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Conversational Atmosphere Model and Reproduction by Animated Agents

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Abstract Humans not only prefer to speak precisely and to convey information, but also enjoy conversation for its own sake. This type of conversation plays an important role in establishing bonds of solidarity among participants. In this study, a model is developed that can portray various types of conversational atmospheres based on the concept of phatic expression, and reproduce conversations and atmospheres using multiple animated agents. A simulation system is also developed to reproduce conversational atmospheres by controlling animated agents' verbal and nonverbal behaviors. Based on the proposed model, a simulation can generate informative or phatic atmosphere.

Keywords Animated agent, character, conversation, atmosphere

1. Introduction

Humans not only prefer to speak precisely and to convey information but also enjoy conversation for its own sake. In conversation studies [1, 2], such a conversation is categorized as "phatic expression" [1, 2]. This type of conversation plays an important role in establishing and maintaining bonds of solidarity among participants [1]. Coates postulated that conversation among women involves not only the construction of a shared floor, but also comprises an amount of overlap (simultaneous talk) [3]. The study also suggested that the overlap in speech was not a deviant phenomenon, but a way of expressing the solidarity of friendship; the deviation is expected in the form of a phatic expression. Roger et al. described both cases in which simultaneous speech is repaired, and ones in which it is not repaired when participants conform to the rule that one speaker starts to speak at a time [4]. When phatic expressions are used, violation of standard conversational rules are allowed slightly, as the phatic expression takes priority over the conversational rules. Thus, the importance of deviation as a phatic expression has been described in literature; however, it has not been used for developing conversational robots/agents. If the relationship between the violation of conversational rules and solidarity of friendship is revealed, robots/agents that can make sense of the unity between robots/agents and humans can be developed.

Therefore, in this study, we develop a novel model by focusing on phatic communication and the social constraint of human communication. The model represents two types of atmospheres, (phatic/informative atmosphere and also expresses the validity of participants' conversational behaviors. Phatic atmosphere indicates a state of violation of conversational rules; however, it may make solidarity of friendship. Based on the model, we can develop conversational robots/agents that can reproduce various types of atmospheres, leading to a friendly atmosphere for humans.

To confirm the validity of the model, we develop a multi-agent simulation system based on the idea of autonomous turn-taking agent system in previous studies [5-7]. The system can reproduce conversational atmospheres based on the proposed model. The atmospheres are created by controlling the animated agents' verbal and nonverbal behaviors. The model may be able to estimate an upcoming mood, or create a specific mood across multiple situations.

Developing the atmosphere model and investigating the mechanism of atmosphere will enable development of various types of application using the atmosphere [8, 9]

2. Overview of Proposed Model

We hypothesize that phatic communication is a main factor in our atmosphere as humans have the desire to communicate with other fundamentally. On the other hand, informative (formal) communication is assumed by social constraints against phatic communication. For example, there are important conversational rules such as if a participant starts to speak, the others should not start to do so, and if a participant wants to start to speak, he/she should express this [10,11]. Social rules make conversation smooth and avoid silence. These rules are more rigid in a formal situation (informative atmosphere) than in an informal situation (phatic atmosphere). Thus, we hypothesize that humans essentially desire phatic communication in an unrestrained manner; however, social constraints exist that do not allow unconstrained behavior

in conversation.

The proposed model is shown in Figure 1. In this example, there are three participants (P1-P3) and the figure indicates their behaviors in areas. “Informative atmosphere” is located in the circle, which represents social constraints. If there is no circle of social constraints, they are allowed to behave freely in the area, and the situation indicates behaviors of friendly phatic communication such as chat or small talk. On the other hand, if the circle of social constraints exists, participants’ behaviors are limited by conversational rules. In this way, the model can express phatic or informative atmosphere by using the size of the circle in the center.

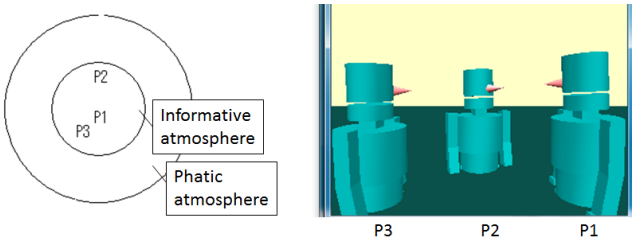

Figure 1. Phatic / informative atmosphere model and conversational atmosphere simulation system using animated agents. P1-P3 represent participants’ behaviors in conversation

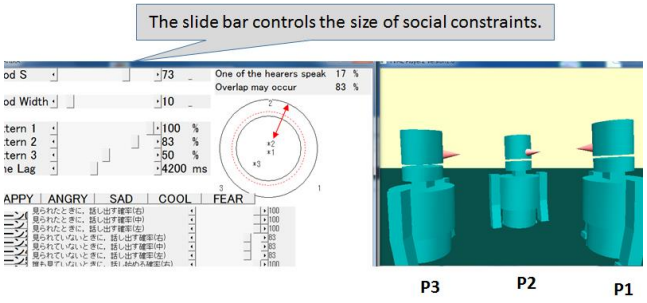

Figure 2. Controlling the size of social constraints circle and agents’ behavior

3. Representation by Animated Agents

Based on the proposed model, we develop a conversational atmosphere simulation system using animated agents. This system is based on the autonomous multi party conversation system [5-7]. From the findings of previous studies, we know that turn taking significantly influences atmosphere [7]. For example, “a lot of turn taking” might produce excited or energetic moods (e.g., an amusing conversation), and “little turn taking” might imply sorrowful moods (e.g., at funerals). We use TV Program Making Language (TVML) in this study [13]. In this system, we can control the timing of turn taking using the slide bars on the control panel; this generates various atmospheres (Fig 2). For an unbiased evaluation, we selected characters who do not show any facial expression, but can express head directions and mouth movements. The agents said random words from the word set with no meaning (e.g., ARABAHIKA or UKUJARAH).

Based on previous studies [5, 10], we prepared typical conversational behaviors in that the next speaker was selected in the following turn-taking patterns in the system.

Pattern 1: When the person finish speaking, he/she looks at the hearer would be the next speaker

Pattern 2: The person being looked at by the previous speaker would be the next speaker

Moreover, in this system, we can choose the size of the social constraints; this value and agents’ behaviors are displayed in the panel. Thus, we can observe agents’ behaviors (turn-taking) and the validity of the behaviors (figure 2).

4. Discussion and Conclusions

Examples of the relationship between the produced behaviors of agents and the notation of model are shown in Figure 3. In the current system, we prepared two types of turn-taking;

T1: only one of the hearers started to speak (following the conversational rule)

T2: overlap of utterance occurs (deviation from the conversational rule.)

T2 implies that not only one of the hearers starts to speak, but also the other hearer starts to speak.

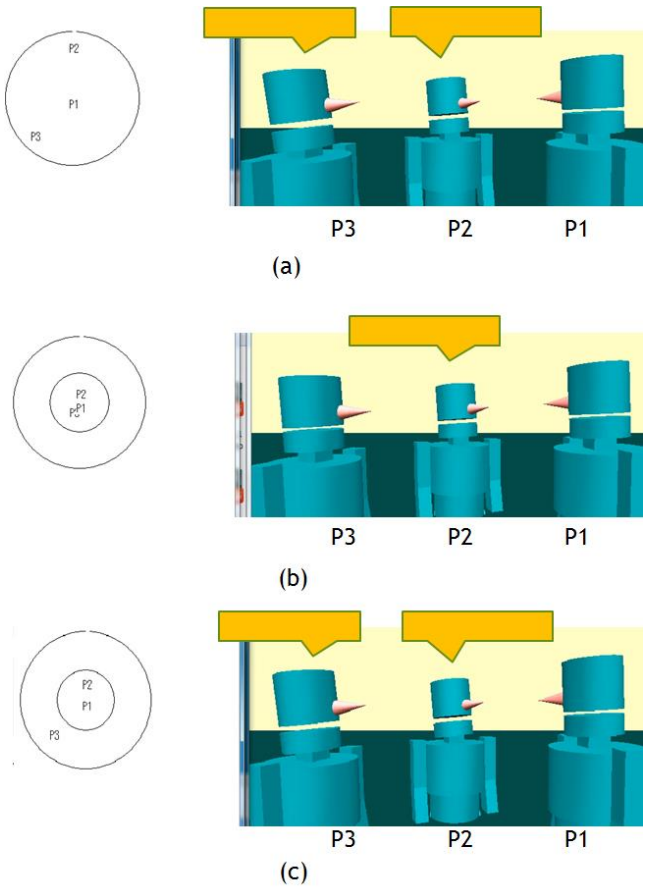

Figure 3. The model and agents' behaviors

As described in the latter, the participant who starts to speak and who was looked at by the previous speaker was decided by probability (randomly) in the system; however, the chance level of overlap was chosen depending on the size of social constraint.

Figure 3(a) shows that no social constraints and turn-taking patterns were chosen freely. Both single turn-taking (only one speaker starts to speak) and overlap were present. A slight bustling and friendly atmosphere could be created by overlap, and phatic atmosphere could be produced by the system. The (b) in Figure 3 expresses that there was social constraint and the turn-taking behaviors were limited. Only single turn-taking was produced and it was felt monotonous.

Furthermore, we used the special parameter that agent could deviate the constraint within social constraint. Figure 3(c) shows that only P3's behavior deviates although there was social constraint. The situation meant that P1 and P2 behaved as in an informative atmosphere (formal communication), however P3 behaved like the atmosphere was phatic. The behavior may not match the atmosphere. The agents' behavior was valid as the notation of the model.

However, it must be known whether the situation has a phatic or informative atmosphere in advance to judge the matching the behavior. It is hard to judge the behavior by observing only the agents' behaviors without notation of the social constraint. Thus, to comprehend the atmosphere, situation setting (the current situation is phatic or informative atmosphere) is required in advance. The approach to prepare the situation settings will be taken up in future studies.

Moreover, because the system only generates and expresses atmospheres, we can only evaluate the atmospheres subjectively, such as by conducting a questionnaire experiment. We should find an appropriate objective method (i.e., measurement of eye movements or reaction times) and interactive methods against robots/agents for future studies.

To summarize, according to the finding from previous studies that humans' conversations have deviation and the possibility to make "solidarity" of friendship, we developed a conversational model to express the phatic communication and informative communication. Based on the model, we developed multiple animated agents to model the types of phatic and informative communications. The reproduction by the agents were thought to have validity. In future, we will conduct an experiment to confirm the validity of the reproduction.

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