Chapter 12
Combining UML Profiles to Design Serious Games Dedicated to Trace Information in Decision Processes

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ABSTRACT

An expert assessment consists of an ordered series of decisions that have to respond to time-evolving information contexts. Improving decisions made in a risk context requires better knowledge of reasoning mechanisms. The authors think that serious games can constitute a rich observatory for reasoning and decisions. However, the design of these games is not trivial and is rarely scalable or reusable. This paper proposes a UML profile library for generically modeling expert reasoning in situations using serious games that involve risks. Two main UML profiles are dedicated to both serious games and gamer decisions traceability modeling. Complementary profiles address risk expert reasoning modeling and data quality modeling. The authors illustrate the approach using the design of a serious game about avalanche risk analysis.

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1. INTRODUCTION

Generally, making a decision requires the consideration of a large amount of heterogeneous information in an uncertain context. The quality and availability of data involved in a decision-making process can vary (Bouyssou, Dubois, Prade, & Pirlot, 2013) and significantly influence decisions. In the field of natural risk management, such as snow avalanche engineering, experts examine multiple factors that describe the phenomena and its stakes to identify the most avalanche-prone areas, design defense structures, and draw risk maps. Experts may need to make real-time decisions, such as decisions regarding road closures if environmental conditions become too dangerous. These decisions are not exclusive to the avalanche risk. Several types of decisions exist; they differ according to the objectives, stakes, environment, participants and quality and availability of data. These decisions need to be explained from a legal point of view (Lacroix, 2005). We need to improve knowledge transfer to users and learn from decisions from the past. In practice, a decision is the risk situation assessment final objective. However, we also admit that the risk situation assessment is composed of many smaller decisions. Therefore, we consider an expert evaluation as a series of decisions (Tacnet, Dezert, Curt, Batton-Hubert, & Chojnacki, 2014).

To observe the decision process and analyze decision makers' behaviors, real conditions need to be simulated, especially in natural risk management. Researchers have to identify the different successive steps of decision-making and link their assessment of phenomena with the availability and quality of information. Decision process traceability is required. This traceability can be implemented in an information system to enable further decision analyses. Therefore, the main goal of our approach is to propose design tools to improve traceability linked to any decision and its implementation in an information system.

The requirement to observe decision makers' behaviors in almost-real conditions led to serious games. According to (Michael & Chen, 2005), serious games intend to deliver a message, teach a lesson or provide an experience without entertainment as the primary purpose but with an explicit thought-out educational goal. Because of the game mechanics, the authors of (Constant, Buendia, Rolland and Natkin, 2015) define serious games as reflexive tools to observe the decision-making of players. These games are relevant supports to analyze the decision-making process, regardless of the game theme. (Abt, 1987) is the first author to consider a player as a decision-maker. To play is to decide. The serious games enable decision makers to play a concrete decision scenario while scientists can study the reasoning scheme that produces a decision. A serious game can be considered an efficient decision observatory. Thus, this aspect raises the question of designing software tools and information systems for the decision process traceability.

As stated by (Combemale et al., 2016), information system designers and software developers use models to address complexity. For various purposes, models are deeply linked with many concerns: system design, alternative solution exploration, mutual understanding among different stakeholders involved in design, and simulation of a not-yet-existing system. Basing a system design on Model-Driven Engineering ensures that paths to address the previously mentioned issues can be identified. The Unified Modeling Language (UML) of the Object Management Group (OMG) is a visual language for specifying systems using many models that may describe static or dynamic aspects (OMG-UML_2.5, 2015). Even if the UML is probably the most widely accepted and utilized modeling language, it remains too general in some situations, especially for modeling applications of specific complex domains. The OMG defines an approach, where the UML can be specialized to be more focused on a concern while respecting the UML metamodel. These specializations are possible by extension mechanisms of the language referred to as UML profiles.