Towards a Framework for the Measurement and Reduction of User-Perceivable Complexity of Group Decision-Making Methods

Andrej Bregar, Informatika d.d., Maribor, Slovenia

ABSTRACT

Methods for group decision analysis are based on various preference and aggregation models, and may exhibit a significant level of complexity that is perceived by decision-makers. It is therefore essential to apply appropriate methods and keep the complexity within controllable limits. In the paper, factors that influence the user-perceivable complexity are systematically specified, correlated and decomposed into measurable units. They address cognitive load, asynchronous interaction, autonomous guidance and conflict resolution, thoroughness and depth of analysis, problem structuring, efficiency of judgements, imprecision, psychophysical applicability, etc. In addition, several mechanisms and techniques to reduce complexity are presented, evaluated and systematized in accordance with the factors of the framework.

Keywords: Complexity Studies, Decision Support Systems, Evaluation Models, Group Decision-Making, Multi-Criteria Decision Analysis, Systematization Models

1. INTRODUCTION

Many methods for group decision-making and negotiations exist (Kilgour & Eden, 2010). Because they can be based on various preference and aggregation models, they exhibit different characteristics with regard to the complexity that is perceived by human decision-makers. Consequently, only a small subset of available methods is generally suitable for either specific problems or specific group settings in which group members may be subjected to knowledge and time constraints. It is hence essential to assess the complexity of candidate methods and to determine their appropriateness for the given situation.

The goal of this paper is to systematically specify factors that influence the user-perceivable complexity of group decision-making methods. These factors are derived from the common universal framework for the assessment of decision-making methods and systems (Bregar, 2011a). It is the purpose of the paper to focus solely and thoroughly on the aspect of complexity, so it omits other aspects of the existing general framework. On the other hand, it deals with complexity indicators in a broader sense than a previous study on the cognitive load (Bregar, 2009a).

DOI: 10.4018/ijdsst.2014040102
In addition to the primary goal, the paper aims at addressing several secondary goals:

1. To provide hints and directions on how to reduce the user-perceivable complexity on the basis of the introduced complexity factors;
2. To identify correlations between the defined complexity factors;
3. To systematize and evaluate several existing mechanisms and techniques that limit complexity, such as the aggregation-disaggregation analysis (Matsatsinis & Samaras, 2001; Siskos & Spyridakos, 1999), robustness analysis (Bregar, Gyöörkös & Jurič, 2009; Hodgkin, Belton & Koulouri, 2005), autonomous and hybrid approaches (Bregar, 2013), structuring and Delphi techniques (Linstone & Turoff, 2002), and fuzzy/holistic/imprecise judgements (Choudhury, Shankar & Tiwari, 2006; Herrera-Viedma, Herrera & Chiclana, 2002; Van den Honert, 1998; Zimmermann, 1996).

The limitation of the paper is that it does not define and justify correlations between factors and groups of factors in a formal, rigorous and in-depth manner. It merely identifies the directions of several key correlations. We believe that a formal study exceeds the scope of the paper. Further research will be conducted in the future, and its results will be published in a follow up paper. An exception to this limitation are the correlations between the ability of autonomous guidance and other factors. These correlations have been formally inferred with a simulation study.

There are two key differences between the proposed framework and similar approaches. Firstly and primarily, this framework focuses strictly on the user-perceivable complexity and several techniques for its reduction, while other approaches represent either general-purpose evaluation models (Peniwati, 2007, 2013) or very specific and narrow studies. And secondly, it is the aim of the framework to address complexity comprehensively and objectively.

The rest of the paper is organized as follows. Section 2 gives a review of related literature. In Section 3, factors that influence the user-perceivable complexity of group decision-making methods are introduced. Definitions, decompositions and applications of these factors are provided in subsections. Most factors in subsections 3.1 to 3.3 are newly defined, while some factors in subsections 3.4 to 3.6 are adopted from Peniwati’s model. In Section 4, correlations between factors are specified. Section 5 addresses several techniques to reduce complexity. Finally, Section 6 concludes the paper by giving a resume and directions for further work.

2. REVIEW OF RELATED LITERATURE

Several models for the empirical evaluation of group decision-making methods, systems and processes exist. Two frameworks are comprehensive, while other models focus on specific aspects, such as idea generation in brainstorming (Ait Haddou, Camilleri & Zarate, 2012), analysis of face-to-face vs. asynchronous group decision-making (Benbunan-Fich, Hiltz & Turoff, 2002), collective memory support (Paul, Haseman & Ramamurthy, 2004), cultural differences in group decision-making (Tung & Quaddus, 2002), etc.

The first framework has been developed by Peniwati (2007, 2013) based on the consolidation of various existing models. It consists of 16 qualitative criteria which utilize a five-level ordinal scale with values of very high, high, medium, low and NA (not applicable). It does not apply any quantitative subcriteria or metrics. Peniwati has evaluated and compared several group decision-making methods with the aim of showing which method is more attractive, and is likely to gain greater attention both in academia and in practice. These methods include analogy, boundary examination, brainstorming/brainwriting, morphological connection, why–what’s stopping, voting, nominal group technique, Delphi, disjointed incrementalism, matrix evaluation, goal programming, conjoint
Fusing Theory to Practice: A Case of Executing Analytical Strategic Leadership Tool
[www.igi-global.com/article/fusing-theory-to-practice/143200?camid=4v1a](www.igi-global.com/article/fusing-theory-to-practice/143200?camid=4v1a)

[www.igi-global.com/chapter/idsse-software-system-engineering-methodology/75687?camid=4v1a](www.igi-global.com/chapter/idsse-software-system-engineering-methodology/75687?camid=4v1a)