

A process-oriented approach to model agent personality

(Extended Abstract)

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ABSTRACT

We present a process-oriented approach to specify personality-based behaviors in agents. The main aim is to make the agents able to reason about their choices following a preferred reasoning strategy according to a personality type. With this method, the decision-making of the agent becomes flexible enough to be reused in different scenarios while staying consistent with the used psychological theory.

Categories and Subject Descriptors

I.2.0 [General]: Cognitive simulation—*Personality modeling*; I.2.11 [Distributed Artificial Intelligence]: Intelligent agents

Keywords

Personality-based agent, Planning, MBTI

1. INTRODUCTION

In the last years, several works proposed new forms to introduce personality in agents. They normally rely on the deployment of personality as valence-based mechanisms. This is a quantitative approach where the agent decision-making is controlled by the influence of certain personality traits on a specific situation. More specifically, they model personality through the level of agent preference for certain actions in a given context.

In this paper, we present a different approach to specify personality-based behaviors. It is based on the planning mechanism of the agent, which creates plans following a preferred *reasoning process* instead of pursuing preferred actions. In this approach, the decision-making mechanism of the agent becomes flexible enough to be reused in different contexts. We used a general BDI-based structure as the

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cognitive architecture for the agent and the MBTI model [2] as a theoretical basis for extracting the main characteristic of human personality.

2. PERSONALITY-BASED REASONING

As agents normally does not have a perfect knowledge of the entire environment surrounding them, they should reason under uncertainty and make choices according to behavioral preferences. For this, we used a personality type associated to agents to define the reasoning strategy they use for exploring possible actions.

In order to illustrate the mechanism, consider the following firefighting simulation scenario. A building is on fire and a person in danger is crying for help. To help him, a firefighter agent can: plan A) to put the safety-net in place and wait for the person to jump on it, or plan B) to enter in the building and bring the person safely out. Time urges and a behavior must be executed quickly. However, the firefighter agent can decide to execute plan A and the person in danger may refuse to jump. On the other hand, the firefighter can choose plan B and discover too late that it is not possible to go through the on-fire building. Thus, there is no “best” solution. What makes “*individuals to be psychologically distinguished from another*” brings on some firefighters choosing plan A and others plan B. In any case, the chosen alternative should reflect the preferred *way of reasoning* about a situation. For this, we used the MBTI model of personality.

The MBTI model attempts to categorize people in terms of their primary modes of psychological functioning and categorizes individuals into different dichotomies according to patterns of behavioral preferences. In this work, we explore two of them: Sensing or Intuition (S-N), and Thinking or Feeling (T-F).

2.1 Sensing-Intuition dichotomy

Sensing persons differ from the Intuitions persons by the fact that the former prefers what is concrete and factual, while the latter are likely to be most interested in and trust possibilities [3]. In the above scenario, a Sensing firefighter

tends to follow plan A since all the information necessary for him to execute it is known, contrarily to plan B where no information about the interior's building is known. The first plan is then more concrete. An Intuition firefighter is open to follow both plans, but will tend to choose the second one since besides the possibility that the fire did not overtake the interior of the building and it is possible to go through, there is also the possibility to find other persons in danger.

In order to model this in the agent decision-making, we doted our agents with a hierarchical planning capabilities [1]. A solution for a problem the agent is facing is initially planned in a high level of abstraction and then be detailed into more concrete plans until reaching to atomic actions. The full-detailed plan is then a hierarchical tree of actions. However, there are several ways for developing this hierarchy. We attached the agent personality type to two different approaches of producing the tree. A Sensing firefighter agent will develop the entire hierarchy prior to performing any concrete action. In other words, the agent believes that the plan is feasible after a full plan development and, so, it can be committed to it (the agent intention). For the Intuition firefighter agent, an abstract plan is feasible if the requirements on its level of abstraction are present. It will commit to the abstract plan and develop it into more concrete actions only when the current abstract action needs refinement.

2.2 Thinking-Feeling dichotomy

Thinking people tend to make decisions based on objective and logical analysis, while feeling people prefer to make decisions based on subjective person-centered values [3]. More precisely, Feeling people “*mentally walk in another's shoes to look at a situation*” [3]. So, a mutual-modeling mechanism, where an agent tries to model the beliefs of other agents (agent *a* believes that agent *b* believes *c*), is used to put this dichotomy in practice. In our approach, the way in which an agent infers the beliefs of other agents is determinate by the agent personality type. While the Thinking agent analyzes a situation assuming that the other agents also carry out their own beliefs (what is true for the Thinking agent is assumed to be equally true for the other agents), the Feeling agent does not assume this rule. The mutual-modeling of the Feeling agent has no prior assumption, exploring then the agent's beliefs about the other agent's beliefs.

In this second personality dimension, the difference between the Thinking and Feeling types is not based on how the hierarchical plan is developed (as it occurs with the Sensing and Intuition types), but rather based on how plan nodes are likely to be expanded. When a plan depends on the actions from other agents, several outcomes become possible. However, just one is picked as the probable outcome according to what the agent believes about the other agent's beliefs.

In the example scenario, the Thinking firefighter agent will analyze the first plan and conclude that, as the safety-net is safe (its beliefs), the other agents can jump on it free from danger. The first plan is feasible and can then be committed. However, the Feeling firefighter agent does not assume the same inferring rule, i.e. it will take into account that not necessarily other agents know how safe is the safety-net. In this case, the first plan can be unachievable (they may not jump).

The mechanisms explained for Sensing-Intuition and Thinking-Feeling types presented here are combined in the agent reasoning process, providing the four core types existing in the MBTI model: ST (Sensing-Thinking), SF (Sensing-Feeling), NT (Intuition-Thinking), and NF (Intuition-Feeling). As a result, different behavior may be adopted for each one of the four types.

3. RESULTS AND FUTURE WORK

In order to check the ideas presented in the paper in a computer-based model, a simple use-case agent-based simulation was designed and implemented. This simulation aimed to evaluate different action plans elaborated by agents with different personalities. Four types of agents were able to be modeled: STAgent (Sensing and Thinking agent), SFAgent (Sensing and Feeling agent), NTAgent (iNtuition and Thinking agent), and NFAgent (iNtuition and Feeling agent). The simulation results reproduced what was explained in the previous section, i.e. STAgent always choose the use the safety-net (plan A), NTAgent and NFAgent always choose to enter into the building (plan B), and SFAgent mix its choice between the previous choices. For the latter, none of the abstract plans could be turned to concrete ones. In this particular case, the SFAgent takes one of them randomly.

The idea exposed in this paper and implemented in the simulation was able to reproduce an expected behavior following a personality characteristic without having to define preferences over the set of possible actions. The choices made by the agents resulted exclusively from the way in which the decision-making occurred. This process-oriented way of introducing personality in agent provides a natural way of representing personalities, since it is not related to a particular context or situation. Indeed, we bring our personality where ever we go and we act according to it even in situations never faced before. This approach has also the advantage of providing a good way to design agents with personality, since the proposed mechanism can be reused in many domains. Briefly, it is more natural and it is more reusable.

Future work involves the design of mechanisms taking into account more aspects of the personality functions, the inclusion of Introvert-Extrovert and Perceiving-Judging dimensions, as well as the relation of personality with other elements of human behavior. With this regards, a special interest is the link between personality and emotions.

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