Visual management for decision analysis

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Introduction

It is today well-known that Analytic Hierarchy Process (AHP) is an extremely useful method. Several reviews have compiled their success stories (Zahedi 1986; Golden, Wasil et al. 1989; Shim 1989; Vargas 1990; Saaty and Forman 1992; Forman and Gass 2001; Kumar and Vaidya 2006; Omkarprasad and Sushil 2006; Ho 2008; Liberatore and Nydick 2008; Sipahi and Timor 2010; Dung, Luan et al. 2016). In this paper, we argue that the usefulness of AHP can be even enhanced with visual management techniques. Visual techniques have been long used in AHP for evaluating the pairwise comparisons (Figure 1) and sensibility analysis (Figure 2). They have been integrated in the main software that support AHP and greatly facilitated the decision-making process (Ishizaka and Labib 2009). However, visual techniques cannot only facilitate the decision-making process but also be used as a descriptive tool that explains the whole problem (Nemery, Ishizaka et al. 2012). In the next section, we present GAIA that has been coupled with AHP for the first time in (Ishizaka, Siraj et al. 2016).
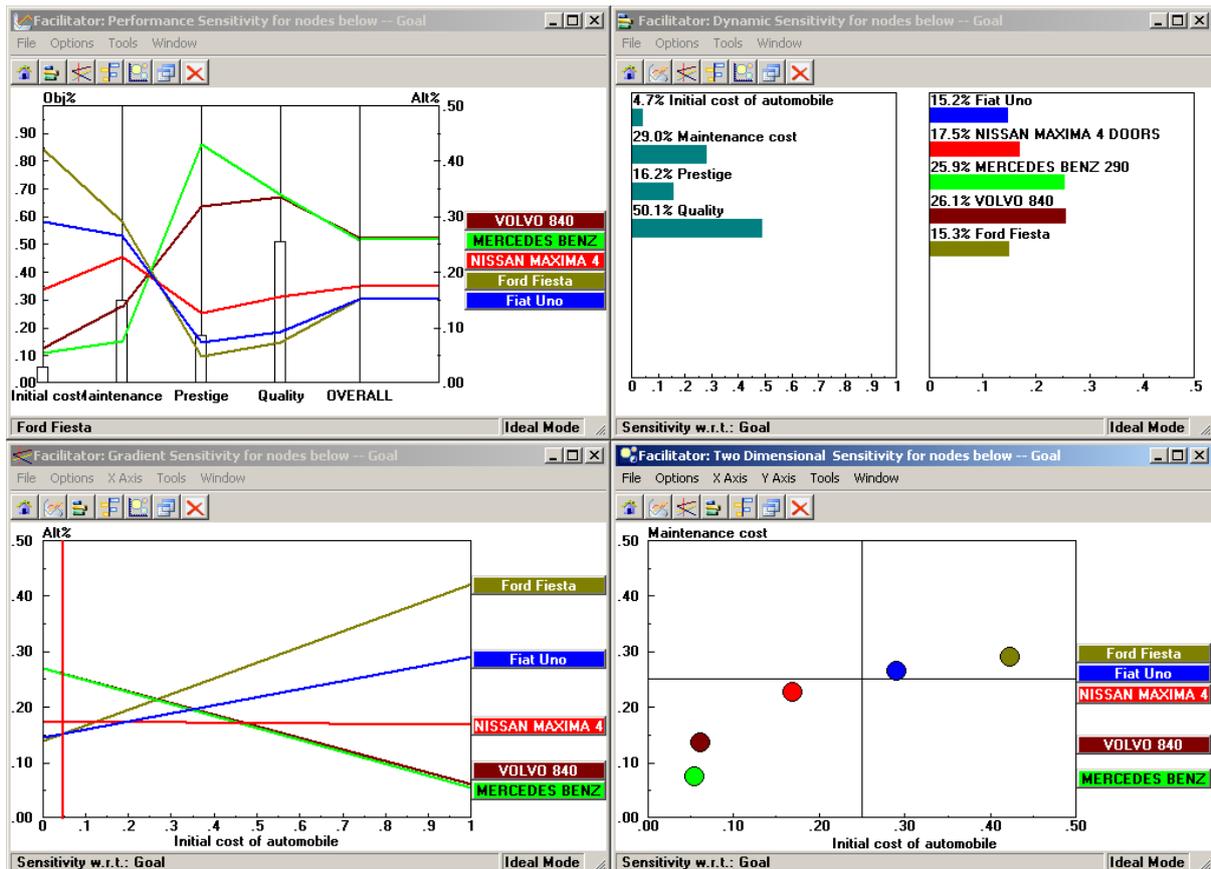

Figure 1: Graphical scale

Figure 2: An example of four possible graphical sensitivity analyses in Expert Choice

Graphical Analysis for Interactive Aid (GAIA)

The idea of GAIA (Mareschal and Brans 1988) is to visualise on a plane as much information as possible of a problem. For this purpose, we can use the dimensionality reduction technique of the principal component analysis (PCA). The PCA is applied on the local priorities of AHP entered in a matrix. Data are displayed on a plane with the two axes having the maximal and next-to-maximal dispersions (Collins, Ishizaka et al. 2017). These two axes correspond to the first two principal components.
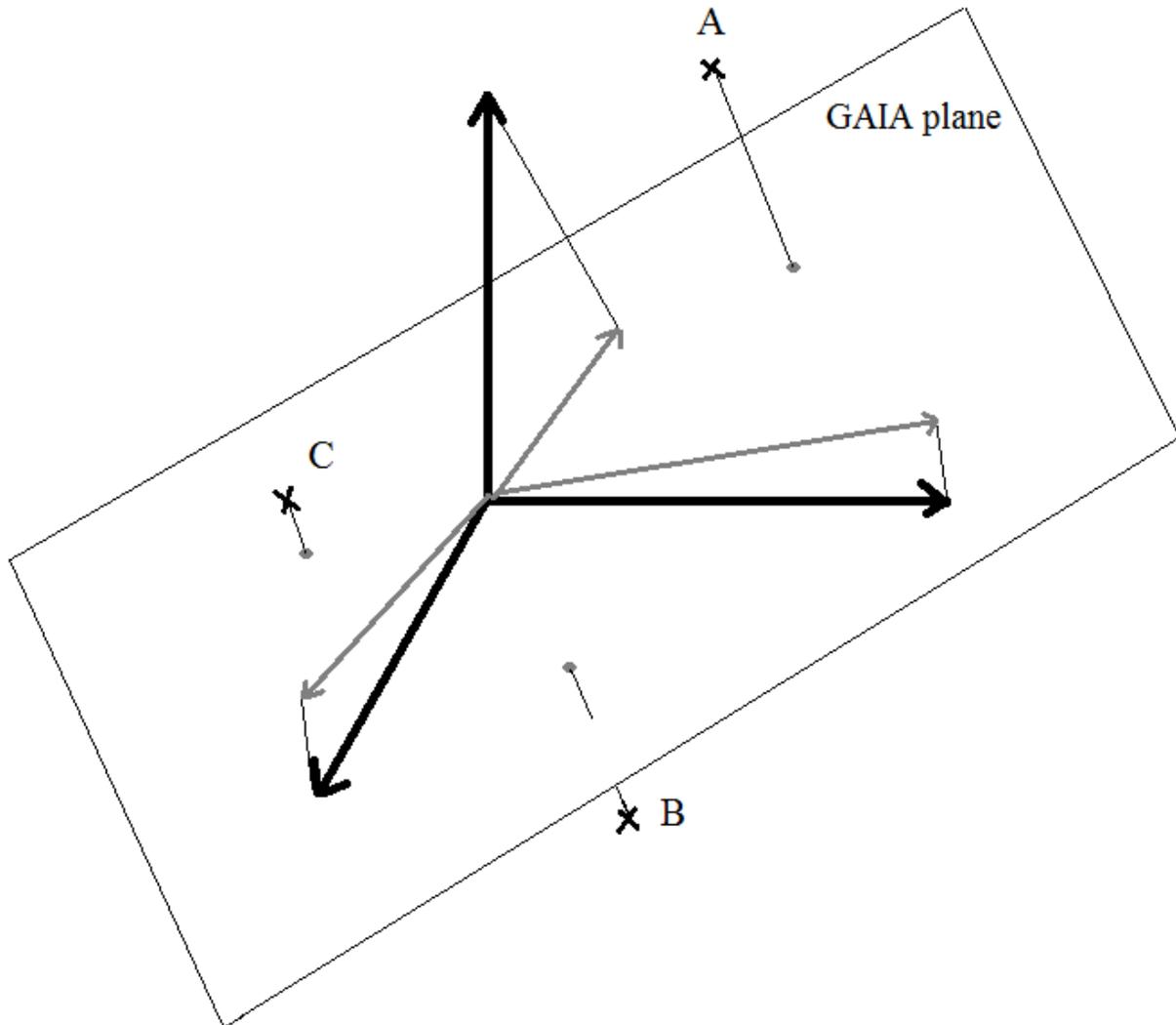
Figure 3 : GAIA plane

Interpreting the GAIA plane

An illustrative example of a GAIA plane with more than two criteria is given in Figure 4, where the criteria are represented by four vectors (see blue arrows emanating from centre) and the alternatives are represented by dots. The decision stick (labelled as DMG) represents the performance direction taking into account all criteria. The reading is done by projection on the relevant arrow. For example, alternative 3 is the best performing alternative overall, but on criterion 4, alternative 1 is the best.

An angle between two vectors represent the degree of correlation between the two criteria, i.e. the smaller the angle between two arrows, the more correlated they are. For example, criterion 1 and 2 are closely correlated, but criterion 3 and 4 have an almost negative correlation. Finally, if alternatives are close, they have a similar level of performance on the different criteria (e.g. alternative 2 and 4).
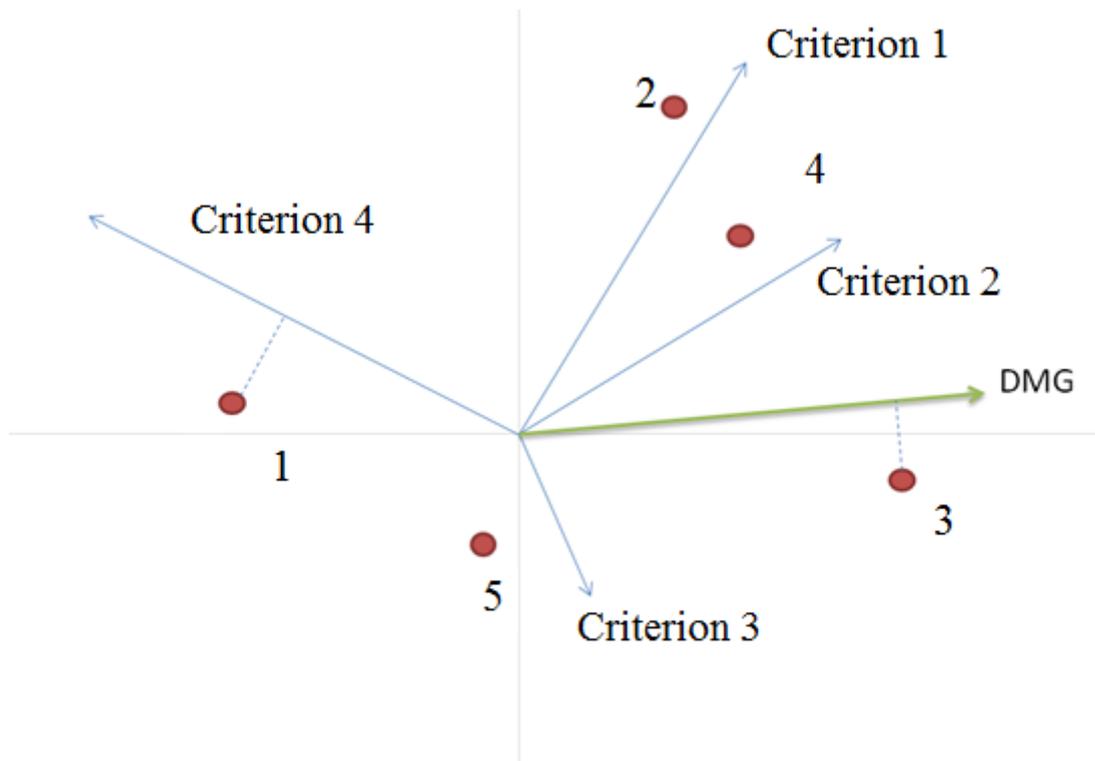
Figure 4 Example of the obtained GAIA graph

Conclusion

A multi-criteria decision making method can only be helpful if the decision-maker understand the reasons underpinning the prescribed results. Otherwise, she and/or her team will not accept it and it will lead to an unproductive change management resistance. Visual management have been long helpful to structure the problem, to elicit the pairwise comparisons and to analyse the sensitivity of the ranking. This paper presented GAIA, which permits to visualise the whole problem on a unique page. In my consulting experience, a picture has always been the best way to explain results. I strongly believe that AHP will become even more popular, if it is followed by GAIA.

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