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Space Coast Human Factors & Ergonomics Society

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A Note from the President

By Michael Vandall

Hello Fellow SCHFES Members!

It seems that time is flying by, and here we are in May of 2011 already! Wow! Well, we have started off our year very well, I believe, with a wonderful dinner presentation from Dr. Jonathan Lazar of Towson University on the subject of "Web Accessibility: Recent Research and Policy Activity." Dr. Lazar is a wonderful speaker who brought the topic to life and raised everyone's awareness. Before I get too far ahead of myself, let me recap 2010.

We held three dinner meetings in 2010 that were also very interesting and thought and discussion provoking. The first was "Leveraging Advanced Technology Capabilities to Create Unique Design and Evaluative Tools and Metrics" by Meredith Carroll outlining their research with new eye-tracking tools and simulation-learning techniques. Dr. Daniel McCune gave a presentation on "Accident Prevention by Managing Human Error," enlightening us on how creating a culture of openness and non-judgment can drive down human errors. Finally, Dr. Kelly Neville presented on "Coping with the Complexity of the Human Element in Systems Development," reminding us what a daunting task dealing with humans and systems truly is and some ways they have found to handle that complexity.

So, what's ahead for 2011? It is our goal to organize at least three dinner meetings for this year, one of which I mentioned above. The second of which should be occurring sometime in late May by Dr. John Deaton, human factors chairperson at FIT, on his recent experiences performing human factors research in a Martian simulator in the Utah desert. In addition, this year we would like to do something for National Ergonomics Month which is October, (it also includes human factors but for convenience they shortened it), http://hfesnem.org/. This could be some sort of ergonomics/human factors awareness raising activities like giving a talk at a local school, writing an article for the local newspaper, etc. As you can see we are continuing our newsletters and new submissions are welcome for a second edition. Lastly, if possible we will hold a holiday gathering if there is sufficient interest.

In order to meet these goals we will need your help – yes, there is a catch! We would like to solicit ideas, contacts, and maybe a small amount of your time to make this year's events come to life. Our chapter can be as fulfilling as we make it, so we should all try and contribute a little something to make it good for everyone. So, please feel free to contact myself, Kim Richards, or Henry Riley with any ideas and suggestions. And thanks so very much to those who have contributed to this newsletter!

With all of that said, I will close this letter by saying that I am looking forward to the rest of this year, hope to see you all at one of our events ;-) and keep up the great work!

Cheers!

Why am I Out of Control?

By Michael Vandall

Why am I out of control? I mean, why won't my machines respond to my control inputs in a timely manner? I press, rub, push, roll, etc. yet the machine ignores my action, my intention, my goal, my need to control the thing. Like this morning, I'm rubbing, rubbing, and rubbing my touch pad, but nothing is happening – my cursor isn't moving – even after quite a few attempts. It was working just a few seconds ago – what is happening? I glance down and see the blinking can, the flogging of my hard disk, indicating that the machine is working and busy processing something while I wait patiently for it to return control to me. Normally this is not a problem for me or for the machine and I'm tolerant when it comes to technology because I realize all of the work that's going on behind the scenes, after all, I work in the field! However, it's been happening more and more often and not just on my pc. This trend of interjecting a delay in the processing of a control input seems to be widespread as the digital revolution rolls along.

Recently my wife bought a digital camera and we were excited and happy to see and get the immediate joy of having our pictures right away. But not too long after we bought the camera we started noticing a troubling behavior – the shutter wouldn't open exactly when we pressed the button or the camera didn't take the picture right away. There was a delay. Not extremely long in daily time reckoning but just long enough to miss the moments you were trying to capture. Now, my wife is an artist and photography is one of her loves. So you can imagine how well the delayed shutter goes over. According to the Shutter lag comparison site, http://www.cameras.co.uk/html/shutter-lag-comparisons.cfm?sort=ShutterLag.

Approximately half of the digital cameras have shutter lags that are greater than or equal to a third of a second. Approximately one third of digital cameras have a shutter lag greater than one half of a second, some greater than 1.5 seconds! "Life comes at you fast" - it really does, and moments are measured in milliseconds not seconds (excluding the dictionary or colloquial definitions). At least now I know about this shutter lag, but a little late.

Take another example, we own a DVD player that works fairly well; however, when turning on the player it attempts to read the disk in the drive first even though I'm pressing the eject button. I have to wait quite a while until it's finished reading the disk and doing whatever else it has to do before it will allow me to put in another disk that I really want to watch. The actual time it takes is only about 10 or 12 seconds, but when you are standing there waiting, it feels like much longer and it is annoying that the machine is ignoring my control actions and not even acknowledging that I've pressed the button. I can wait; I've got all the time in the world!

Consider the Web, albeit much improved in recent years with high speed connectivity, increased bandwidth, and processing power. Can someone please rescue me from those insidious 1 sec delays in web applications? In and of themselves these single or double second delays are nothing and wouldn't "bother" me, yet when there are a continuous barrage of them, i.e., for every one of my actions there is a 1 sec delay in response from the application as it communicates with its server or host and back again – it becomes the cyber death of a thousand cuts!

Other examples of the delay problem are too easy to find, e.g., my operating system load time is still an issue – albeit better than previous versions – it takes nearly 5 or 6 minutes! If we had to wait for our cars or light switches like we wait for the computer to boot up and become ready, we would certainly be upset and demand better performance! Another example is changing the channels on a digital, HD television. I mean, each change takes only a second or two, but why? I mean, I thought the digital revolution would make everything better, faster, etc.? We could have changed channels on an analog radio or TV instantaneously, from the point of control action to response. It seems quite prevalent that digital technology has introduced a certain "digital wait" or pause that we are adapting to, albeit some of us are less than happy about it.

Obviously, over time those seconds add up to minutes, and then, hours of our lives. Not all sites or applications are guilty of this but there are many that have interactions that have 1-2 second delays between control action and response, e.g., fetching the options of the next dropdown list, etc. This is not a smooth interaction but a choppy, awkward, frustrating transaction. This type of interaction is difficult to stay with. Reducing the number of round trips to the server/host is essential, i.e., pushing more functionality and data caching – (a fine balance certainly) - down to the client side. Any type of interaction that requires a great deal of control input or manipulation should be performed on thicker clients where the client can perform basic functions independently.

Why are these delays so important? Besides the fact that all of us have a finite lifespan or that we are typically trying to meet some deadline or goal and have limited time, there are some very good psychological reasons why and how delays affect us. First, we have a cognitive system or working memories that have a finite capacity and whose contents decay quickly over time, (Miller, 1956). Thus we take an action and expect a response or result to that action right away.

Our cognitive processing predisposes us to a need and expectation for immediate or nearly immediate responses; hence we have guidelines to provide feedback on control actions within 2 seconds. Interjecting delay thwarts or interferes with our straight-forward, smooth cognitive processing. Jakob Nielsen, human-computer interaction expert, states that 5 - 10 seconds is about the limit for keeping the users attention focused on a single thing. 1.0 sec is the limit of user's flow of thought to stay uninterrupted, and .1 seconds (100 msec) is the limit of having the user feel that the system is responding instantaneously, (Nielsen, 2010). Therefore, delays increasing greater than 1 second, a noticeable amount of time delay, equate to increasing perception of loss of control and increasing likelihood of giving up or believing that something is wrong with the system. At somewhere near 10 seconds, the user has moved their attention to something more productive.

Therefore as working memory deteriorates over time, the likelihood of staying on task decreases as the time between control action and response increase, thereby, creating negative effects for focused attention tasks, like using a web page, operating an electronic device, etc. For instance, a study funded by Akamai Corporation, conducted by Forrester research found in 2009 that, "Two seconds is the new threshold in terms of an average online shopper's expectation for a webpage to load, and 40% of shoppers will wait no more than three seconds before abandoning a retail site…" Agreed! However, I would argue that even 1 second is too long for most control action-response timings. Sure, we will embrace a 2 second response time compared to a 4 second response time, but that isn't our preference or what our cognitive system requires, and surely if we added up all those one or two seconds we would want them back if we could get them.

Delays in feedback create havoc in other contexts, i.e., dynamic decision making environments that change over time, e.g., controlling a car, flying an airplane, working within a supply chain, factory production, inventory control, managing a budget, etc. – everyday tasks. Delays in control responses cause control overshoots and system oscillations, as well as additional control actions without respect to prior actions. (Diehl & Sterman, 1995). In these dynamic contexts, delays have a deleterious effect on human performance because of our expectation that current system state is the result of current or recent control actions, i.e., a mental expectation for an immediate, temporal causality.

Users thus have a strong predisposition for systems that respond in ways that make them more immediate, instantaneous, and generally, responsive. If this cannot be accommodated, then timely animated feedback or progress indicators are warranted. However, for machines or devices, especially computers that purport to be efficient, responsive, modern, etc., the topic of feedback indicators seems superfluous. If you have to provide an animated feedback indicator just to respond to control actions, then you may be missing the mark altogether and the idea of keeping the user in control has been lost. Of course sometimes delays cannot be avoided. For those instances, responsive, timely feedback to control inputs is essential. For longer or systemic delays, e.g., dynamic decision-making tasks, providing interfaces that highlight previous control actions or that provide predictive functions can help.

What can we do? Well, these suggestions may not be new; however, they seem to still be valid:

- Include the user in the design-development lifecycle, e.g., as in user-centered design.
- Keep *user* needs, all of them, including cognitive resource constraints, active in the design, development, and evaluation of the system prior to deployment (Raskin, 2000).
- Reduce the delays between control actions and responses, i.e., .1-.2 seconds (100-200 milliseconds), and if this cannot be accomplished, then provide appropriate, timely feedback.
- Keep the *users* versus technology foremost in mind when designing and implementing, (Cooper, 1998 & 2004).
- Open the system development up to a larger audience to garner feedback before launch.
- Have a usability, human factors, or user interaction design specialist on the team.
- Change the attitude that users can wait. Part of a satisfying experience is derived from instantaneous control and responsiveness which should be feasible nowadays.

In general the digital revolution, although bringing many benefits, seems to be forgetting or leaving behind some of the most basic characteristics which our analog methods didn't suffer from, i.e., the need to be responsive to our human, cognitive capacity and the need for immediacy of control, immediate feedback, and continuous control over our own destinies, (Raskin, 2000). We can only hope that manufacturers or creators of our technologies moving forward have the presence of mind to look back and learn without throwing out the old goodness.

Remember that touch-pad I mentioned earlier? Honestly now I am dismayed yet sufficiently “beaten” to accept what is happening – the computer continues not to respond to my touch. A kind of learned helplessness has overtaken me; I have adapted, but in a less productive way. If we do not attend to this seemingly small issue now we risk slipping further away from basic human requirements, forgetting fundamentals, or worse, ignoring them in favor of the latest and greatest features and functions. Put the users back in control and keep them there!

References

September 14, 2009 - Akamai Reveals 2 Seconds as the New Threshold of Acceptability for eCommerce Web Page Response Times. http://www.akamai.com/html/about/press/releases/2009/press_091409.html

Cooper, Alan (1998 and 2004). The Inmates Are Running the Asylum: Why High-Tech Products Drive Us Crazy and How to Restore the Sanity. Sams - Pearson Educa

Miller GA (March 1956). "The magical number seven plus or minus two: some limits on our capacity for processing information". Psychological Review 63 (2): 81–97

Nielsen, Jakob (June 2010). Alertbox: Website Response Times. http://www.useit.com/alertbox/response-times.html

Raskin, Jef 2000.The Humane Interface, Addison-Wesley

Diehl, E., & Sterman, J. D. (1995). Effects of feedback complexity on dynamic decision making. Organizational Behavior and Human Decision Processes, 62(2). 198-2

HEMAP Lab

By Katrine Stelges

Katrine Stelges is an Industrial and Human Engineer with United Space Alliance with over 11 years’ experience of implementing projects that have reduced risks, improved efficiencies, and applied user inputs and human factors criteria into practical solutions. She has been recognized for her individual leadership and team efforts through Space Flight Awareness, NASA Group Achievement Awards, and performance awards on projects such as replacing Orbiter Processing Facility Operations Desks with safer, more efficient configurations putting equipment at operators’ reaches; modifying work access stands to accommodate two-person operations, tool placements, and adjustable heights; and implementing Emergency Life Support Apparatus staging units, Reinforced Carbon-Carbon In-Situ inspection equipment, and mezzanine platforms to reduce risks to personnel and collateral damage while improving staging, accountability, handling, and efficiencies.

Facilitation and expertise has also been applied to memberships on Shop Aid Approval Board, OPF Safety Committee, and Requirements Build Team; work instruction and KSC Ground Processing 101 human factors awareness training; inputs to Ground Operations Risk Assessments (GORAs) and Process Failure Modes Effects and Analyses (PFMEAs); and currently, project management and principal investigator of the Human Engineering Modeling and Performance (HEMAP) Lab and its Independent Research and Development projects.

Stelges is a Lean Six Sigma Certified Green Belt and is pursuing a second Master’s of Science degree from the University of Miami in Industrial Engineering to add to her Management of Technology industrial engineering and business management M.S. degree. Prior to joining the Industrial and Human Engineering group, Stelges was a Materials and Process Engineer with USBI, currently SRB Element, and taught secondary physical science and chemistry for Brevard and Orange County public schools.

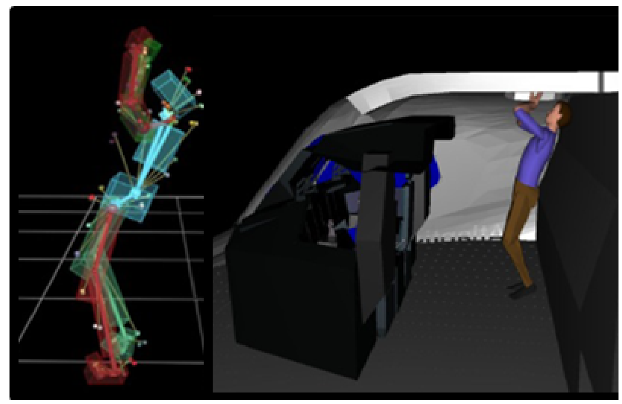
The Human Engineering Modeling and Performance Laboratory or HEMAP Lab, is a United Space Alliance (USA) company asset developed under research and development for use in human spaceflight vehicle manufacturing and production, ground operations processing, and flight crew operations. The team, comprised of industrial & human engineers and advanced visualization engineers, uses state-of-the-art motion capture tools to examine human, machine, and environment interfaces in order to provide customers with exceptional insight into their products and processes.

The HEMAP Lab features a distinctive combination of software –combined with personnel expertise to provide a unique and novel approach to motion capture. The team is able to not only track human motion in real time, but is also able to simultaneously stream those motions through avatars in a virtual environment.

The Process

1) Anthropometric Measurements:

Prior to capturing motions, 26 critical anthropometric measurements are recorded in a database and input into the ergonomic software to create avatars that are biomechanically accurate digital humans; this is a crucial parameter for assessments such as the lower back analysis (LBA), static strength prediction tool, or Rapid Upper Limb Assessment (RULA).

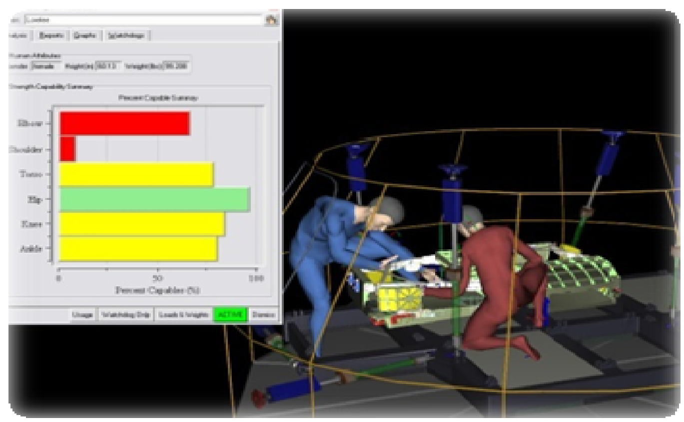


2) Velcro Suit

Participants are asked to don a Velcro suit and booties that are outfitted with over 50 retro-flective markers. The latter are strategically placed on bones and limbs to help create one's virtual skeleton.

3) Motion Capture

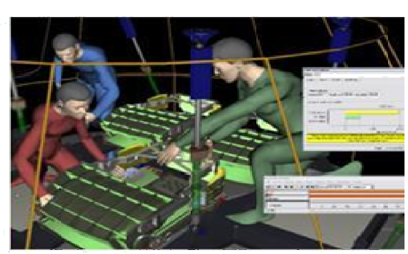
Once suited up, participants walk into the environment where over two dozen high-resolution cameras record their every movement. The cameras are powerful enough to capture complex motions for humans in challenging work environments with extreme accuracy. Motions are then imported into the human modeling and simulation software, where the biomechanically-accurate avatars can be observed as they interact with the environment.



4) Data Analysis

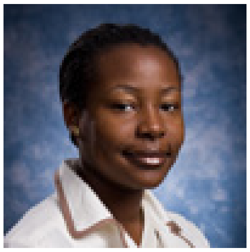
Once the tasks are evaluated for potential safety hazards, the team is able to offer solutions or recommendations to reduce the risks of future injuries to workers. Upon completing all captures, the biomechanical data is analyzed by engineers to produce a comprehensive human factors evaluation. Depending on the project requirements, the evaluation may assess collision detection, manual handling, lifting, forces and risks on the body and hardware, visibility, reach, or other critical aspects.

The HEMAP Lab is a powerful, cost-saving, time-saving tool for those customers who want to optimize design prior to build, and to develop processes and procedures with optimal efficiency and safety in mind. The 3D simulation videos can be used as a visual training tool to assist workers in learning how to minimize bodily strain, maximize hardware protection, and optimize process efficiency.



Lifting 2.0

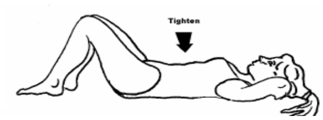
By Marie-Jeanne Steadye Ndaiye (MJ)



I Joined USA in 2007 as an Industrial & Human Engineer co-op; I am currently working in the Human Engineering Modeling & Performance (HEMAP) Lab using state-of-the-art motion capture tools to examine human, machine, and environment interfaces in order to provide customers with exceptional insight into their products and processes.
Before joining USA, I very much enjoyed my time as a graduate teaching and research assistant at Embry-Riddle Aeronautical University. I studied the effects of bone conduction on speech intelligibility to help the military incorporate radio communication in a multi-tasking environment. I was also involved in studies that assessed how intelligent adaptive displays impacted pilot performance.

I am keen on R&D because it is a vital part of any company's growth; developing new products and process to improve/expand operations is really rewarding.
I particularly enjoy participating in NASA Desert RATS (Research and Technologies Studies Team). The Desert RATS tests offer a NASA engineers, astronauts and scientists from across the country an opportunity to come together every summer to conduct technology development research in the Arizona desert.

Lifting 2.0: Everybody knows that the *only* proper lifting technique is to place the objet between your legs and to lift with latter, not your back. Right? Right. But is it really? Proponents of this method never had to lift cantilever hoists, or a bundle of scaffolding pipes. Unfortunately, this technique doesn't reflect the real world of over-sized pipes, boxes, and other heavy and bulky apparati that get handled in the manufacturing field. This method also assumes that most people have legs strong enough to perform these lifts; many simply do not – and that's a fact. With a) three in four adults (about 80%) suffering back injuries (10% to suffer re-injuries), and b)back injuries being the second most common reason for absenteeism in the workforce (after the common cold), identifying a better suited way to safely move objects is essential.



Unfortunately there isn't *one perfect* lifting technique. But the following lifting principles will help minimize the risks associated with lifting, lowering, and moving objects.

- Maintain the natural curve in your lower back.
  When standing straight, your lower back follows a natural curve and creates a slight hollow. Your spine and back are most stable in this position; try to keep that curve when performing a lift.
- Contract your abdominal muscles
  This will improve your spine's stability and reduce the likelihood of injury.
- Avoid twisting
  When parts of the body are near the extremes of their range of movements, stretching and compression of the tendons occur making your back less stable.
- Hold it close
  Keeping loads close to your body reduces the strain on back muscles and trunk muscles.
  Note: Employers should eliminate a much manual lifting as *practically possible*.

Work up your strength and endurance: Activity is your best friend!
In order to maintain healthy muscles and tissues, you must challenge them. It is a balancing act; the challenge must be sufficient- not too little, not too much. The idea is that if you're back and abdominal muscles are strong, you will most likely have good posture, and keep your spine in its correct position. These exercises are intended only as suggestions.

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Human Factors in Health Care: Medical Errors

by Deborah S. Carstens, Ph.D., PMP

Deborah Carstens, Ph.D., PMP is an Associate Professor of Information Systems and Academic Chair of the Online MBA Project Management Track. She holds a Ph.D. in Industrial Engineering from the University of Central Florida (UCF), MBA from Florida Tech and B.S. in Business Administration also from UCF. She is certified as a Project Management Professional (PMP). Dr. Carstens joined Florida Tech in Fall 2003. Previously, she worked for NASA Kennedy Space Center (KSC) from 1992 through 2003. One of Dr. Carsten's specialties is human computer interaction where she teaches about usable designs for a range of technologies including personal computers, ipads, kiosks, mobile devices, and much more. You can find out more about Dr. Carstens by visiting her Florida Tech Profile at: http://www.fit.edu/faculty/profiles/profile.php?tracks=carstens

Back in 1999, a government report from the National Institute of Medicine (IOM) sparked a lot of activity to improve patient safety when it estimated that preventable medical errors kill between 44,000 and 98,000 people in U.S. hospitals each year (IOM, 2001). Medical error is a term becoming more familiar as it is an increasingly prevalent cause of death in the United States (Boyer, 2001). Medical error is the eighth leading cause of death in the United States using the lower figure and the fourth leading cause of death if the higher figure were applied. The report, titled "To Err is Human," encouraged the public to become involved, and includes four industry issues (Epstein, Hamel, & Leape, 2002). "The IOM report (1999) made four major points: the problem of accidental injury is serious, the cause is not careless people but faulty systems, we need to redesign our systems, and patient safety must become a national priority." Since the report was released there has been an increased focus by consumers and the industry on patient safety and medical errors, which has applied pressure to hospitals to show the steps they are taking to reduce medical error (Scalise, 2002). A safer healthcare system is a priority for all healthcare professionals (Boyer, 2001). Nielsen (2004) feels there is a need for the redesign of current systems, and those changes would lead to dramatic improvements in the reduction of medical errors.

The IOM report addressed several items in the healthcare industry including the reduction of medical error and increase in patient safety (Scalise, 2002). To meet safety objectives and reduce medical errors, hospitals should have the flexibility to select trainings and practices that best suit them. One focus of this report was that most medical errors occur because of the failure of systems, not because of one individual (Epstein, Hamel, & Leape, 2002). This idea shows a shift of focus by healthcare management away from earlier training to rely only on the individual performance but instead on the errors present in the healthcare system as a whole. With the complexities of the healthcare industry and current healthcare culture, change is difficult because of the history of assigning blame for errors and the focus on the individual in the past. Though system failure is a major cause, human error is still a factor in medical error. James Reason published a breakthrough concept of latent error (Epstein, Hamel, & Leape, 2002). These errors are those deficiencies in design, organization, maintenance, training, and management that create an environment for mistakes. One example of this would be the decision of management to increase workloads, which can lead to mistakes by overburdened healthcare staff.

Medical error is a serious problem in the healthcare industry (Scalise, 2002). There are many proposed solutions to the problem, from implementing technology to the changing of past ideas of what causes errors. The healthcare industry is very complex and changes and improvements cannot be made overnight. Reducing medical error should increase the quality of care at patient receives, and the public should be demanding an increase in safety and quality, not just safety. Medical error such as transition errors have been identified as a major threat to patient safety. Through many national organizations such as Institute Of Medicine and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the risks posed from medical error have been significantly linked to patient safety. JCAHO (2010) has listed sentinel events as being an outcome of medical error. Researchers in the field of human error in medicine and human error analyses such as Bogner (1994) and Reason (1997, 1990) have further addressed this link. The Institute for Healthcare Improvement (2003) discusses how our care systems have built-in defect rates that are too high and how most medical errors have less to do with carelessness or neglect than with failures of systems. The Institute further discusses that errors can be decreased through the redesign of systems that introduce the hazards in the first place. The term systems can be used to describe processes, procedures, medical informatics, etc. Ǿvretveit (2000) discusses the importance of not viewing safety and quality as a result of an individual clinician but rather the design and operation of an entire healthcare system. The National Database of Nursing Quality Indicators (NDNQI) is a project of the American Nurses Association's (ANA) (2007) Safety & Quality Initiative that addresses the patient safety and quality of care issues arising from changes in health care delivery. NDNQI (2003) advances this initiative through the development of an information resource that will be used to quantify the relationship between nursing and patient outcomes. The Leapfrog Group (2010) composed of more than 140 public and private organizations that provide health care benefits also acknowledges the need to identify problems and propose solutions that it believes will improve hospital systems that could break down and harm patients. Many hospital beds today are populated by elder adults that can be even more likely to suffer an adverse event should an error occur. For example, people over 65 are using almost two-thirds of general and acute hospital beds in the UK (Cowan, 2003).

McFadden, Stock and Gowen (2006) performed research that identifies the link between identification and implementation of patient safety initiatives. The research suggests that positive impacts to implementation can be achieved through developing partnerships with healthcare stakeholders such as administrators, doctors, nurses, etc. to encourage open discussion groups on errors to create a learning environment from errors made. Furthermore, research indicated that education and training programs along with the redesigning of systems such as procedures, technology design, and restructuring the functioning of equipment can positively impact patient safety. It has been suggested by Firth-Cozens, Firth and Booth (2003) that learning from error can occur through reporting errors. However, healthcare workers can be fearful of reporting errors for reasons such as feared retribution, no person to tell, advised against by peers, hurting a colleague, etc. Their research indicated that an organizations' culture is largely responsible for the level of internal reporting that occurs and through organizations providing clear systems for employee reporting, mechanisms to bring about necessary change, and safety for those with the courage to report that an organization can achieve better patient care.

There are many factors involved in patient safety today, and there are many factors to consider when improving the safety process within healthcare environments. New innovation can be achieved when organizations build, adapt, integrate, reconfigure and release competencies (Herrmann, Gassmann & Eisert, 2007). Government organizations are taking steps to improve patient safety in the United States, but each individual healthcare organization must also take steps within to improve the current systems and processes through a focus on patient safety.

Not Multi-Tasking

By John Chamberlin

John is currently employed through United Space Alliance, LLC, where he applies his system safety expertise in the GSS Safety/Industrial and Human Engineering Department at Kennedy Space Center and he has received a B.S. in Aero-nautical Studies with a concentration in Transportation from Embry-Riddle Aeronautical University and an MBA with a concentration in Human Factors from the University of Central Florida. John's areas of expertise include fall protection, scaffolding, cranes, mis-hap investigations, work tool design, training classes, construction safety, aviation safety and general industrial safety.

A human limitation is that it is not possible to hold two independent thoughts in your brain at the same time yet everyone has heard others talk about their multitasking abilities. People perceive that doing more than one thing at a time is the same as doing two or more things at the same time. In actuality we are switching back and forth between multiple tasks producing the appearance of more than one task performed at the same time.

In any operation that involves more than one task there is a primary and a secondary task or tasks. For instance driving and listening to the radio. Walking and talking on a cell phone. Difficulties arise during these operations when task substitution occurs. This is when the primary task becomes supplanted by the secondary task. In a static situation such as typing and taking on the phone, these substitutions rarely create a hazard, ME" are few secondary tasks that can distract from the dynamic primary task of driving. The seconds it takes to switch between tasks can be enough of a distraction to cause an undesired outcome. however this is not the case in dynamic situations. The level of risk depends on what the primary task is and what is the rate of change associated with that task. Driving 70mph or 103 feet per second while programming a GPS, yelling at a CD that just started skipping or defusing WWIII in the back seat because "HE KEEPS TOUCHING ME" are few secondary tasks that can distract from the dynamic primary task of driving. The seconds it takes to switch between tasks can be enough of a distraction to cause an undesired outcome. When was the last time you had a similar experience, last week, yesterday?

What's the solution?

- Recognize that multitasking does not exist.
- Before starting any operation or activity identify and verbalize the primary task.
- Recognize the likelihood of task substitution increases with routine or repetitive tasks, such as walking or driving.
- Anticipate the possibility that a task transfer will occur.
- Stage the operation so that if concurrent operations must take place, the secondary operation will cause the minimum time intrusion into the primary task.

We transfer or between tasks all the time but type of primary tasks we are transitioning away from makes a difference. Making a phone call while walking down stairs, using a sharp knife or watching TV produces a much different level of risk then making the same call while driving a car, flying a crop duster, parachuting or juggling chainsaws. Performing an objective analysis of the primary task prior to starting it will help uncover transfer issues. If your evaluation determines the level of risk is unacceptable, suspend the primary task or delay the secondary task.

Pilot/Flight Deck Interaction

By Kimberly Richards

As a Human Factors (HF) and Systems Engineer (SE), Kim has applied HF principles to the RAH-66 Comanche Helicopter, NASA Space Shuttle, the design of the Next Generation Crew Module-Orion, multiple Army Instrumentation/Simulation programs and the NASA Constellation Program. She began her career by providing testing and validation of the Army RAH-66 Comanche Helicopter LCD cockpit displays using usability studies to assess the pilot's overall capabilities and limitations to provide an efficient and user friendly cockpit display. She also applied her systems expertise to Space Shuttle systems support and select ground processing tasks, where she used PFMEAs and PHAs to help identify, assess, and track risks/hazards in the process or system design. She currently works as a Human Factors and System Safety Engineer for Booz Allen Hamilton using her expertise within Air Force, NASA, and Army markets.

Although it is common to consider the pilot interfaces to be the only or primary consideration in human factors in flight deck design, the interaction between the pilot(s) and the flight deck must also be considered. Some of the most visible examples of the importance of this topic, and the consequences of vulnerabilities in this area, are in the implementation of advanced automation. Advanced automation (sophisticated autopilots, auto-thrust, flight management systems, and associated displays and controls) has provided large improvements in safety (e.g., through reduced pilot workload in critical or long-range phases of flight) and efficiency (improved precision of flying certain flight paths). However, vulnerabilities have been identified in the interaction between the flight crews and modern systems.

For example, on April 26, 1994, an Airbus A300–600 operated by China Airlines crashed at Nagoya, Japan killing 264 passengers and flight crew members. Contributing to the accident were conflicting actions taken by the flight crew and the airplane's autopilot. During complex circumstance, the flight crew attempted to stay on glide slope by commanding nose-down elevator. The autopilot was then engaged, and because it was still in go-around mode, commanded nose-up trim. A combination of an out-of-trim condition, high engine thrust, and retracting the flaps too far led to a stall. The crash provided a stark example of how a breakdown in the flight crew/automation interaction can affect flight safety. Although this particular accident involved an A300–600, other accidents, incidents, and safety indicators demonstrate that this problem is not confined to any one airplane type, airplane manufacturer, operator, or geographical region. A lesson to be learned here is that design of the interaction between the pilot and the systems must consider human capabilities and limitations. A good human-machine interface is necessary but may not be sufficient to ensure that the system is usable and effective. The interaction between the pilot and the system, as well as the function of the system itself, must be carefully "human engineered.''

References:

Billings, Charles E., Aviation Automation: The Search for a Human-Centered Approach, Lawrence Erlbaum Associates, 1997.

Federal Aviation Administration, The Human Factors Team Report on: The Interfaces Between Flight crews and Modern Flight Deck Systems, July 1996.

Sanders, M. S. and McCormick, E. J., Human Factors in Engineering and Design, 7th ed., New York: McGraw-Hill, 1993.

Norman, Donald A., The Psychology of Everyday Things, also published as The Design of Everyday Things, Doubleday, 1988.

Wickens, C. D., Engineering Psychology and Human Performance, 2nd ed., New York: Harper Collins College, 1991.

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