mains input to be basic insulated from earth. There is also a requirement for Double/Reinforced Insulation between mains input and the DC outputs.

However in the case of the ATX PSU the dc output ground is connected to PE, therefore wouldn't this be compromising the Double/Reinforced Insulation requirement between mains input and the DC outputs by reducing it to Basic Insulation?

The report shows that the lab tested with 1.5kV between PE and mains input, and with 3kV between mains input and DC outputs tied together, and the unit was compliant. Does this simply mean that the designed Basic Insulation is withstanding the electric strength requirement for Reinforced Insulation?

Class I construction requires two safeguards:

1: Basic Insulation between mains and earth;
2: An earthing path to carry fault current in the event of a failure of Basic Insulation.

Class II construction also requires two safeguards:

1: Basic Insulation between mains and Supplementary Insulation;
2: Supplementary Insulation between Basic Insulation and accessible conductive parts to prevent the accessible conductive parts from becoming live in the event of failure of Basic Insulation.

We assume that the low-voltage secondary circuits are accessible and therefore comprise accessible conductive parts. This is usually true as the secondary circuits are often connected to connectors with accessible terminals. Or, the secondary circuits are accessible when installing additional circuit boards.

When conventional 50-60 Hz transformers were used in power supplies, it was common to install a shield between primary windings and secondary windings. This shield was connected to earth, and could carry the fault current in the event of a fault in the Basic Insulation.

Today, such a shield in a switching-mode power supply transformer reduces the coupling of

the transformer and increases its size. So, SMPS transformers are built with Double Insulation (Basic plus Supplementary).

So, in a Class I SMPS, the Basic Insulation between primary and earth must be tested (typically at 1500 V rms).

And, the Basic plus Supplementary Insulation between primary and secondary must be tested (typically at 3000 V rms).

If the secondary is connected to earth, then both the primary-to-earth Basic Insulation and the primary-to-secondary Double Insulation is tested at the same time.

It is possible to construct a transformer such that the secondary winding can carry the fault current in the event of a fault of the Basic Insulation. In this case, the secondary winding would act as a shield as in the 50-60 Hz transformer.

However, typical SMPS uses a bridge rectifier, so the secondary is connected to earth via the rectifier. Semiconductors are not considered reliable safeguards, so the secondary circuit earthing cannot be considered as meeting the earthing requirements. So, the secondary is required to be isolated from the primary by Double Insulation.

In general, certification houses ignore the fact that when they test the Double Insulation they are also subjecting the primary circuit Basic Insulation to an excessive test voltage. Fortunately, both the minimum required clearance distance AND the solid insulation can easily pass the 3000 V rms test. (Actually, the minimum required clearance is good for about 5000 V rms; solid insulation is typically good for more than 10000 V rms.)

In some cases, the outputs of a SMPS are floating, i.e., are not connected to earth in the power supply, but are connected to earth in the end-product. In this case, the test is applied between the primary and the secondary, with the secondary not being connected to earth. In this case, the primary-earth insulation is not subjected to excessive voltage.

This construction does not reduce the primary-secondary insulation to Basic Insulation. The transformer is actually built with Double Insulation, and is separately tested BEFORE it is installed into the ATX power supply.

You are correct: The Basic Insulation is indeed subjected to the Double/Reinforced Insulation test voltage.

Certification houses SHOULD disconnect the secondary from ground while testing the primary-secondary insulation.

Here is why Basic Insulation clearance (and creepage) can pass the Double Insulation 3 kV rms test:

EN 60950-1 requires 2 mm clearance (air insulation) for Basic Insulation rated up to 300 V.

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2007 IEEE International Symposium on Electromagnetic Compatibility

EMC 2007

honolulu, hawaii

July 8-13, 2007

Hawaii Convention Center

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Education

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The breakdown of air insulation is a function of the incremental V/mm between the two conductors.

The incremental V/mm is a function of the SHAPE of the the two conductors between which the electric field exists.

The shape extremes create a homogeneous field or an inhomogeneous field.

A homogeneous field is created by two parallel planes, and is characterized by equidistant equipotential lines between the planes (or large spheres). In other words, the V/mm between the two planes is a constant.

An inhomogeneous field is created by two points, and is characterized by non-equidistant equipotential lines between the two points. The V/mm between the points is not constant. Indeed, the equipotential lines near the points have very high V/mm compared to the V/mm at the midpoint between the two points.

This means that, for a given distance between conductors, an inhomogeneous field will break down at a much lower voltage than a homogeneous field.

According to IEC 60664-1 {ed1}, Annex A, Table A1, 2 mm purely inhomogeneous field will break down at 1.68 kV rms. So, the 2 mm and 1.5 kV requirement is reasonably consistent with physics and includes a small margin. The V/mm is about 0.85 kV/mm.

On the other hand, 2 mm purely homogeneous will break down at 4.48 kV. The V/mm is about 2.5 kV/mm.

(The breakdown data is for 2000 meters above sea level. So, at sea level, the breakdown voltage is slightly higher because there is more air between the two conductors.)

In real life, we never have purely homogeneous or purely inhomogeneous fields, but something in between (and somewhat unpredictable due to the design of the clearances).

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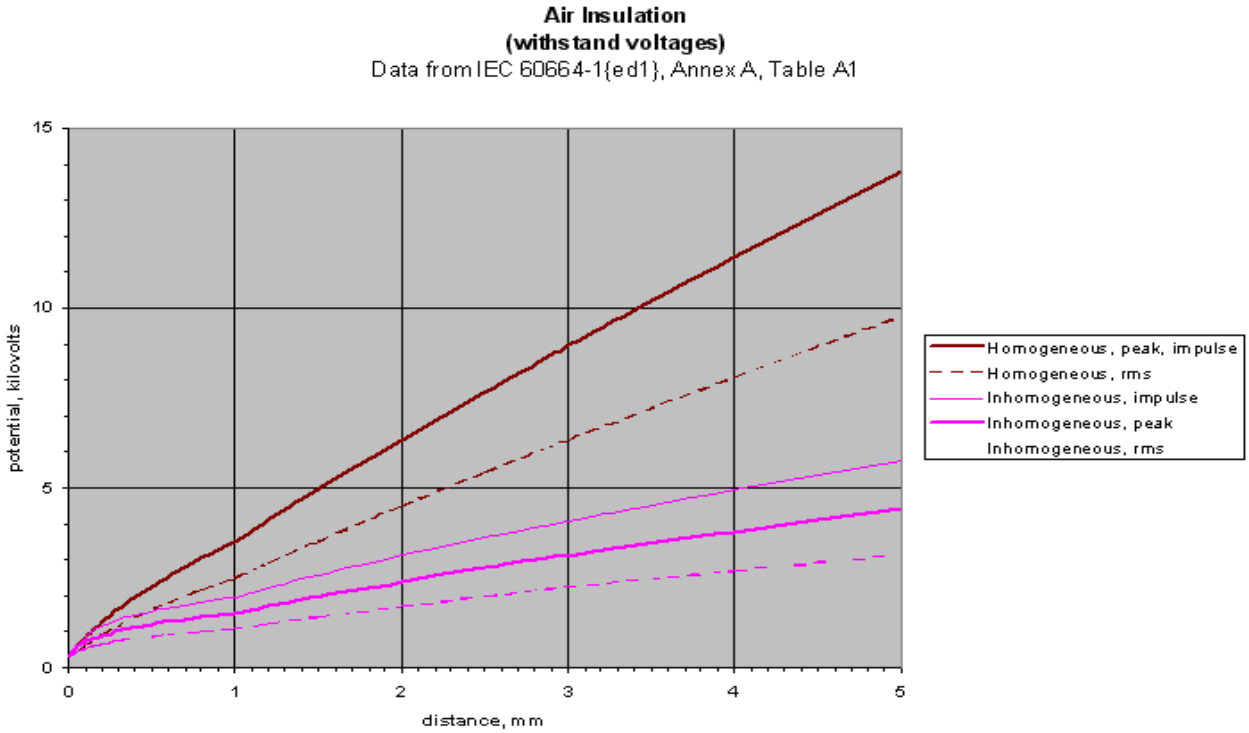
Booked your trip to the 2007 Symposium on Compliance Engineering yet?



So, if a 2 mm clearance does not break down at 3 kV, then we know the clearance is more homogeneous than inhomogeneous.

If the closest approach of two conductors is on a printed wiring board, and the pads are circular, then the shape of the field is approaching homogeneous.

And, if there is any solder mask on the pads, then the electric strength is higher because of the solid insulation.

And, most PWB layouts include some margin above the minimum, so the minimum clearance is often more than 2 mm.

Hence, in my experience, primary-earth breakdowns are in the neighborhood of 5 kV.

A creepage is the interface between air and solid insulations, which are in parallel. Physically, a creepage cannot be shorter than a clearance, but it can be longer than a clearance.

In a parallel construction (as on a PWB), the equipotential lines are unaffected by the nature of the insulation, whether air or solid. Equipotential lines exist within solid insulation. However, the V/mm of solid insulation is orders of magnitude greater than the V/mm of air.

By the way, air does not break down below about 300 V rms, regardless of distance.

*****

If you have a question about safety, and would like to see it published here, please send the question to Richard Nute, richn@ieee.org.

IEEE PSES Membership savings

UL University Offers IEEE PSES Members 15 Percent Discount

UL University (ULU) has established a discount code which will provide all IEEE-PSES members with a 15 percent discount off the price of all ULU instructor-led workshops, online programs, videos, books, and other services/products offered under the ULU brand. The discount is automatically applied during registration or purchase of ULU products. Registration or product purchase can be accomplished online at www.uluniversity.com or by calling 888-503-5536 in the U.S. or the country-specific number posted on the ULU website.

To receive the discount, members must enter or mention the discount code found in the Members Only section of the PSES website.

If you or any member has specific questions regarding ULU products or services, please call or email me or call the local country specific number posted on the UL University website.

Tony Robertson
Manager – Customer Training

Advantages of Membership in the IEEE PSES

Makes you part of a community where you will:

- Network with technical experts at local events and industry conferences.
- Receive discounts on Society conferences and symposiums registration fees.
- Participate in education and career development.
- Address product safety engineering as an applied science.
- Have access to a virtual community forum for safety engineers and technical professionals.
- Promotion and coordination of Product Safety Engineering activities with multiple IEEE Societies.
- Provide outreach to interested engineers, students and professionals.
- Have access to Society Publications.

IEEE | PSES Product Safety Engineering Society

E-Mail List: http://www.ieee-pses.org/emc-pstc.html
Virtual Community: http://www.ieeecommunities.org/emc-pstc
Symposium: http://www.ieee-pses.org/symposium/

Membership: The society ID for renewal or application is "043-0431". Yearly society fee is US $35.

NARTE Certification will Validate your Knowledge and Experience

NARTE, The National Association of Radio and Telecommunications Engineers, and the IEEE Product safety Engineering Society have signed a formal Agreement that serves as a framework within which both organizations support and cosponsor programs, or events intended to foster and promote technical awareness, education, and achievement within product safety engineering.

It is intended that this agreement will promote joint coordination and exercise of the resources of both IEEE PSES and NARTE to recognize the potential and capability of individual Engineers and Technicians in the furtherance of their technical understanding and achievement in product safety engineering, and related fields of safety engineering. NARTE is specifically engaged in the provision of credentials as recognition of, and reward for, such achievement.

NARTE serves as the certification agent for the PS Credential Certification Program. As certification agent, NARTE performs all tasks associated with the administration of the program. This includes distribution of application forms, administration including the designation of locations, times, dates and costs of completed examinations, and issuance of documents of certification.

Product Safety Credential Certification is a four-step process based on education, work experience, peer endorsement and examination. Educational requirements for engineers include graduation from an accredited four year curriculum in engineering. For technicians, education includes graduation from a trade or vocational school course in electronic technology. A number of years of direct work experience in the field is required of both engineers and technicians. Peer and supervisory endorsements are used to substantiate the credibility of the candidate.

Examinations are confined to the area of PS essentials. The target of the essential examination is to establish that a candidate has a broad knowledge in many specific areas.

NARTE will present a Workshop and will administer a Certification Examination during the IEEE PSES 2007 Symposium to be held at the Radisson Hotel & Conference Centre. The Workshop is currently scheduled for Monday, October 22nd and the Examination for Wednesday, October 24th.

Application for Product Safety (PS) credential certification may be secured by forwarding requests to:

The National Association of Radio and Telecommunications Engineers, Inc.
(NARTE)
167 Village Street
Medway, MA 02053
Telephone: 508-533-8333
800-89-NARTE
Fax: 508-533-3815
http://www.narte.org

Application forms are available on the web site. Completed application forms should be forwarded directly to NARTE.

Applications for other NARTE programs may also be submitted for examination at this event.

The Product Safety Engineering Newsletter is published quarterly during the last month of each calendar quarter. The following deadlines are necessary in order to meet that schedule.

Closing dates for submitted articles:

1Q issue: February 1
2Q issue: May 1
3Q issue: August 1
4Q issue: November 1

Closing dates for news items:

1Q issue: February 15
2Q issue: May 15
3Q issue: August 15
4Q issue: November 15

Closing dates for advertising:

1Q issue: February 15
2Q issue: May 15
3Q issue: August 15
4Q issue: November 15

We need papers, news, articles, etc. for the Newsletter, *eDJ* and Symposium.

eDJ Publication Schedule

The eDJ is published as a special section of the PSEN.
Contact Mike Sherman for details.

Symposium Author's Schedule:

Intent to present and topic (e-mail) April 29, 2007
Draft e-paper June 1, 2007
Notification of Acceptance July 6, 2007
Complete e-paper August 17, 2007

Defining and Designing for the Reasonable Person

by Greg Tolchinsky and Michael S. Morse, Ph.D.

I. Introduction

"The reasonable person is an abstract individual of ordinary mental and physical capacity who is as prudent and careful as any situation would require him to be."[1] Either the consumer, product designer, or even both can be considered negligent in a product liability case, when this "reasonable person standard" is breached. Yet, when apportioning negligence, the ambiguities in the definition of the "reasonable person" can lead a jury to delicately balance such important questions as:

- Which party must assume the higher standard of reasonableness, the consumer or the product designer?

- What defines how a reasonable consumer will act—environmental factors or the factors associated with design of the human machine?

- Should a simple warning label override the limitations ascribed unto human beings through thousands of years of evolution?

When considering the relative novelty of modern technology along the timeline that defines the evolution of human beings, one understands how a modern machine can exceed the limitations of the human machine tasked with operating it. Among the first and best examples of this appeared in the design of the fighter and bomber planes of WWII. "The complexity of these modern machines strained the capabilities of even experienced flyers."[2] Attempting to remedy the problem, operators were given more "thorough training and education. After these attempts failed to reduce the accidents and injuries, design engineers realized the impossibility of modifying people to fit machinery."[2]

With recognition of the approaching conflict between man and machine, a new science was thrust into prevalence. Human factors engineering studied the "behavior of normal people under conditions of potential danger."[3] This science gave product designers the proper tools to tailor modern technology to the consumer.

As such, it appears that to best define the reasonable person, one must consider both environmental and human design factors. More importantly, one must keep in mind that while we can change our environmental factors, we can no more change our biological design than a zebra can change its stripes. There is an envelope of human perception and performance that simply cannot be changed or exceeded. This is why the standard of reasonableness ultimately must be higher for the product designer. A reasonable consumer has little more duty than to act with common sense inherent to biology and environment, while a reasonable product designer, must understand and respect exactly what defines the reasonable consumer.

Continued on Page 16

II. Human Design Limitations

It is impossible to comprehensively analyze all complexities of human design in the span of this article. Nonetheless, this section will attempt to give general insight into a small number of human limitations that greatly impact a human being's actions and as such must become critical in product design.

A. The Eye

The physical limitations of the eye can be described by the different functions of the fovea and the periphery. The fovea, which is a portion of the retina composed nearly entirely of cone cells, is responsible for providing a viewer with visual acuity at a focal point[4]. However, beyond the boundaries of the fovea, the density of cone cells drops dramatically into an area of the retina known as the periphery, composed predominantly of rod cells. The rod cells function to orient space, but they have a much lower visual acuity and are not very responsive to static objects. The rod cells extend the spectrum of vision from the focal region to the visual boundary, occurring at about 140°.[5] This shows that anything that is 1.5° above or below one's line of sight will strike the less sensitive rod cells; and anything from 140° to 180° is out of the field of vision.[5]

Product design that expects one to see static objects in the periphery of vision, is design that expects more from the human than the limits set by the design of the human.

B. Natural Head Posture

Through the process of evolution the modern human being has developed a decreased awareness from a direction upward of the horizontal. One could attribute such an effect to the lack of a threat to humans from airborne predators. The natural static head posture of the human being is directed at a 12° to 18° angle with respect to the horizontal.[6] This declivity expresses the man's natural visual line of sight, which is further enhanced when a person walks. The static natural head posture minus the walking head posture is +4.60°.[7] A human's natural posture causes one to look earthward when walking. We can only assume this aspect of human design arose as part of the need to avoid static obstructions on the ground along the path followed by the generally earthbound human.

Modern designers must incorporate the human being's proclivity to direct himself toward the ground. Products that do not anticipate such behavior—or worse, require a non-natural posture—will ultimately be linked to failures, injuries, and litigation.

C. Mental Capacities and Attention Span

Even in relatively calm environments, human beings are continuously bombarded with large amounts of sensory data. Consider, for a moment how much processing power must be dedicated to perform even rudimentary computer analysis on a single photograph and then consider how humans constantly are analyzing vastly complex and dynamic visual and auditory fields in real time. It is pretty amazing that we can do things which supercomputers can barely even touch on.

Still, the mind cannot possibly process all the amounts of information available in the environment, forcing the human being to filter pre-cognized information, a mechanism of the human

Continued on Page 18

design known as a person's attention[8]. In the case of eyesight, with increased likelihood, the mind captures image data from large dynamic objects that are significant to the perceiver. However, in noticing these objects the mind discards a large portion of other sensory data. The discarded signals lead to the potentially detrimental effects of inattentional blindness, occurring when a person's lack of attention forces him to fail to notice something critical. The effects of inattentional blindness are enhanced by an engaged mind.[9] Humans become increasingly less likely to observe objects (that may be perceptually significant) while engaged in tasks that seem to set the boundaries for significance.

It is thus critical that product designers consider the environment and the risk that important cues will be lost to the realm of intentional blindness, making things which should seem obviously dangerous, quite invisible.

D. Human Response to Familiarity

Most manufacturing and service industry professionals believe that an operator's experience with a specific machine is directly proportional to an operator's safety with that machine. While seemingly a logical conclusion, the opposite can in fact be true. Due to a human beings inherent nature, an operator familiar with a machine can often exchange following the correct safety procedures, for a higher level of performance or a minimum amount of effort.

While the operator may feel that such an exchange is warranted, the nonoccurrence of an accident is not due to the safety of the machine. It is instead due to the lower probability of an accident with respect to a safe operation. Over time, as the operator becomes less vigilant an accident is bound to occur.[3]

E. Human Response to Warning

A correctly employed warning has the capability to alleviate some of the danger associated with a product. To be effective, a warning must evoke the following responses from the operator.[10]

- The operator must notice the warning
- The operator must read the warning
- The operator must comprehend the warning
- The operator must follow the warning

The typical environment is awash with distractions. The product designer who wants his warning to be noticed must make use of colors and wording that would stand out in such an environment. In many cultures the color red is associated with danger, making a red warning more noticeable to the average person then the same warning of another color. Words such as DANGER or CAUTION, signal icons such as an exclamation point enclosed by a triangle, or pictorial illustrations of the danger can also make a warning more noticeable. One study measured the amount of time it took a person to find two different types of warning labels on an alcoholic beverage. One warning was colored red, showed a triangle enclosing an excla-

mation point and contained a pictorial illustration of a slash over a car and cocktail glass enclosed in a circle. The other warning did not include these features. It took the average person 2.07 seconds to find the first warning as compared to 2.80 seconds for the latter.[11]

While an individual may notice a warning, whether he reads it or not is largely dependant on his beliefs and attitudes towards the product. As mentioned before, "familiarity breeds contempt,"[3] causing an individual who feels experienced or comfortable with a product to be less likely to read the warning. On the other hand, an operator who perceives a product as unusually dangerous will be much more likely to read and follow the warning. Because an individual's attitude towards a product will greatly influence whether he will read the warning, the product designer must take it upon himself to make the public aware of the dangers associated with the product.

If an individual does decide to read a warning, it is imperative that he understand and not misinterpret the danger. Considering that "almost 50 percent of Americans do not read above the 4th grade level",[12] it becomes apparent that the use of complex words and technical terms in warnings is not the most effective way to communicate a danger. The language in a warning should be intelligible to the least linguistically-abled percent of the population.

Now that the individual has noticed, read and comprehended the warning he must finally follow the safety instructions. Human actions tend to originate from a subconscious cost-benefit analysis. (As an example, try to remember the last time you watched a late-night infomercial, while the remote sat on a counter, a seemingly infinite distance away. Why did you not get up and change the channel? The answer is simple, the cost of moving from the couch was greater then the benefit of tuning out the advertisement. Advertisers count on this behavior.) Humans learn to ignore a warning labels when they feel the benefits of ignoring the label outweigh the risk of injury. One major motivator for an individual to follow a warning, is fear that the injury will be severe. Thus, a warning label with an explicit statement of dangers associated with the product can motivate an individual to follow the warning.

Still, warnings lack a guarantee that they will be followed. Relying on warnings puts the product designer at added risk. One of the greatest mistakes a product designer can make is implementing a clutter of warning labels on a product, simply to escape liability. It is important to understand that a warning does not eliminate a danger, only a design improvement can do that. Moreover a clutter of warnings is an ineffective way to reduce danger because of an individual's finite processing power.[2]

F. Human Reaction Times

To understand the human response to an emergency, one must realize that the reaction time interval starts only when the brain recognizes a danger, not when a person sees the danger.[2] Consider the scenario of an individual driving down a road, when a box appears in his path. At first considering the box empty, the person does not make any alterations to his driving. Suddenly the driver notices an object in the box. This starts the reaction time interval as the driver attempts to take preventive measures. When the driver hits the brakes, the reaction time interval stops, thus defining the extent of reaction time. If the driver had decided to steer around the box, but couldn't decide whether to go right or left, his indecision would delay the reaction time interval from starting.

The reaction time of a human being can be affected by a large number of variables, making it difficult to pinpoint an average time. The International Association of Athletic Federations (responsible for writing the rules and regulations for track and field), consider a reaction time of less than 100 milliseconds an impossibility for even the most athletic and trained human being.[13] The standard reaction time depends on the authority, for example a 700 millisecond time[14, 15] is used by some authors but a 2.5 second time is used by the American Association of State Highway Officials.[15] "One study which presented drivers with completely unexpected dangers recorded reaction times of 5.7 to 9.1 seconds."[15]

A product must be designed in such a way as to allow a human being the time to take preventive measure in case of emergency. Consider the case of Berkebile v. Brantly Helicopter Corp[16]. In 1961 Brantly manufactured a B-2 model helicopter designed such that an operator had only one second to place the helicopter into auto rotation in case of emergency engine failure. Autorotation is comparable to setting the helicopter in a glide thus making an emergency landing safer then going down at full speed. The lack of appreciation by Brantly Helicopter to the limitations of the operator was found to be partly responsible for the death of Cloyd Berkebile.

IV. Failure To consider Human Design

The authors of this article haved observed that a frequently litigated example of modern design's failure to consider human limitations occurs when an individual comes in contact with power lines. The California Public Utility Commission reported 17 "ladder related contacts" from the period of 1989 to 1997.[17] While power line contact scenarios are unique, the defense in court is often predictable. All product designers will argue that any individual who contacts a power line is not a reasonable person. Nowadays, warnings are placed on all devices that have the capability of coming into contact with power lines. Power line companies spend an incredible amount of money on campaigns to make the public aware of dangers associated with live wires. City codes have been enacted mandating that power lines not be in vertical or horizontal proximity to structures.

If human performance was solely the product of societal factors, then indeed no reasonable individual would ever come in contact with power lines. Only when accounting for limitations set by the envelope of human design, can a jury be swayed to see that the product designer has acted negligently.

Consider the case of Jerry M. Beary v. Container General Corporation.[18] Beary was an employee of an independent contractor, hired to construct a storage tank at a batch house. As Beary walked alongside a crane, uphill towards the house, the crane boom came in contact with live electrical wires, causing serious injury to Beary. One can clearly analyze how design limitations of an ordinary individual made this scenario predictable.

As previously mentioned, the human being has only a finite processing power. When involved in a task, an individual must allot some of that power to that task. If the task is a high priority to the individual, he will allot the majority of his processing power to that task, leading him to discard low priority information. Considering the complexity of Beary's work, it is not difficult to see how his attention could have been diverted from the danger of the electrical lines above. An additional variable that can diminish an individuals processing power, is that

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of an outside distraction. It would be safe to assume that Beary's environment was full of distractions. "Evidence revealed there was noise emanating from machines and passing trucks at scene of accident." Distractions such as noise consume a certain amount of processing power, leaving less for other tasks.

If awareness of power lines was indeed a low priority for Beary, a sufficient warning could have raised his conciousness to the danger. Yet, while Beary was given a verbal warning to watch out for electrical lines, he was not made aware of the high voltage on them. Simply said, the warning did not instill a sufficient amount of fear in Beary to make him fully aware of the danger.

Moreover, the static nature of electrical lines and their position at much higher then the natural head posture, would take them out of the field of vision of the ordinary individual. When presented with the human design factors relevant to this case, the jury returned a verdict in favor of Jerry M. Beary. This case was later upheld by the Superior Court of Pennsylvania.

V. Conclusion

When considering the great amounts of money spent on defending product liability lawsuits, it is easy to see the economic benefit of implementing human factors engineering in modern product design. Designers who expect hyper-vigilance that exceeds a typical (reasonable) person's ability to process the environment should plan on writing checks to lawyers and injured consumers. The same expectation should arise for designers who build their design around a wish-list for human performance rather than incorporating the known envelope of human performance into the design. There will always be humans who fail to be the reasonable person but so long as designers design for the real reasonable person (and then some), the exposure to liability will be reduced and product safety will be elevated.

Greg Tolchinsky is a student and Michael S. Morse, Ph.D. is a member of the faculty at the University of San Diego Department of Electrical Engineering. Dr. Morse is also a co-editor of the PSEN*. Contact information for Dr. Morse: gulfstar99@aol.com*

References

1. Katz v. Helbing (1928) 205 Cal. 629, 638, 271 P. 1062.

2. James E. Link, II. "Placards, Warning Labels & Operation Manuals: An Aircraft Manufacturers Duty to Warn," Journal of Air Law and Commerce, pp. 265-302, 1989-1990.

3. Frederick L. Ryder, "Human Factors Engineering in Accident Litigation: A Primer for Nontechnologists," Journal of Products Liability, vol. 10, pp. 51-59, 1987.

4. Bailey, R.W., *Human Performance Engineering: Using Human Factors/Ergonomics to Achieve Computer System Usability (2nd ed.)*, Prentice-Hall, Inc., Upper Saddle River, NJ, 1989.

5. aadfa, "Dashes – Log of Photography" online at www.dashdot.nl/wordpress/?m=200604 (April 26, 2006).

6. Cooke, MS, and SH Wei, “A Summary Five-Factor Cephalometric Analysis Based on Natural Head Posture and the True Horizontal,” *American Journal of Orthodontics and Dentofacial Orthopedics*, Volume 93, Number 1.

7. Usumez, Uysal, Orhan, and Soganci, “Relationship Between Static Natural Head Position and Head Position Measured During Walking,” *American Journal of Orthodontics and Dentofacial Orthopedics*, Volume 129, Number 1

8. Green, M, “’Inattentional Blindness’ and Conspicuity” online at www.visualexpert.com/Resources/inattentionalblindness.html, (April 25, 2006).

9. Simons, D. J., “Attentional Capture and Inattentional Blindness,” *Trends in Cognitive Sciences*, Volume 4, Number 4.

10. Michael S. Wogalter and Kenneth R. Laughery, “WARNING! Sign and Label Effectiveness,” *Current Directions in Psychological Science*, vol. 5, no. 2, pp. 33-37, 1987.

11. Kenneth R. Laughery, Stephen L. Young, Kent P. Vaubel, and John W. Brelsford, Jr., “The Noticeability of Warnings on Alcoholic Beverage Containers,” *Journal of Public Policy & Marketing*, vol. 12, no. 1, pp. 38-56, 1993.

12. Gary Weidner, “The Role of Warnings and Instructions,” IEEE PSES *Product Safety Engineering Newsletter*, vol. 2, no. 4, p. 12, 2006.

13. International Association of Athletics Federations, “Competition Rules 2006-2007,” www.iaaf.org/newsfiles/23484.pdf. (If a runner’s reaction time to a gun is less than 100 milliseconds, the runner is considered to have committed a false start.)

14. Frederick L. Ryder. “Human Factors Engineering in Accident Litigation: A Primer for Nontechnologists.” *Journal of Products Liability*, vol. 10, pp. 52, 1987.

15. James E. Link, II. “Placards, Warning Labels & Operation Manuals: An Aircraft Manufacturer’s Duty to Warn.” *Journal of Air Law and Commerce*, p. 295, 1989-1990.

16. 462 Pa. 83; 337 A.2d 893; 1975 Pa. LEXIS 837.

17. California Public Utility Commission, Electrical Injury Database, 2001.

18. 368 Pa.Super. 61, 533 A.2d 716.

Special Note: To the best of my knowledge this is the first time a student has coauthored a paper for the Product Safety Newsletter.

Jim Bacher

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Mark your calendars to attend the 2007 IEEE Symposium on Product Compliance Engineering.

Author's Schedule

Intent to present and topic (e-mail) April 29, 2007
Draft e-paper June 1, 2007
Notification of Acceptance July 6, 2007
Complete e-paper August 17, 2007

See http://www.ieee-pses.org/symposium/index.html#CFP for more details on requirements and dates.

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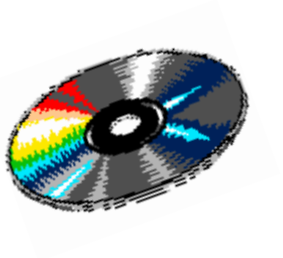

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News and Notes

Society

PSES to approach academia

The March 2006 *PSEN* noted that the PSES is developing a letter to go to the deans of engineering schools, inviting participation in the PSES. At last report, the letter remains under development.

What's new

• **Volunteers Needed as Editors** Lingfeng Chen has resigned from the News & Notes Column. We need volunteers for this column. Please contact Gary Weidner if you are interested. He can be reached at gweidner@ieee.org.

WHO-IS-IN-WHAT

"WHO-IS-IN-WHAT" project

The value of networking with others who do the same work is widely recognized. Therefore, the *PSEN* recently conducted a networking experiment.

In this department of the previous issue of *PSEN*, we published a survey of PSES members to learn what product-safety-related committees, panels, IEC National Committees, National Committee Advisory Groups, trade association technical or standards committees, and such our members belong to. The survey resulted in one response, so the "WHO-IS-IN-WHAT" project has been abandoned.

Notes

Product safety self-declaration proposal remains under consideration by U.S.-OSHA

As reported in previous issues of *PSEN*, the U.S. Occupational Safety and Health Administration (OSHA) had posted in the *Federal Register* a public notice and request for information and comments regarding a proposal to allow IT manufacturers to bypass OSHA-mandated Nationally Recognized Testing Laboratories (NRTLs) and self-certify that their products meet safety standards. The matter remains in the current OSHA Regulatory Agenda. Review of comments was scheduled to be completed during October 2006, but at this writing comments are still under review by OSHA.

Role of Warning and Instructions course

When: April 11–13, 2007
Where: University of Wisconsin, Madison, WI
What: 2-1/2 day course covers provides full treatment of safety warnings on products and in instructions
More information: http://epd.engr.wisc.edu/emaH085

New PSES Members from January 01, 2007 Through March 23, 2007

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EDITORIAL

User-UNfriendly Standards Administration

It is well known that Standards Developing Organizations (SDOs) generate a goodly share of their income by selling their published standards. It is also well known that a lot of sharing and swapping goes on among those who purchase those standards. (The situation has even been likened to the music swapping scene.) Regardless of whether or not any particular standards are fairly priced, SDOs deserve considerable sympathy regarding the sharing and swapping of their products.

Nonetheless, I was recently dismayed by the truly draconian measures being taken by one organization to prevent sharing of its standards. I learned of these measures when I purchased and downloaded a pdf copy of the new ANSI Z535.6, *Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials*. The standard is published by the National Electrical Manufacturers Association (NEMA) and distributed through global.ihs.com.

The download went in the usual smooth manner. The first problem surfaced when I went to print the standard. The printer I use does not print double-sided in a single run. I simply print the even-numbered page-sides, then flip the bundle over and print the odd-numbered pages on the other side. Not with this standard! The first discovery was that the file was doctored so that I could not access the normal Acrobat print menu and could not select even or odd pages for printing. Instead, only a generic Windows print menu with minimal options was accessible.

After printing one trial page, a message appeared informing me that I had used my one print-activation and could not print anything else. A call to Global confirmed that the file is set to allow exactly one “click of the print button.” Global remotely reset my pdf file to allow one more print run and confirmed that I would have to print everything single-sided.

I am involved in various standards-related activities, and I work on a desktop computer in the office and take a laptop to meetings. That scenario gave rise to the next two discoveries. Namely, (1) I am not permitted to copy a usable version of the document to my laptop; (2) although the two computers are networked, I am not permitted to view the desktop document on the laptop. Global confirmed that if I want the standard on my laptop, I will have to purchase a second copy.

To repeat, SDOs deserve considerable sympathy regarding the sharing and swapping of their products. However, the measures taken to protect this standard go beyond what is reasonable. Although I am not an IT-knowledgeable person, it seems to me that the SDO could have attained some reasonable measure of document protection combined with some reasonable measure of user-friendliness had it been willing to invest in suitable software modifications.

A standard that can be printed just once (and single-sided at that) and cannot even be viewed on any computer other than the specific machine to which it was downloaded is not an acceptable solution to the problem of inappropriate sharing.

—Gary Weidner

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