

# BUYERS ARE LIARS, SELLERS ARE YELLERS

## SUMMARY

In many games, players communicate with virtual characters. Using the traditional approach of handling dialogues, players often experience the communication as rigid and unnatural. TNO and RANJ explored the BDI approach to create unique virtual characters, each fitted with their individual goals and strategies. The virtual characters initiate communication based upon these goals and can respond to the human player. The approach is very promising for realizing flexible and natural dialogues. This, in turn, should improve the involvement of the player in the game, and help to create better learning opportunities.

In many games, a player communicates with virtual characters. The common approach is to pre-define a structure or script that determines how a dialogue evolves. The player has little influence and the virtual character also has to follow the appointed schema. As a result, communication is rigid of nature. TNO and RANJ explored how artificial intelligence can be used to create unique virtual characters, each fitted with their individual goals and strategies. These characters respond to the player, not to a script. The resulting freedom in interaction leads to more natural and involving dialogues.

Serious games should enable a player to learn in a playful fashion for which interactions with characters in the game (Non-Playing Characters, or NPCs) are an essential element. In order to become an active learner, the player needs to experience that his actions and communications affect the NPC. Likewise, the NPC should not be a blank individual, but instead should have an identity that determines the way it acts and responds. This requires NPCs to be equipped with capabilities that enable them to display natural behavior in accordance with their human-like properties (e.g. intelligence, emotions, personality) and to respond dynamically to situations occurring during the game. Recently, advances in artificial intelligence have brought about new methods for modeling human capabilities. In this project we investigated whether such a method can be used successfully in games to create natural, rich, and truly interactive dialogues between humans and NPCs.

## BDI-MODELLING

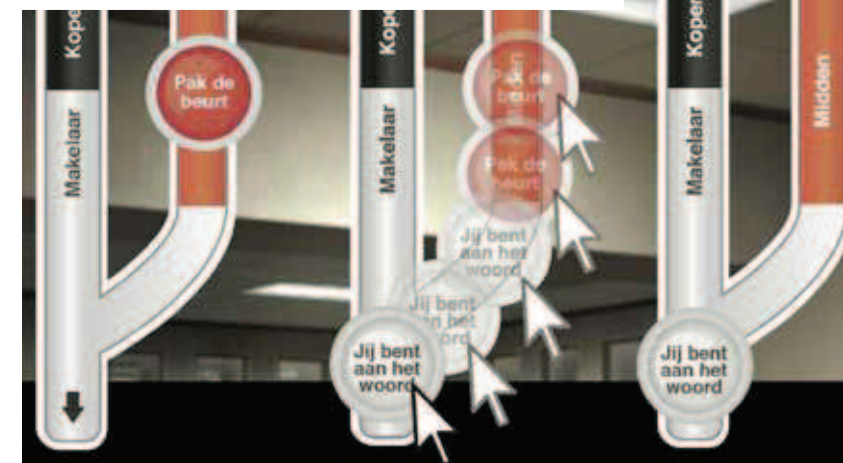
When people are asked to describe their behaviour (or that of others), they generally do so in terms of *Beliefs, Desires, and Intentions* (BDI). When NPCs are modelled us-

ing these concepts, they will therefore produce behaviour that is experienced as natural by human observers. BDI is fundamentally different from traditional methods such as scripting or FSM. A BDI character does not respond to a particular situation or state in the scenario, but to the *interpretation* of the situation. To achieve this, the character's role needs to be analyzed in terms of its underlying characteristics (role, goals, plans, etc) and the developer then specifies when and how beliefs are formed, and adjusted by events in the environment. Constructing BDI characters tends to require more development efforts, but the return on the investments are better functionality (more natural and interactive behaviour), flexibility (adaptive to scenario adjustments), and reuse (easy to use once-developed characters in new domains).

## THE GAME

TNO and RANJ developed a demonstration of BDI characters, set in a "sales" game, based upon the *Glengarry Glen Ross* (GGR) film (1992). In the film 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. This game allows the player to practice these skills.

The player in the GGR-game is a real-estate salesman; the leads are BDI-based NPCs. 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 his goals). In a sales conversation, the player must discover the NPC's wishes and influence his opinions (see Figure). The player can do so by emphasizing qualities of the house desired by this buyer,



"As both the player as the NPC can take the initiative in the dialogue, a 'turn-taking' mechanism was developed."

or by providing appropriate anecdotic material. Eventually, the player must persuade the NPC to buy the house.

## DEFINING THE GAME'S WORLD

A large number of concepts related to 'house-buying' is represented in an ontology, determining the scope of the game. These, of course, include properties of the house (e.g. number of rooms; surface area; maintenance state), but also topics that are typically addressed in house-buying negotiations (e.g. safety of the neighbourhood; 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. The broadness of the ontology generates an abundance of options to the player. This requires a good interface to handle appropriately, for which we used the metaphor of a dossier (see Figure).

## PROPERTIES OF THE NPC

The NPC is initialised using concepts defined in the ontology (e.g. specifying a priori knowledge and wishes on the house and vicinity, financial limits, etc.). NPCs are equipped with building blocks that enable them to develop wishes and opinions (e.g. "I want a house with a large kitchen", or "the kitchen is too little/ adequate / too large"). Fur-

thermore, NPC characters have their own personalities (e.g. extravert making them talkative and 'open', versus introvert making them withdrawn and sparse with details).

## MIXED-INITIATIVE DIALOGUE BETWEEN PLAYER AND NPC

The NPC uses its sets of beliefs, goals, and strategies to (proactively) initiate communication, and to respond to the player. For example, the NPC can ask and answer questions; make a bid; make a counteroffer; take a (buying) decision; terminate the conversation; etc. As both the player as the NPC can take the initiative in the dialogue, a 'turn-taking' mechanism was developed.

## CONCLUSION

Modelling behaviour using BDI allows the development of different unique NPCs that are internally consistent and that respond to situations in a representative and believable manner. Rather than interaction being limited to guiding the player through a predefined schema, BDI allows a truly mixed-initiative dialogue between player and NPC. From the developer's perspective, the investments of developing BDI characters yield substantial more flexibility and reuse in conversational games. •

## CONTACT

Dr. Karel Van Den Bosch is Senior Research Scientist at TNO. His research interest is making game-based training more effective by using cognitive software agents (e.g. agents playing the role of team mate, adversary, or instructor). He investigates how such agents can successfully support training, thus making training more systematic (uniform behaviour of agents), more effective (agents consistently eliciting intended behaviour of trainee), and more efficient (staff and team members need no longer be present during training). [karel.vandenbosch@tno.nl](mailto:karel.vandenbosch@tno.nl)



Team's project members:  
Dr. I. (Ivo) Swartjes (RANJ)  
Dr. A. (Annerieke) Heuvelink (TNO)  
Ir. T.J. (Tijmen) Muller (TNO)

