

A Comparison of the Effectiveness of Bayesian Network-Directed Dialogue and Scripted Dialogue

Chloe Cyan Apacible

Statement of the Problem

- Dynamic dialogue adapts according to the conditions in the world to provide a sense of immersion
- The adaptability of dynamic dialogue can be achieved with a dialogue tree
- As the number of conditions increase, the complexity of a dialogue tree increases
- Bayesian network is effective to represent relationships between the conditions that determine which dialogue to select

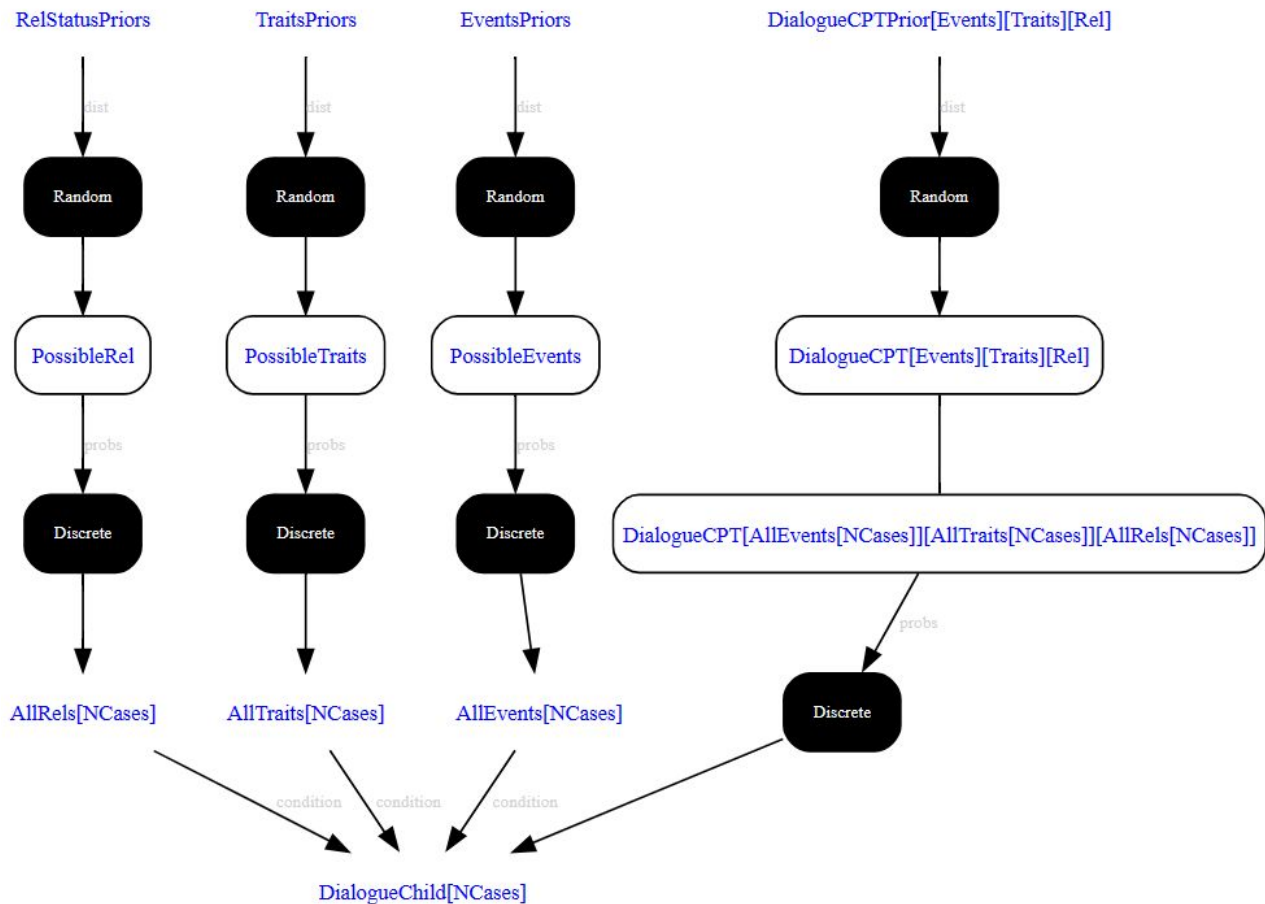
Objectives of the study

The main objective is to use a Bayesian network to create a system that can direct dynamic dialogue. The following smaller objectives must be performed to do so:

- 1) Develop a 2D adventure game prototype
- 2) Create a Bayesian network that represents the relationship between the world state, NPC, player, and other factors using Infer.NET;
- 3) Implement the Bayesian network into a dialogue system
- 4) Evaluate the effectiveness of a Bayesian network as an alternative to creating dynamic dialogue.

Implementation and Prototype

- 1) Before building:
 - a) Generation of IGeneratedAlgorithm.
 - b) Inference of initial dialogue CPTs.
- 2) In-game:
 - a) Deserialization of initial CPTs
 - b) Creating an instance of the IGeneratedAlgorithm
 - c) Director is now ready to select a line



Implementation and Prototype

For every line selection, final value of each line L is:

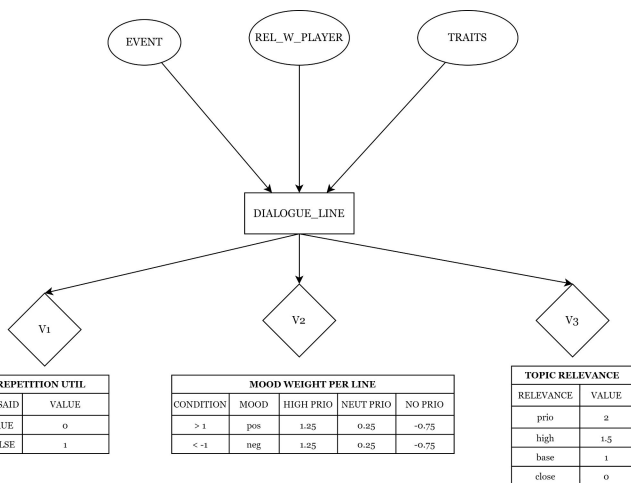
$$\sum_{i=1}^3 V_i$$

Where:

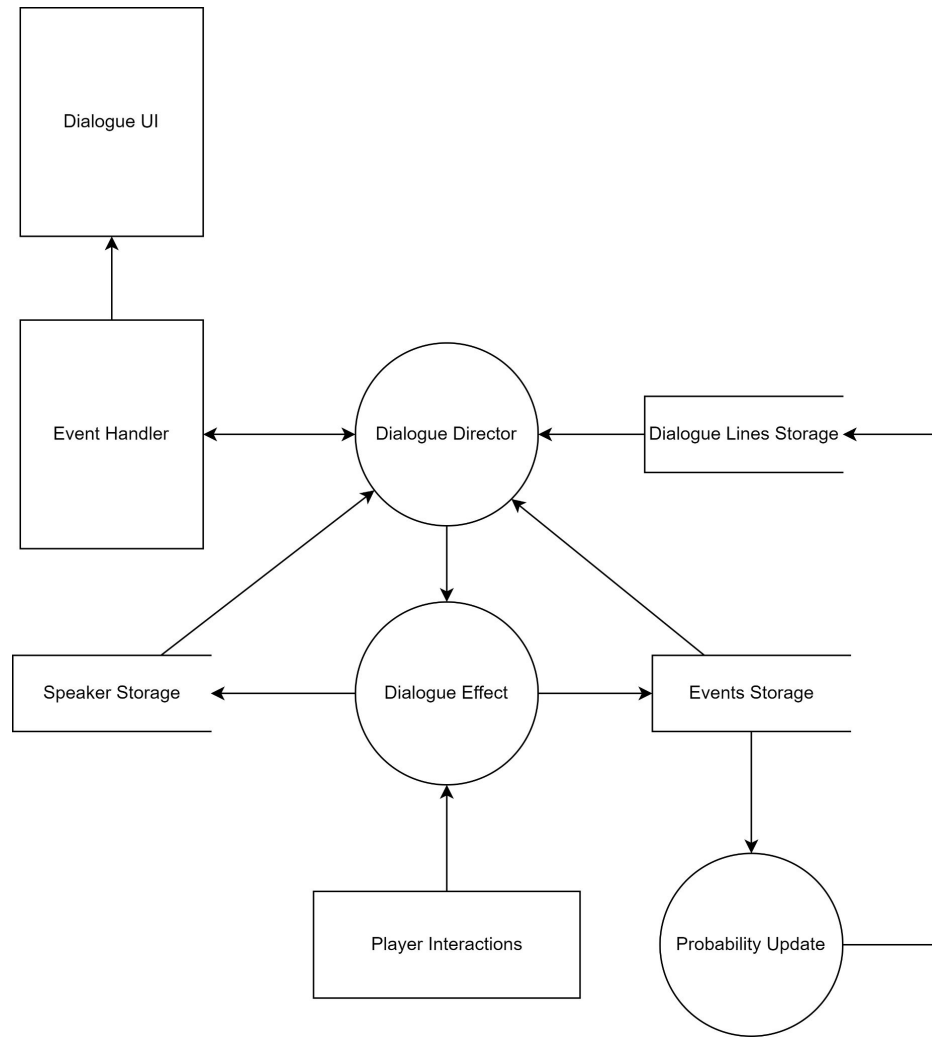
$$V_1 = \begin{cases} 0, & isSaid = TRUE \\ P(L), & isSaid = FALSE \end{cases}$$

$$V_2 = \begin{cases} P(L) * posWeight_{prototype}, & mood > 1 \\ P(L) * negWight_{prototype}, & mood < -1 \end{cases}$$

$$V_3 = P(L) * \prod_{i=0}^n R_i$$

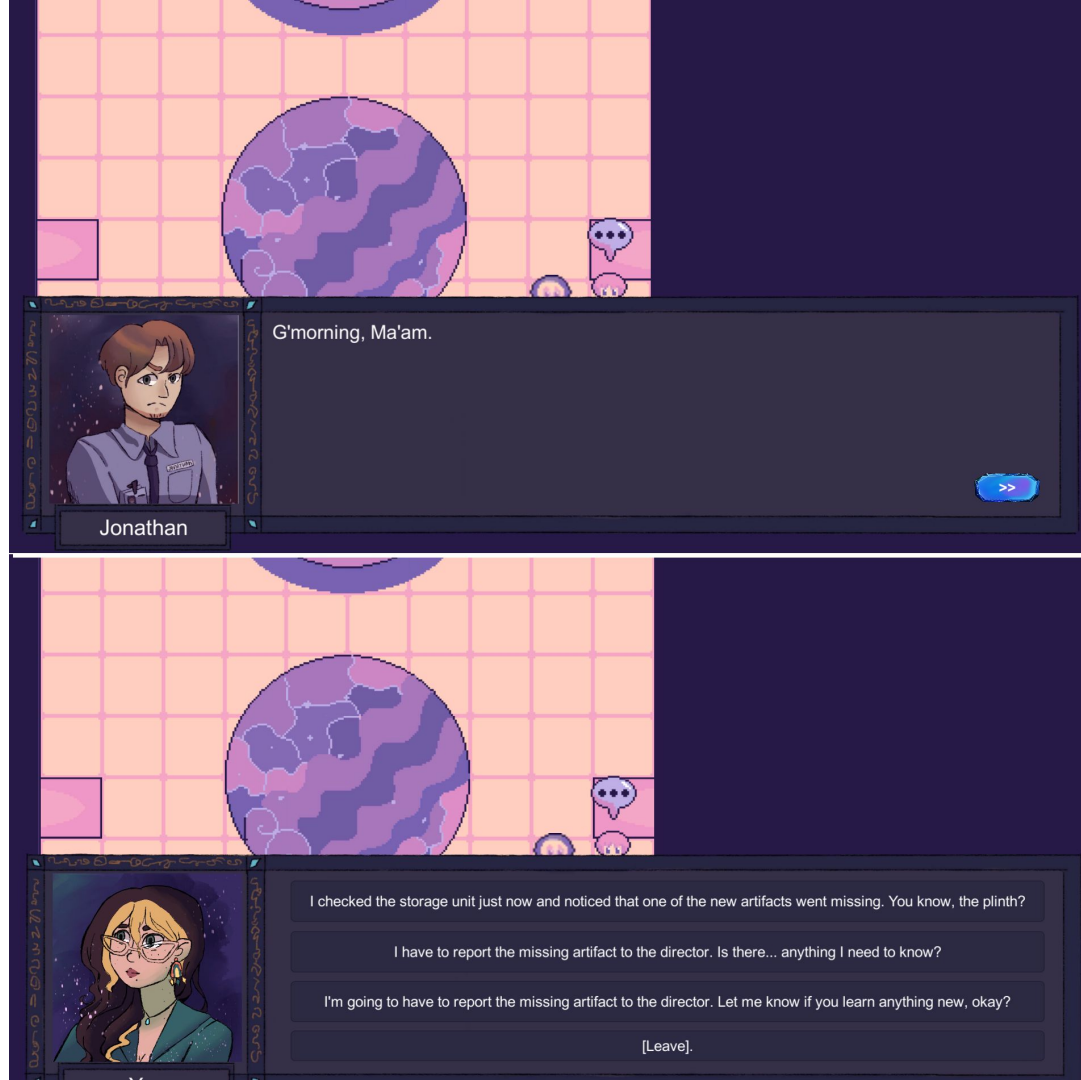


Implementation and Prototype



Prototype

- Two-person, turn-based dialogue system to represent the usage of a director in a simple form (exchanging information)
- 2 main characters, 4 filler:
 - 2 filler characters with same archetype
 - 1 filler uses only a script written in Ink





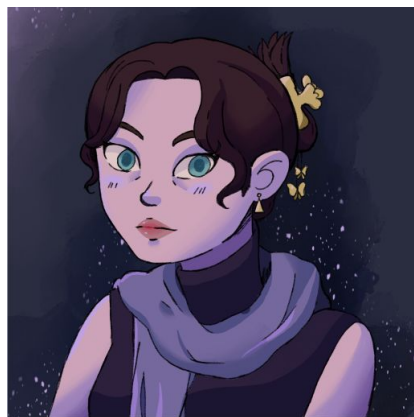
Jonathan



Morris



Annie



Cassandra



Beau



Virgil

Testing and Results

Relevance

Character	Highest Count	Mode	Average
Jonathan	3	3	3
Cassandra	4	3	3
Player	3	2	2.714285714
Morris	3	2	2.142857143
Beau	3	1, 2, 4	2.428571429
Annie	2	2	2.571428571
Virgil	3	3	3.428571429

- Most participants agree that the main characters and Virgil often have the most relevant dialogue
- Virgil skews towards a higher score naturally because he is the scripted character
- Beau and Morris have vastly different scores despite being the same archetype, likely due to differing factors such as location and assigned trait

Relevance (Generalized)

Character	Most frequent relevance score
Directed Characters	2
Scripted Characters	3

- All filler characters have a large amount of low relevance scores, causing the whole group of directed characters to have a low average score
- The filler characters affect the consistency of the dialogue director

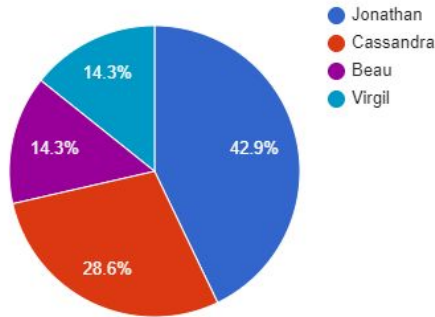
Repetition

Type	Mode	Average
Repetition Between Main Characters and Filler Characters	2	3.285714286
Repetition Between Both Main Characters	4, 5	4.142857143
Repetition Between Filler Characters of a Different Archetype	5	3.857142857
Repetition Between Filler Characters of the Same Archetype	1	2.142857143

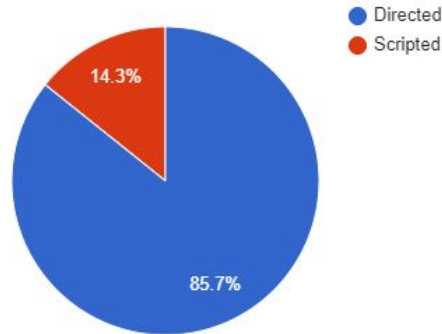
- The average of case 3 skews downwards despite having the highest mode.
- Participants who experience frequent repetition in case 3 are outliers, likely stemming from a writer's error (incorrect labelling of prerequisite events, traits, topics, or relationships)

Player Discernment

Player Discernment



Player Discernment by Implementation of Dialogue



- Like in 'Relevance' and 'Repetition', the main characters are the most favorably-selected by the participants.
- The main characters appear most "scripted-like" or natural

Further Observations

- Cases of being soft-locked occur in some participants during the dialogue puzzle segments
- Initial interactions between the player and the characters appear natural, but became worse as the player explored the world and temporarily deviated from the main story beats.

Conclusions

- The dialogue director created is best used in **linear interactions**. Branching is possible but branches may never converge to a single conclusion.
- The situations and variables that the dialogue director can successfully adapt to is limited to the confines of the player and NPC back-and forth
- The current method of writing dialogue is prone to user error especially in a game like the prototype where exploration is heavily used.
- The dialogue director remains inconsistent because it frequently unable to select an appropriate dialogue line for filler characters
- A Bayesian network is useable in directing dynamic dialogue, but the level at which **this** director can do so is still limited

Recommendations

- The system will work best for games with simple and linear gameplay such as visual novels.
- The inefficient method of writing the dialogue must be replaced. Ideally, there has to be a tool that aids the writing process by keeping track of the dialogue and its prerequisites in a more user-friendly manner
- The player line selections are often flawed—it's recommended to explore the ways in which the player lines are more fixed and less reliant on uncertainty.