Chapter II
A Bio–Psycho–Social Review of Usability Methods and their Applications in Healthcare

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ABSTRACT

The purpose of this chapter is to provide the reader with an overview of several models and theories from the general HCI literature, highlighting models at three levels of focus: biomechanical interactions, individual-cognitive interactions, and social interactions. This chapter will also explore how these models were or could be applied to the design and evaluation of clinical information systems, such as electronic medical records and hospital information systems. Finally, it will conclude with how an understanding at each level compliments the other two in order to create a more complete understanding of the interactions of information systems in healthcare.

INTRODUCTION

The field of human computer interaction (HCI) is a fast growing field of research in computer science. It is interested in understanding how we use devices and how the usability of those devices can be improved. HCI sits between several disciplines including computer science, psychology, cognitive science, sociology, and anthropology. Although a young field, it offers a wealth of understanding into the use of systems. It provides a relatively rich collection of quantitative and qualitative models and methods that have been applied to the design and evaluation of information systems (IS) in many domains (Carroll, 2003). Despite the advances in HCI to guide design and evaluate systems, their published impact in health information systems has been limited in scope—systems are still designed, evaluated, and selected without often formally considering issues of usability, cognitive load and fit. There is a need to better understand where models from HCI can assist in the design

and adoption of clinical information systems in health care.

In medicine, a biomedical, reductionist view has been the prevailing perspective through the 20th century. It has led to a great number of advances in medical science: from Pasteur's experiments in microbiology that led to the popularization of the germ theory at the end of the 19th century (Ewald, 2004) through to the mapping of the human genome at the beginning of the twenty-first (Venter, Adams, Myers et al., 2001), the science of medicine has seen an explosion in information, in diagnostic options, and in the treatment of diseases. During this time, prominence and understanding of illness, the patient's experience of the disease, decreased. In 1977, George Engel proposed a new conceptual model for illness: The bio-psycho-social model. His approach expanded the biomedical model to include both the psychological and the social impacts of a disease. It was meant to aid in better understanding and management of a patient rather than simply treating a disease (Engel, 1977). In this model, Engel stresses that the reductionist biomedical model, while it is powerful and has moved our understanding of *disease* forward, is not sufficient to describe the impact of *illness* to a patient and their surroundings. Indeed, an illness typically has a biologic component, but it also has a psychological impact on the patient as well as a social impact on those around the patient.

In this chapter, we will review applications of HCI in health information systems development and evaluation and will propose a model that aligns with Engel's bio-psycho-social model.

Clinical Example

Throughout this chapter, the reader will be brought back to aspects of a common clinical example: electronic prescribing (e-prescribing).

Recent reports on healthcare in North America describe high error rates (Baker et al., 2004; Kohn, 2000). Recommendations to improve the processes of care delivery are often focused on the increased use of information technology, information systems and, specifically, electronic medical records (EMR) (Romanow, 2002) with the expectation that these systems will improve care and reduce errors (Bates et al., 2001; Wilcox & Whitham, 2003). Despite promise, however, the adoption of clinical information systems has been slow and problematic. There are many reasons for this and strategies to align systems to support the adoption of electronic tools to support delivery of better care (Middleton, Hammond, Brennan, & Cooper, 2005). One reason for failure of adoptions of clinical information systems, and the focus on this chapter, is the usability of systems (Walsh, 2004). Computerized provider order entry, and more specifically e-prescribing is complex and involves interactions between the computer system and the user (Horsky, Kaufman, & Patel, 2003) and between members of the care team, making e-prescribing a good example for this chapter.

Clinical Example: Prescriptions

These examples will use the example of writing a prescription for Ramipril. Ramipril is a commonly prescribed, but expensive, blood pressure medication. It will be used to highlight some of the strengths of methods described in this chapter. Different steps in prescribing will be used to highlight aspects of models presented as appropriate.

BIOMECHANICAL MODELS OF INTERACTION

Early work in human computer interaction stemmed from human machine interaction and focused on physical interaction between humans and computers. Nearly all computer interaction is through various forms of physical movement and control of input devices, such as keyboards,

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