Characters with Personality!

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Abstract. Serious games offer an opportunity for learning communication skills by practicing conversations with one or more virtual characters, provided that the character(s) behave in accordance with their assigned properties and strategies. This paper presents an approach for developing virtual characters by using the Belief-Desire-Intentions (BDI) concept. The BDI-framework was used to equip virtual characters with personality traits, and make them act accordingly. A sales game was developed as context: the player-trainee is a real-estate salesman; the virtual character is a potential buyer. The character could be modeled to behave either extravert or introvert; agreeable or non-agreeable; and combinations thereof. A human subjects study was conducted to examine whether naïve players experience the personality of the virtual characters in accordance with their assigned profile. The results unequivocally show that they do. The proposed approach is shown to be effective in creating individualized characters, it is flexible, and it is relatively easy to scale, adapt, and re-use developed models.

Keywords: intelligent agents, behavior modeling, training, personality, virtual characters, serious gaming, BDI.

1 Introduction

This paper is about a method for developing intelligent virtual characters with a flexible and easily expandable domain of discourse to be used for conducting dialogues with a human player in serious games. In particular it is about modeling the personality characteristics of a virtual character in such a way that it behaves in accordance with its assigned personality.

Serious games offer an opportunity to develop a contextually rich and flexible environment for training skills (e.g. Korteling et al., in press; Michael, 2006). They are considered to be effective for learning tasks that rely upon communication skills, like legal profession, project management, human resources (e.g. negotiating employment terms: Broekens et al., 2012), intelligence, sales, and many other professions (e.g. Core et al., 2006). Communication skills can be practiced in serious games by conducting conversations (e.g. interviews, sales conversations, negotiation talks) with one or more virtual characters (Cassell et al, 2003).

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Such practice conversations usually have one or more objectives, like (a) familiarizing the player-trainee with various types of conversational partners (e.g. cooperative versus intractable; empathic versus reserved; extravert versus introvert), (b) enabling practice in various conversational strategies (e.g. fact-driven versus emotion-driven); and (c) make the player-trainee experience how different communication styles (e.g. asking rather than telling; providing facts instead of opinions) affect the partner and the course of the conversation.

Although agents evidently do not possess human properties, users perceive agents to have these qualities when interacting with them (Reeves and Nass, 1996). Moreover, people do so automatically and mindlessly. The convincingness of a virtual character to a human interlocutor is strongly influenced by its functionalities, and very little by its features (Catrambone et al., 2004).

The quality of the virtual characters in the game determines the quality of the learning situation. Proper training requires characters that behave in accordance with the assigned properties and strategies, and use these to respond to player-trainee actions in a consistent manner. Virtual characters that fail to act in a consistent and believable fashion, and that do not respond in a logical way to their conversational partner may bring about a training with no or limited learning opportunities. It is even possible that it induces the player-trainee to adopt inappropriate conversation strategies, resulting in negative transfer of training.

The classic approach towards developing dialogue in serious games is to make use of scripts. In scripted dialogue, communications of a virtual character (from now on called "Non-Playing Character", or NPC) and the player-trainee are predefined as option sets. An NPC selects its response based on the option chosen by the player. This approach usually results in (large) decision trees that define both flow and content. The advantage of scripting is that it is a robust technique, and it allows complete control over the dialogue. However, if learning requires more than simple conversations, the dialogue tree grows exponentially, which makes adding new content both complex and laborious. Furthermore, the deterministic nature of scripted conversation often results in stereotyped and rigid non-playing characters, leading to a predictable game experience.

An alternative to scripting dialogues is the Belief-Desire-Intention (BDI) model of human behavior, proposed by Bratman (1987). In a BDI model, a character is not instructed to act upon a statement in the conversation, but rather upon the *belief* that the statement brings about. The belief then triggers a goal in the Non-Playing Character. What goal is triggered depends upon the context, and upon the properties of the NPC. For example, an agreeable NPC may decide to comply with a partner's suggestion to change the topic, whereas a non-agreeable person may decline the suggestion and hold on to the current topic. The advantage of BDI over scripts is that behavior is more flexible and reusable. It has been shown that with BDI it is possible to develop intelligent Non-Playing Characters that behave autonomously and realistically in simulations and games (Shenandarkar et al., 2006; Van den Bosch et al., 2009).

The research presented here makes use of the BDI approach to model Non-Playing Characters equipped with (combinations of) personality traits that make them behave in a fashion that is typical for individuals with such a personality profile.

The next section describes the game that is used as research context, followed by an account of the personality traits selected for the study and how these traits have been accommodated in the model. The model is tested experimentally in a human subjects study. The implications of the results are discussed in the final section.

2 The Game

A 'sales' game was developed, inspired by the Glengarry Glen Ross movie (1992). In the movie, four salesmen working at a real-estate agency become desperate when the corporate announces that all except the top two salesmen will be fired. Superior sales skills (e.g. listening, persuading, negotiating) are of the essence. The player in the present GGR-game is a real-estate salesman; a lead (a potential buyer) is a BDI-based NPC. See Figure 1 for an impression.

Fig. 1. Impression of the game's interface, showing the dossier with discussion topics (left), the player's communication options for the selected topic (below), and the NPC (potential buyer) that just asked a question and awaits a reply (middle right).

The principles of the game will be explained below. An elaborated account of the game can be found in Muller et al., [submitted]. Each NPC has its own belief base (e.g. knowledge of the house in question, wishes/demands), goal base (e.g. requesting information, deciding whether to buy the house, choosing topics to discuss), and plan

base (strategies to achieve its goals). In a sales conversation, the player can ask questions to discover the NPC's wishes and can communicate information, interpretations and opinions in order to convince the NPC that the house suits its needs. The player can do so by emphasizing qualities of the house desired by this buyer, or by providing appropriate anecdotic material. The NPC uses its sets of beliefs, goals, and strategies to respond. But it is not only the player who can take the initiative in the dialogue. The NPC can also initiate communication. For example, the NPC can ask and answer questions; give opinions, take a decision to visit the house; terminate the conversation; etc. As both the player as the NPC can take the initiative in the dialogue, a 'turn-taking' mechanism was developed (visible on the right in Figure 1).

2.1 Domain Ontology

A large number of concepts related to 'house-buying' are represented in a predicate ontology, providing the structure of topics that the player and NPC can talk about. These, of course, include properties of the house (e.g. number of rooms; surface area; maintenance state), but also other topics that are typically addressed in house-buying negotiations (e.g. safety of the neighborhood; access to public transport/ motorways, etc.). Both the player and the NPC can refer in their communications to any of the concepts defined in the ontology.

2.2 Building Blocks

In order to assign meaning to the lemmas in the predicate ontology, a series of 'building blocks' were developed: *Fact*, *Interpretation*, *Opinion*, *Wish*, *Importance*, *Illustration*, and *Argumentation*. These building blocks define the dialogue.

- The *Fact* building block defines information about a given predicate (e.g. kitchen has a surface area of 12 m^2). Facts can be used by both player and NPC.
- *Interpretation* defines a subjective value about a predicate (e.g. kitchen has a large surface area). Interpretations can be used by both player and NPC.
- *Opinion* represents an opinion of either player or NPC (e.g. kitchen is fine), expressed by a number between 0 and 1.
- A *Wish* defines the desired value or range of values of a predicate and is used by the NPC only. A wish can be expressed as fact values (e.g. KitchenSurface [11, 20]) or interpretation values (KitchenSurface, [large, very large]).
- *Importance* defines the importance of the predicate to the NPC. It expresses how much importance the NPC attaches to the predicate (e.g. KitchenSurface) when judging the house.
- *Argumentation* is a building block to be used by the player only. It can be used as instrument to influence the NPC's opinion on a specific predicate. For example, the player argues "the nosy neighbor increases neighborhood safety". This may indeed affect the NPC's opinion on safety. However, it may also affect its opinion on tranquility.

- *Illustration* is a remark to be used by an NPC to provide hints to the player about its underlying motives. For example, an NPC may respond to the message that the house has an open kitchen with "Great, so I can keep chatting with my friends in the living room while cooking."

The following communication types were distinguished: *Tell*, *Ask*, and *Acknowledge*. This means that a player or NPC could tell a fact, wish, interpretation, opinion, etc., they could ask for them, and they could acknowledge a given fact, wish, etc. in a number of ways.

Sentence templates are used to interface message types, building blocks, and predicates in complete sentences to the player. For example:

```
Ask(Fact(FeederRoads))
```

uses the following sentence template to bring across the NPC's question to the player:

"What is the position of the house with respect to feeder roads?"

Likewise, the sentence template

"The house is close to feeder roads."

is used as player's dialogue option to convey the following information to the NPC:

```
Tell(Interpretation(FeederRoads, nearby))
```

The NPC continuously updates three parameters indicating the result of the game play. These involve: (1) its opinion on the suitability of the house in question, (2) its opinion about the conversation, and (3) the status of its information need. It is the task of the player to enquire about the NPC's wishes, to maintain a good atmosphere (to make the NPC find the conversation pleasant), to deliver relevant and positive information (to provide the NPC's with the needed information, and to establish a positive attitude in the NPC towards the house). The interface displays the status of the first two parameters to the player (see upper right corner of Figure 1); the status of the NPC's information need indicates whether the NPC is ready to take a decision (to visit the house or to place a bid) or whether it desires more information. The status of information need is not shown to the player.

3 Modeling Personality

Personality can be defined as a dynamic and organized set of characteristics that uniquely influences a person's behavior in various situations. In sales training, learning to recognize and utilize the relationships between personality and behavior is usually an important part of the program (e.g. McFarland et al., 2006; Sujan et al., 1988). Serious gaming offers the opportunity to familiarize trainees in a realistic setting with different simulated personalities. Furthermore, trainees may use such games to try different approaches in communicating with the various simulated personalities, experience the outcomes, and adjust their strategies accordingly. However, a precondition for meeting the potential of serious games is that the behavior of the modeled personalities accurately reflects the behavior of real humans with such a personality profile.

The question is then: is it possible to model NPCs in such a way that they behave in accordance with their assigned personality?

The literature shows that the study of personality has a broad and varied history in psychology, with an abundance of theoretical traditions. It is obviously beyond the scope to review all proposed dimensions and categorizations of personality here. Instead, the purpose of the present study is to investigate whether it is possible to capture one, or a few, well known personality traits in our behavior model of the NPC, and to examine whether the model generates behavior for the NPC that people experience as characteristic for that personality trait.

The literature shows interesting previous work. Bevacqua et al. (2010) used Eysenck's three-factor model to develop Sensitive Artificial Listeners that in dialogues respond in accordance with their assigned personality by means of non-verbal behavior (e.g. facial expressions, back channeling). In contrast, our study attempts to express personality through verbal behavior in human-agent dialogue.

Bostan (2010) uses a needs framework to define a series of 27 'psychological needs' as the driving force of behavior. Needs are affected by many factors, like feelings, desires, emotions, and also personality traits. Personality Inventories are used to build character profiles, like 'male dominant leader', or 'character of trustfulness'. In our approach, traits are used directly to generate behavior rather than indirectly through needs.

3.1 Selection of Personality Traits

Perhaps the best known framework of personality is 'the Big Five' (Costa & McCrae, 1992). The Big Five factors are openness, conscientiousness, extraversion, agreeableness, and neuroticism. Conscientiousness is exemplified by being disciplined, organized, and achievement-oriented. Neuroticism refers to degree of emotional stability, impulse control, and anxiety. Extraversion represents a high degree of sociability, assertiveness, and talkativeness. Openness is characterized by a strong intellectual curiosity and a preference for novelty and variety. Finally, agreeableness refers to being helpful, cooperative, and sympathetic towards others. Of course, the five traits are a gross categorization; they represent human personality at a broad level of abstraction.

From the Big Five, we selected *extraversion* and *agreeableness* to be modeled. The two traits were selected because they distinguishably affect behavior in a conversation: extravert personalities (compared to introvert people) use more social and positive language. They give more compliments and are more focused on reaching agreement. Furthermore, they tend to produce less formal but more complex sentences (Dewaele et al., 1999; Furnham, 1990). With respect to agreeableness, Mehl (2006) showed that agreeable persons explicitly communicate their understanding, are more open to suggestions of others, and are more likely to express appreciation (Graziano & Eisenberg, 1997). Mairesse et al. (2007) found evidence that agreeableness is a trait that can be observed by others.

3.2 Using Personality Traits to Shape Conversation

The next step is defining how the two selected traits affect the nature of conversation. Three main aspects of a conversation can be distinguished: *Form*, *Content* and *Strategy*. The form of a conversation refers to how sentences are being derived and put together, and how sentences are being pronounced. An extravert personality is, for example, likely to have a poorer lexical composition than an introvert personality. The content of communication refers to the information being exchanged. For example, a conversation may cover many topics or only a few; exchange of information may pertain to social information or domain-specific, and so on. Strategy, finally, defines how persons act and respond to the actions of their conversation partner. It determines, for instance, the topic(s) being addressed, initiative to shift to topics, to disclose or conceal certain information.

In a spoken dialogue, the form affects the nature of conversation significantly. For example, a friendly message spoken in a sarcastic tone can bring across a totally different meaning than what is actually being said. Form can also affect textual communication. In general, form can have a large impact on the nature of conversation, while the instruments to shape messages can be very subtle (e.g. tone, prosody, sarcasm, double-denial, etcetera). It was considered that it is still too difficult to model the use of these instruments to shape the nature of conversation as a function of personality trait. It was therefore decided not to include the aspect of form in the model, but instead focus on modeling how the selected personality traits affect the NPC's choice of content and strategy of communication.

3.3 Implementation of Personality Traits

This section addresses the way the selected personality traits extraversion and agreeableness have been modeled to affect the communication behavior of the NPC in the sales conversation (see Brandenburgh, 2012). In order to prevent stereotyped and rigid characters, the influence of a personality trait on behavior has been modeled in terms of probability. Thus, an extravert NPC is just more likely to spontaneously tell details than an introvert NPC, it is not a certainty.

Extraversion

Selection of communication type: Extravert NPCs are more likely to tell information; introvert NPCs are more likely to ask for information.

Selection of information type: Extravert NPCs are more likely to express wishes and opinions (e.g. "I'd like the house to be easy to reach by public transportation."); introvert NPCs are more likely to tell, or ask for, facts (e.g. "How many minutes walking distance is the house from public transportation?").

Selection of type of acknowledgment: Extravert NPCs are more likely to disclose their opinion implicitly when giving an acknowledgement for received information ("Great!"), whereas introvert NPCs are more likely to just acknowledge that the received information is understood ("Okay.").

Selection of wish expression: Extravert NPCs are more likely to generate a wish in subjective, interpretative terms (e.g. "I'd like a large bathroom."), whereas introvert NPCs are more likely to express wishes in factual terms (e.g. "I'd like the bathroom to be $12m^2$.").

Selection of detail of information: Extravert NPCs are more likely to provide details (e.g. opinions, illustrations) when telling information or answering questions (e.g. "That's rather large for two persons, a bit of a waste of the space.", after acknowledging the information that there is a large bathroom); introvert NPCs are more likely to stick to pure facts.

Selection of type of opinion: Extravert NPCs are more likely to select a positive opinion (spontaneously or when asked for, e.g. "I think the condition of the bathroom is great."); introvert NPCs are more likely to select a negative opinion (e.g. "I think the condition of the kitchen is not all that good."). Clearly, the NPC will always share their opinion truthfully, so an extravert NPC will simply not select the opinion on a negatively valued fact; vice versa for introvert NPCs.

Agreeableness

Selection of information content: Agreeable NPCs are more likely to discuss the house or the environment; non-agreeable NPCs are more likely to tell about themselves.

Commitment to current topic: Agreeable NPCs are more likely to continue the conversation on the current conversation topic even if they find another topic more important (e.g. asking questions about the bathroom facilities, surface, condition, et cetera); non-agreeable NPCs are more likely to propose a new topic for discussion (e.g. moving from bathroom surface to kitchen condition).

Tractability: Agreeable NPCs are more likely to accept when the player proposes a topic change (e.g. switching from kitchen to bathroom); non-agreeable NPCs are more likely to refuse such requests.

Compliance: Agreeable NPCs are more likely to adopt a player's opinion as their own; non-agreeable NPCs are more likely to stick to their own opinion.

Selection of type of acknowledgment: Agreeable NPCs are more likely to acknowledge received information (e.g. by giving a neutral acknowledgement like "Okay." or, more probable, a qualitative acknowledgment like "Great!" or "That's too bad."); non-agreeable NPCs are more likely to refrain from acknowledgments.

Table 1 gives an impression in pseudo code of how this is formalized.

4 Evaluation

The model outlined above is intended to generate behavior for NPCs that is in accordance with the assigned personality profile in terms of the traits extraversion, agreeableness, and combinations thereof. The question is, of course, do people recognize the assigned personality when interacting with such characters?

Table 1. Impression of formalization of **Selection of information type** in pseudo code

```
if (agreeable) then              /* Boolean based on probability
  if (extravert) then              /* Boolean based on probability
    if (probability .5 ) then      /* With equal chance:
      return: tell(wish)           /* Tell a wish
    else
      return: tell(opinion)        /* Tell an opinion
    end if
  else                             /* Act introvert:
    return: tell(fact)             /* Tell fact about the house
  end if
else                               /* Act non-agreeable:
  return: tell(fact)               /* Tell fact about itself
end if
```

When complex characteristics are incorporated into an agent framework (such as emotions or personality), an appropriate approach has to be selected in order to evaluate the effects of these modifications. Merely running scenarios is not sufficient to establish the effects. Norling et al. (2002) argue that data from subjective judges must be collected and analyzed statistically. This approach was used in this study.

The question whether people recognize the assigned personality in virtual characters was investigated in a human subjects experiment. Subjects played the game several times. In each session, the buyer had a different personality profile. After each game session, participants were asked about their impression of the buyer. The hypothesis is that that player's impression matches the implemented personality traits of the buyer agent.

4.1 Methods

Subjects. 30 (under)graduate students (18 male, 12 female) were recruited from the VU University Amsterdam. Their mean age was 21.7 (SD = 2.45). Subjects were paid 30 Euro for participation.

Materials. For this study, it is important that the subject forms his or her impression of the NPC on its behavior, not on its appearance. For example, a friendly face may make the player feel that the buyer is agreeable. In order to eliminate appearance as contaminating factor, the game's interface just showed the NPC's silhouette.

Design. A 4x2 factorial within-subjects design was used. Orthogonal combinations of agreeableness and extraversion produced four buyer NPCs, each with a different personality profile, see Table 2. Subjects played the game four times: each time the buyer NPC had a different personality profile. The order was randomized for each subject.

Table 2. Values indicate the probability that the NPC shows extravert or agreeable behavior

Condition	Extraversion	Agreeableness
Low_E - Low_A	.1	.1
High_E - High_A	.9	.9
Low_E - High_A	.1	.9
High_E - Low_A	.9	.1

Procedure. Subjects were told that were going to play a series of game sessions and that after each session they would be asked about their impressions of the character in the game. A short familiarization session, with the NPC modeled as neutral in terms of agreeableness and extraversion, was used to introduce the game to the subjects.

Then the experiment proper started. Each game session took about 10-15 minutes to complete. After completing a session, subjects were asked to fill out a personality questionnaire. In addition, a series of statements regarding the (kind of) NPC behaviors were presented to the subject. The subject was asked to rate the applicability of the statements for the agent in that particular session. Then the next session of the game was started. This continued until all four games session were completed. At the end of the experiment, subjects were debriefed.

Measurements. To assess how the player evaluated the NPC's personality, the Dutch translation of the HEXACO questionnaire was used (Lee & Ashton, 2009; De Vries et al., 2009). Only the 32 items measuring extraversion and agreeableness were used. Subjects rated items on a 5-point Likert scale. They were specifically instructed to use the extremes of the scale when they considered this appropriate. If subjects argued that the experience during the gameplay was insufficient to form an adequate impression, they were told to score to the best of their ability.

For exploration purposes, subjects were presented a series of statements regarding the NPC's behavior and asked to rate the applicability on a 5-point Likert scale. Although the statements were unfortunately not designed to systematically capture the manipulated behaviors (see §3.3), it was afterwards possible to connect statements and manipulations. For example, the statement "the buyer took initiative" was considered to reflect extraversion. The statement "the buyer asked a lot of questions" was consistent with introvert behavior (extravert buyer agents, by design, spontaneously reported information; introvert buyer agents were more inclined to ask questions). "The buyer behaved friendly" was considered to reflect agreeableness, and "the buyer made clear what he wanted" was considered to indicate non-agreeableness (see 'tractability' in §3.3).

4.2 Results

For all 30 participants, the mean score on extraversion and agreeableness was calculated for each experimental condition. There were no missing data. Figure 2 shows the results. An analysis of variance was executed with the mean scores on extraversion and agreeableness as dependent variables, and with condition (4) as within-subjects variable. Results show that scores differed significantly over conditions ($F=26.43$; $df=3$; $p<.01$).

The mean scores on extraversion were calculated for conditions 2 and 4 (high extraversion, HE), and for conditions 1 and 3 (low extraversion, LE), and entered in paired t-tests. Likewise, the mean scores on agreeableness were calculated for conditions 2 and 3 (high agreeableness, HA), and for conditions 1 and 4 (low agreeableness, LA), and also entered in paired t-tests.

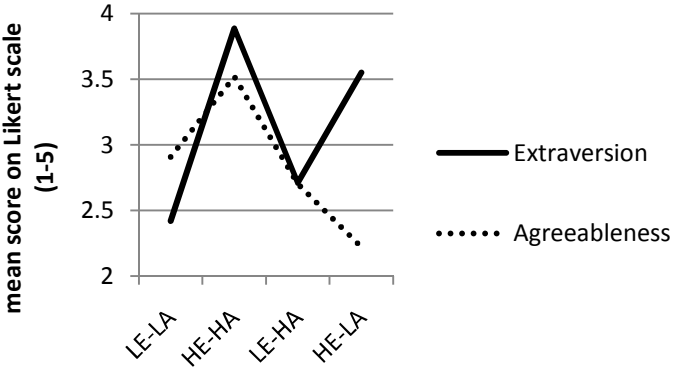

Fig. 2. Mean ratings on Extraversion and Agreeableness, split by condition

Results show that players rated high-extraversion characters as considerably more extravert than low-extraversion characters (3.72 versus 2.56), a significant difference ($t(29)=8.22$; $p<.01$). Furthermore, players rated high-agreeable characters as considerably more agreeable than low-agreeable characters (3.11 versus 2.56). This too was a significant difference ($t(29)=2.63$; $p<.05$).

The results above confirm that subjects perceive NPCs in accordance with their assigned personality traits. Do subjects also recognize the constituent behaviors, indicative for these personality traits, in their interactions with the NPCs? This question was addressed by examining the data on the rated statements. Table 3 shows the results.

Subjects indicated to recognize the behaviors typical for extraverts more in extravert buyer agents ($t(29)=16.2$, $p<.01$) and found behaviors that are typical for introverts to be more applicable to introvert agents than to extravert buyer agents ($t(29)=11.2$, $p<.01$). Furthermore, subjects indicated to recognize the behaviors typical for agreeable persons more in agreeable buyer agents ($t(29)=3.3$, $p<.01$). Behaviors that are typical for non-agreeable persons were not considered to be more applicable to non-agreeable buyer agents.

Table 3. Mean Likert ratings for statements concerning extravert, introvert, agreeable, and non-agreeable behavior

	ratings for statements concerning … behavior			ratings for statements concerning … behavior	
Condition ↓	**extravert**	**introvert**	Condition ↓	**agreeable**	**non-agreeable**
HE	4.65	4.45	HA	3.55	2.84
LE	1.88	2.08	LA	2.77	2.98

4.3 Discussion

This study was to test the question whether the model was able to correctly express personality traits into behavior. The results unequivocally show that players recognize

the assigned personality of the character when interacting with them. Only one measurement was at variance. In the LE-HA condition, the players rated the NPC at a fairly low level of agreeableness, where a high score on this trait was expected (see Figure 2). Inspection of individual data, nor observations of the experiment leader, revealed an explanation for this unexpected result.

The HEXACO Observer Report proved to be an appropriate instrument for measuring how participants experience the behavior of their conversational partner in terms of personality traits. Although a number of subjects said in the debriefing that they found it difficult to rate the NPC given the limited exposure, the results show that the instrument is sensitive enough to detect and categorize even partial impressions.

5 Conclusion

Serious games are an immersive and attractive vehicle for learning and practicing communication skills required for many professions. Games may, for example, be used to train people in conducting sales conversation skills through dialogues with virtual characters. In such applications, the quality of the Non-Playing Character is decisive for the quality of the game as a learning tool. If characters act according to their modeled properties and strategies, this gives the game the potential for being a good learning environment.

In this paper we proposed the BDI-approach to create individualized NPCs, each with their own personality profile. By defining relationships between the building blocks that underlie the NPC's actions (e.g. Facts, Wishes, Opinion, et cetera), its modes of communication (Tell, Ask, and Acknowledge), and its personality traits (defined as parameters on the dimensions 'extraversion' and 'agreeableness'), we were able to construct NPCs that act in accordance with their personality profile. The results of the experimental study support this claim.

The strength of using BDI over the alternative method of scripting behavior is its flexibility. If a trait like extraversion is assigned to a character through scripting, then separate decision trees have to be worked out in depth for extravert and introvert NPCs. Furthermore, scaling the level of a trait like extraversion would be a difficult, if not unfeasible, job. BDI instead allows the developer to use the aforementioned relationships between traits and the building blocks of behavior in a more general fashion, making it easier to scale, adapt, and re-use the developed model.

The proposed approach opens up various paths for future research. One possibility is to expand the number of personality traits and to validate the models with respect to those constructs (does NPC behavior indeed represent the modeled (mix of) traits?) and to purpose of application (do the developed NPCs adequately prepare trainees to deal with various personalities in real-life communication?). Another possibility is to investigate whether the architecture proposed here can also be used for modeling other properties affecting behavior, like emotion. Acknowledging the need for future work, the present research may prove an important step towards developing individualized NPCs, each equipped with their own traits, properties, and strategies.

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