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Conceptualization and application of an approach for designing healthcare software interfaces

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ABSTRACT

Objective: The aim of this study is to conceptualize a novel approach, which facilitates us to design prototype interfaces for healthcare software.
Methods: Concepts and techniques from various disciplines were used to conceptualize an interface design approach named MORTARS (Map Original Rhetorical To Adapted Rhetorical Situation). The concepts and techniques included in this approach are (1) rhetorical situation – a concept of philosophy provided by Bitzer (1968); (2) move analysis – an applied linguistic technique provided by Swales (1990) and Bhatia (1993); (3) interface design guidelines – a cognitive and computer science concept provided by Johnson (2010); (4) usability evaluation instrument – an interface evaluation questionnaire provided by Lund (2001); (5) user modeling via stereotyping – a cognitive and computer science concept provided by Rich (1979). A prototype interface for outpatient clinic software was designed to introduce the underlying concepts of MORTARS. The prototype interface was evaluated by thirty-two medical informaticians.
Results: The medical informaticians found the designed prototype interface to be useful (73.3%), easy to use (71.9%), easy to learn (93.1%), and satisfactory (53.2%).
Conclusions: MORTARS approach was found to be effective in designing the prototype user interface for the outpatient clinic software. This approach might be further used to design interfaces for various software pertaining to healthcare and other domains.

1. Introduction

A user interface is the space, where interaction between humans and computers occurs. The interface allows a user to manipulate a system (input) and shows the effects of the user's manipulation (output) [1]. In the recent years, the interface design of healthcare software has been a hot topic of discussion in various national and international forums because it plays a vital role in the success, as well as the failure of healthcare Information and Communication Technology (ICT) systems. A study in Germany reported that a small improvement in interface design enhanced the quality of healthcare data being captured [2]. In another study at the Academic Medical Center of Amsterdam, Netherlands, the pre and post usability of the former and redesigned Electronic Health Record (EHR) system was evaluated. The redesigned EHR system was appreciated because of its user-friendly interfaces, enhanced functionality, and capability [3]. Similarly, the failure of several healthcare ICT systems has been attributed to non-friendly design of user interface. Several studies have shown that designing a user-friendly interface has been one of the biggest challenges faced by healthcare ICT systems [4]. A study in Finland has reported that the increasing use of computers stole the time and attention of doctors, nurses, and other healthcare professionals and distracted them from patients in delivering quality care [5]. In addition, several other studies have reported that doctors and nurses have faced numerous difficulties in their routine work due to non-friendly user interface [6–9].

To rectify the interface design problems, the involvement of users has been always recommended during the software development [10,11]. However, users' involvement of has been always given a low priority. Therefore, the strategy to involve users has remained unexplored until now [12]. After the advent of Graphical User Interface, their use has been suggested in healthcare ICT systems. However, due to the high complexity of the healthcare

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domain, even Graphical User Interface cannot bring much change in the usability of healthcare software [7,13]. Therefore, the healthcare domain has continuously faced the interface design related problems. Our literature searches uncovered some of the possible causes behind the poor usability of healthcare ICT products, as explained below [14–18].

First, the evolution of ICT took place 'inside-out' manner. In the earlier days, computer systems were extremely expensive; therefore, the system efficiency usually had priority over the convenience [19–21]. At that time, finding cost-effective and efficient hardware solutions was the focus of research and development [22–26]. Over the time, the computer hardware turned out to be cheaper, effective, and efficient [27]. On the other hand, due to ever-growing software complexity, the failure of the software became a common phenomenon [28–31]. These intermittent software failures motivated its designers to involve users in the process of software development; however, users were always the last one to be involved [32,33]. The partial involvement of users works well in developing ICT products for domains such as banking, finance, insurance, and telecommunication because users of these domains are not diverse and have clearly defined system workflow. Nevertheless, about 68% ICT projects failed in these domains too, which caused the loss of nearly 63 billion USD [34,35]. Ironically, in spite of such failure prone situations, designers of healthcare ICT products continued to stick with the same traditional 'inside-out' approach with the minimal participation of users [36].

Second, the healthcare is a complex adaptive system – dynamic, nonlinear, consists of a number of independent agents, diverse settings such as clinics, polyclinics, hospitals, and a wide variety of stakeholders such as doctors, nurses, patients. Therefore, healthcare systems face several limitations pertaining to their design and management [37–39]. Very often, interface designers are not aware of the underlying complexity of the health care organization. In addition, the time allocated to the interface designer is usually not sufficient to understand complex requirements of

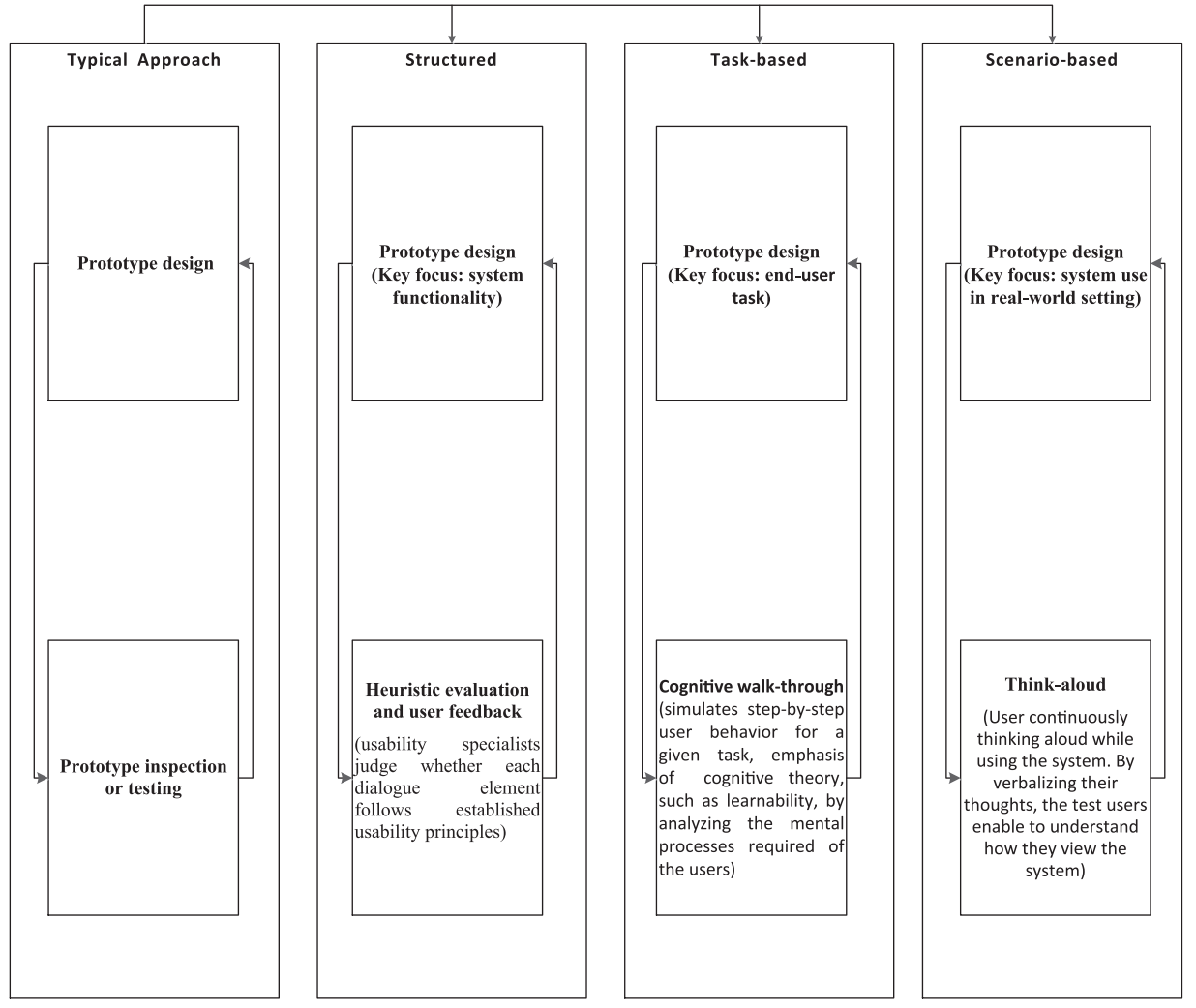

Fig. 1. Typical approach for interface design along with popular approaches such as structured, task-based, and scenario-based.

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