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On communication assistance via bots —towards IMDJ

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Abstract

Communication robots (bots) have been popular in our lives. Actually robots have several shapes and possibilities. In several applications such as SNS, bots with simple pattern matching are installed and they do not provide natural conversation. However users sometimes can enjoy the conversation. There might be a certain shikake in the applications or users can enjoy the vertual conversation as it is.

In this paper we investigate what types of bot are preferable in the Human-Computer interaction. We prepare several types of bot to determine the preferable features of bots. From the experiments, we could determine types of words for an enjoyable or comfortable conversation (interaction). Thus we can install such a conversation shikake in the bot applications. In addition, we will give a certain suggestion for the preparation of a certain mechanism for the conversation activation in the Innovators Marketplace on Data Jacket (IMDJ).

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1. Introduction

According to the development of internet applications such as SNS, the feature of communication has changed and the usage and the frequency of such communication have increased recently. Many internet users use the Facebook and the Twitter for the communication instead of e-mail. Such applications have the feature as multiple user communication. That is, users can enjoy communication every when they go into such a situation and they can communicate those who are not expected to communicate with. It seems very lucky for the internet users. However, it is not so simple. For instance, a blog flaming occurs several times. Accordingly, it will be necessary to reduce or remove such flamings and provide environments for the safe communication.

In addition, for the internet communication, sometimes an automatic robot communication is introduced. In order to offer the safe communication space, it becomes more and more important to design a human-like and comfortable communication space.

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A communication among users is very important to reorganize or improve their thinking. In addition, sometimes even new idea might appear. For instance, in [3] and continuing researches, the effect of communication among participants is reported and discussed. This type of communication is thus important in chance discovery [2].

In addition, the other type of communication can be considered. We think a type of *holistic communication*[1] can be effective in chance discovery. That is, a key person, matter, thing or event plays a role as a media or guidance between curator and general or novice audiences. This type of key person, matter, thing or event functions as a hub of communication. That is, it sometimes functions as a help or a guidance to discover chance. Such discovery is sometimes achieved by a certain communication among users. In addition, such discovery strategy might be learnt by referring to the other's activities. Actually such a key person shown above can be played by a robot.

In this paper, we will discuss the character or strategy of communication robot and effects or influences of such communication. Then we will discuss the possibility of the introduction of such automatic robot (bots) in IMDJ [3,4].

2. Previous conversation or communication systems

Previously several conversation or communication systems have been proposed and developed. In this section, such systems are illustrated and we discuss the weak point of such systems.

2.1. ELIZA

ELIZA is a program developed by Weizenbaum which makes a natural language conversation with a computer possible [5]. Input sentences are analyzed on the basis of decomposition rules which are triggered by key words appearing in the input text. Responses are generated by reassembly rules associated with selected decomposition rules. Weizenbaum pointed out that the fundamental technical problems with which ELIZA is concerned are:

(1) the identification of key words,
(2) the discovery of minimal context,
(3) the choice of appropriate transformations,
(4) generation of responses in the absence of key words, and
(5) the provision of an editing capability for ELIZA "scripts."

ELIZA adopt very simple pattern matching strategy to proceed a conversation. For instance, an example of the conversation between human (we) and ELIZA is shown in Fig. 1 (by the application provided in `http://nlp-addiction.com/eliza/` in Japanese).

Sometimes insufficient replies are given. For instance, as you can see, if the user say "no," ELIZA usually replies "You are being a bit negative." Perhaps ELIZA is installed to reply if it is said "no." Because it does not have any brain. It mainly uses the technique of a pattern matching for continuing a conversation. Even with such a simple pattern matching technique, we can enjoy a communication. However the more intelligent strategy will be required for the activation of the communication.

2.2. Artificial non-intelligence

This is an old type application in a game-type communication. It does not have any brain for the communication. In this sense, it is the same as ELIZA. However, it has a very unique feature. It speaks as if it were a very young girl. On the other hand, ELIZA speaks as if it were a Rogerian psychotherapist. Perhaps the reason of the difference between two communication robots will be the aim of the communication. In fact, the artificial non-intelligence is for the entertainment. ELIZA is for the research. Anyway, it will not be sufficient to the fruitful communication.

[1] In a holistic communication [1], an advertiser seeks active consumers and makes them a sort of hub from which a lot of information will be delivered and exchanged to other consumers (B to C to C model (B: business, C: customer).

```
* yes please
> Are you Sure?
* of course
> Tell me more...
* I feel a fear.
> Tell me more about such feelings.
* gee... I think I see a ghost.
> Do you really think so?
* Yes.
> I see.
* What is your advice?
> Have you asked anyone else?
* No.
> You are being a bit negative.
* Why do you think so?
> Oh...  think so?
* Yes I ask you.
> You're not really talking about me, are you?
* Ummm.... I'm not sure.
> Did you come to me because you are not sure?
* Perhaps.
> OK... "Ummm.... you're not sure". Tell me more.
>     *** Are We going to Chat? ***
>   I can't help you without a dialog!
```

Fig. 1. Chat in ELIZA

Fig. 2. Paro

2.3. Paro

Paro (`http://www.daiwahouse.co.jp/robot/paro/`) is a communication robot. Its shape is come from a seal (Fig. 2). It is mainly used in hospitals and educational organizations for the therapy for children or aged persons. In addition normal users can use it as an artificial pet. In fact it is regarded as a healing-type and animal-shaped robot. It can understand around 50 words. It will react by moving its eyelid, head, and foot according to the recognized words. It does not say any phrases. Therefore it can be used as healing-type communication, but it cannot be used for the activation of communication.

2.4. Discussion

The above type of communication tools are designed very simply. They can reply by using the simple pattern matching technology. In addition, they will not have complicated database for the conversation. For the activation of communication, it will be necessary to prepare database containing several patterns of communication. Especially

it should have communication pattern that will activate communication. For that it is necessary to analyze blogs to determine which type of conversation will activate communication. Of course recently rather intelligent robots such as PALRO (`http://palro.jp/` in Japanese) have been developed. However they may not have emotion. It will be necessary to develop robots that can act as if they had emotion.

3. Phrases according to the user's mental status

Before the construction of communication robots (bots), we tried to collect phrases according to the user's mental status. For that we conducted internet-question-based experiments. The experiments involve several questions. The questions are:

- Q1: What phrase do you feel warm?
- Q2: For what phrase do you think you are understood?
- Q3: What phrase do you think comfortable when you feel sad?
- Q3′: What phrase you do not like to be said when you feel sad?
- Q4: What phrase makes you get angry?
- Q5: What phrase makes you disappointed?
- Q6: What phrase makes you encouraged?
- Q7: What phrase makes you healed?

Participants: 14 females and 17 males (21–60 years old).
Answers to the above questions are:

- Q1: **Thank you.**; It's good for you.; I's hard time.; You did your best (appreciation).; You do not need be worry (try to remove uneasiness).; Are you OK?; It's nice weather.; Hot spring.; sun bathing (can imagine something hot); Some phrase involving additional ans implicit sense.
- Q2: **It will be XXX's style. (XXX is somebody's name).; Indeed!! XXX made it good, right?; It's really so.; I understand it!!**; The listener summarize his/her speech.
- Q3: **It was hard time (appreciation).; What's a matter with you?; Are you alright?(make proceed the conversation); Let's go to play!; Let's go to drink!(suggest the other vector); Do do not need to be worry.; It will not be only you (try to make somebody giving up).; Because you did your best, it will be OK (make the result positive).**
- Q3′: **I said so.; You did bad.; You are lazy.; You also have a reason.(blame); It is not so special.; Why you are so disappointed?(non-sympathy); Not talk to me!!(reject); Do better!!(encouragement which seems non-sympathy)**
  For these phrase, we can not feel sympathy.
- Q4: **You female do it?!; It is really blood type B.(feature we cannot change); disparage his/her favourite/loving thing; blame without reason; You cannot do it anymore.; I don't know....(non-sympathy**); speech without politeness
  Blame and non-sympathy have a certain relationship both with something we do not to be said when we are sad and anger.
- Q5: **You did not complete.; You do not understand.; You did not achieve any result.; You look child.; You are not independent.; Hypocrite (negative phrase)**; caution to what we know; Are you really a man?! (estrangement from ideal situation)
- Q6: **Cheer up!!; XXX should be OK; You can do it.(encouraging phrase); You are not alone.; I will believe you.; I will do the same thing.(Cooperative and sympathizing phrase); I'm supporting you!! (cooperative encouraging phrase)**; Tomorrow is another day.; Effort pays in the future.
- Q7: **You will be alright!!; Have a good night (***Otsukaresama deshita***); I can understand.**;
  Not so many common answer.

The bold font phrases are mainly answered ones.

For the better and comfortable conversation, using sympathizing phrase will be important. Especially when persons are depressed they need such sympathizing words. Since they are depressed, they cannot feel self-affirmation. Of course, we are not so simple, but we can find a certain tendency in our feeling in conversation.

In the following section, according to the obtained results, we use the above types phrase to build several types of communication robot.

4. Experiments by using bots with several characteristics

We conducted several experiments by using bots with several characteristics.

4.1. Experiments

According to the analysis in the previous section, we categorize the phrases in conversation into several patterns from the viewpoint of "sympathy." Then we construct the following bots.

1. standard (adjustment) type: many responses (aizuchi) and introductions to conversation.
2. conversation introduction type: many introduction to conversation are given.
3. response type: many responses are given.
4. non-sympathy type: blame and non-sympathy words are given.
5. puppet type: imagine the feature of the puppet and speak according to it.
6. humour type: more playful and context is not considered.

4.2. Objective of the experiment

As shown in the previous section, it is said that ELIZA, which is a very old conversation robot, performs very simple conversation to make significant effects to the user's emotion. However, if we perform a conversation with a robot with matching-type strategy, we sometimes feel stressful because of mismatching of conversation. Even when we expect very simple conversation, sometimes we can have a comfortable conversation. What is the trigger or reason of such a comfortable conversation? What type of difference exists according to the personality?

For this experiment, we installed certain (typical) phrases to bots to generate those having certain personality. Then we examine how the participants feel according to the type of bot.

4.3. Method

participants: 40 (university students)
tools : (computational) conversation robot (bot) programmed by Perl. We have developed ELIZA-like conversation system (Fig. 3[2]).
Procedure: Participants perform conversation with the conversation robots. Each participants perform conversation with two types of the conversation robots. The conversation continued until participants feel enough (they feel the conversation could end). But they should continue at least ten conversations. They could make conversation with their favourite theme. But if they could not find any proper theme for the conversation, certain hints were given to determine the theme. They are, for instance, weather, condition, what they did that day, etc. We ask the participants about their impression to six index in eight degrees.

[2] For japanese, the system is implemented in Japanese. The phrases are, for instance, "Hello, what did you eat last night?"
"I ate Oden."
"I see."
"And you?"
"Let me see....."
"Didn't you remember??"
....

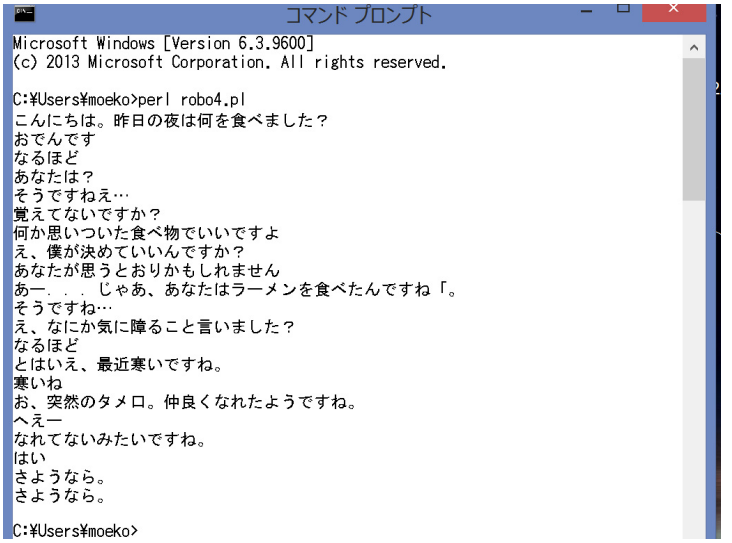


Fig. 3. The conversation system used in the experiment (in Japanese).

Six impression index are: healing, sense of security, boredom, irritation, unpleasant feeling, and pleasure. These impression index are determined by the previous experiments shown in chapter 3.

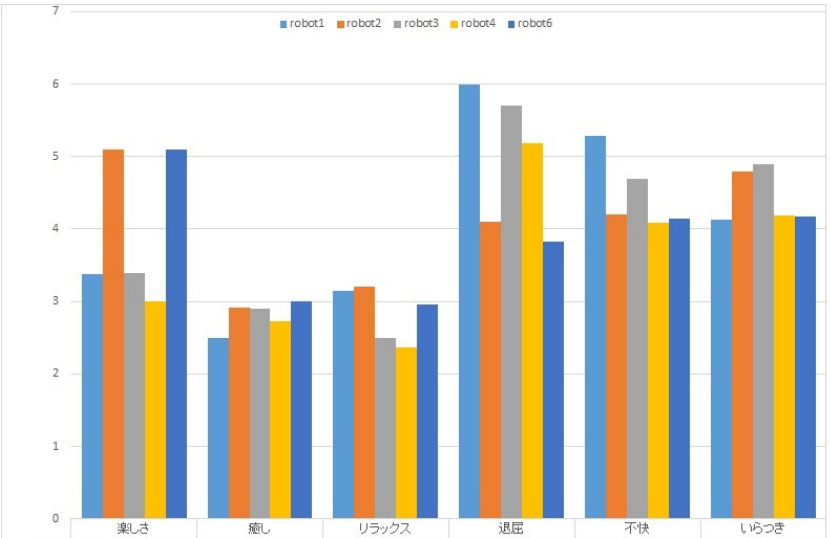
In addition, in order to check the relationship between personality and the results, we ask their depression and enjoyment thinking in four degrees. This result will be used to see the relationship between an index that has a relationship with that supporting humour and an evaluation in humour type or the other evaluation.

Index of questions are:

A. acceptability of negative events
   including questions such as:
   Do you agree “failure is a mother of success?”
   Do you think you will have a good time and bad time?
   You cannot accept your failure?
B. feature of the negative event acceptance
   including questions such as:
   You cannot easily give up?
   You will not give up even when you will fail?
   When you are in hard time, you will exert all your powers?
C. enjoyment thinking
   including questions such as:
   You are always thinking how to enjoy the life?
   You are always seeking for interesting matters?
D. depression index
   including questions such as:
   Your are in low spirits and melancholy?
   Is it easy to be depressed by a trivial thing?
   Are you interested in love?

4.4. Results and discussions

For the type-5 robot, since we could collect only one data, we will not take the result into the count.



	楽しさ	癒し	リラックス	退屈	不快	いらつき
robot1	3.375	2.5	3.142857	6	5.285714	4.125
robot2	5.1	2.909091	3.2	4.1	4.2	4.8
robot3	3.4	2.9	2.5	5.7	4.7	4.9
robot4	3	2.727273	2.363636	5.181818	4.090909	4.181818
robot6	5.103448	3	2.965517	3.827586	4.137931	4.178571

Fig. 4. Emotion index of each type communication robots.

The result is shown in Fig. 4.

In Fig. 4, emotion index are written in Japanese. The index are (from left to right): enjoyable, healing, relax, boredom, unpleasant feeling, and irritation.

We can see that for the type-2 robot (conversation introduction type) and the type-6 robot (humour type), an evaluation as enjoyable is high. On the other hand, for the type-3 robot (response type) and type-4 robot (non-sympathy type), an evaluation as boredom is high.

For each robots we can see their effects to conversation:

1. standard type: evaluations as boredom and unpleasant feeling are high.
2. conversation introduction type: evaluation as pleasure seems high, but not extremely high compared with other factors.
3. response type: evaluation as boredom is high.
4. non-sympathy type: evaluation as boredom is high.
6. humour type: evaluation as pleasure is high.

In Fig. 5, evaluations according to individual's measure are shown. The vertical line shows the score of individual's evaluation to robots. The ABCD evaluation test was espacially conducted to check the relationship between C (enjoyment thinking) and type-6 (humour type).

First, C (enjoyment thinking) and D (depression index) have big difference. C is generally high and D is generally low. For C, the type-3 is low and the type-6 is high. For A, the group with low score has low evaluation to the type-4. Only A has statistical significance for the above result, but those results suggest the evaluation to the type-4 has a certain relationship with individual's negative thinking.

For the index sense of security and relax, no types of robot can obtain high evaluation. For the type-2, though it is mostly listener type, participants evaluate it as pleasure instead of boredom. For the type-6, as we expected, the evaluation as boredom is low and the evaluation as pleasure is high. For the type-4, it is evaluated as both boredom and irritation.

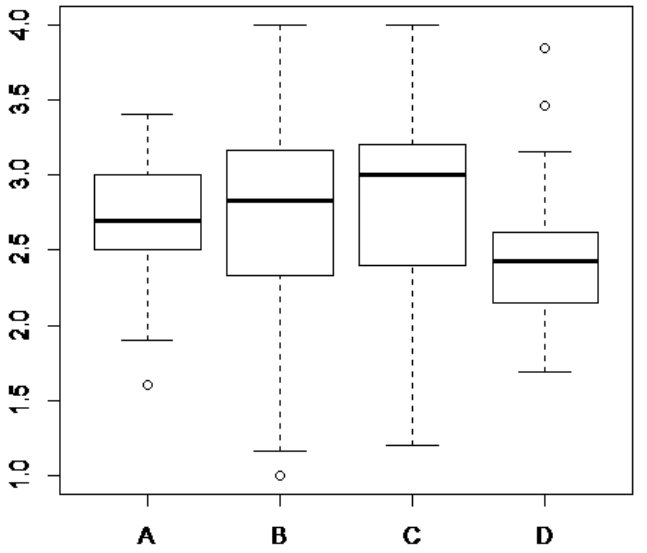


Fig. 5. ABCD evaluations.

When we conduct the additional experiments, we found that participants asked the computer's opinion and personality. That is, they tend to evaluate low when the computer's interest to them is low. In addition, if participants can find a certain personality in computer, some of them could enjoy the personality. Unpredictability of the computer sometimes can be regarded as a certain personality to enjoy the conversation.

5. Conversation robot in IMDJ

In this section, we will discuss the feature of conversation robots (bots) in the IMDJ.

5.1. Innovators Marketplace on Data Jacket (IMDJ)

Innovators Marketplace on Data Jacket (IMDJ)[3,4] is called as Innovation Game. The Innovation Game seems a game where a new production will be obtained during the combination of various techniques, materials and previous products. Usually the game adopt an analogous game system. It uses a large paper. KeyGraph's output is printed on a large paper (game board). On the KeyGraph's output, techniques and their abstract explanations are printed. In addition, techniques are linked by the links generated by KeyGraph. In the game, participants generate several proposal by combining techniques on the game board and additional techniques. Then several applications which will satisfy requirements are proposed.

During the game, conversation among the participants[3] is very important. Accordingly it will be necessary to design a proper robot for activation of the conversation in IMDJ.

5.2. Towards a conversation robot in IMDJ

An shown above, the conversation introduction type robot (type-2) and the humour type robot (type-6) obtain a high evaluation as enjoyable. In order to activate conversation in IMDJ, it will be necessary to make participants feel enjoyable and free. According to our experiments, in IMDJ if users can feel enjoyable the introduciton of the conversation introduction type robot (type-2) and the humour type robot (type-6) will be necessary. In fact, type-2

robot is mostly listener type, but participants evaluate it as pleasure instead of boredom. Perhaps users sometimes want to speak more, thus a proper silence will be confortable and enjoy the conversation.

Thus it will be enjoyable and constructive to introduce such robots as type-2 and type-6. Then the effectiveness of development will be improved.

6. Conclusions

In this paper, we discussed what types of communication tool can encourage user's communication and make users feel enjoyable and comfortable. According to our experiments, the conversation introduction type robot (type-2) and the humour type robot (type-6) make users feel enjoyable. Thus for the communication encouragement, it will be necessary to prepare these types robots.

In addition, we discussed to introduce robots to the IMDJ system. We conclude that it will be enjoyable and constructive to introduce such robots as type-2 and type-6. Then the effectiveness of development will be improved.

In the future these types of robots can be introdueced to improve activities in IMDJ.

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