Invited Talk

The Law of Stretched Systems in Action: Exploiting Robots

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Abstract
Robotic systems represent new capabilities that justifiably excite technologists and problem holders in many areas. But what affordances do the new capabilities represent and how will problem holders and practitioners exploit these capabilities as they struggle to meet performance demands and resource pressures? Discussions of the impact of new robotic technology typically mistake new capabilities for affordances in use. The dominate note is that robots as autonomous agents will revolutionize human activity. This is a fundamental oversimplification (see Feltovich et al., 2001) as past research has shown that advances in autonomy (an intrinsic capability) have turned out to demand advances in support for coordinated activity (extrinsic affordances).

The Law of Stretched Systems captures the co-adaptive dynamic that human leaders under pressure for higher and more efficient levels of performance will exploit new capabilities to demand more complex forms of work (Woods and Dekker, 2000; Woods and Hollnagel, 2006). This law provides a guide to use past findings on the reverberations of technology change to project how effective leaders and operators will exploit the capabilities of future robotic systems. When one applies the Law of Stretched Systems to new robotic capabilities for demanding work settings, one begins to see new stories about how problem holders work with and through robotic systems to accomplish goals. These are not stories about machine autonomy and the substitution myth. Rather, the new capabilities trigger the exploration of new story lines about future operations that concern:

• how to coordinate activities over wider ranges,
• how to expand our perception and action over larger spans through remote devices, and
• how to project our intent into distant situations to achieve our goals.

Research on these story lines provide new results on awareness of remote environments through robotic systems and brittleness/resilience in coordinating people and robots that define promising directions with high potential return for supporting work though robotic systems (Woods et al., 2004). These results also help us identify new candidates for challenge cases in HRI and new classes of metrics (e.g., the fractal path scores developed by Phillips and Voshel).

General Terms: Human Factors, Design, Measurement, Reliability

References

Bio
Professor in the Institute for Ergonomics at the Ohio State University. Dr. Woods has been President of the Human Factors and Ergonomic Society. He is a Fellow of that society as well as the American Psychological Society and the American Psychological Association. He has shared the Ely Award for best paper in the journal Human Factors (1994), a Laurels Award from Aviation Week and Space Technology (1995) for research on the human factors of highly automated cockpits, the Jack Kraft Innovators Award from the Human Factors and Ergonomics Society (2002), an IBM Faculty Award (2005). Dr. Woods has served on National Academy of Science and other advisory committees including recently Engineering the Delivery of Health Care (2005), and Dependable Software (2006). He has testified to U.S. Congress on Safety at NASA and on Election Reform. He was one of the founding board members of the National Patient Safety Foundation, Associate Director of the Midwest Center for Inquiry on Patient Safety of the Veterans Health Administration, and was an advisor to the Columbia Accident Investigation Board. Multimedia overviews of his research developing the foundations and practice of Cognitive Systems Engineering are available at url: http://csel.eng.ohio-state.edu/woods/ and he is co-author of the monographs Behind Human Error (1994), A Tale of Two Stories: Contrasting Views of Patient Safety (1998), Joint Cognitive Systems (2005; 2006), and Resilience Engineering (2006).