

# Processing and Acquisition of Socio-pragmatic Knowledge in First and Second Languages: Neural Correlates of Honorific Expressions

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博士論文の内容要約

**Processing and Acquisition of Socio-pragmatic Knowledge in  
First and Second Languages: Neural Correlates of Honorific  
Expressions**

(第一言語と第二言語における社会語用論的知識の処理と獲得--敬語表現の神経基盤--)

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## 1. General Introduction

Socio-pragmatic factors play a vital role in influencing the processing of languages (Tomasello, 1992). It has been well-documented that both first language (L1) speakers and second language (L2) learners can use various of socio-pragmatic contextual information, such as an interlocutor's gender, his/her voice, as well as his/her social roles, to facilitate efficient and successful linguistic processing (Lattner & Friederici, 2003; Molinaro et al., 2016). Crucially, the acquisition and development of such linguistic processing skills are tightly associated with each individual's language experience in different social, cultural, and pragmatic contexts (Ellis, 1998; Peirce, 1995). Much previous neuroimaging research has investigated the effect of socio-pragmatic contextual information in mediating neural processing of semantic or phonological information (Gennari et al., 2007; Jiang et al., 2018). However, very few studies have considered the effects of socio-pragmatic factors in L1 and L2 syntactic processing. Furthermore, although the effect of language experience and exposure in the brain is well discussed in the L2 acquisition (DeLuca et al., 2019; Mechelli et al., 2004), little is known about whether such effect would reflect in L1 acquisition.

To fill the gaps, the present thesis put a special focus on investigating the neural correlates of processing and acquisition of Japanese honorifics by native speakers and second language learners of Japanese under the influence of socio-pragmatic factors.

In Japanese, the socio-pragmatic factor of interlocutors' social status relationship often decides the extent to which a speaker uses different syntactic forms towards an addressee (Agha, 1994; Okamoto, 1999). In the case of referent honorifics, when a speaker with perceived relatively lower social status (e.g., office worker) refers to an event which the subject is a higher social status addressee (e.g., president), the sentence with the "respect"-verb form ending (e.g., office worker: president-verb-*ni narimashita*) could be used. In contrast, if the subject is the speaker of a lower social status him/herself, the sentence with a "humble" verb form ending (e.g., office worker: I-verb-*itashimashita*) could be expected (Irvine, 1985). As a verb is formed in agreement with the social attributes of a subject, previous studies often regard the Japanese honorifics as syntactic rule-governed agreement dependency, which is analogous to the subject-verb gender or person agreement phenomenon existing in most of the Indo-European languages (Boeckx, 2006; Hasegawa & Hirose, 2005).

However, sociolinguistic and pragmatic approaches of referent honorifics have pointed out that the Japanese honorific agreement is different from the other syntactic agreement dependency in terms of its socio-pragmatic function and usage (Irvine, 2015; Okamoto, 1999). In Japanese social convention, the usage of referent honorifics is optional and nonobligatory. Additionally, it is mainly expected to be performed by speakers with relatively lower social status towards addressee of higher social status or longer social distance, for showing good manners and politeness. In contrast, speakers with higher social status usually do not expect to apply referent honorifics toward the lower social status addressee. They only need to use sentential expressions with plain or polite (*masu*)-verb form ending toward the lower social status addressees. Moreover, a speaker's violation in the use

of honorifics (e.g., office workers: I-verb- *ni narimashita*) does not render syntactic violation rather than a social/pragmatic convention violation. In these senses, the Japanese referent honorifics are accounted for as following the socially-agreed upon rules. This is because deciding whether an honorific expression is an obligatory or appropriate depends on the perceived social status relationships between a speaker and addressee and the socio-cultural contexts in which honorifics occurs (Ide, 1992).

From a language acquisition perspective, honorific expressions are often categorized as a type of formal speech register, in which people are demanded to use in formal workplace contexts. Therefore, native speakers of Japanese are supposed to be able to fully acquire such honorific speech register at a mature age when they are exposed to workplace contexts. Consequently, even for adult native (L1) speakers, individual differences may exist in honorific speech fluency related to their language experience of honorifics in a variety of workplace contexts (Dunn, 1999).

## **2. Study one: Neural Correlates of Japanese Honorific in L1**

### **2.1 Background**

Many previous related neuroimaging studies have so far investigated the neural correlates of syntactic agreement processing without considering the socio-pragmatic factors (Momo et al., 2008; Moro et al., 2001). Although these previous studies vary in terms of types of agreement features, they mainly use the violation paradigm (e.g., comparing syntactic agreement violations with the correct ones). Generally, these previous studies posited that the left inferior frontal gyrus (IFG) plays a critical role in reanalyzing violations of syntactic agreement (see Friederici, 2002; Heim et al., 2006 for review).

Psycholinguistic research has demonstrated that the social and pragmatic contextual information, such as interlocutors' gender, age, voice, or stereotyped language styles, could influence online syntax and sentence comprehension (Bergen & Grodner, 2012; Hanulíková & Carreiras, 2015; Kwon & Sturt, 2016). In particular, studies examining syntactic agreement processing have found comprehenders used social and pragmatic information as cues to retrieve or process syntactic agreement features in a predictive manner (Kwon & Sturt, 2016). More recently, a number of neuroimaging studies have evidenced that left IFG activation is associated with the predictive process of syntactic features when certain cues are available during language comprehension (Jakuszeit et al., 2013; Kristensen et al., 2014; Söderström et al., 2018). However, less has been known about how the brain processes syntactic features cued by social and pragmatic-related contextual information.

On the other hand, a considerable number of studies have demonstrated that the involvement of socio-pragmatic contextual information could elicit the brain response sensitive to the semantic integration process (Feng et al., 2017; Hagoort & van Berkum, 2007; Jang et al., 2013). In particular, the anterior temporal regions (ATL) were involved in

semantic integration operations to successfully build sentence-level situation-relevant meaning.

Furthermore, there is emerging evidence showing that L2 experience is associated with brain structure change and functional responses in the inferior parietal lobes, which reflect the language acquisition effect (Abutalebi et al., 2015; Jeong et al., 2010; Mechelli et al., 2004). In contrast, little is known about whether language experience would affect L1 acquisition in the brain.

## **2.2 Rational hypothesis**

In considering the social conventions of Japanese language use, the referent honorifics are mainly expected to be used by a speaker with perceived relatively lower social status toward addressees with higher social status. In contrast, speakers of higher social status are expected to use expressions of plain or polite form. Based on the social status-relevant syntactic style differences, a socio-pragmatic judgment task was created. The task contained sentential expressions which had a  $2 \times 2$  factorial design with the combination of two levels of ‘social status’ (lower and higher social status speakers’ expressions) and two levels of ‘conventionality’ (conventional and unconventional expressions). The study hypothesized that the presence of lower social status speakers would cue the listeners to retrieve or process the syntactic features of honorifics in a predictive way. Thus, it was expected that the brain regions related to syntactic prediction (i.e., left IFG) would be engaged in the effect of ‘social status’ (lower social status speakers relative to higher social status). Moreover, it was assumed that under the processing of sentences by both lower and higher social status speakers, an integration operation may be elicited between sentence-level conventional linguistic meaning and socio-pragmatic contextual information (i.e., information about interlocutors). Therefore, the brain regions related to information integration (e.g., ATLS, IFG) would be expected to be engaged in processing socio-pragmatic norms and appropriate expressions. Finally, it was hypothesized that Japanese native speakers’ language experience of honorifics in workplace contexts would be associated with the acquisition of L1 formal speech register (i.e., honorifics). Therefore, the brain areas sensitive to L2 acquisition (i.e., IPL), as reported in previous L2 studies, would be expected to be associated with L1 language experience.

## **2.3 Methods**

### **2.3.1 Participants**



The study recruited 33 native speakers of Japanese (Female: 16, Male: 17). Their mean age ( $\pm$  SD) was  $21.15 \pm 1.61$  years old. At the time of the experiment, all the participants were undergraduate or graduate students of Tohoku University. Also,

participants' full time or part-time work experience (i.e., the total amount of working time/month) was surveyed by using a questionnaire adapted from a previous surveying study of honorific use (Nakagawa, 2012). Given all the participants were undergraduate or graduate students at the time of this experiment, doing their part-time jobs outside the university (e.g., waiter, cashier, school tutors) likely required them to use appropriate referent honorific expressions towards different social classes. It also gave the participants opportunities to master the honorific expressions through real-life social interaction.

### 2.3.2 Materials

Based on the social convention and social status roles-determined syntactic style differences, a socio-pragmatic judgment task was created, which contained auditory sentences accompanied by visualized stimuli of interlocutors. The auditory sentences were designed based on a  $2 \times 2$  factorial design, which contained two factors, each with two levels: social status (lower social status and higher social status speakers' expressions) and conventionality (conventional and unconventional expressions). Thus, four-sentence conditions were made as shown in Figure 1: the LC condition (lower social status speaker use conventional referent honorifics, that is, the sentences with correct respect and humble verb form ending), the LU condition (lower social status speakers unconventionally use referent honorifics, that is, the sentences with incorrect respect and humble verb form endings), the HC condition (higher social status speakers use conventional sentential expressions with polite verb form ending), and the HU condition (higher social status speakers use referent honorifics render to unconventional use).

Figure 1. Example of sentence stimuli

 <b>Professor</b>  <b>Student</b>	<b>Lower - Conventional (LC)</b> <b>e.g.,</b> 先生が 私の ポスターを お貼りになりました <small>Sensei-ga watashi-no posuta-o o-hari-ninarimashi-ta</small> <small>Professor-NOM 1SG-POSS poster-ACC HON-paste-HON-PST</small> '(The) professor pasted my poster' <b>e.g.,</b> 私が 先生の ポスターを お貼りいたしました <small>watashi-ga sensei-no posuta-o o-hari-itashimashi-ta</small> <small>1SG-NOM professor-POSS poster-ACC HON-paste-HUM-PST</small> 'I pasted (the) professor's poster'	<b>Lower - Unconventional (LU)</b> <b>e.g.,</b> 私が 先生の ポスターを お貼りになりました <small>watashi-ga sensei-no posuta-o o-hari-ninarimashi-ta</small> <small>1SG-NOM professor-POSS poster-ACC HON-paste-HON-PST</small> 'I pasted (the) professor's poster' <b>e.g.,</b> 先生が 私の ポスターを お貼りいたしました <small>sensei-ga watashi-no posuta-o o-hari-itashimashi-ta</small> <small>Professor-NOM 1SG-POSS poster-ACC HON-paste-HUM-PST</small> '(The) professor pasted my poster'
	<b>Higher - Conventional (HC)</b> <b>e.g.,</b> 私が 君の ポスターを 貼りました <small>watashi-ga kimi-no posuta-o harimashi-ta</small> <small>1SG-NOM 2SG-POSS poster-ACC paste-PST</small> 'I pasted your poster' <b>e.g.,</b> 君が 私の ポスターを 貼りました <small>kimi-ga watashi-no posuta-o harimashi-ta</small> <small>2SG-NOM 1SG-POSS poster-ACC paste-PST</small> 'You pasted my poster'	<b>Higher - Unconventional (HU)</b> <b>e.g.,</b> 君が 私の ポスターを お貼りになりました <small>kimi-ga watashi-no posuta-o o-hari-ninarimashi-ta</small> <small>2SG-NOM 1SG-POSS poster-ACC HON-paste-HON-PST</small> 'You pasted my poster' <b>e.g.,</b> 私が 君の ポスターを お貼りいたしました <small>watashi-ga kimi-no posuta-o o-hari-itashimashi-ta</small> <small>1SG-NOM 2SG-POSS poster-ACC HON-paste-HUM-PST</small> 'I pasted your poster'

### **2.3.3 Procedure**

Participants were instructed to judge whether each auditory sentence was a socially conventional or unconventional expression within six seconds. Each participant was engaged in performing one set of stimuli (80 trials) in two separate sessions. Each session lasted 13 minutes and 6.27 seconds.

### **2.3.4 Data analysis**

Brain imaging data were entered into a flexible factorial ANOVA implanted in SPM12 with a 2 (social status: lower [L] and higher [H]) by 2 (conventionality: conventional [C] and unconventional [U]) as within-group factors. The statistical threshold was set at voxel-level  $p < 0.05$  whole-brain family-wise error (FWE) corrected for multiple comparisons.

## **2.4 Results and Discussion**

Brain imaging results showed that in the effect of lower social status speakers [L > H], greater activation was evoked in the left IFG, the dmPFC, and the bilateral insulae (Figure. 2a). This result has met the expectation, suggesting that the presence of lower social status speakers cues the listeners to process honorific syntactic features in a predictive manner. Hence, the left IFG was not simply involved in processing syntactic violation but engaged in syntactic prediction. In addition, greater activation in the bilateral ATLS was observed for the effect of conventional expressions [C >U] (Figure. 2b), suggesting comprehension of social convention or norms involves successful integration of linguistic and social-pragmatic information. Moreover, the correlation analysis shows that the participants' experience of honorifics used in workplace contexts was associated with brain activation in the left IPL in the lower social status speaker-conventional condition (Figure. 2c). This finding suggests that L1 and L2 acquisition may share similar mechanisms in terms of they all rely on social context support.

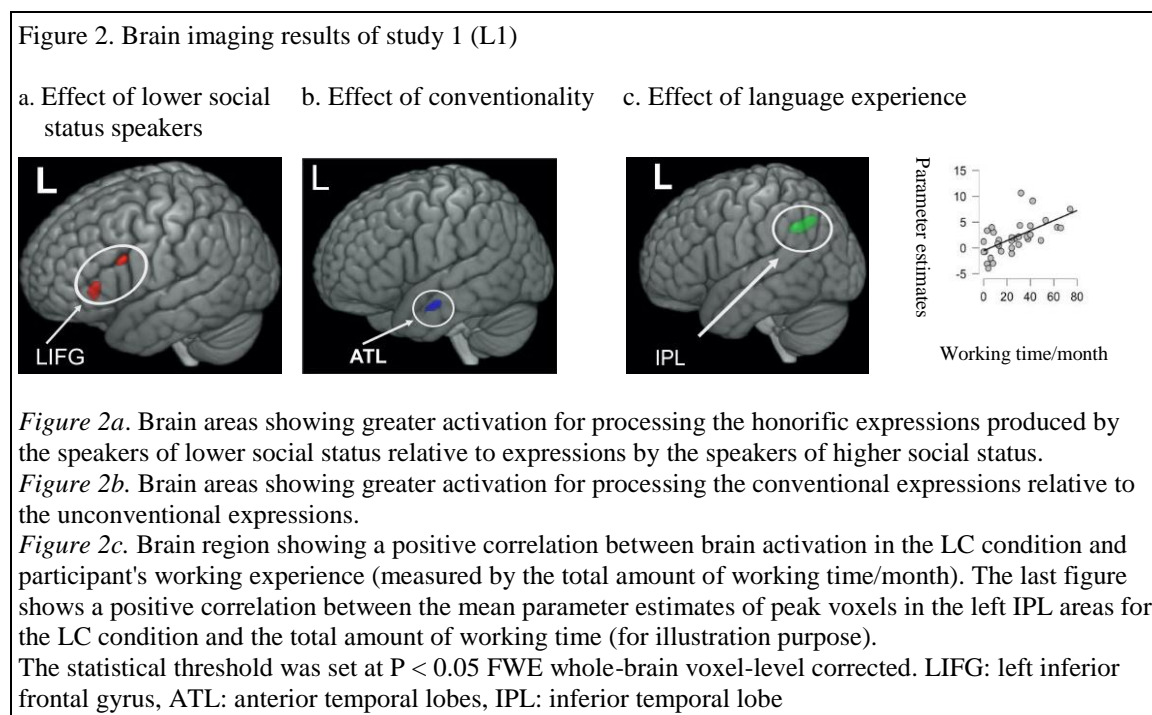
## **3. Study two: Neural Correlates of Japanese Honorific in L2**

### **3.1 Background**

Previous psycholinguistic studies have suggested that L2 learners could also make use of cues to process the upcoming linguistic information or features in a predictive manner. Nonetheless, they might be less able to predict the detailed syntactic information as L1 speakers do, due to limited L2 proficiency and exposure, or cross-linguistic distance between

their L1 and L2 (Kaan, 2014; Leal et al., 2017). Moreover, neuroimaging studies of L2 syntax acquisition and processing have shown that similar factors in affecting L2 predictive mechanisms also play roles in influencing whether the brain activation pattern of L2 syntax processing differs or overlaps with L1 speakers. Generally, these studies have demonstrated that for adults L2 learners, syntactic processing could differ from, or overlap with, the brain areas associated with L1 syntactic processing (i.e., left IFG, temporal regions, and basal ganglia), dependent on several important factors.

These include age of acquisition, L2 proficiency, exposure (learning or acquisition environment), and cross-linguistic differences between L2 and L1 (Grant & Li, 2019; Jeong et al., 2007; Stein et al., 2009). However, less has been known about the neural mechanisms of L2 syntax processing under the influence of socio-pragmatic contextual information. Furthermore, studies on investigating the effect of L2 experience-based factors found that learners' experience of L2 in immersive social contexts, along with the duration of active L2 use, modulated the brain structure changes related to executive control functions, suggesting L2 learners gained efficient language control abilities though L2 exposure (DeLuca et al., 2019). However, it remains unknown whether the same effect would be observed in the case of experience to L2 formal speech contexts.



### 3.2 Rational hypothesis

The second experiment of this thesis intended to explore these questions with a focus on examining the neural processing of Japanese honorifics by Chinese learners of Japanese. The study formed the following hypotheses: L2 learners could make use of cues (i.e.,



presence of speakers' social status role) to process the honorific syntactic features predictively. However, they may show a different brain activation pattern in comparison with L1 speakers due to the earlier stage of learning honorifics, and cross-linguistic distance between learners' L1 and L2 (i.e., Chinese has no verb morphosyntactic system, and has different word order structure compared with Japanese). Moreover, L2 learners were expected to be able to integrate the linguistic meaning with socio-pragmatic norms to process socio-pragmatic conventions produced by both speakers, similar to native speakers. Finally, for the effect of language experience, the assumption was that experience with using honorifics in workplace contexts would associate with brain activation sensitive to cognitive control. The L2 learners who have exposure to workplace contexts may need to attentionally select which honorific forms (e.g., humble to respect) should be used as appropriate expressions to communicate with native speakers. As a result, L2 learners who had more experience may have a better ability to control honorific expression use.

### **3.3 Methods**

#### **3.3.1 Participants**

The experiment recruited 31 Chinese learners of Japanese as an L2 group (Female: 18, Male: 13). Their mean age ( $\pm$  SD) was  $24.22 \pm 1.36$  years old. At the time of the experiment, all the participants were undergraduate or graduate students of Tohoku University and had, on average, stayed in Japan for one and a half years. All participants have obtained the highest level (N1) of Nihongo Noryoku Shiken (or Japanese Language Proficiency Test) certification, indicating they have considerable high Japanese language proficiency. Same as the L1 group, we surveyed L2 learners' full time or part-time working length (i.e., the total amount of working time/month) by using a questionnaire adapted from a previous surveying study of honorific use (Nakagawa, 2012).

#### **3.3.2 Material, procedure, and data analysis**

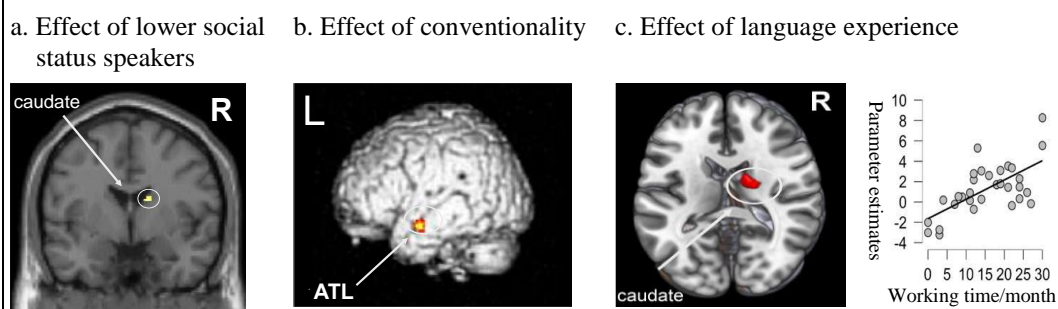
The same material was used in the second experiment. L2 learners performed the task in the same way as the L1 speakers did. The brain imaging data of L2 learners was also entered into a flexible factorial ANOVA implanted in SPM12 with a 2 (social status: lower [L] and higher [H]) by 2 (conventionality: conventional [C] and unconventional [U]) as within-group factors.

### **3.4 Results and discussion**

Three major findings were found. First, the effect of lower social status speakers was

observed in greater activation in the right caudate, the right fusiform, and the right insular regardless of conventionality (Figure. 3a). This result has met the expectation that the presence of a lower social status speaker cues L2 learners to predictively process honorific syntactic features as native speakers did. Since the right caudate activation has been frequently reported associated with L2 syntax acquisition and processing, L2 learners could not predict the detailed syntactic information in comparison with native speakers. This is possibly due to the following: 1) the L2 learners are still under the initial learning stage of honorifics through exposure to Japanese society. Although they obtained relatively higher Japanese language proficiencies and had stayed in Japan for one and a half years on average, they may have fewer chances to learn how to use honorifics as socio-pragmatic expressions; 2) the cross-linguistic distance between L2 learners' first language (i.e., Chinese) and second language (i.e., Japanese) may influence the L2 learners' predicting processing. Second, albeit non-significant, higher activation was observed in the bilateral ATLS in the conventional expression than unconventional expression conditions (Figure. 3b), suggesting that the conventional social expressions are processed in the ATLS. Third, the participants' experience of honorifics used in workplace contexts was associated with brain activation in the right caudate under the lower social status speaker-conventional condition. This finding suggests that L2 learners may have acquired or gained cognitive control abilities through exposure to L2 social contexts (Figure. 3c).

Figure 3. Brain imaging results of study 2 (L2)



*Figure 3a.* Brain areas showing greater activation for processing the honorific expressions produced by the speakers of lower social status relative to expressions by the speakers of higher social status.

*Figure 3b.* Brain areas showing greater activation for processing the conventional expressions relative to the unconventional expressions.

*Figure 3c.* Result of correlation analyses between brain activation in the LC condition and the total amount of working time (month). Brain image shows significant activation in the right caudate. The right figure shows a positive correlation between the mean parameter estimates of peak voxels in the right caudate areas for the LC condition and the total amount of working time (for illustration purpose). ATL: anterior temporal lobes

#### 4. Conclusion

By focusing on Japanese honorifics, the present thesis found new evidence showing social-pragmatic contextual information (i.e., speakers' social status position) affect L1 and

L2 language comprehension in the brain implicated in both syntactic and semantic processing. In particular, the study revealed that the left IFG was critical for L1 syntactic prediction cued by the presence of speakers' social status roles. The basal ganglia (i.e., caudate) is sensitive to L2 syntax acquisition and processing. Moreover, the study revealed that the factor of cross-linguistic distance might affect L2 syntactic predictive processing. Furthermore, the ATNs are implicated as important regions for successfully integrating linguistic and socio-pragmatic norms in comprehending social conventional expressions. Finally, the study firstly elucidated that native (L1) speakers' language experience in socio-pragmatic contexts could promote the acquisition of L1 formal speech register, which shares similar brain mechanisms with L2 acquisition. With respect to L2 experience, learners may have improved cognitive control abilities through exposure to social settings, which demand to selectively use different L2 socio-pragmatic (i.e., honorifics as formal speech) expressions.

However, despite the novel findings, several limitations should be acknowledged. First, conventional usage of honorifics was not only influenced by the factor of speakers and addressee's social status relationships but by social solidarity and familiarity between interlocutors. Future studies will be needed to investigate how language is processed under diverse social and pragmatic settings. Second, this study used subjective measures (i.e., self-report) to test participants' use of honorifics in workplace contexts. Therefore, future studies should use objective measures to examine the use of pragmatic expressions (and ultimately pragmatic knowledge). Moreover, the thesis examined the effects of socio-pragmatic factors in language processing and acquisition mainly by focusing on honorifics as a case study. Future studies are required to investigate other aspects of linguistic processing under the influence of social and pragmatic information.

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