Human Factors[1,2]

The field of human factors (HF) has contributed significantly to shaping how people connect with one another and how they interact with products, devices, and services whether they are at work, at home, or at play. Human factors (or ergonomics) *is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance* (International Ergonomics Association, 2016).

The field is generally considered to have originated during World War II with a focus on designing machines to fit the human (Wickens & Hollands, 2000; Meister, 1999). Prior to this, design emphasis focused on fitting the human to the machine by studying industrial workers and their workflow to improve productivity (Taylor, 1911). Following World War II, HF continued to have a major role in military-sponsored research and expanded to both academia and industry (Shaver, 2009). The application of HF has grown to influence the design of a wide range of systems and devices including computers (Helander, Landauer, Prabhu, 1997; Tillman, Fitts, Woodson, Rose-Sundholm, & Tillman, 2016), websites (Cooper, Reimann, Cronin, & Noessel, 2014; Vu & Proctor, 2011), medical devices (Weinger, Wiklund, & Garner-Bonneau, 2010; Wiklund & Wilcox, 2004), and consumer product design (Karwowski, Soares, & Stanton, 2011; Lindholm, Keinonen, & Kiljander, 2003).

An important objective of HF is to reduce human failures and errors through the design of appropriate human interaction while optimizing system efficiency and prioritizing safety. No matter how well trained and motivated people are they can still make errors – some with catastrophic consequences and far-reaching effects (Reason, 1990). As people interact with systems, they build mental models of how the systems work to guide how they use them (Gentner & Stevens, 1983). When a mental model is incorrect, it becomes difficult to predict what to do next, which leads to using trial and error and in worst-case scenarios may result in accidents. In fact, accident investigation and analysis has found that human failure is often a contributing factor and that most events leading to accidents are predictable and could have been avoided (Reason, 1990). By identifying the factors that contribute to human error (e.g., task complexity, inaccurate mental models, inadequate training, environmental factors, and distractions), more error tolerant systems that reduce the risk associated with their use can be designed.

More recently, research has focused on user-centered or human-centered design activities and processes that place intended users squarely in the center of the design process to ensure their needs and human characteristics are the foremost consideration when making design trade-offs and decisions (Pratt & Nunes, 2012; Ritter, Baxter, & Churchill, 2014). Conducting observational studies, focus groups, interviews, usability testing, participatory design sessions, and administering questionnaires are all techniques used to gather user input and feedback to inform design. Interpreting results obtained from the conduct of these activities requires competency in experimental design, and knowledge of sensation, perception, cognition, and physiological psychology.

Critical to designing error tolerant systems is the application of what has been learned about human cognition – how humans think, understand, learn, remember, and convert intentions into actions – to system design. User interface guidelines that provide the rationale and fundamental principles of

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[2] Human Factors. (2018, August 28). Retrieved from https://www.siop.org/Events-Education/Educators/Incorporating-I-O

psychology upon which they are based, facilitate the ability of those new to the field to apply them appropriately to design (Johnson, 2010; Lidwell, Holden, & Butler, 2010). However, the continual introduction of new technology (e.g., robotics, wearables, virtual reality, and micro displays) creates gaps in our body of knowledge increasing the demand for basic HF research to understand how these technologies interact with human capabilities in order to augment human performance.

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