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Towards an Evaluation Framework for Modelling Languages in Healthcare Contexts

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Abstract

This research-in-progress paper describes a research agenda that aims to help IS practitioners and other stakeholders in Healthcare systems to determine which modelling languages are best suited for their problem. Overall the objective is a develop a research informed decisions support system that will recommend specific modelling language based on contextual requirements The paper describes a research agenda designed to guide the development of this system using a mixture of empirical work and best practice from the extant literature.

Keywords: Modelling Languges, Healthcare

1 Introduction

The design, development and implementation of effective Healthcare Information Systems (HIS) is the pre-eminent concern of the discipline of Health Informatics. While the potential of HIS is widely recognised, the fulfilment of this potential represented an enormous, multifaceted challenge that requires full engagement from health care professional, software engineering and systems development practitioners and the academic community. Successful HIS implementations require partnerships between a variety of stakeholders with varying needs, interests and objectives (Reid, Lotter, Burton, & Richardson, 2012). Conceptual models of data, processes and workflows play a vital role in enabling effective communication between these different stakeholders, particularly due to the dynamic and knowledge-intensive nature of these pathways (O'Leary, Noll, & Richardson, 2013).

There are a myriad of modelling language and tools. Based upon their syntactical and semantic structure, different modelling languages have different strengths and weaknesses. Some languages may use symbols to communicate processes and activities in an easily understandable, but imprecise manner, while others may have use a complex syntax to precisely specify requirements and relationships at the expense of ease of comprehension. The variability between the capabilities of different modelling languages means that different modelling languages are more or less suited to particular contexts depending on their syntactic and semantic properties.

Since modelling languages are enablers of crucial development activities such as requirement capture, systems analysis and prototyping, it is important that the most appropriate modelling language is chosen with respect to the particular context the development activity occurs in

This research-in-progress paper describes a research agenda that aims to help IS practitioners and other stakeholders in Healthcare systems to determine which modelling languages are best suited for their problem. Overall the objective is a develop a research informed decisions support system that will recommend specific modelling language based on contextual requirements. The development of this decision support system will be informed by answering three main research questions.

RQ1: What are the key modelling requirements of modelling languages in various Healthcare contexts

RQ2: What are the strengths and weaknesses of various modelling languages

RQ3: How does the suitability of modelling languages differ between contexts.

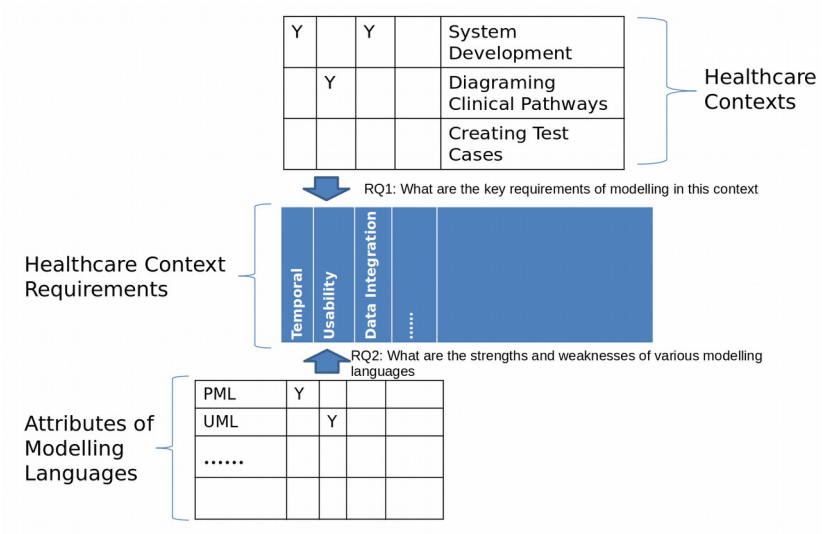

Figure 1. Relationship of Research Questions to Project

The remainder of this paper is structured as follows. In the Modelling Languages in HIS section, we derive from the literature a list of requirements of modelling languages in Healthcare contexts. In the Proposed Methodology section, we describe how we hope to validate our list of requirements and address the other research

questions.

2 Modelling Languages in HIS

A model is an abstract representation of something. It seeks to capture the relevant attributes of an entity and represent them in a useful manner. Models of systems and processes play a crucial role in supporting the development of information systems (Bennett, McRobb, & Farmer, 2001). They support requirements capture and analysis. They are used to design, control and monitor system development and often serve a role in post-development validation and implementation (O'Leary, Buckley, & Richardson, 2013). Crucially, models of workflows and care pathways must be understood by many different stakeholders, who may have different experiences, backgrounds and knowledge (Shelly & Rosenblatt, 2011). In the healthcare context, modelling is recognised as providing a unique challenge caused by factors such as the unpredictable and dynamic nature of workflows (Hicheur, Dhieb, & Barkaoui, 2013).

The model of an information system is different and distinct from an instance of that information system. Similarly, the model of a health information system will be different and distinct from an instance of a health information system. A model will always be simpler and more abstract than an instantiated HIS. Models are described using a modelling language. A modelling language is any artificial language that can be used to express information or knowledge or systems in a structure that is defined by a consistent set of rules. There is an enormous variety of modelling languages in existence. Modelling languages can be graphical (e.g. UML), textual (e.g. PML) or mathematical. Modelling languages are designed in such a way as to balance a large number of competing attributes including, but not limited to, how easy they are to understand, how well they support the development of software and what kinds of different syntactic structures such as loops and conditional branching they support. Different modelling languages balance these competing requirements in different ways, and the syntax of a modelling language will have a major impact on the models that are created with it. Therefore, since the efficiency of a HIS is determined in part by the utility of the model, which is in turn partly determined by the choice of modelling language, it stands to reason that the choice of modelling language used is an important determinant of the eventual success or failure of a HIS.

3 Proposed Methodology

This research is envisaged as a multi-stage process where a number of subsidiary questions are addressed before the knowledge collected is synthesised into a whole that will provide empirical and best practice based guidance on what modelling languages should be used in particular healthcare contexts.

Stage 1: Initial Requirement Generation

The extant literature fails to provide a clear picture of the requirements of modelling languages in a healthcare context. The first step of this research project will be to conduct a systematic literature review of the literature on the modelling and development of HIS and healthcare pathways with a view to identifying the key requirement of modelling languages in these contexts.

Stage 2: Validation of Requirements

The proposed next stage of the research is empirical validation of the requirements derived from the literature in the first stage. A survey will be distributed to a wide range of stakeholders involved in healthcare into medical and IT professionals. They will be asked to confirm the relevance of the listed requirements and identify any requirements that are missing.

Stage 3: Mapping Contexts to Requirements

As part of the empirical survey, respondents will be asked to identify situations they require modelling languages for, and the relative importance of the various requirements in particular situations.

Stage 4: Evaluation of Modelling Languages

This stage will consist of a systematic literature review which will aim to identify the currently extant modelling languages and identify their strengths and weaknesses vis a vis the requirements identified in stage 1.

Stage 5: Mapping Contexts to Requirements to Modelling Languages

In this stage, the knowledge collected in the prior research will be synthesised to map healthcare contexts to their pre-eminent requirements to modelling languages that best meet those requirements.

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