

COMPUTER MODELS OF HUMAN PERSONALITY TRAITS

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This paper presents a goal-based analysis of human personality traits. A process model for automated understanding and interpretation of personality traits is developed. The model is based on the goal-tree and planning/counterplanning strategies developed to represent subjective beliefs in the POLITICS system. The automated analysis of personality traits plays an integral role in natural-language story-understanding processes and in computer models of human social interactions.

1. Why Analyze Personality Traits?

Understanding stories requires information and reasoning about the situation, the causal structure of the events, and the characters in the story. Schank [1], Cullingford [2], Rumelhart [3], and Beaugrande and Colby [4] have analyzed the narrative structure of stories and developed means of automating the analysis process. Schank and Abelson [5], Wilensky [6], and Schmidt and Sridharan [7] developed means of inferring the goals and plans of the characters in a story from their actions. Both the narrative structures and the goals and plans of the characters are crucial in integrating the information contained in stories into a coherent memory representation. Such memory structures are necessary to answer questions about the story in much the same way that people appear to reason about the stories they read.

Character development, however, is an important aspect of story understanding that has been largely ignored by Artificial Intelligence researchers. A person reading a story identifies with one or more characters depending on whether the characters are heroes, villains, compassionate, intelligent, unscrupulous, etc., and depending on how the character's personality relates to the reader's self-image and to other people he knows in real life. Furthermore, knowledge of the characters and their personality helps to interpret their actions and induce their goals. Thus, understanding character development is an integral part of processing natural language stories. Here we deal with the most simple form of character development: the attribution of personality traits to actors in simple stories. We analyze personality traits in terms of personal goal trees and predispositions towards applying certain classes of planning and counterplanning strategies. Goal trees and counterplanning strategies were developed to model ideological beliefs in the POLITICS system [8].

2. What Information Do Personality Traits Convey?

Consider an example of personality-trait attribution in the following story.

Bill was very brave, but his brother John was very cowardly. One night the two brothers were walking by the road when a masked bandit surprised them. The younger brother panicked and ran headlong into the forest where he was lost, never to be seen again. The elder brother fought off the bandit, and, in the process, recovered the long lost royal sapphire, stolen years earlier. The king rewarded him handsomely.

QUESTION: Whom did the king reward?

A person reading the above story has little trouble in answering the question: Clearly, the king rewarded Bill. However, it is not particularly easy to see how one goes about formulating the answer. No simple rule will serve. For instance, the last mentioned character in the story before the word "him" is the bandit, but this is obviously not the correct referent. The first step in resolving the referent requires one to understand why the king gave the reward, thus establishing that the elder brother who recovered the sapphire received it. This, however, is only half of the task. How do we know that Bill is the elder brother who deserves the reward?

In order to determine which brother is which we must use the information contained in their respective character traits. One brother is brave; the other is cowardly. Running away in the face of danger is a characteristic behavior associated with cowardly people. Fighting bandits, or otherwise risking one's life for a worthy cause is the type of behavior characteristic of bravery. Therefore, we determine that Bill, the brave one, must have been the elder brother who fought the

bandit and recovered the sapphire. This determination requires knowledge about some types of actions that are characteristic of bravery and other actions that are characteristic of cowardice. Thus, we need to know, or be able to infer, typical behaviors associated with certain character traits. We need to answer the general question: If actor X has character trait P, is he likely to do action A in situation S? It seems, therefore, that an investigation of personality traits and their associated typical behavior ought to be a worthwhile pursuit.

3. Goal Trees Representing Personality Traits.

One way of analyzing personality traits is by associating with each trait the goals people described by that trait are likely to have. Once these goals are established, certain behaviors can be inferred. Since we have developed mechanisms for understanding goal based events (e.g., PAM [6] and POLITICS [8]), it seems quite fruitful to reduce personality traits to the pursuit of certain types of goals. For the present discussion we borrow three general classes of goals from the Schank and Abelson goal taxonomy [5]: acquisition goals (A-goals), preservation goals (P-goals) and enjoyment goals (E-goals).

Consider the process of understanding a story starting with the following initial segment:

John is a very inquisitive and uncompromising person. He is also rather thrifty in his personal affairs...

There have been no actions thus far in the story, nor any physical or temporal setting that helps the understander establish the situational context. Yet, John's personality traits provide a goal-expectation setting. That is, the understander knows the following information from the above fragment of 6: John's goal of increasing his knowledge about most matters is a goal of very high importance. We denote the acquisition of knowledge goal as A-know(John,X,+). (The "+" means John wants knowledge about X. A "-" would signify that John's goal is to actively avoid knowing about X, and a "0" signifies that John ignores new knowledge about X. Thus, if we know that Mary is apathetic, we mean A-know(Mary,X,0).) The fact that John is thrifty tells us that he also has the goal of preserving his money. In fact, the word "thrifty" states a relationship between the P-money goal and the set of A-goals that can be accomplished by spending money. John holds the goal of P-money to be more important than most such A-goals.

Since most personality traits describe deviations from a culturally-defined normative person, we know that John's A-know goal is much more important to him than other people's A-know goals are to them. Similarly, we know that his P-money goal is a little more important to him than is generally the case. We may also infer that John's A-goal of things that cost money may be a little less

important to him than other people's corresponding A-goals are to them. The trait "Uncompromising" exemplifies an across-the-board deviation from the norm. John will give higher than normal importance to most of his goals. Using this information, we can build a fragment of John's relative importance (RI) goal tree:

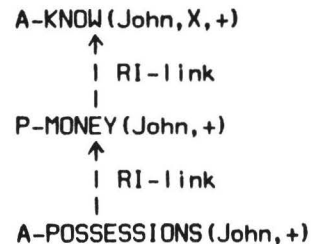


Figure 1: Fragment of John's RI goal tree.

Figure 1 tells us that of the three goals that we know John to have, he considers acquisition of new knowledge as most important, followed by preserving his money, followed by acquiring new material possessions. Since we know that John is a person and a member of western society, we know that he has certain normative goals common to most people in the society. The following list includes some of the prototypical person's goals, arranged in a relative-importance hierarchy in figure 2.

GOAL	EXPLANATION
1) P-health(Self,+)	Self-preservation
2) P-health(Family,+)	Preservation of family
3) A-possession(Self,+)	Acquire new wealth and belongings
4) P-possession(Self,+)	Preserve one's belongings
5) A-scont(Self,others,+)	High social standing
6) A-know(Self,X,+)	Learn new things
7) E-unpleasant activity(Self,-)	Avoid going through unpleasant experiences
8) E-pleasant activity(Self,+)	Have fun doing enjoyable things
9) P-health(others,+)	Philanthropy
10) P-anything(enemies,-)	Wish doom upon one's enemies

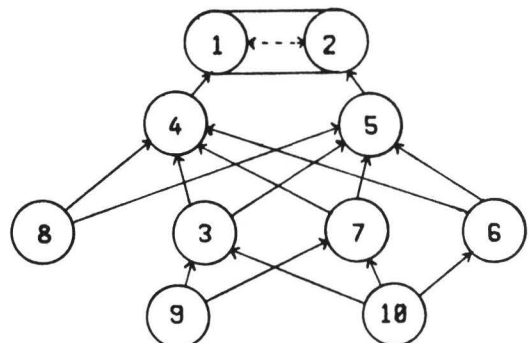


Figure 2: Goal tree for a normative person.

Many personality traits can be represented as deviations from a person's normative goal tree. Table 1 lists a small sampling of such traits and the changes in personal goals that they imply. For instance, "ambition" means that a person holds his A-scont and A-wealth goals as more important, while considering the goals of other people as less important. "Compassion" implies the opposite. Other personality traits refer to the means that a person is willing to use in order to achieve his goals. A more thorough analysis can be found in [8].

Table 1 PERSONALITY TRAIT	GOALS AND THEIR IMPORTANCE (deviations from the socially accepted norm)
1) Ambitious	A-possessions(self,+) higher A-scont(self,others,+) higher P-anything(others,+) lower
2) Inquisitive	A-know(self,+) higher
3) Prudent	P-anything(self,+) higher
4) Spendthrift	P-money(self,+) lower E-anything(self,+) higher
5) Vindictive	P-anything(ones who cause goal failure,-) higher
6) Compassionate	P-health(others,+) higher E-anything(others,+) higher

A person's goal tree, modified by his personality traits, is used to predict which goals he will strive for in a given situation. Since relative-importance links are transitive, the following rule summarizes the function of personal goal trees:

If a course of action affects two goals, and no other rules determine which goal to focus on, the effect on the higher-importance goal determines whether the course of action should be pursued.

We developed a set of heuristics for combining personality traits. Consider a person described by traits A and B, where A and B are defined in terms of their deviations from the normative person. A and B consist of a list of attribute-rank pairs. An attribute is the name of a goal. The rank encodes the positive or negative deviation from normative position of that goal in the goal tree. If A and B contain no goals in common, their combination is simply the union of the attribute-rank pairs, otherwise the following heuristics apply:

CONTRADICTIONARY TRAITS - If both rankings have a high magnitude, but opposite sign, the two traits cannot be combined. (e.g. A generous miser, and a cowardly brave person are instances of contradictory traits.)

REINFORCEMENT OF EXTREMES - If both rankings have a high magnitude and the same sign, assert the attribute with a ranking slightly larger than the maximum of the two original rankings. (e.g., An unscrupulous, vindictive person is more likely to violate other people's goals than someone who is merely vindictive, or just unscrupulous.)

DAMPENING MINOR VARIATIONS - If the magnitude of both rankings is small, but the signs opposite, delete this attribute from the combined trait, as it is of little importance and uncertain consistency.

PREFERENCE TO EXTREMES - If none of the above rules apply, average the two ratings, but give greater weight to the rating with the higher magnitude.

The heuristic rules were empirically derived by analyzing many personality traits into their component attributes and recombining them in different ways. The analysis of personality traits is part of a larger research effort into subjective understanding of stories and discourse.

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