Use Case Diagrams in Support of Use Case Modeling: Deriving Understanding from the Picture

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ABSTRACT

Use case modeling in the Unified Modeling Language (UML) is a popular text-based tool for systems analysis and design. Use cases can be used with or without supporting use case diagrams. This paper uses an experiment to explore the effectiveness of including a use case diagram with a set of use cases. The Cognitive Theory of Multimedia Learning is used to hypothesize that the use case diagram improves the effectiveness of use cases for novice users by providing visual cues aiding model viewers in selecting and integrating relevant information. The level of understanding developed by participants viewing either use cases or use cases with a supporting use case diagram was measured using comprehension, retention, and problem solving tasks. Results showed that participants viewing the use cases with the supporting diagram developed a significantly higher level of understanding, as measured by performance on the problem solving task, than participants provided with use cases alone. This analysis suggests practitioners should consider combining a visual representation, such as a use case diagram, with text-based use cases to achieve higher levels of understanding in persons viewing these descriptions.

Keywords: conceptual modeling; system analysis; unified modeling language (UML); use case modeling

INTRODUCTION

The Unified Modeling Language (UML) offers a standard language specification to support an object-oriented approach to systems analysis and design. The use case is a text-based description defined in the UML that provides a structured sequence of processes within a system (Jacobson, Ericsson, & Jacobson, 1994). Use cases are a popular modeling technique amongst UML practitioners (Batra, 2008; Dobing & Parsons, 2008) and use cases have received significant research attention (Burton-Jones & Meso, 2006; Siau & Loo, 2006). While text is a rich, familiar and expressive modeling tool, the exclusive use of
text across multiple use cases may be difficult for users to conceptualize, particularly as the size of the modeled system increases.

Given the popularity of use cases, it seems reasonable to consider whether a diagram in support of use case modeling, specifically in this case the use case diagram, provides a more effective method for communicating system analysis information than text-based use cases alone. This question is of interest as Dobing and Parsons (2000) found that while use case narratives and use case diagrams were the UML tools most likely to be used in interacting with users, that 42 percent of respondents indicated that use case diagrams provide insufficient value to justify their cost. In a subsequent survey, Dobing and Parsons (2008) found that the use case diagram seems to be gaining popularity: for client validation, implementation, documentation, and clarification, respondents believed the use case diagram to be at least moderately useful.

Communication of analysis information is recognized as an important factor in information system development success. The oft-quoted CHAOS report (Standish Group, 1994) and more recent reports (Charette, 2005) suggest that poorly defined system requirements and poor communication with users remain important inhibitors to development success. This paper hypothesizes that understanding of text-based tools such as use cases could be significantly enhanced by incorporating diagrams conveying the information in a graphical format. The Cognitive Theory of Multimedia Learning (CTML) developed by Mayer (2001) recognizes that both graphical and textual cognitive channels are involved in developing understanding and supports this assertion.

An experiment was undertaken to compare the effectiveness of use cases with and without supporting use case diagrams in conceptual modeling. To accomplish this, we take the view that techniques should be compared on how well they support the development of an understanding of the domain they represent (Gemino & Wand, 2003). The CTML (Mayer, 2001) is used to hypothesize that diagrams improve the effectiveness of use case delivery by providing visual cues aiding model viewers in selecting and integrating relevant domain information into effective cognitive representations. To test understanding, we use a problem solving task (Bodart, Patel, Sim, & Weber, 2001; Burton-Jones & Meso, 2006; Gemino, 1999) that requires reasoning about the domain and focuses attention on higher levels of understanding.

**BACKGROUND**

The term “use case” refers to a complete sequence of events in the system as understood from a user’s perspective. In other words, a use case represents the actions associated with an actor’s “use” of the system (Jacobson et. al., 1994). The use case has become an important part of object-oriented analysis methods...
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