

# An Approach to Construct an Emotional Dialogue System Based on Subjective Observation

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**Abstract:** *This paper introduces basic concept of an emotional dialogue system and shows how to construct the system by computer simulation. We discuss a dialogue between two simulated persons who know only emotional words. At first, we show Image Code Table (ICT) of mixed emotions which are regarded as emotions in usual life, introduced by R. Plutchik. Secondly, we also show how to design an emotional dialogue system based on the theory for Subjective Observation Model (SOM), which have high applicability to several kinds of fields. We explain the outline of the theory. Finally, we show several attractive dialogues by computer simulation.*

**Keywords:** *Emotion psychology, Emotion processing, Mixed emotion, Subjective observation model, Fuzzy inference, Emotional dialog*

## 1. Introduction

We, human beings are almost impossible to recognize the absolute meanings of objects or the true relationships among them directly, then we usually understand the meanings concerning the objects by dropping the order of dimension and aggregating the observed information from several angles.

Subjective Observation Model (SOM) stands on the philosophy that all cognition and understandings can be done only on the observation space, mapping the objects defined on the high dimensional space onto the observation space.

And we consider a number of observation spaces as a kind of cognition (or interpretation). The system has two observation spaces corresponding to two persons on dialogue. The emotional words on each observation space dispatched to the partners are mapped on the particular observation space on which the origin of mapping and the scaling are taken into special consideration.

## 2. Eight Pure Emotions and Image Code Dictionary

We introduce and outline of Plutchik's theory. In emotional psychology, R. Plutchik proposed a four pair emotional ring constructing by eight pure emotions (see Figure 1), whose constructive idea came from the analogical inference for the three-dimensional, mixed-color model (Plutchik [4]).

These are regarded as four-dimensional attributes, constructing a Rectangular Basal Coordinates Frame (RBCF). And the mixed emotions which are felt in usual human life, are supposed to be defined by the vectors on RBCF in the form of linear combination of the coefficients. In fact, as for some mixed emotions, R. Plutchik in his paper [4], considered some intensities on the 8 pure emotions constructing a mixed emotion. So, in the similar way to him, we made an image code dictionary (see Table 1) consisting of sixty-eight mixed emotional words.

## 3. Outline of the Theory for Subjective Observation Model

We explain SOM shortly, because detail of the theory is in the paper [1].

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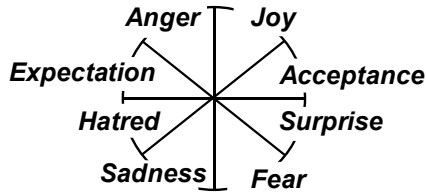


Figure 1. The ring of 8 pure emotions

Table 1. A part of Image-Code dictionary of the Mixed Emotional Words (×0.01)

Mixed Emotional words	Joy-Sad.	Ang.-Fear	Exp.-Sur.	Acc.-Hate.
ecstasy	91	0	30	30
joy	74	0	50	30
happiness	65	0	50	30
pleasant	52	0	30	30
quiet	40	0	10	30
calm	30	0	10	30

Abbreviations: Ang, anger; Exp, expectation; Sad, sadness; Sur, surprise; Acc, acceptance

Image codes of the mixed emotions  $\{x_k\}$  ( $k=1,2,\dots,68$ ) can be expressed by the vectors  $\{\vec{x}_k\}$  consisting of the coefficients on 4 attributes of a Normalized Rectangular Basal Coordinate (NRBC) whose system is denoted by,  $\{\vec{e}_i\}$ , i.e.;

$$\vec{x}_k = x_{k1}\vec{e}_1 + x_{k2}\vec{e}_2 + \dots + x_{k4}\vec{e}_4 \quad (1)$$

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“My emotion is *hopeful*.” Miss B replied, “I wanted to *attack* somebody.” Fig.9 shows an simulated example of the dialogue in the case the coefficient  $\alpha = 1$ .

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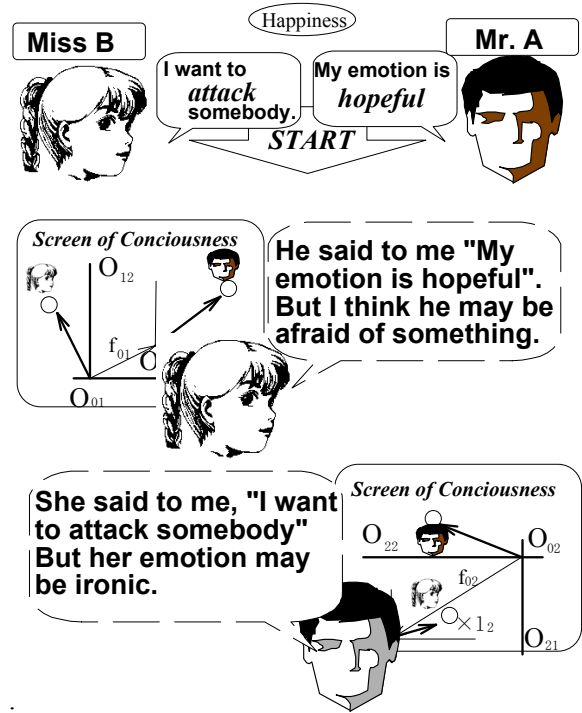


Figure 9. An simulated example of the dialogue

#### 4. What is Nursing

A lot of readers tend to think that the nurse works busily in white in the hospital, or gives cares to patients. People, who have deep knowledge or the concern of nursing, may notice there is more profound meaning in nursing. It is important to clarify something essential in nursing. The essence of the real work of nursing is described in many works [3-5]. First of all, it should be pointed out that it is wrong to understand nurses as doctor’s supplementary followers. The reason is that both of doctors and nurses have different original roles.

Doctor mainly plays a role to determine the origins of lurking in a patient’s body from his body symptom, and attempts complete cure or improvement of the symptom by medical prescriptions such as the operations and medicines.

On the other hand, nurse’s role is to consider not only the body symptom but also the state of the mind although nurses receive the doctor’s instruction. Nurses provide caring for the patient, and their caring improves the patients mentally and physically. The nurse manages all of patients, and can lead to healthy state including the mind while the doctor can cure completely or improve a body symptom by treating a cause of disease. It can be said

that the nurse will cure the sick person while the doctor is struggling with diseases. The nurse is embracing the entire medical treatment of the patient while doctor's purpose is direct for the cause of illness.

On the nurse's role, Patricia Benner, who is an American authority of the nursing practice theory, insists that only the nursing practice with a deep sympathy to the patient (caring) should be nurse's role [3]. Moreover, Kiyoko Ikegawa explains that the basis of nursing is a deep human love [4]. These opinions of two leaders in nursing can be greatly approved. However, it doesn't mean that nursing is conducted only by the human love. It is necessary to combine "Human love" with the knowledge of nursing and the technology of nursing though a deep human love is necessary for the source of behavior of nurses. An ideal nurse sincerely accept the patient who is originally others, and the nurse should fight the sickness together with the patient, and do her best nursing act as she can do. The example is given below [5].

The elderly woman of hardly breathing has been carried by an ambulance to a certain hospital. The chief nurse who had been waiting for receiving the patient in a stretcher was surprised when she tried to take off the sheet which wrapped this elderly woman. It is because that the woman was wrapped by dirt, and the skin seems peel off, and few layer of the skin is nearly fallen. The chief nurse carried the stretcher to the stall shower without do anything, then scraped the dirt of the whole body. The elderly woman was not able to do the skin respiration because there was no one around taking care of her, and she may have no bath for a long time and was painful. The elderly woman was carried to the room, then, after the shower the chief nurse rubbed her waist and her body in order to reduce even a little the pain of the elderly woman who continues hard breath and was showing her body painful. After a while, the elderly woman who shut her eyes for long time and behaved faintly, then suddenly conscious, and muttered, "Thank you."

The author thinks that this is true nursing. This chief nurse feels patient's suffer assuming she has the same pains, and is naturally doing nursing (deep care) that improves the patient. This is the one based on the human love. On the other hand, at once the chief nurse saw this elderly woman, she immediately noticed that the elderly woman had a pain since she could not do the skin respiration, then performed a care which excludes her suffer. It is one of the nursing techniques to do the shower. This

is intuitive expression of the knowledge of nursing. In a word, it can be said that the true nursing is an application of the nursing technique based on the human love.

This kind of act cannot be done except the nurse. Doctors don't have such a kind action that they rub the body and waist of their patients. On the other hand, even if the family members have very love, they don't have the nursing technique. Then the family cannot remove the cause of disease, or improve the symptom. It is therefore emphasized that the true nurse has both of these important elements, i.e., "Heart and Knowledge."

## 5. Conclusion

We have applied the basic theory behind our subjective observation model to an emotional dialogue system. The simulations suggest that it is possible to use the system to mathematically extract human's emotional views against another person. This study is in its infancy; a lot of subjects for research have not yet been studied. However, it is considered that the idea of this research will be very useful for construction of artificial emotional dialog system in the near future, or for creating some new type of processing system containing subjective emotional functions in the background.

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