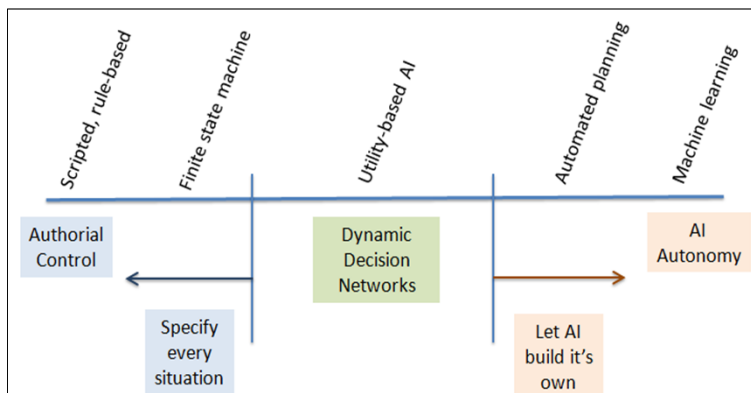


## Conversational Non-Player Characters for Virtual Training

Dennis M. Buede, Ph.D., IDI  
Paul J. Sticha, Ph.D., HumRRO  
Elise T. Axelrad, Ph.D., IDI



## Overview of AI Based NPCs



\*based on Dill, K. (2011). A Game AI Approach to autonomous Control of Virtual Characters. Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC).

3

## Approach

- ▶ Adaptive Human Behavior Avatars (AHBAs) utilize Dynamic Decision Networks (DDNs) to respond to **non-scripted, free-form** text chat input from the trainee.
- ▶ A behavior model implemented as a Bayesian Network combines evidence of **sentence tone, cultural understanding,** and **conversational structure** which changes the impression the AHBA has for the trainee as rapport is built (or not) throughout the conversation.
- ▶ Based on rapport and personality, the AHBA decides whether to respond **truthfully, evasively, deceitfully** or to **walk away**.

## Sample Interactions

### Conversation 1

Trainee: Hello.  
 Mayar: Salam.  
 Trainee: How are you, sir?  
 Mayar: I'm fine, thanks.  
 Trainee: Who is Rayhan Karimov?  
 Mayar: Rayhan Karimov is the local medicine man.

### Conversation 2

Trainee: Who is Rayhan Karimov?  
 Mayar: I've heard his name before but don't know much about him.  
 Trainee: Do you know Sajida Karimova?  
 Mayar: I've heard of her, but I'm not sure who she is.  
 Trainee: Do you know where she lives?  
 Mayar: I've seen her around town, but I don't know much about her.

### Conversation 3

Mayar: What was it like during the Soviet rule?  
 Mayar: You are clearly not from around here. Let's not talk about that.  
 Trainee: Well there seems to be a lot of poverty.  
 Mayar: Speaking of such things is not polite, I do not want to talk about it.  
 Trainee: Who is Rayhan Karimov?  
 Mayar: Rayhan Karimov owns the electrical shop.

## Response Generation

Response = ?

natural language understanding + behavior modeling

- ❖ What is the trainee asking about?
- ❖ What information should be included in the response?
- ❑ Has the trainee developed rapport with pleasantries and polite words?
- ❑ How helpful should the response be?

## Natural Language Understanding

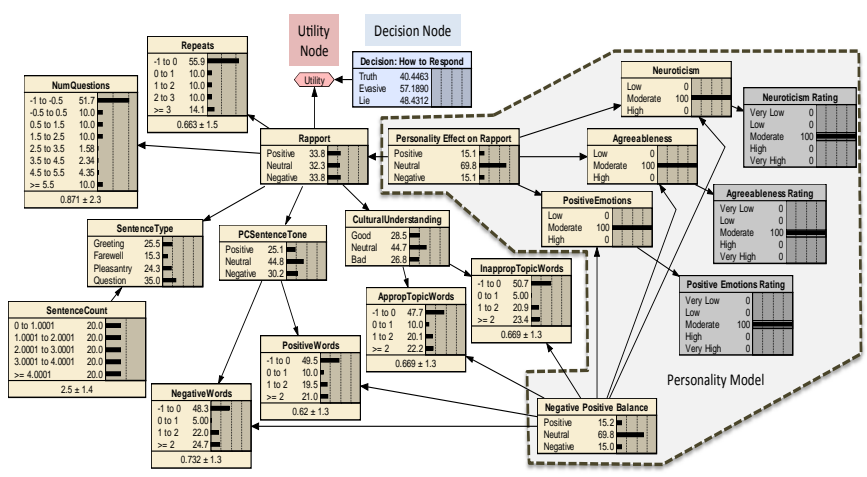
- Parse input statement and collect keywords
- Classify input statement as greeting, pleantry, substantive, or farewell
- Prioritize the set of keywords in the input statement, build an SQL query, look up response

How are you, sir? ➡ Pleantry + positive word ➡ Query for pleantry response

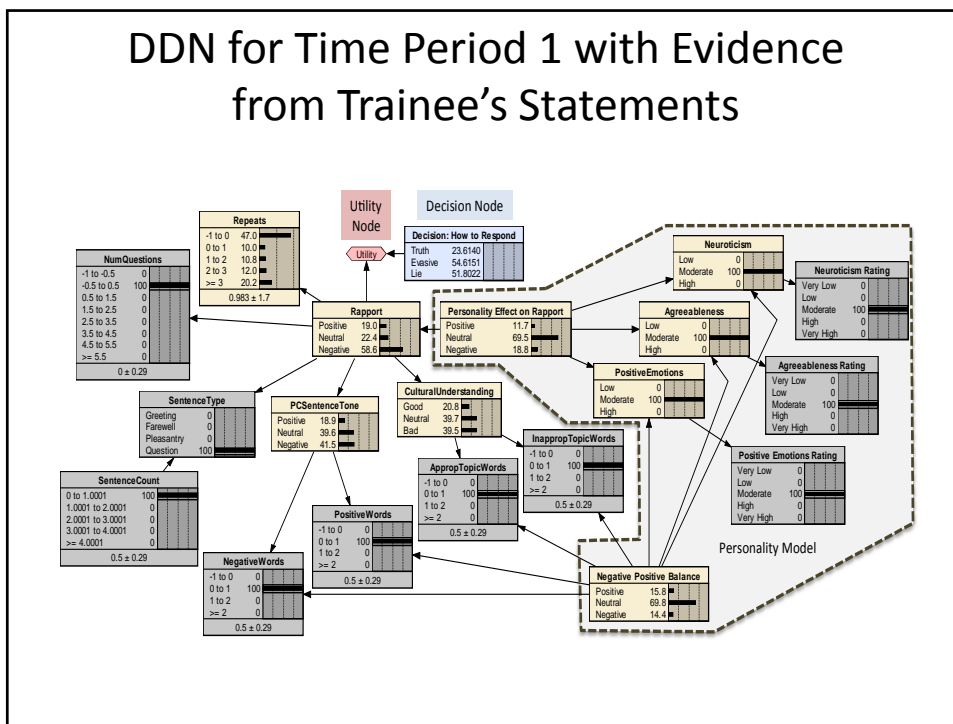
Who is Rayhan Karimov? ➡ Question word + person ➡ Query for fact response

What was it like during the Soviet rule? ➡ Question word + culturally inappropriate word ➡ Query for culturally inappropriate response

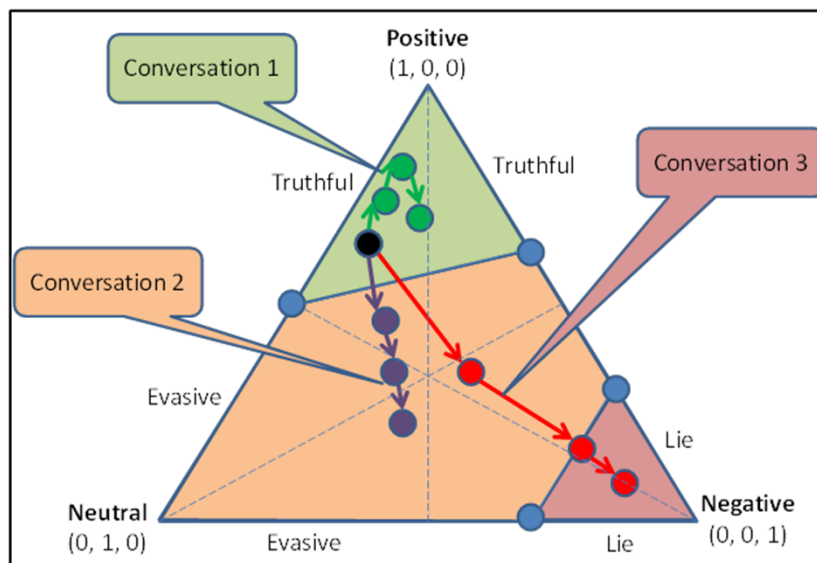
## DDN for Time Period 0 with No Evidence from Trainee's Statements



## DDN for Time Period 1 with Evidence from Trainee's Statements



## Rapport-Decision Map



## Representing AHBA Rapport

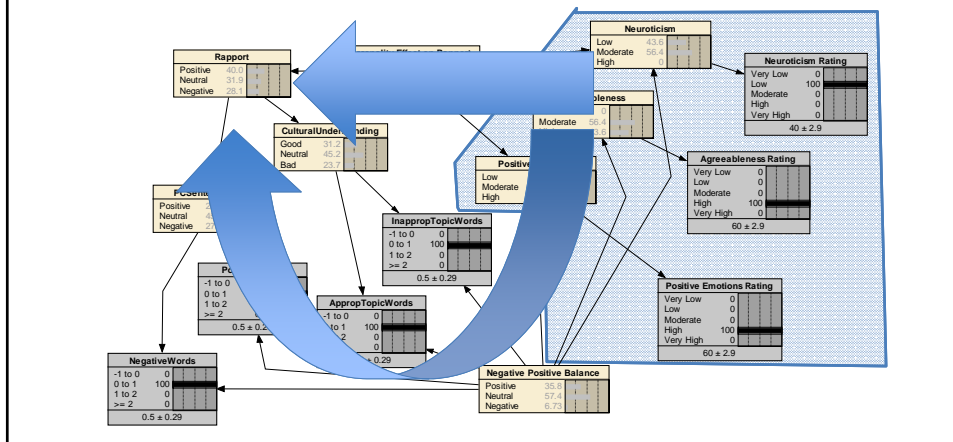
- ▶ Two constructs capture the experience of someone responding to a stranger
  - ▶ Initial Impression – based on personality and initial interactions
  - ▶ Rapport – changes over time based on AHBA personality and details of the interaction
  - ▶ Both initial impressions and recent impressions matter, but have potentially different weights
- ▶ Theoretical background to rapport
  - ▶ Spradley (1979), in research on ethnographic interviewing to develop rapport and elicit information, defined four stages of rapport: Apprehension, exploration, cooperation, and participation
  - ▶ Spencer-Oatey (2000) defined three elements of rapport management: management of face, sociality rights and obligations, and interactional goals.

## Representing AHBA Personality

- ▶ The ABHA personality affects both the initial impression and the development of rapport
- ▶ Relevant personality variables taken from the Five-Factor Model (FFM) of personality
  - ▶ Neuroticism – indicates negative emotionality, characterized by anxiety, nervousness, sadness, or tension
  - ▶ Agreeableness – reflects prosocial orientation, including altruism, tender-mindedness, and trust
  - ▶ Positive Emotions – a facet of extraversion expressing a tendency to experience emotions such as joy, happiness, love, and excitement
- ▶ Positive initial impressions and rapport related to high agreeableness, positive emotions and low neuroticism

## Implementation of the Rapport Model

- ▶ Levels of personality variables specified by developer
- ▶ Personality has direct effect on initial impression
- ▶ Personality also has indirect effect on rapport by specifying the relative importance of positive and negative aspects of the conversation



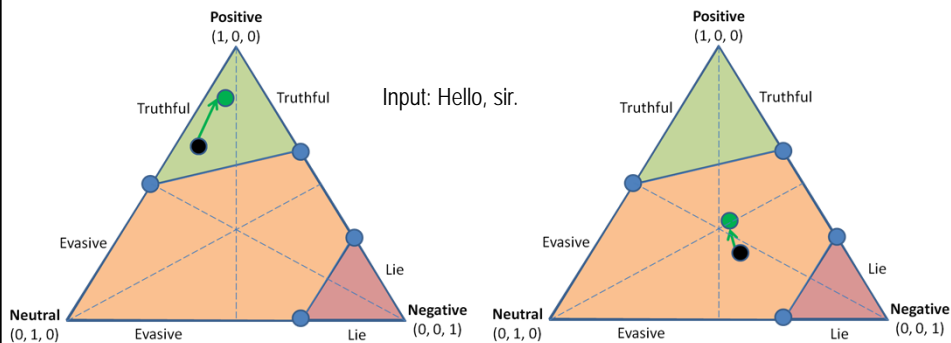
## Personality Model

Mayar Gasimov

- ▶ Agreeableness: High
- ▶ Positivity: High
- ▶ Neuroticism: Low

Mahir Fadein

- ▶ Agreeableness: High
- ▶ Positivity: Moderate
- ▶ Neuroticism: High



## Summary

- ▶ Innovative utility-based approach to conversational NPCs
  - ▶ NPCs evaluate the conversation and decide whether to provide a truthful, evasive, or deceptive response
  
- ▶ Robust approach to modeling rapport
  - ▶ Based on anthropological literature and conversations with regional subject matter experts