Assessing the Effectiveness of Bayesian Network-Directed Dialogue in Terms of Narrative Immersion

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Statement of the Problem

- Dynamic dialogue adapts according to 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

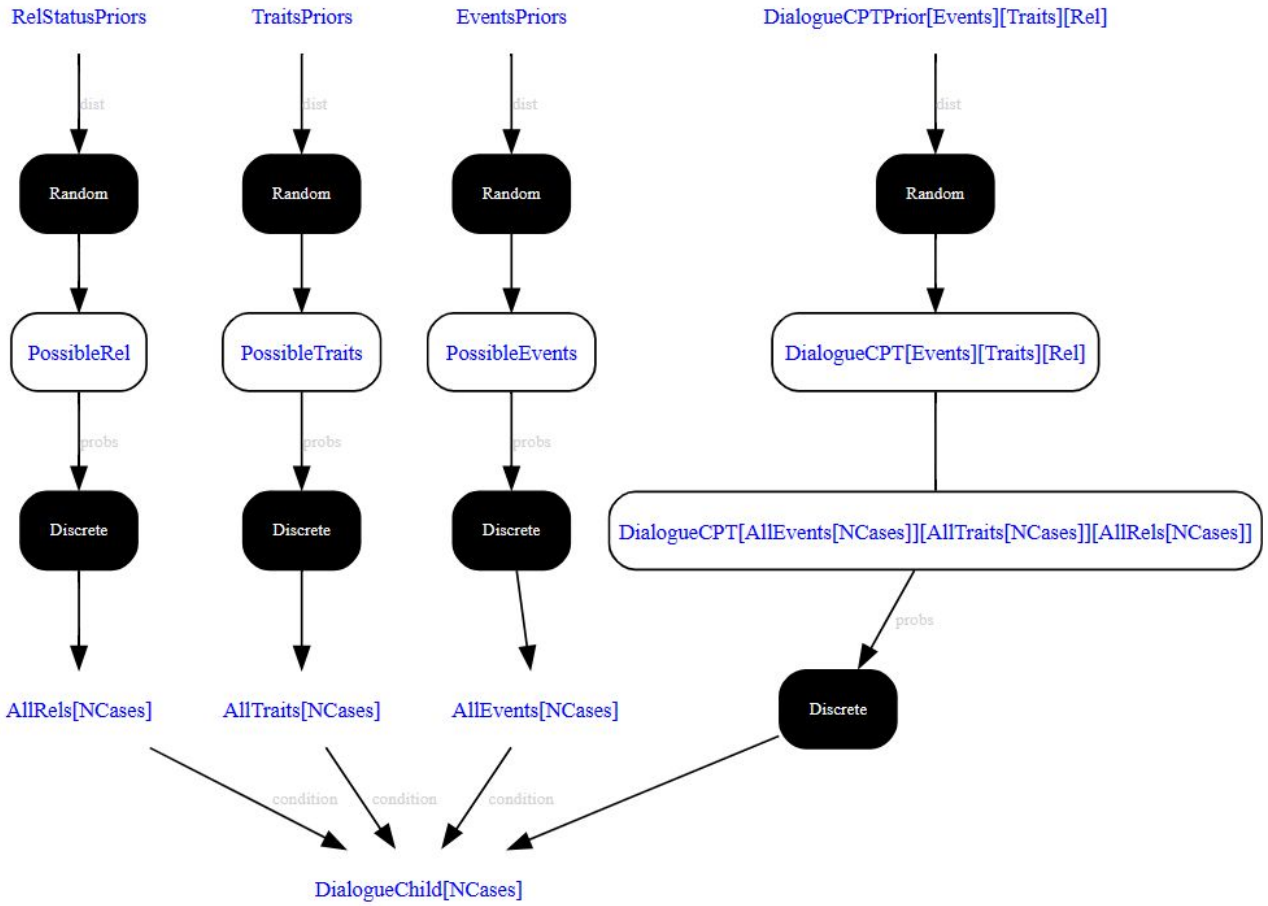
Objectives of the study

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:

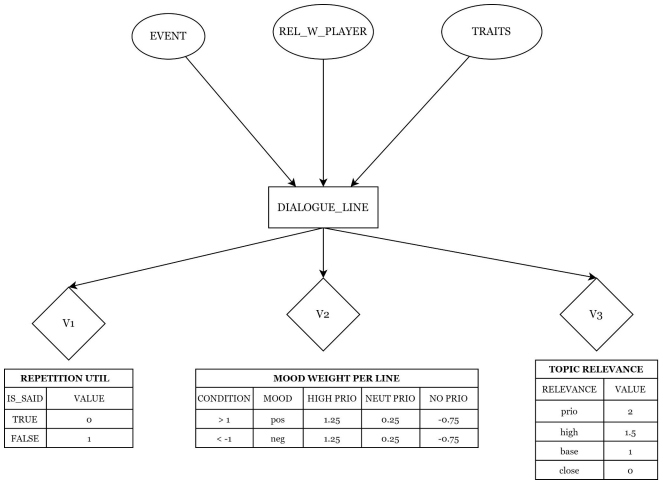
1) Develop a 2D adventure game prototype
2) Create a Bayesian network that represents the relationship between the world state, NPC, player, and other factors using Infer.NET;
3) Implement the Bayesian network into a dialogue system
4) Evaluate the effectiveness of a Bayesian network as an alternative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



REPETITION UTIL	
IS_SAID	VALUE
TRUE	0
FALSE	1

MOOD WEIGHT PER LINE				
CONDITION	MOOD	HIGH PRIO	NEUT PRIO	NO PRIO
> 1	pos	1.25	0.25	-0.75
< -1	neg	1.25	0.25	-0.75

TOPIC RELEVANCE	
RELEVANCE	VALUE
prio	2
high	1.5
base	1
close	0

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

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

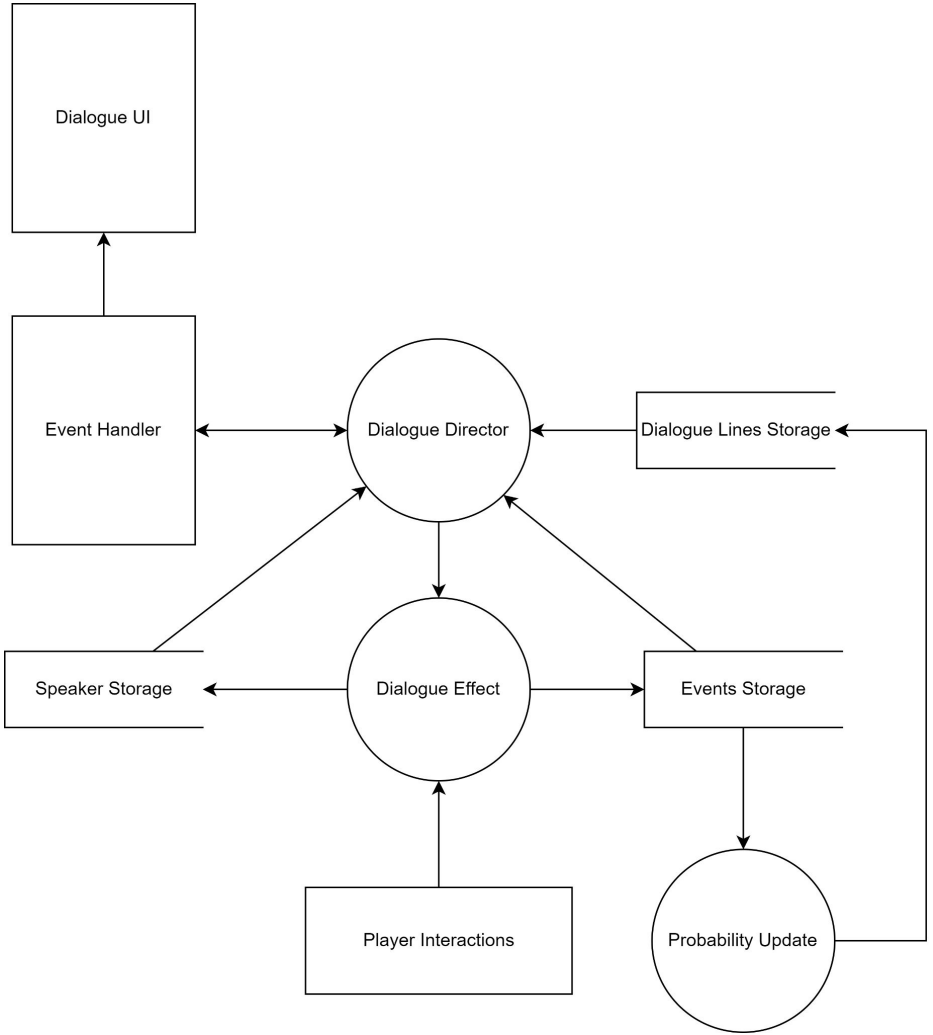
Where:

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

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

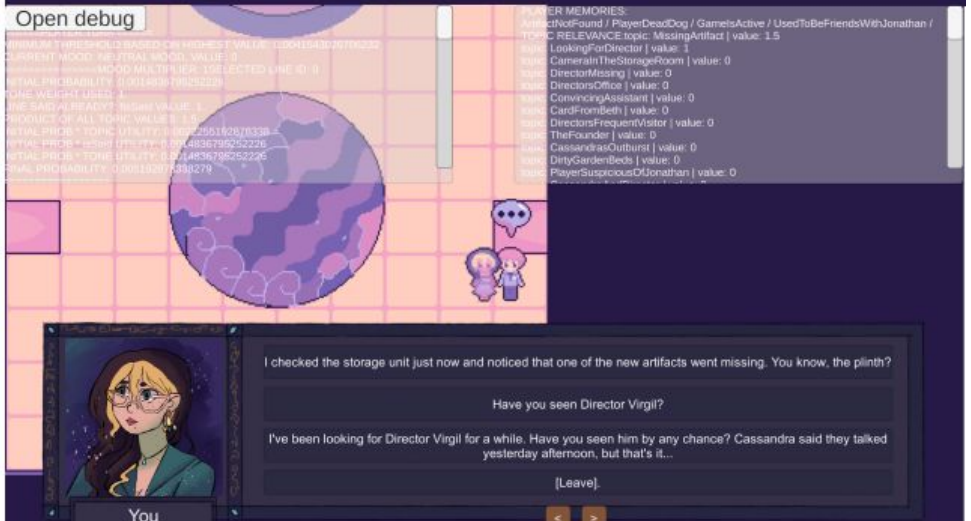
$$V_3 = P(L) * \prod_{i=0}^{n} R_i$$

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

Inter-Quartile Range

ID	Question	IQR	Median
CU-1	The story quickly grabs my attention at the beginning.	2	5
CU-2	Many events in the game story are novel.	2	3
CU-3	I want to know the rest of the storyline in the course of playing.	4.5	5
CO-1	I concentrate on the story for a long time.	3	2
CO-2	I become less aware of the real world and unhappy things around me when I concentrate on the progress of the game story.	3.5	5
CO-3	When I enter into the game story world, time always flies quickly.	4	3
COMP-1	I can make sense of the relationship between events.	1.5	3
COMP-2	I think the position of the events in the whole story's progress is clear.	2.5	2
COMP-3	I know my next goal while finishing an event every time.	1	3
COMP-4	I can comprehend the game story clearly.	0.5	3
COMP-5	The obstacles or tasks do not influence my comprehension of the game story.	3	2
CTRL-1	I explore actively what I want to in the game story.	1.5	5
CTRL-2	Parts of the story are formed by me in the course of playing the game.	3	5
CTRL-3	I can control the progress of the game story.	1	3
CHAL-1	Some tasks or conflicts in the game story are stimulating and suspenseful.	3	4
CHAL-2	I feel successful when I overcome the obstacles, tasks, or opponents in the game.	3.5	5
EMP-1	Sometimes I think I really am the avatar in the game.	2	2
EMP-2	My emotion often varies with the story's progress.	2	5
EMP-3	After finishing the game, it takes a long time for me to return to the real world psychologically and emotionally	1.5	2
EMP-4	I spend time thinking about the storyline sometimes when I am not playing the game.	2.5	3
EMP-5	Sometimes I recollect the characters in the game in my spare time.	2	2
EMP-6	I discuss my experiences in the game story with other players.	2	5

Inter-Quartile Range

- The question with the least variability is COMP-4 (IQR = 0.5; Median = 3)
  - Hence, most players disagree with the statement that they can comprehend the game story clearly
- The most polarizing question of the survey is CU3 (IQR = 4.5; Median = 5).
  - The sentiment between players is that they either want to know more about the story or they don’t–the answers are dissonant.
- 50% of the questions have an IQR greater than or equal to 2.125, the median IQR
  - Hence, 50% of the questions have more varied responses than average.

Relative Frequency of Responses

Dimension	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
Curiosity	4.76%	23.81%	14.29%	9.52%	19.05%	19.05%	9.52%
Concentration	14.29%	28.57%	9.52%	0.00%	19.05%	14.29%	14.29%
Comprehension	25.71%	14.29%	31.43%	17.14%	5.71%	5.71%	0.00%
Control	14.29%	19.05%	14.29%	4.76%	28.57%	14.29%	4.76%
Challenge	7.14%	21.43%	7.14%	14.29%	14.29%	21.43%	14.29%
Empathy	23.81%	23.81%	7.14%	19.05%	11.90%	11.90%	2.38%

- In most of the dimensions, player responses were split between a positive and a negative experience.
- Comprehension, Empathy, and Concentration are rated negatively by a large number of respondents
- The measured immersion of the game trends towards negative (not that immersive) but with some dissonance of opinion

Qualitative Assessments

Sentiment	Frequency (total = 6)	Relative Frequency
Responses do not make sense	2	33.33%
Dialogue options appearing early without prior context	6	100.00%
Got locked out of story progression	1	16.67%
Encountered repeated or redundant dialogue	2	33.33%

- 6 respondents gave a qualitative assessment in the paragraph section of the survey; used to contextualize the players' responses in the quantitative section.

Conclusions

- The dialogue director received an overall negative assessment, which means it has a lot more to improve. The biggest issue is that player lines appear earlier without context.
- While there are dissonance of opinions, this can be explained by the player doing different things to progress the story (going different places, etc.). The non-linear nature of the prototype caused player experience to wildly vary, hence, the director is better for **linear gameplay with little external variables** for now.
- The current method used to write the dialogue lines is very prone to user error

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.