



## Modeling Personality Influence over Preference Model's Parameter Values

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<b>Abstract.</b>	<p><b>Abstract.</b></p> <p><i>Every enterprise faces the necessity of taking decisions in their everyday activities. The decision process is leaded by one or several Decision Makers (DMs) who are in charge of deciding the proper combination of resources to achieve the goals of the company. Among others, approaches based on outranking relations have been developed to create computable models that aid in the selection of the best alternatives in the decision process. Such models require the elicitation of a set of parameters, a task that so far still has areas of opportunity for research. This work presents an architecture that integrates the personality as a factor that influence the parameter values of preference models based on outranking relations. It is pointed out that with the development of this architecture, it will be possible to integrate personality models in direct parameter elicitation strategies for preference models.</i></p> <p><b>Keywords:</b> Decision Aid; Personality Influence Model; Preference Model; Optimization.</p>
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### Introduction

Nowadays enterprises face the necessity of taking many decisions related to their everyday activities. Usually, these decisions are made over real world problems whose solutions contribute to the achievement of desire results. The most common strategy followed to provide assistance in such situations is through the development of optimizations models that reflects the needs of an enterprise but

also that incorporates particular preferences of the Decision Maker (DM) who is meant to select the best solution, e.g. see (Roy, 1996).

According to (Coello, 2000), the strategies that have been used so far to model preferences are based on goal attainment, utility functions, preference relations, outranking and fuzzy logic. Of particular interest are the outranking approaches which exploits outranking relations to give answer to Multi-objective Optimization Problems (MOPs), see (Roy, 1996). Such approaches have allowed the development of computable preference models, based on a predefined set of parameters that reflect the interests of a DM. The most practical way that can be used to set the parameter values for that preference model is through Preference Disaggregation Methods (Rangel-Valdez et al., 2015; Cruz-Reyes et al., 2017), which are methods that based on a battery of examples provided by the DM elicits the entire set of parameters.

Through recent work, it has been observed that the preferences of a DM could be strongly influenced by abstract aspects of his/her personality (cf. Morales-Rodriguez, 2007), e.g. his/her level of tolerance. In this direction, the personality and the emotional state are relevant elements that provide in some way an added value to these preferences, and they could produce more descriptive and approximate solutions to the reasoning of the individual (Paranagama et al., 1997). Hence, it is acceptable to think that the personality should influence the values of the parameters that define a specific preference model that is used to characterize a DM, e.g. the ones used in (Fernandez et al., 2013).

The main objective in the proposed research is to develop an architecture that allow future study of the impact of the influence of personality on preferences within a decisional context. The work presents the architecture, which takes as input aspects of a personality and consider them as possible modifiers of the parameter values for preference models. The considered parameters of preference models were those of ELECTRE III (cf. Roy, 1991), a well-known model that takes into account the preferences of a DM to compare different alternatives characterized by several criteria. The proposed architecture considers the use of the most recurrent models of the theory of personality in order to provide a computable measure of the tolerance of an individual. As a result, the research set some insight on how to adjust tolerance and intensity, two features from the personality of a DM, from existing personality models, and how to use the values to modify the credibility threshold used by ELECTRE III.

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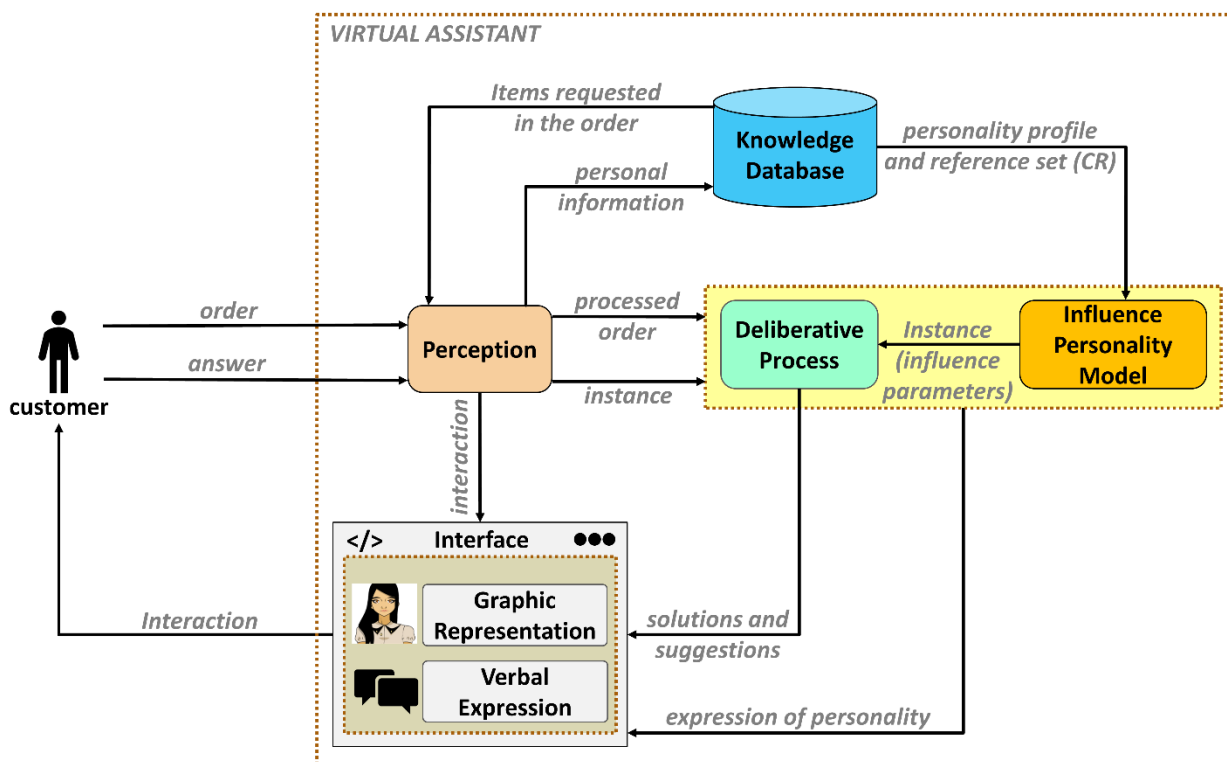
### **Materials and Methods**

The present research proposes an architecture based on the rational agent proposed by (Russell, Norvig & Davis, 2010). The architecture has the basic principles of any intelligent system, it has reactivity, internal state and goals, also it can estimate the degree of satisfaction of a state in the agent that could be used to select among distinct valid actions; also, the architecture incorporates autonomy, sociability and reasoning, required to involve agents that are not only reactive such as Embodied Conversational Agents (cf. Picard, 1997; Buisine, 2004).

The architecture proposed should be of deliberative type because the agent involved must have: 1) A social and intentional behavior; 2) A high cognitive level; and, 3) The capacity of symbolically representing the real world, as indicated in (Iglesias-Fernández, 1998; Wooldridge, 2002). The type of reasoning of such architecture can be related to the outranking relational preference approaches (through Preference Disaggregation Methods) with the personality models based on personality traits (e.g. OCEAN) and personality types (e.g. MBTI and KTS). Basically, the components required for the

architecture in order to achieve the expected behavior are based in four modules: *perception*, *deliberative process*, *influence personality model*, and *interface*. Figure 1 presents the interrelation of all these elements; note the use of a knowledge database whose purpose is serve as memory of the agent and maintain the key information of the DM that is been model, for example, the reference set that can be used to indirectly approximate its preferences. Details on each module are provided in the remaining of this section.

**Figure 1.** Architecture to integrate influence of personality into preferences of a DM.



**Perception Module.** This module is in charge of receiving the input information necessary from the DM in order to support the decision process. The first time that the agent derived from the architecture is in contact with the customer, the knowledge database should be filled with personality information retrieved from the DM such as the reference set, i.e. the set of examples that provide guide in the preferences of an individual.

**Personality Module.** This module has the personality model, and it provides the behavior of a DM. This model is the one that contains the methodology that should be applied to change of parameter values of a preference model due to particular aspects of personality such as tolerance or intensity. Where, the personalities models applied are FFM-OCEAN, MBTI and KTS.

**Deliberative Module.** This module conceals a selection process in which, with the aid of metaheuristics such as evolutionary algorithms that can incorporate preferences models (cf. Fernandez et al., 2013), it approximates the region of interest of the decision maker and try to resolve a set of alternatives for the decision process in question (defined in the Perception Module). This module can be seen as the optimization process in charge of delivering a solution for a specific problem (cf. Rivera-Zarate, 2011).

**Interface Module.** This is the module that will allow interaction between the agent and the real DM. Let's note that the architecture defines an agent that simulates the influence of personality of a real DM over its preferences, then there should exist a way in which the real DM transfer such knowledge, and it is through the interface module.

## Results and Discussion

The development of the previous architecture opens the lines of research to the investigation of models that compute the values for different characteristics of the personality. As an example, the intensity and the tolerance are two personality aspects that can be measure through the models Five Factor Model (OCEAN) (McCrae & John, 1992), MBTI (The-Myers-Briggs-Foundation, 2017) and KTS (Keirsey, 1998).

In order to provide an example Equation 1 shows the computation of the intensity from the values obtained by the IPIP-NEO questionnaire, there the value of intensity is the total sum of each level of the five factors of OCEAN Model.

$$In = \frac{\sum_{k=1}^5 L_k}{5} \quad (1)$$

In Equation 1,  $In$  is the intensity of a personality profile,  $k$  refers to each of the five factors, and  $L_k$  is the value of each OCEAN factor  $k$ . The value of  $In$  represent the degree of intensity in percentage. Table 1 show an example of a possible result, each column represents the value of each OCEAN factor for a strict personality profile, and the last column the value of  $In$ , the value of 60% might indicate a relaxed personality.

**Table 1.** Example of the use of OCEAN model to compute the intensity of the personality.

	$L_1$	$L_2$	$L_3$	$L_4$	$L_5$	
	O	C	E	A	N	$In$
OCEAN (L)	0.8	0.7	0.9	0.4	0.2	60%

The value of intensity can be a main component in the definition of other features of the personality, for example the *tolerance*. The *tolerance* might be the flexibility of an individual to choose an alternative that is distinct from its preference. It is suggested that the intensity  $In$  can be integrated into a mathematical model in order to estimate a proper value of the tolerance; this estimation could be further supported by other personalities models, as the KTS model. Table 2 show an example of how the result could be; there, eight decision profiles are defined and each of them related with the different temperaments defined by KTS (see second column). By making a uniform distribution of the proportion, each temperament is related with a tolerance value, third column where the extreme values 1 and 0 represent complete and absence of tolerance, respectively.

With the values of tolerance given in Table 2, one proposal to associate them with the credibility threshold  $\lambda$  of ELECTRE III could be an indicator like this  $\lambda = \frac{1+To}{2}$ ; this indicator represents the influence of tolerances in inverse proportions with respect to the credibility index. The latter comment makes sense if one observes that the higher value of  $\lambda$  is the stronger the support information for a comparison in ELECTRE III must exist, hence a tolerant person might be related with low values of  $\lambda$ ,

and a non-tolerant one with high values. The model previously proposed is an example of approaches that can be made in order to relate personality with preference of a DM in computable models.

**Table 2.** Suggested range for an initial tolerance model.

Decision Profiles	KTS Temperament	Tolerance
Strict	Rational (NT)	0
	Guardian (SJ)	0.125
Inquirer	Rational (NT)	0.25
	Artisan (SP)	0.375
Collaborative	Guardian (SJ)	0.5
	Idealist (NF)	0.625
Optimistic/ Relaxed	Idealist (NF)	0.75
	Artisan (SP)	0.875

## Conclusions

The present work is a brief research about the development of an architecture that integrates personality as a factor of influences in preference models. The application of existing personality models to define computable values for features of personality, such as tolerance and intensity can be further extended to modify parameters' values of preference model, and, in a way serve as an alternative direct elicitation strategy that could be a good competitor for others such as preference disaggregation analysis. The present research will continue the line of work of successfully integrate the personality influence in preference and study if there is or not a significant difference in it.

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