Space Medicine. Not as we Know it. 
Human-computer Interaction, Night Nurses Paralysis and Space Technology 

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Abstract

Space is still a relatively new science; space medicine is even newer. The use of established knowledge in Human-Computer Interaction (HCI) fields and in medicine is invaluable in order to progress further in space exploration. This is because sophisticated technology requires examination of its use by humans and computers. Vigilance, monitoring and interpretation of data are essential skills and need to be mapped carefully between humans and computers so that accuracy, specificity, reliability and validity is maintained.

Introduction

The furthest most frontier of space is an exciting concept for most of us. Reality has also been encouraging since the NASA space missions in the 1960s, followed by the technologically advanced space station and even further intrusions into space accompanied by spectacular photography of distant planets and stars and artist’s impressions of previously unknown entity (Illustration 1 - Mewhinney, 2010 and Illustration 2 - Hoover, 2011).

Our curiosity of space seems limitless despite retracting finances and halts on space missions. European initiatives have also continued with renewed interest in human-computer interaction (HCI) projects that examine computer-operative vigilance, monitoring and interpretation of new data. HCI has been a branch of science for some time and the blending of science and medicine has continued to flourish (Thompson & Coleman, 1988).

As space systems become increasingly sophisticated, there is an increasing demand for HCI exploration to ensure the deployment of new mission systems and technology. The team at the NASA Ames Research Center in the United States has also considered employing methods that redress potential cognitive strain of users (ARC, 2011). As a member of the Human-Computer Interaction Consortium, they have designed a Mixed-Initiative Planning Environment where extensive baseline data from observation of past missions has provided valuable information for the designers of future missions and mission systems.

Tools of the trade

Tollinger and colleagues (2004) know all too well how difficult it is to determine which tools are useful and the importance of designing scientifically-sound equipment for space. In the design and deployment of a collaborative software tool, designed for the Mars Exploration Rovers (MER) 2003 mission, Tollinger and colleagues (2004) found positive support for groups of people jointly managing collaboratively created content during the design of space technology for NASA missions. Tollinger describes difficulties encountered amongst personnel during the design process. As with individual work on desktop computers, it would seem that collaborative work products on shared virtual “boards” were saved, retrieved and shared. Some of this content became “living documents” and was used on a day-to-day basis by designers. However, as the mission progressed, the shared “boards” were not being used in the way the designers anticipated; they intended them to be just like using whiteboards to collaboratively create and annotate images and is not of permanent value. Rather, they consulted and stored images but did not update or alter them. A number of HCI researchers have noted in the past the need for improving electronic whiteboards (Pedersen, McCall, Moran, & Halasz, 1993), and for using larger displays that act more like traditional tools such as large semi-public displays (Elrod, Bruce, Gold, Goldberg, Halasz, Janssen, Lee, McCall, Pedersen, Pier, Tang, & Welch, 1992; Huang, & Mynatt, 2003) and video interfaces (Tang & Minneman, 1991). In this way, users are seen to increase their interaction with the shared displays that are perceived to be more shared than shared computer files.

Humans and computers

Apart from sharing information, single-person vigilance is an important part of human-computer interaction especially in “real-time” environments and where output must be closely monitored and altered according to need. Examples include air traffic control and the chemical and nuclear industry where environment and flow may require emergency intervention. This is also of great importance during
space missions particularly when new technology is being evaluated remotely. For several decades, the phenomenon of “night paralysis” has been discussed and observed in connection with night shift working. Often this is confused with fatigue or sleep deprivation (Meijman, Thunnissen, & de Vries-Griever, 1990) and parallels have been drawn with narcolepsy and other neurological exceptions. However, “night nurses’ paralysis” has been observed when ward environments were spacious and monitored by a single nurses’ station at the end of rows of dormitory beds. Anecdotes have been documented of nurses being unable to respond to the matron’s requests because of apparent paralysis due to immobility induced by cold or because of remaining motionless for long periods of time.

In 1969, G de M Rudolf, MRCP, wrote “Night Nurses’ Paralysis” (Rudolf, 1969) and a review article appeared in the British Medical Journal (Stengel, 1970). Rudolph describes the condition as a “brief transient disability of the voluntary muscles, of which the patient is fully aware without being able to terminate it.” (Stengel, 1970, p.221). He states that it may occur at any time of day or night and the person may be speechless and dazed. Rudolph collected details of this condition for over a quarter of a century. However, it has been difficult to study because the transience may be of only a few seconds.

The British nurse who turned to journalism, the late Claire Rayner, remembered in a personal communication being affected twice, and on both occasions the experience was terrifying. She recalls being totally unable to move, clutching a pencil in her hand on the table as though she was working (Thompson, 1995). Others have noted the condition in more modern environments such as in air traffic control personnel particularly in low-lit areas (Folkard & Condon, 1987).

Researchers have become concerned that this is a condition that readily affects those who need to be vigilant for long periods at a time, often when monitoring tedious, repetitive or monotonous tasks (Thompson, 2002a,b). Some have explained it in terms of irregular body rhythms (Healy & Whitehouse, 1991); while others recognise that this is simply a symptom of night shift work that needs to be examined (Akerstedt & Knutsson, 1989; Skipper, Jung, & Coffey, 1990; Torsvall, Akerstedt, & Gilander, 1989).

Conclusions

Space has received renewed interest and advances in technology have meant that researchers have re-visited work previously conducted in other areas of interest such as in HCI and medicine. New technology has brought with it the need to examine HCI in this context, particularly, in real-time environments that involve the need for prolonged vigilance of operatives. Collaborative research is needed in the area of HCI and space medicine in order to best support space initiatives and future space missions worldwide.

References

Illustrations

Illustration 1

Illustration 2

Artist concept of Kepler-10b. Credit to NASA 2011.
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