Subject and Subjectivity: A Conversational Game using Possible Worlds

Ben Kybartas[1], Clark Verbrugge[1], Jonathan Lessard[2]

[1] McGill University, Canada
ben.kybartas@mail.mcgill.ca, clump@cs.mcgill.ca
[2] Concordia University, Canada
jonathan.lessard@concordia.ca

Abstract. We present *Subject and Subjectivity*, an exploratory conversational game where players are tasked with matching their friends with the ideal bachelor. The system uses a modal logic approach to modeling the narrative, based upon Marie-Laure Ryan's possible worlds model for narrative [1]. The dialogue occurs in real-time and consists of navigating each character's multiple and often conflicting world views. The system allows flexible character authoring, demonstrated by having the demo be playable with either hand-authored or procedurally generated characters. The demo serves as an early experiment into the use of possible worlds logic for interactive storytelling and dialogue systems.

Keywords: Dialogue Systems, Possible Worlds, Interactive Storytelling

1 Introduction

Conversation poses a unique challenge and opportunity in the field of interactive storytelling. Conversation may serve multiple purposes, from conveying character personality and narrative meaning, to giving context about the underlying simulation and mechanics driving the narrative [2]. Most dialogue in games generally relies on branching and hand-authored dialogue, where players are presented with several choices of what to say or ask at each point in a dialogue [3]. This approach, however, is limited when dealing with systems where dialogue has to dynamically adapt to changes in context, such as when using procedurally generated content, or in heavily systems-driven games, where the authoring burden of traditional branching dialogue would be too great.

We present *Subject and Subjectivity*, a conversational game that uses character modeling to implement what Short calls an "exploration" conversation system [4]. In, exploration systems, the possible conversation topics are treated abstractly as a landscape, throughout which the player is able to traverse, often to make specific discoveries about the narrative. In the game, the conversation is used to explore the different characters' varying and conflicting perspectives of what makes an ideal bachelor, and attempts to match them with corresponding bachelor who most closely meets this ideal. Conversation occurs in real-time, and rather than picking literal lines of dialogue, the player picks directions in

which to steer the conversation, e.g. changing the topic, or the bachelor being discussed.

2 Possible Worlds Model

In *Subject and Subjectivity*, the narrative and characters use a possible worlds model, based upon the model described by Marie-Laure Ryan [1]. Ryan's model consists of an *actual world*, that contains all truths about the narrative world, and a set of characters, who are each modeled with a set of *possible worlds*. Each possible world is a set of beliefs that the character wishes were true about the actual world. According to Ryan, the actual narrative consists of characters taking *actions* to make the actual world perfectly match each of their possible worlds. This is impossible, due to conflicts between a character's internal set of possible worlds, as well as conflicts between the possible worlds of different characters. The navigation and discovery of these conflicts forms the core of the narrative experience.

While a more formal model of Ryan's work remains a future goal, for the purpose of the demo we used a simplified and generalized form of the model, and based the content in part on the works of Jane Austen. In our model, a possible world is modeled as an array of boolean values. The boolean values map one-to-one onto a fixed array of propositions, and state the value of that proposition in this possible world. For the demo, there are three propositions: *the ideal bachelor is (not) wealthy*, *is (not) religious* and *is (not) ambitious*. So the possible world $[true, true, false]$ would imply that the ideal bachelor is wealthy and religious, but not ambitious. We give each character three possible worlds, focused on different social perspectives, so each character considers their *personal* ideal bachelor, their *family*'s ideal bachelor, and what they think *society* considers an ideal bachelor. The bachelors themselves are also modeled as an array of the same three booleans, which in this case represents their truth-values, i.e. if they are wealthy, religious and/or ambitious. For this demo, the actual world consists only of the mapping between character and bachelor, as changing these mappings are the only action which may be taken. Given this minimal input, the system is still able to generate rich character interactions and exemplifies the potential of adapting the system to larger-scale interactive fiction scenarios.

3 Dialogue System

The dialogue system is specifically focused on discovering *conflicts*, which we define as points where the property of a given bachelor conflicts with a proposition from a character's possible world. For example, if a character's family thinks the ideal bachelor is wealthy, then a non-wealthy bachelor would be in *conflict* for that particular character, possible world, proposition combination. Since there are three propositions and three possible worlds, each character can have nine potential points of conflict with any given bachelor. We define *character satisfaction*, as the percentage of non-conflicts with a given bachelor. So if a character

has 4 points of conflict with a bachelor, their overall satisfaction will be 5/9 or approximately 56%. The satisfaction is used at the endgame to provide players with feedback on whether the match went well or not. Since the satisfaction is hidden to the player, the conflicts must be discovered through conversation.

Conversation occurs in real-time, where the characters are able to talk among themselves, and even match/unmatch themselves with bachelors. The intention was to have a more natural feel to the dialogue, and avoid an interrogative conversation entirely controlled by the player. The dialogue maintains a notion of the *current position*, which is an array of four integers marking the index of the bachelor/character/possible world/proposition that are currently being discussed, and for simplicity we will call the four *topics*. There are two possible dialogue moves, asking and telling. A telling consists of the current character stating if the current bachelor is in a position of conflict or not. Asking, allows the current position of the dialogue to shift, but only in one topic at a time. This lends a flow to the dialogue and furthers the game-play goal of having the player feel like they are navigating through a dialogue rather than simply asking whatever question comes to mind.

In addition to dialogue, there are also two main actions, matching and unmatching bachelors. Players are only ever able to match characters with a bachelor, while the characters themselves can match or unmatch themselves as they see fit. Again, to keep the dialogue flowing smoothly, only the character and bachelor at the current point can be matched. While the player must make the matches based on what they have learned, characters determine potential matches by keeping a history of conflict/non-conflict points for each of the bachelors. Essentially, if the character has a majority of non-conflict points with the current bachelor, they will match themselves, and will unmatch if they are matched with a bachelor but have a majority of conflict points. The character memory is limited to the last five points of conflict/non-conflict, since full knowledge would theoretically allow them to converge on the ideal bachelor without any player input. Characters also have full knowledge of each other, and use this when they guide the conversation themselves. For example, if a character wants a particular bachelor who is matched to another character, then they will try to make that character discover points of conflict in order to get them to unmatch with that bachelor.

Actual lines of dialogue are realized using a context-free grammar (CFG), similar to Compton et al.'s *Tracery* [5], which the system queries by first converting the dialogue move into a symbol. The symbol then gets expanded by the grammar and is returned to the system as a line of dialogue which is then displayed to the player. The grammar approach allowed for custom and unique styles of speech for each character. For larger scale narratives, more scalable approaches to generating dialogue text would be required, for example using Ryan et al.'s *Expressionist* system, that allows the inclusion of metadata within a CFG [6].

Using this dialogue system and model also allowed for the use of procedural content. While it is possible to play an authored scenario that maximizes differ-

ences between characters, possible worlds and bachelors, there are also two additional scenarios, *random* and *balanced*. A random scenario assigns completely random true/false values to each bachelor and possible world, and allows for gameplay-breaking scenarios such as where no bachelor is ideal. Balanced generation generates characters and bachelors such that at least one bachelor is ideal for each character, which supports the gameplay goal of letting the player discover an ideal pairing for each character.

4 Conclusion

We presented *Subject and Subjectivity*, a conversational game that uses a possible worlds model of narrative and characters to support an exploratory dialogue system. The accompanying interactive demo shows that a dynamic and engaging dialogue system can be achieved, even with a small amount of content and a simple conflict model. Future work aims to more deeply explore the breadth of conflict that can be achieved with the possible worlds model, such as internal and inter-personal conflicts, as well as methods for scaling the system for large-scale interactive storytelling applications, where characters are deeply modeled and can be expected to take a number of actions. Similarly, extending the system to cover different forms of dialogue, such as non-verbal forms of communication, is also a goal. *Subject and Subjectivity* serves as a solid foundation and first step towards novel interactive storytelling systems based upon subjective characters and dialogue systems.

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