

# Neckle: Network-based Communicative Kanji Learning Environment focusing on the Difference between Japanese and Chinese Kanji Meaning

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This study focuses on the problem of language transfer in foreign language learning. We analyze the meaning relationship between a learner's mother language and target language, and propose a CGM (Communicative Gap Model) due to language difference. We develop an educational system called Neckle (Network-based Communicative Kanji Learning Environment) to support foreign language learning through communication with native speakers. In Neckle, Pakal (Peer agent for kanji learning) observes the conversation between the learner and the native speaker, checks up the communicative gap according to CGM, and notices the gap for the support of language learning congenial to each learner. Learners can also acquire knowledge and its backgrounds from the native speaker. The knowledge database can also be enlarged.

**Keywords:** computer assisted language learning, communicative approach, cross-cultural education, issue of language transfer, Japanese Kanji learning

## 1. Introduction

With the fast development of computer networking, people around the world have more chances to communicate directly. It is now possible for learners to communicate with native speakers in foreign languages, by applying computer networking to language learning. In fact, many approaches, which are intended to improve exchange among different cultures and language learning by e-mail, have been proposed [1], [2], [3]. In [1] Hanson et al. have introduced the Internet for improving international cooperation and understanding among university students around the world. Through the exchange of e-mail, the ability of learner's to comprehend and express themselves in foreign languages has been highly improved. In [3] Saita et al. have examined the variation of learners' language misuse and correct usage while learners communicate with native speakers by e-mail. Saita et al. pointed out that through the exchange of e-mail, the percentage of language misuse has gradually declined, learners have come to use sentences with more complicated structure, and the ability of the learner to use the language has been improved. This approach, which emphasizes communication, is called the communicative approach [4]. Recently, it has attracted much interest. In this study, there was a focused on supporting foreign language learning through communication with native speakers in language-learning cyberspace constructed with existing communication tools.

Language transfer means that one's knowledge or mother language tends to influence foreign language learning. It is an important issue in foreign language learning and usually happens especially in the meaning of vocabulary and causes a communicative learning gap [5]. If a transfer takes place with no difference between the languages resulted it is called "positive transfer". If a transfer happens with difference resulted it is called a "negative transfer". Therefore, language learning support, which focuses on the language difference, is necessary. Bull [6], [7] has proposed a foreign language learning support system focusing on

language transfer, considering the grammatical difference between Portuguese and English.

In this paper, by introducing a software agent into the Internet communication environment, an agent based language learning environment called Neckle (Network-based communicative kanji learning Environment) was proposed while considering the difference between a learner's mother language and target language [8]. In Neckle, the software agent that supports Chinese people's Japanese learning was named Pakal (Peer agent for kanji learning). The rest of this paper is organized as follows. In section 2, an analysis of the relationship between languages and describe a communicative gap model based on language difference. In section 3, present the system framework and agent model and explain the foreign language learning supporting. In section 4 show the development of Neckle system, which is Network-based communicative kanji learning environment focusing on the difference between Japanese and Chinese kanji meaning. Finally, conclusions are drawn in section 5.

## 2. Languages difference and communication

Language transfer is related to the difference between languages. In this section consider the meaning difference and analyze the relationship between the learner's mother language and the target language.

### 2.1 Relationship between languages

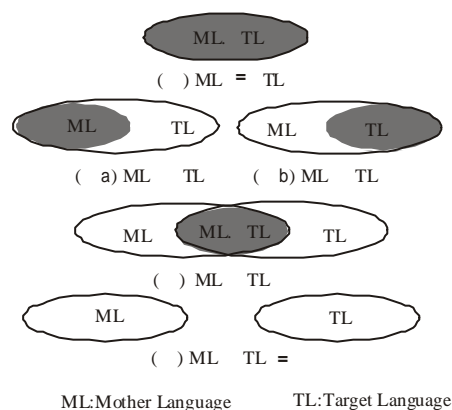


Table 1. Example of meaning relation between Japanese and another language

Relation	Example (Japanese: another language)
(I)	春 : Spring (English)
( a )	着る : Put (English)
( b )	兄弟 : Brother (English)
( )	単位 : 単位 (Chinese)
(IV)	鳥居 : Nothing

Fig.1 Meaning relationship between mother and target languages

In contrastive linguistics, research has been carried out on the relationship between vocabulary meaning of different languages' vocabulary. Andou [9] classified the relationship into (1) "Same", (2) "Overlap", (3) "Nothing". In this study, considering the meaning scope of learner's ML (Mother Language) and a TL (Target Language) from the foreign language learning's viewpoint, subdivided (2) "Overlap" into "Inclusion" and "Overlap-difference".

- (I) Same: both of learner's ML and TL signify the same or common meaning.
- (II) Inclusion: (IIa) the meaning scope of ML is a subset of TL; (IIb) The meaning scope of ML is wider than that of TL.
- (III) Overlap-difference: while ML and TL have common meaning, the difference exists.
- (IV) Nothing: vocabulary that has common meaning doesn't exist due to difference in culture.

Fig.1 shows meaning relationship between learner's ML and TL. Table.1 shows the example of Japanese and another language. For example, "単位" belongs to (III). In Chinese, "単位" has no meaning of "credit" like Japanese, it means "place of employment" instead. However, a common meaning of "a unit" exists.

### 2.2 CGM (Communication Gap Model)

The factor of communication gap between learner's ML and TL are analyzed as follows.

- (1) Meaning difference of learner's ML and TL: Tanaka [5] pointed out that meaning difference is a factor of language transfer. Therefore, when the relationship is (II)

- “Inclusion” or (III) “have common meaning and different meaning between each other”, a communication gap occurs.
- (2) The same letters: this research focuses on text-based communication. Therefore, it is possible that language transfer might occur even with the same letters. For example, as shown in table 2. (IV). If letters were different, there would be no gap. But, if the letters are the same, gap will occur. Such as “走”. In Chinese, “走” means “walking” instead of “running” as in Japanese.
  - (3) Learner’s position in the communication: Two positions exist, one is sender and the other is receiver, however communication gap does not occur because of their positions.

After consider the three above factors, CGM (Communicative Gap Model) that represents gap model of language difference communication was proposed (see Table 2).

- In (I), because the meaning is same, there will be no gap.
- In (IIa), when the student’s position is receiver, the student will take the TL’s meaning with a narrower view than the TL, so a gap will occur. When the student’s position is sender, a gap will not occur because the native speaker is able to understand the meaning by the context.
- In (IIb), when the student receives information from a native speaker, native speaker’s intentions can be got easily. When the student is the sender, a gap can occur if the native speaker takes the student’s meaning into a narrower scope than the student intended.
- In (III), depending on a common meaning, a gap can occur at both positions of student and the native speaker.
- In (IV), if the letters is different, a caused by language transfer will not occur. However, if the letter is the same, a gap can occur between the sender and the receiver.

Table 2 Communication gap model.

Meaning relation	Same letter		Different letter	
	Receiver	Sender	Receiver	Sender
(I)	×	×	×	×
(IIa)		×		×
(IIb)	×		×	
(III)				
(IV)			×	×

### 3. Network based framework of foreign language learning environment

An agent base collaborative learning environment called GRACILE [10] has been proposed to support Japanese language learning among learners in a networked environment, but systems that focus on language distinction have not been challenged yet. In this paper, under a networked environment, we proposed a learning-support framework where a Software Agent, which focuses on language distinction, provides support to learners communicating with native speakers. In this section, present an agent-oriented framework, which focuses on the meaning difference between learner’s ML and TL, to support foreign language learning through network communication.

#### 3.1 Design strategies of learning environment

The design strategies of the framework are as follows:

- (1) Communicative approach: learners study TL through communication with native speakers. And moreover, the achievement of different culture communication is also provided.
- (2) Language learning focusing on the language difference: mainly supporting the knowledge where there is a difference between learner’s ML and TL.
- (3) Learner-centered environment: knowledge of TL is based on learners’ needs and depends on the contents of the conversation. And agent supports the learning according to the communication contents and the status of knowledge understanding.

### 3.2 Diagram of the agent's support

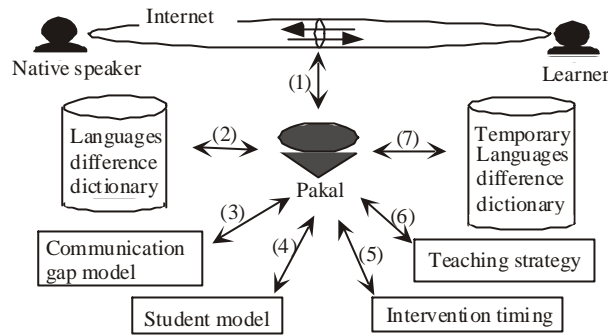


Figure 2. A framework of support language learning focusing on meaning difference

The framework shown in fig 2 uses the above design strategies. The agent works as the following diagram.

- Step 1 Observing the communication between learners and native speakers.
- Step 2 Analyzing the conversation in real time using the "dictionary" and judging the relationship between ML and TL.
- Step 3 Judging whether a communication gaps exist according to the CGM.
- Step 4 Constructing "intervening tactics" according to the student model and existence of a conversation gap, thus reducing the influence of intervening.
- Step 5 Intervening in the communication by asking whether the student has already understood, then reflecting the responds to student's model.
- Step 6 Deciding the "teaching strategy" based on the response from learners. If a student's answer was wrong, the agent would notice the difference of knowledge according to certain teaching strategies.
- Step 7 Obtaining knowledge from native speaker and registering those that weren't registered into a temporary dictionary. After if a Japanese teacher confirmed the knowledge, it would be registered into the dictionary.

### 3.3 Student model and intervention, teaching strategies

In this study, it is important to learn a foreign language through communication with a native speaker based on the communicative approach. The support principles were decided as follows. The student model, agent intervention, and teaching strategy according these principles were suggested.

- (1) The agent doesn't frequently intervene in the conversation between student and native speaker, so that the communication is not disturbed.
- (2) The agent teaches knowledge gradually while interrupting the communication as little as possible.

#### 3.3.1 Student model

Intervention	Student model	Teaching strategy
Always	(iii) Misunderstanding	Detail teaching
Always	(ii) Temporary misunderstanding	Simple teaching
Always	(i) Initial state	
Not always	(iv) Temporary understanding	No teaching
Never	(v) Understanding	No teaching

→ Correct a nswer    → Wrong answer    → With time

Figur 3. Relationship between student model, intervention and teaching strategy.

In this system, we grasp the state of student's knowledge by questioning. The state of

knowledge is classified into “understanding” and “not-understanding.” We then divide it further into “temporary understanding” and “temporary not-understanding ” according above principles. The status of knowledge understanding evolves as Fig. 3.

- (i) The system has not checked any Kanji words with meaning difference in the dialogue.
- (ii) Temporary not-understanding state: Answer to a question was wrong but only once.
- (iii) Temporary understanding state: Answer to a question was correct but the meaning was not fully grasped.
- (iv) Not-understanding state: Despite the notice at the temporary not-understanding state, Figure 3. Relationship between student model, intervention and teaching strategies. The answer to the same question was wrong again.
- (v) Understanding state: Answer to a question was correct again, the meaning was fully grasped.

### 3.3.2 Intervention and teaching strategies

If there is any gap, the Agent will intervene into the conversation as following according to the student’s model.

- (1) Always: always intervene if student’s knowledge state was “initial”, “temporary not-understanding”, and “not-understanding”.
- (2) Not always: agent intervenes when state of “temporary understanding” appears several times
- (3) Never: agent does not intervene if the state is “understanding”.

### 3.3.3 Teaching strategies

In order not to interrupt communication, we fixed teaching strategies into “simple” and “detail”(See Table 3).

Table 3. Teaching strategy.

Simple teaching	Detail Teaching
Relation among the ML & TL	Relation among the ML & TL
Meaning of the TL	Meaning of the TL
_____	Meaning of the ML
_____	Relevant Knowledge of TL

- (1) Simple teaching: showing the relationship between learner’s ML and TL intended for “temporary not-understanding ”.
- (2) Detail teaching: teaching knowledge of meaning, spell, grammar, and usage, etc. about TL intended for “not-understanding”.

## 4. Neckle

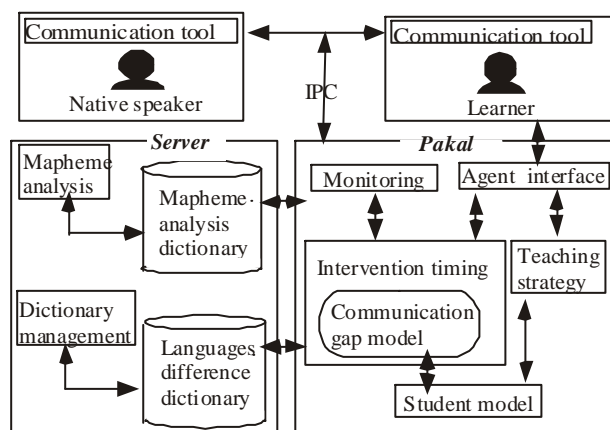


Figure 4. System configuration

A system called Neckle was developed, it is a network-based KanJi learning environment focusing on the difference between Japanese and Chinese. In this environment, learners whose ML is Chinese learn Japanese Kanji through conversations with Japanese native

speakers. In this section explain the development and user interface of Neckle

#### 4.1 System structure

Fig 4 shows the system structure. Neckle is composed of three parts, i.e. communication tool, Pakal and server. Communication tool uses text-based chat.

##### 4.1.1 Pakal

Pakal always stays in learner’s environment, supporting Kanji learning. It is composed of modules as following.

- (1) Monitor: it is used for recording a dialogue between the learner and the native speakers.
- (2) Agent interface: it is used for supporting a dialogue teaching knowledge.
- (3) Student model: it is used for recording the learners’ status of knowledge understanding, last attending date and attending times (see Table 4)
- (4) Intervention strategy mechanism: agent checks the gap existence according to CGM, notices a gap based on the learner model, and then determines intervention timing.
- (5) Teaching strategies mechanism: it determines the teaching strategies by referring to the student model.

Table 4. Example of student model.

Kanji	State of knowledge	Attending date	Attending times
祖父	Temporary understanding	1998/11/02/15:27:32	2
単位	Understanding	1998/12/5/14:09:53	3

##### 4.1.2 Server

Server is composed of the following modules.

- (1) Morpheme analyzer: a Japanese morpheme analyzer system. It analyzes the morphemes in a conversation and replays the result to Pakal.
- (2) Dictionary server: The Kanji knowledge of Chinese and Japanese is recorded in this base. It is used for Pakal to judge any difference and teach this Kanji knowledge.

If the Kanji used in conversation not recorded in the knowledge base, Pakal will record it as temporary knowledge in this base. The knowledge base will also be enlarged.

#### 4.2 Data representation

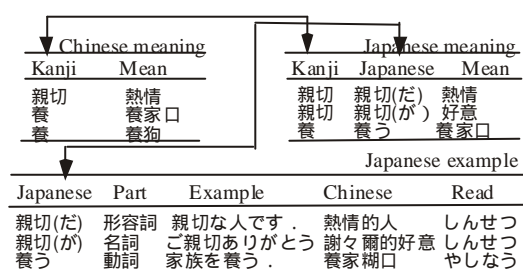


Figure 5. Data representation

The database of language’s dictionary is shown in Fig 5. Japanese knowledge including meaning, grammar, and an example are explained by Chinese. Japanese table is linked to Chinese table and Japanese example table by field of “Kanji” and “Japanese”. Refer to [11], [12] , and recorded 403 Kanji which are different between Japanese and Chinese.

#### 4.3 User interface

User interface is shown in Fig 6. It is divided into windows of “chat”, “Pakal ”, “question”, “teaching” and “dictionary”.

- A) Chat window: learner can engage in a dialogue with a native speaker through the Chart in real time.
- B) Agent window: agent Pakal has an interface of Personification, which starts with the Chat window. It monitors the dialogue and intervenes when a difference in knowledge is involved in the dialogue. Pakal provides the learner with the message and transmits the intention to the learner using prepared dialogue template

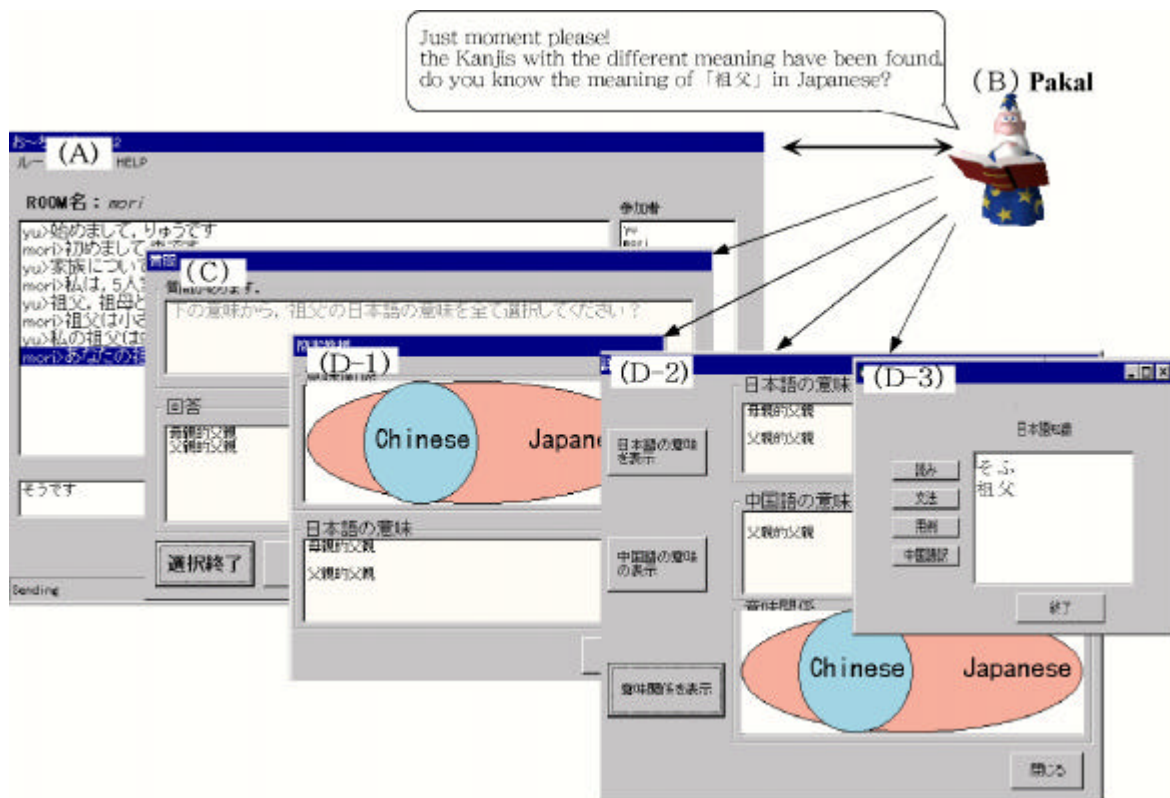


Figure 6. User interface

- C) Question window: Pakal provides learner with the question checks the answer and informs the learner about the correctness of it with sound. Then, it enters or amends the student model.
- D) Teaching window: to prevent too long communication, the system supports learning in two ways:
  - D-1) Simply teaching window: for “temporary misunderstanding”, the system gives with a diagram of the relationship of the Japanese-Chinese Kanji meanings. When the learner clicks a Japanese area, the meaning window will be popped up.
  - D-2) Detailed teaching window: for “misunderstanding”, the system compares the learner’s Chinese with Japanese meaning to support the understanding of Japanese meaning. If the student requests to know other knowledge, a dictionary window will be showed.
  - D-3) Dictionary window: in addition to the Kanji meaning, Grammar, spelling and so on are also provided.

#### 4.4 Experimentation

We evaluated the learning environment of Neckle with nine Japanese students and nine Chinese students in which four beginners, three intermediates, and two advances. We arrayed nine groups that consisted of one Japanese student and one foreign student. They talked about three topics that are “my family”, “the circumstances of China”, and “staying in Japan” in Neckle. At least, they had talked 30 minutes about each topic. After three days, they talked about same topics on Neckle. The results of experimentation are:

- (1) The entering timing of Pakal is proper.
- (2) It is reasonable that our teaching strategies are divided into two parts, the simple one and the detailed one.
- (3) The Neckle is more useful for beginners than for advanced learners.
- (4) The efficiency of learning by Neckle is very highly.

Moreover, we obtained many comments from learners. The following are a few examples of the comments.

- Talking of learning foreign language, grammar or vocabularies come into our mind. However, Neckle changed traditional study manner, It provides a new learning method through conversation with native speaker.
- Neckle supported to learn not only language itself but also Japanese culture and customs (such as Japanese Oshyogatu, Japanese family. etc).
- It very good that Pakal entering when learner dose not know whether Kanji could be understood Chinese meaning.
- It is easy for learner to learn by conversation with native speaker.

Under viewing the results of experimentation, Neckle highly facilitate language learning

## 5. Conclusions and future work

This paper aimed at the problem of language transfer in foreign language learning, and analyzed the meaning relationship between learner's ML and TL. We also proposed a communication gap model caused to meaning difference and suggested a framework of foreign language learning environment – Neckle (a network-based communicative environment focusing on the difference between learner's ML and TL meaning) and described agent support. Finally, we described the development of the Neckle by agent Pakal and experimentation about Neckle.

In the future work, firstly, we will make Pakal to consider more learners' knowledge state, especially for advanced learners, and let agent take part in conversation between learner and native speaker in a natural way. Secondly, we will collect and add more learning data. Thirdly, we will keep on evaluating for a long time. Firally, we will try to apply Neckle to another language learning. Neckle was developed on the Windows NT using Visual Basic 6.0. Access 97 was used for the Database. Morpheme analyzer of Japanese is Chasen [13], and Microsoft Agent [14] was used as agent interface.

## Acknowledgments

This research was supported in part by the Grant-in-aid for scientific research (B) (2) No. 09558017 from the Ministry of Education, Science, Sports and Culture in Japan.

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