

Gossip Mechanism in the Open World Game: Sunset Valley

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Abstract

Sunset Valley is a novel game on the basis of open-world role-playing games and social simulation games with the addition of the gossip mechanism. This paper presents *Sunset Valley*'s implementation and the gossip mechanism's necessity in social simulation games. The main goal of this paper is to solve one common problem that can be found in open-world games — insufficient realism in background characters. We integrate a well-known personality model, Five-Factor Model (FFM), into our game to solidify the gossip mechanism and implement the dialogue system to provide interactions between characters and the player. Dialogues with non-player characters (NPCs) that a player can trigger depend on NPCs' social relationship statuses. Social relationship statuses could be affected by not only the direct interactions that an NPC had with the player, but also the gossip spread among NPCs.

Keywords

Gossip Mechanism, social simulation, game design

1. Introduction

Relationships between the player and characters in open-world games such as *Cyberpunk 2077*, *Skyrim*, and *The Witcher3* are often built by direct interactions and indirect effects between characters. Direct interactions include a hug, an insult, a smile, etc. For indirect effects, a specific behavior will affect

more than just the involved parties. However, these indirect effects are often generated by the plot or the system by default. A player does not have access to interact with them or witness the indirect effects happening. In this paper, we propose a novel approach, the gossip mechanism, to solve one common problem that can be found in open-world games — insufficient realism in background characters. With the gossip mechanism, characters are able to exchange their thoughts about the player. An NPC whom the player has never met may already have some impression of the player. Based on the hearsay about the player, NPCs may have different responses, dialogues, or behaviors. Players also have chances to witness the scene of NPCs talking about them and try to change the content of the gossip. The gossip mechanism helps to increase indeterminate elements in open-world games, making the game more realistic and spicing up the plot and players' experiences with more drama.

To achieve the goal listed above, an innovative open-world game, *Sunset Valley*, is designed and implemented. In terms of gameplay, the player is allowed to walk around and explore the whole map freely. Interacting and having conversations with NPCs is the primary way for the player to progress through the storyline. More architecture of *Sunset Valley* will be further introduced in Section 3. In terms of social mechanism, each NPC has a set of social relationship statuses and

unique personalities. Social relationship status will grow or shrink depending on the progress of dialogues. NPC's personalities are built based on the famous personality model, Five-Factor Model (FFM), which is also known as OCEAN [5]. NPCs' distinctive personalities directly influence their performances in gossip, such as the probability of initiating gossip and the reliability when spreading gossip. More details about the character's personality and how it affects gossip will be explained in Section 4.

2. Related Work

Mentioning open-word games that focus on social interactions, several games come into our minds: *Cyberpunk2077*, *The sims*, *Skryim*, *Final Fantasy XV*, and *the Witcher3*. There are also games that emphasize more on social simulation but are not entirely open, such as *Animal Crossing*, *Detroit: Become Human*, and *Heavy Rain*. *Sunset Valley* is a combination of these two kinds: Allows players to heartily explore our fascinating worlds and provides meaningful player interactions with characters at the same time. On top of the traditional social simulation setting, *Sunset Valley* comes with a novel mechanism, the gossip system.

Gossip is often considered a form of deviant behavior, as it violates social norms of privacy and confidentiality. However, in some sociology research, gossip is viewed as a non-trivial form of communication that serves important social functions, such as creating and reinforcing social bonds, negotiating social status, and maintaining cultural norms and values [16][17][18]. These studies provide insightful analysis that helps us to

justify our motivation and fully understand the concept of gossip.

Among all the studies, one important fact that can not be ignored is that the personality of gossip participants is indispensable to the process of gossip. Our gossip model will not be accomplished without a complete foundation to support the personality system. The Five-Factor Model (FFM) is a well-known taxonomy of personality that is both easily understandable and whose traits can be represented on a discrete numerical scale [5][6][12][13]. It is adopted to be a prototype of personality in projects such as *Non-Player Character Personality and Social Connection Generation* and *Sunset Valley*. While using FFM as the basis of our personality system, we found other papers that establish the connections between FFM and gossip [7][8][9].

To provide a more sophisticated structure of social relationships, we refer to social networks in *Prom Week* [14] and social relationships in *The Sims 4* [15].

3. Sunset Valley

Sunset Valley is an open-world game where the player can explore Sunset Valley village freely by having dialogues with seven distinct NPCs. In *Sunset Valley*, the player plays the main character, who has long left the village he grew up in and finally came back. The player will find that the sun never sinks in the village, and the player needs to solve the mystery by discovering clues in dialogues with villagers. The mechanism of *Sunset Valley* is illustrated in Figure 1. We utilized four

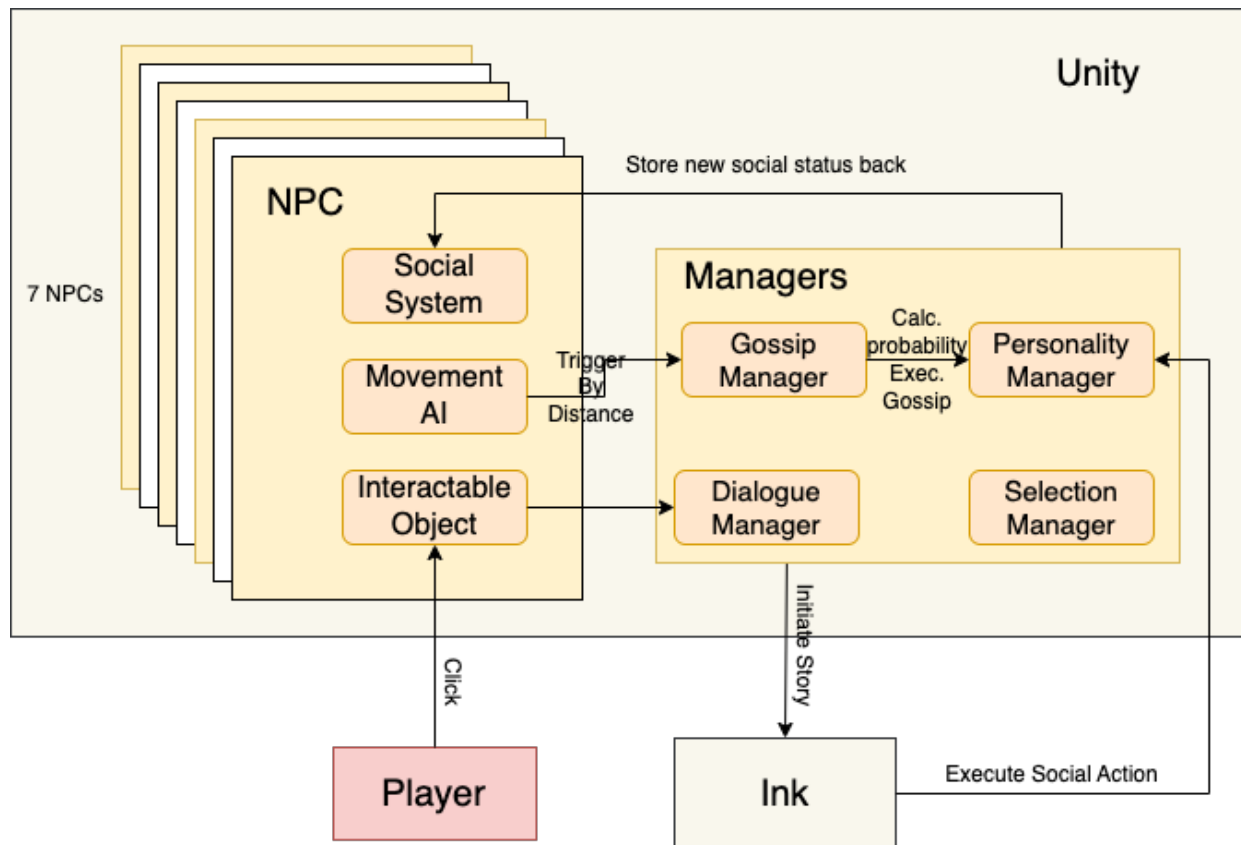


Figure 1. Sunset Valley's Software Architecture. Including major components and how they interact with each other.

unique singletons, gossip manager, personality manager, dialogue manager, and selection manager to

manage all behaviors in the game. The gossip manager manages the social system of each NPC and calls the personality manager when NPCs are about to gossip. The personality manager decides if characters will eventually gossip, calculate the result of gossip, and process the result of non-gossip social actions. The dialogue manager initiates dialogues (stories) written with Ink while the player clicks on an interactable NPC. The selection manager keeps track of the object that the mouse is pointing at.

In each NPC, there are three main components, social system, movement AI, and interactable object. The social system stores three types of one-way relationship status that each NPC holds toward the player – Affinity, Trust, and Admiration. Relationship statuses are scaled from -100 to 100. These statuses can be built by both direct and indirect effects. Direct effects include having a dialogue with NPCs and finishing quests for NPCs. Indirect effects are such as gossiping. Different levels of status can lead to a different response in the same dialogue with the same NPC. In some quests, the player will even need a certain level of status with NPCs

to complete those quests. Under such a mechanism, building positive relationships with *Sunset Valley*. To prevent players from having this kind of monotonous experience, some NPCs in *Sunset Valley* were designed to have opposite positions from other NPCs. One NPC might ask you to insult the other one in order to bond with him/her. Certainly there is a part of stories that the player can never discover and complete. As a result, whom the player chooses to bond with is extremely crucial to the player's experience.

3.1 Gossip mechanism

Gossip can be defined as “a general interest in the doings, the virtues, and vices of others” or “small talk” [3]. Based on the definition, the gossip mechanism in *Sunset Valley* is designed to spread information about social actions that the player recently executed on NPCs. In our gossip mechanism, there will be only one spreader and one receiver. The mechanism doesn't support group gossip at this time. To start gossiping, the spreader and the receiver will need to be at a suitable distance. While the spreader and the receiver are in the gossip distance, the personality manager will take both the spreader's personality and the spreader's social relationship status to decide if the gossip proceeds. If it does, the personality manager will then calculate how much should the receiver accept. To better display the process of gossip, a thinking bubble will pop up above the spreader's head and a relationship status panel will appear next to the receiver while the characters' are gossiping (Figure 3.).

each NPC seems to be the only reasonable way to play



Figure 2. A dialogue between the player(left) and Eric(right)



Figure 3. Thinking bubble floating pops up when the character is gossiping

3.2 Dialogues

The dialogue system in *Sunset Valley* is made with *Ink*, which is a scripting language that is used to create dialogues in games. *Ink* mostly relies on the operational logic of quest flags to further the plot, however, external functions are allowed if integrated with other game engines like Unity. With external functions, scriptwriters are able to present a dynamic interactive dialogue system even without plot auto-generation technologies. Besides plain stories, our dialogue system also equips with a quest system that can track the player's progress and handle quest items.

We have seven distinct non-player characters with five unique storylines in *Sunset Valley*. Each storyline has at most three different endings, which are decided by the choices

player made and the social relationship status that the characters had. Figure 2. is a glance at the display of our dialogue system. NPC Eric told the player that the beloved and well-respected NPC, Gramma's dementia got worse. Choosing "Show some sympathy" might result in a plus in the relationship between Eric and the player. On the other hand, choosing "Tell the cold truth" might be too straightforward and result in a deduction in their relationship. Different responses contribute to different levels of changes in relationship statuses. The more dramatic the response is, the bigger the change will be.

Though our dialogue system does not combine with any AI technology like CiF[4] or beat manager like ABT[9], due to the flexibility that *Ink* provides, we are still able to infuse unpredictable elements and complex dialogue knots into our dialogue system.

4. Relationship Status and Gossip Formula

In this section, we will elaborate on the method we used to design our characters' social behavior. The well-known personality model in the psychological area, Five-Factor Model (FFM), is adopted in our game to define NPC's personality, and the system goes forward to take personality into account forming the gossip decisions and changing the social relationship status of each NPC. Social relationship statuses can be built by both direct and indirect effects. Direct effects include having a dialogue with NPCs and finishing quests for NPCs. Indirect effects are such as gossiping. We will address more details about direct and indirect effects in sections 4.3 and 4.4 respectively.

4.1 Five-Factor Model (FFM)

Five-Factor Model, also known as OCEAN, is a prominent taxonomy of personality in the psychological field. FFM helps not only psychologists and researchers but also game designers to easily understand one's trait based on a discrete numerical scale. In the gaming industry, FFM is a strong foothold for game developers to construct a social simulation game since personality plays an important role in social activities. The five factors of OCEAN are short for Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. In *Sunset Valley*, each character carries a table of OCEAN, scaling from 0 to 1 representing its personality. Below is the description of each factor [5][13].

Openness – People with high openness scores are inclined to accept unconventional ideas and facts; People with low openness scores usually have second thoughts about the facts they received.

Conscientiousness - People with higher conscientiousness will be more aware of their own behaviors and the consequences. On the contrary, people with lower conscientiousness tend to act irresponsibly. Conscientiousness is one of the pivot factors and an exceptionally unique one when it comes to gossip decisions. We will elaborate on this in Section 4.5.

Extraversion - In a nutshell, extraversion is a measurement of being an extrovert or an introvert. People with higher extraversion are likely to talk often and assert themselves; People with lower extraversion are less involved in social situations.

Agreeableness – People with higher agreeableness tend to avoid arguments and conflicts as much as possible. People with lower

agreeableness, on the other hand, are not people pleasers and are always suspicious of others' kindness.

Neuroticism – People with higher neuroticism scale are more likely to overthink and act self-consciously. They enlarge the negative effects coming toward them; People with lower neuroticism are more likely to act calmer in any situation.

Next, we will explain how we change a character's social status and the probability of gossip based on the five-factor model.

4.2 Social Actions

In section 3.2, we mentioned that responses in a dialogue cause a change in social relationship status. In *Sunset Valley*, we have seven types of social actions, each response can be categorized into a type of social action. For example, "Show some sympathy" belongs to the social action "Bonding" and "Tell the cold truth" belongs to the social action "Straightforward". Each type of social action corresponds to numerical changes in social relationship statuses. For instance, "Bonding" adds 50 in Affinity and 30 in Trust. The numerical changes that a social action corresponds to are only representative values. The actual changes will be calculated in our formula based on these representative values.

4.3 Direct Effects

Direct effects are interactions that happen between the character and the player, such as dialogues or physical contact. Social actions caused by direct effects generate a more powerful impact on social status than indirect effects do.

While considering the social status change caused by direct effects, four factors of FFM, Openness, Agreeableness, Extraversion, and Neuroticism, are taken into account in this operation. A previous paper proves that Extraversion and Neuroticism are capable of influencing one's emotional information processing [8], but the paper also points out that Openness and Agreeableness are not taking part in one's emotional information processing. However, from the description of these two factors [5], and the effort we try to make to the difference between direct effects and indirect effects, we still include Openness and Agreeableness in one's emotional information processing. To better fit the paper's perspective, instead of having the same significance as Extraversion and Neuroticism do, Openness and Agreeableness only bring a small effect in this operation. Table 1. describes the impact of the four factors on the social status change caused by direct effects.

Take social action "Bonding" and NPC Eric as an example. Eric's OCEAN value is mid, high, low, high, and mid respectively. After Eric receives "Bonding" from the player, his social status will change as follow: "Bonding" cause a positive change in Affinity(+50) and a positive change in Trust(+30). Since Eric has a mid-level of Openness, Openness does not impact the changes. On the other hand, because Eric has a high level of Agreeableness, Agreeableness causes an increase in the changes. After calculating the impact that four factors made on the changes, we come up with an average change by adding up each factor's changes and dividing by their weights, and the average change will be the final change in the character's social status.

Factors	Weight	Level	Positive	Negative
Openness	Low	High	Increase	Increase
		Mid	Unchanged	Unchanged
		Low	Decrease	Decrease
Agreeableness	Mid	High	Increase	Decrease
		Mid	Unchanged	Unchanged
		Low	Unchanged	Decrease
Extraversion	High	High	Increase	Decrease
		Mid	Unchanged	Unchanged
		Low	Unchanged	Unchanged
Neuroticism	High	High	Decrease	Increase
		Mid	Unchanged	Unchanged
		Low	Unchanged	Unchanged

Table 1. Rules of Defining Social Status Values by Direct Effects. Weight: The portion a factor takes when calculating the average of all. Level: Amount of the factor, Positive: Positive social status value, Negative: Negative social status value

4.4. Indirect Effects

In comparison to direct effects, indirect effects are interactions that happen between characters without the player, such as gossip between characters. Characters with different personalities have disparate responses when gossiping and accepting gossip. In this section, we will explicate a character's social status change when accepting information through indirect effects.

People with higher Extraversion and Neuroticism scales are more easily to fall for rumors [7]. In our game, gossip means the process of a character passing down the information it gained from direct effects. The operation of handling these social status values is the same as we describe in Section 4.3, except the influences of the personality on each value and the rules are different. Table 2. shows the influences of different levels of Extraversion and Neuroticism factors on gossip [7][8].

	Level	Positive	Negative
Extraversion	High	Increase	Decrease
Neuroticism	High	Decrease	Increase

Table 2. Rules of Defining Social Status Shifting Values by Indirect Effects. Level: Scale of the factors, Positive: Positive social status shifting value, Negative: Negative social status shifting value.

4.5. Gossip Probability

When two NPCs are in the gossip distance, the gossip would have a chance to be triggered. To achieve more realistic rumor spreading, the character's personality and social status are considered while deciding the probability of gossiping behaviors since our urge of gossiping is usually swayed by both of these two elements in real-life [11].

People who have high Conscientiousness, Extraversion, and Neuroticism are more likely to spread rumors while they are in fear or intense emotions [9]. However, you might wonder why the result of this research doesn't match the description of Conscientiousness in Section 4.1. Usually high Conscientiousness would not spread rumors. The explanation is, when highly conscientious people are in intense emotion, they tend to believe the information they got is accurate, thus they deem that spreading or gossiping about these "facts" is a responsible move. Examples are people spreading rumors about COVID-19 because they fear that ignorance of COVID-19 might jeopardize their loved ones. In our game, intense emotions are interpreted as an extremely high or low value in social status.

To produce the probability of initiating gossip, we need Conscientiousness, Extraversion, and Neuroticism from the spreader's OCEAN. We then apply pre-defined rules based on the three factors and the spreader's social status, shown in Table 4.3. After running through the rules, three respective values of Conscientiousness, Extraversion, and Neuroticism are generated. Summing up these three values and dividing them by three helps to conclude a probability of gossiping.

	Level	Intense Emotion	Gossiping Ch
Conscientiousness	High	Yes	High
Conscientiousness	High	No	Low
Conscientiousness	Low	Not Included	High
Extraversion	High	Not Included	High
Extraversion	Low	Not Included	Low
Neuroticism	High	Not Included	High
Neuroticism	Low	Not Included	Low

Table 3. Rules of Defining Gossip Probability

5. Future Work

As hard as we try to refine *Sunset Valley* in the last few weeks, there are always innovative ideas that we can take advantage of. Currently *Sunset Valley* relies a lot on the operational logic of quest flags to further the plot. The major disadvantage of this kind of storytelling game is the creation of a tremendous authoring burden. An intuitive solution to this is integrating AI technology into our dialogue systems such as CiF[4] or ABL[19]. To motivate players to explore the game and enrich their playing experiences, we look forward to integrating an inventory system and a currency system into *Sunset Valley*. Finally, in order to make the gossip mechanism smarter,

merely tracking the social relationship that NPC holds toward the player is not enough. The social relationship between NPCs is an indispensable element too. We are expecting to include NPCs' relationships in the gossip formulation in the future.

6. Conclusion

We successfully presented a prototype of the gossip mechanism in *Sunset Valley* solving one common problem in open-world games: insufficient realism in background characters. Players can enjoy more human-like interaction in open-world games based on our design. The FFM provides the basis of our gossip mechanism and the formulation of our gossip mechanism is supported by sociological studies. We also demonstrate the visual process of gossip including characters walking toward each other when gossiping and a thinking bubble indicating ongoing gossip. Our project can be a great start for game developers that wish to extend their social simulation part in open-world games.

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