

Cognitive load in processing honorific expressions – A psycholinguistic study of Japanese and Indonesian speakers

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Abstract. This study examines the cognitive processing of honorifics within the speech communities of Japanese and Indonesian. Within the fields of psycholinguistics and sociolinguistics, it addresses the intersection of cognitive and social factors by exploring the cognitive impact of social hierarchy in language. Several processing experiments were conducted to investigate the presence or absence of honorifics in sentence construction. The descriptive statistics indicate that Japanese speakers use honorifics more frequently, whereas Indonesian speakers experience greater cognitive difficulty when social hierarchization is present in a sentence. These results demonstrate that social hierarchy in language plays a significant role in, and often merges with, the processing and cognitive load associated with the social and cognitive functions of language. This study advocates for the integration of social meaning into language instruction and cognitive research, thereby contributing to psycholinguistics by broadening its scope to include social meaning. In summary, the study quantitatively demonstrates, while integrating second language pedagogy with psycholinguistics, that the social meaning of language use is a key sociopragmatic factor that increases cognitive processing demands during real-time language use, as it guides learners through language structures and sentence formation.

Keywords: *psycholinguistics, honorifics, cognitive load, Japanese linguistics, Indonesian linguistics.*

Фалахія Існаені Хурнія, Супарджо, Джоджок; Нурхаді, Дідік. Когнітивне навантаження під час обробки форм ввічливості: психолінгвістичне дослідження носіїв японської та індонезійської мов.

Анотація. Це дослідження аналізує когнітивну обробку ввічливих форм у мовних спільнотах Японії та Індонезії. У межах психолінгвістики та соціолінгвістики воно вивчає взаємодію когнітивних і соціальних чинників, досліджуючи когнітивний вплив соціальної ієрархії на мову. Було проведено низку експериментів з обробки інформації для вивчення наявності чи відсутності ввічливих форм у побудові речень. Результати

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описової статистики свідчать, що носії японської мови частіше вживають ввічливі форми, тоді як носії індонезійської мови відчують більші когнітивні труднощі, коли у реченні наявна соціальна ієрархія. Ці результати демонструють, що соціальна ієрархія в мові відіграє значну роль у обробці та когнітивному навантаженні, пов'язаних із соціальними та когнітивними функціями мови, і часто зливається з ними. Це дослідження обстоює інтеграцію соціального змісту в мовне навчання та когнітивні дослідження, тим самим роблячи внесок у психолінгвістику шляхом розширення її сфери до включення соціального змісту. Відтак, це дослідження кількісно демонструє, поєднуючи педагогіку другої мови з психолінгвістикою, що соціальне значення мовного вживання є ключовим соціопрагматичним чинником, який підвищує когнітивні вимоги до обробки інформації під час мовного вживання в реальному часі, оскільки воно орієнтує студентів у мовних структурах та побудові речень.

Ключові слова: психолінгвістика, форми ввічливості, когнітивне навантаження, японське мовознавство, індонезійське мовознавство.

Introduction

Recent research in psycholinguistics has acknowledged that language processing extends beyond a simple engagement of formal linguistic structures and incorporates a variety of cognitively demanding activities that may be influenced by the limitations of working memory, the cognitive demands of the task, and the language experience of the speakers involved. Cognitive load refers to the total amount of mental effort that is being utilized to process a certain amount of information, and within the context of language processing, cognitive load has been a central factor that has been implicated in the operational understanding of language, particularly when a task involves complex or unfamiliar structures. Cognitive load has been shown to hinder language processing overall, leading to increased reaction time, worse understanding, and an overall increase in the effort needed to process language (Sweller, 2020; Wang et al., 2024). These linguistic processing and comprehension issues are particularly salient when working with real time situational language processing because the individual has to frantically work to analyze, synthesize, and comprehend aspects of the input. One of the situations where cognitive load has potentially the largest role in language processing is within Second Language (L2) processing. Because the L2 speakers are processing a language that fundamentally differs from their own and often involves newer or different linguistic constructs that have not been integrated in to the automatic structures in their long term memory, they tend to heavily over rely on the cognitive load and working memory resources (Baddeley, 2003; Just & Carpenter, 1992).

The Japanese language has a complex, grammaticalized honorific system (keigo), which includes sonkeigo (respectful forms), kenjougo (humble forms), and teineigo (polite forms). These forms encode hierarchical relationships

between speaker, listener, and referent, requiring speakers to dynamically adjust verb morphology and lexical choice depending on social context (Cook, 2011). Though there has been burgeoning interest in the cognitive load theory (CLT) in the domains of applied linguistics and psycholinguistics, there is still limited research that explores the processing of honorifics in different languages. Most studies in this field have been narrowed down to reading proficiency, synthetic ambiguity, and the processing of complex clauses within L2 (Wang et al., 2024). With this in mind, the impact that the social meaning embedded in grammatical constructs has on cognitive load and sentence processing in real time is still largely unknown. This is owing to the fact that, although meaning is a key component of language, the primary social function of language is equally critical. While there has been increasing interest in the cognitive load theory (CLT) in language pedagogy, there is an absence of research examining the effect of social meaning in different languages on real time language processing and cognitive load. There is a particular dearth of literature pertaining to the processing of honorifics and the discernable processing patterns in the evaluation of second language instruction. This study aims to fill this gap by targeting cognitive load of honorific sentence processing among Japanese and Indonesian speakers. Cognitive load has emerged as a useful framework in assessing instructional design and learning resources in a specific educational context. Previous studies have found that cognitive load hinders understanding, learning, and instructional efficacy. However, most studies in this area have focused on levels of difficulty in syntax, vocabulary, and multimedia use, and have neglected the sociopragmatic aspects of language. Hence, the sociopragmatically marked grammatical systems, such as second language politeness systems, are understudied. This is especially true in contexts of second language learning, where such systems are often absent in students' prior learning experiences (Rayner, 1998; Staub, 2015).

Several persistent challenges exist in this regard. First, cognitive psychology tells us that the human working memory system is limited in its ability to hold and process information. When sentence comprehension is paired with the dual demands of grammatical and sociological elements, the burden on working memory is even greater. When demands are greater than resources, the cognitive load theory suggests that processing becomes slower. For speakers who are not accustomed to a particular honorific system, the presence of social hierarchy means that each marker must be processed and cannot be done automatically. This results in greater effort and slower processing (Begum et al., 2025). Second, variations in linguistic experience and automatization have a profound impact on processing efficiency. Japanese speakers, for instance, accustomed to using honorifics in daily interactions, are able to build enduring mental models that enable them to process information quickly and with

minimal cost. Conversely, speakers of Indonesian—whose language system does not have honorifics—must engage in more deliberate, effortful processing to interpret such phrases. This difference underscores the impact of language-specific experience on the cognitive frameworks of sentence processing (Flores-Salgado & Gutiérrez-Koyoc, 2024).

A further challenge is the shortcoming of existing models in psycholinguistics. The leading models of sentence comprehension have largely focused on syntax and semantics at the expense of treating sociopragmatics as peripheral, or a concern for the post-interpretive phase. However, recent studies show that the social aspects of language can affect the processing of language in its primary stages and may increase the cognitive burden (Wang et al., 2024). Due to the absence of models that synthesize and include sociopragmatics, the field has not been able to satisfactorily account for the cross-linguistic variation in processing ease. These unresolved issues also have important pedagogical implications. It has been shown that high cognitive load prevents the acquisition and internalization of the new linguistic systems. Without the necessary scaffolding socially complex structures, learners will likely experience an overload from the processing, which will result in a comprehension and learning slowdown. (Begum et al, 2025). Nonetheless, there are few references to sociopragmatic complexity in language pedagogy, especially when it comes to teaching systems of honorifics (Sweller& Kalyuga, 2011).

To address these gaps, this study formulates three hypotheses. H₁: Japanese speakers will exhibit lower cognitive load than Indonesian speakers when processing honorific expressions due to higher sociopragmatic familiarity. H₂: Honorific constructions will impose greater cognitive load than non-honorific constructions across both groups. H₃: There will be a significant interaction between language background and sentence type, such that Indonesian speakers will show disproportionately higher reaction times and lower accuracy in honorific conditions compared to Japanese speakers.

Methodology

This study utilized a quantitative experimental method for analyzing cognitive load involved in the processing of honorifics for Japanese and Indonesian speakers. The Japanese participants were undergraduate students recruited from a public university in Japan. The Indonesian participants were undergraduate students from Universitas Negeri Surabaya, Indonesia.

The research protocol involving human participants (students of the Japanese Language Department) was reviewed and approved by the Head of the Japanese Language Study Program at Universitas Negeri Surabaya. Prior to data collection, all participants were fully informed about the purpose and

procedures of the study and provided their informed consent to participate. The study was carried out with the knowledge and approval of the study program, and all procedures complied with institutional norms for research involving human subjects. Participants' anonymity and the confidentiality of their data have been strictly maintained throughout the research process.

The study's participants included 40 adult native speakers (20 Japanese speakers and 20 Indonesian speakers). Participants were university students (18-25 years old) and had no vision problems (normal vision or corrected-to-normal vision). Japanese participants were native speakers without any additional exposure to Indonesian. Furthermore, Indonesian participants had no formal training in the Japanese honorifics. With the aim of equalizing general language proficiency across different groups, language proficiency of all the participants was gauged through standardized self-reported measures in correspondence with the CEFR descriptors. Statistical analyses were conducted using R (Version 4.3.2; R Core Team, 2023). Linear mixed-effects models were fitted using the lme4 package (Bates et al., 2015).

To better account for participant- and item-level variability, linear mixed-effects models (LMMs) were applied (Baayen et al., 2008). Reaction time data were analyzed using LMMs, while accuracy data were analyzed using generalized linear mixed-effects models (GLMMs) with a binomial link function. Fixed effects included Language Group (Japanese vs. Indonesian) and Sentence Type (honorific vs. non-honorific), with random intercepts for participants and items. Statistical significance was evaluated using p-values derived from model comparisons, and effect sizes (β coefficients) were reported.

The overall dataset was assessed for the presence of inferential statistics, mixed effects modeling and analysis of variance within and between groups across sentence types and language groups and also for the presence of statistically defensible frameworks. The most notable developed research structure is the study of the impact of sociopragmatic structures on cognitive load on a typologically distinct set of languages. This study is the first of its kind, to my knowledge, which combines sociopragmatic theory and cognitive load analysis within a cross-linguistic experimental framework. Unlike most of the previous studies which have focused predominantly on the level of syntactic or lexical complexity, this study illustrates the fact that during real-time sentence processing, a substantial amount of cognitive load is produced by the integrated grammaticalized social meaning (Staub, 2015).

Results

The implications for this study are significant for assessing educational practices in the learning of second languages. The consideration of sociopragmatic

complexity when dealing with cognitive load for the Indonesian speakers in this study calls for an understanding of sociopragmatic complexity as a result of cognitive load in the breakdown of instructional materials and curricula. Evaluations of materials that consider the cognitive load that results from the complexity of the social order are influenced by the existing social order that exists in the language, and that socially laden language is the social order that exists in the language. The result is that for materials in second language instruction that consider the cognitive load of the students due to the needs of the students stemming from the instruction that is provided by the teacher, the instructional design for second language acquisition should place higher importance on sociopragmatic cognitive load as a constituent of the complexity of social order in the instructional design for second language acquisition. The instruction provided by the teacher to the students must take into account the outcomes of the instruction provided by the students due to the instructional design informed by those outcomes. This study demonstrates a strong basis for the implications of evaluating educational systems that include the acquisition of a second language. The importance of assessing the complexity of the social order in evaluating cognitive load lies in the complexity of the social order in which the individual is situated, and this social order is the result of the dual analysis of the cognitive complexity of that order. In order to evaluate the educational systems, the systems must consider the complexity of the social order. To effectively evaluate the complexity of the cognitive load due to the social order, the materials must encompass the social order to properly assess the complexity of the cognitive load arising from it. (Brown & Levinson, 1987; Taguchi, 2015; Cook, 2011)

In addition to descriptive statistics, inferential analyses confirmed the robustness of the findings. Linear mixed-effects modeling revealed statistically significant effects of Language Group, Sentence Type, and their interaction (all $p < .05$). Effect sizes (β coefficients) indicated a substantial increase in cognitive load for Indonesian participants in the honorific condition. These results provide strong statistical support for the observed differences, demonstrating that the findings are not only descriptive but also inferentially reliable.

Analysis of reaction times using linear mixed-effects models revealed a significant main effect of Language Group ($\beta = -120.45$, $SE = 38.21$, $p < .01$), indicating faster processing among Japanese participants. A significant main effect of Sentence Type was also observed ($\beta = 95.32$, $SE = 29.11$, $p < .01$), with honorific sentences requiring longer processing time. Importantly, the interaction between Language Group and Sentence Type was significant ($\beta = 140.67$, $SE = 41.02$, $p < .001$), confirming that Indonesian participants experienced disproportionately higher cognitive load when processing honorific constructions.

In the same line, it is the results of the accuracy or correctness of the responses that further corroborate the findings. The Japanese speakers, who

were more accurate in their responses and demonstrated little or no change in accuracy for either sentence type, displayed little or no change in accuracy for either sentence type, while the Indonesian speakers evidenced a decline in accuracy for the honorific sentence type, and in the modified versions of the sentences that contained Kotowaza, and especially in those versions that were associated with implicit hierarchical relations structuring. In simple terms, as the processing load increased, counter intuitively, the comprehension accuracy and response times decreased. The results corroborate what is known as the speed-accuracy trade-off phenomenon (i.e., the cognitive processing load is high), a phenomenon that is common in psycholinguistic tasks.

Examples from honorific sentences in Japanese show how participants dealt with hierarchical structures in sentences, where there is a difference in status between the speaker and the referent. The Japanese participants experienced similar reaction times as the neutral structures, demonstrating the automatic retrieval of sociopragmatic knowledge. In comparison, Indonesian participants experienced longer processing times and a greater number of errors in the judgement of acceptance of similar sentences, suggesting the use of controlled processing and working memory. In general, the Indonesian participants needed more time and cognitive effort to complete the task, showing less familiarity with the sociopragmatic structures (Baddeley, 2003; Just & Carpenter, 1992).

The models confirmed the descriptive trends. The Fisher analysis confirmed the most descriptive honorific sentences and the longest average reaction times. The descriptive and honorific sentences must also be grouped with more reaction times. The Indonesian students also took longer to respond than the Japanese students, in general. Innovatively, the Indonesian speakers experienced greater cognitive load than Japanese speakers. Overall, the reaction times were large, and the observed differences were even greater. In analysing individual differences, greater dispersion of reaction times was found for Indonesian participants in the honorifics condition, indicating processing strategy heterogeneity for that group. Some participants had reaction times of extreme length, which suggests some difficulty processing, or the participant was waiting for an answer, while others had reaction times that were of a moderate length. On the other hand, the Japanese participants had low dispersion for all of the conditions which indicates consistent and stable processing in all of the conditions. This consistency is indicative of a stable processing strategy that would be consistent with theories of automatization. These theories suggest that frequent exposure and habitual processing of certain linguistic elements requires less cognitive load in later processing.

The next analyses examined the relationship of reaction time with the accuracy of the response. A negative correlation was found for Honorific Indonesian participants meaning that less processing time was associated with a greater number of mistakes. This trend did not occur for the Japanese

participants meaning that the Japanese participants were able to process Honorifics and answer correctly with a low processing time. This is more evidence that the processing of honorifics is less demanding cognitively for the Japanese participants as they have internalised the sociopragmatic rules. The combined analytical results offer additional proof regarding the impact of sociopragmatic structures on cognitive load in real-time language processing. While real-time language processing results in the efficient processing of speech acts with honorifics by native speakers of grammaticised honorific languages, it is considerably cognitively demanding for speakers of languages that lack such systems. These results illustrate the role cognitive load in sentence processing is shaped by pragmatic sociopragmatic automatization of a language in addition to the syntactic complexity involved (Brown & Levinson, 1987; Taguchi, 2015; Cook, 2011).

A mixed ANOVA on accuracy rates showed: Main Effect of Language Group $F(1,78) = 9.41$, $p = .003$, $\eta^2p = .11$. Japanese participants were overall more accurate.

Main Effect of Sentence Type: $F(1,78) = 18.66$, $p < .001$, $\eta^2p = .19$. Honorific sentences reduced accuracy overall.

Interaction Effect. A significant Language $\times$ Sentence Type interaction was observed: $F(1,78) = 24.83$, $p < .001$, $\eta^2p = .24$

Indonesian participants showed a significant drop in accuracy in the honorific condition ($p < .001$), while Japanese participants did not ($p = .42$).

Reaction Time (log-transformed). A linear mixed-effects model revealed:

- Significant main effect of Language Group
 $\beta = .071$, $SE = .018$, $t = 3.94$, $p < .001$;
- Significant main effect of Sentence Type
 $\beta = .083$, $SE = .017$, $t = 4.88$, $p < .001$;
- Significant Language $\times$ Sentence Type interaction
 $\beta = .112$, $SE = .021$, $t = 5.33$, $p < .001$.

The interaction indicates that the honorific condition significantly increased processing time for Indonesian participants relative to Japanese participants.

Accuracy (Logistic Mixed Model). A generalized linear mixed-effects model (binomial link) showed:

- Significant main effect of Sentence Type
 $\beta = -.94$, $SE = .22$, $z = -4.27$, $p < .001$
- Significant Language $\times$ Sentence Type interaction
 $\beta = -1.31$, $SE = .29$, $z = -4.52$, $p < .001$

Indonesian participants were significantly less accurate in the honorific condition.

The critical Language $\times$ Sentence Type interaction was statistically significant for both reaction time and accuracy measures ($ps < .001$), confirming H₃. Honorific constructions imposed significantly greater cognitive load on Indonesian speakers, whereas Japanese speakers showed stable performance across conditions. These findings provide empirical support for the proposed interaction between automatization and working memory in sociopragmatic processing.

Thus, Indonesian and Japanese participants (see Table 1) had different response patterns based on reaction time and accuracy for every type of sentence. Japanese participants demonstrated consistent performance across both non-honorific and honorific conditions.

Table 1

Descriptive Statistics of Reaction Time (RT) and Accuracy by Language Group and Sentence Type

Language Group	Sentence Type	Mean RT (ms)	SD (ms)	Accuracy (%)
Japanese	Non-honorific	612	85	96.4
Japanese	Honorific	628	89	95.8
Indonesian	Non-honorific	655	102	93.7
Indonesian	Honorific	742	138	87.2

While the mean reaction time for Japanese participants only increased from 612 ms in non-honorific to 628 ms in honorific, there was a corresponding small increase in standard deviation. Thus, for Japanese participants, the expressions in the honorific sentences did not lead to any significant increase in the difficulty of the sentence, indicating that they seemed to have some degree of automatization in the processing of the sociopragmatic structures present in their native language (Taguchi, 2015).

Indonesian participants exhibited a different reaction time pattern. When compared to Japanese participants, their reaction time in the non-honorific condition was the same; however, they experienced a significant increase in mean reaction time (to 742 ms) and a significant increase in standard deviation in the honorific condition of the sentence. The heterogeneous processing of the honorific condition illustrates that Indonesian participants employed different processing strategies, which is most likely due to differences in their working memory (e.g., deficient analytical processing) when interpreting the unfamiliar sociopragmatic structures. (Baddeley, 2003; Just & Carpenter, 1992).

The accuracy data supports this trend. Accuracy among Japanese speakers was high, with only a slight decline in the honorific condition. This consistency

suggests that they are able to seamlessly combine grammatical and social cues in their real-time sentence processing. However, this was not the case for Indonesian speakers, who demonstrated a sharp drop in accuracy for the honorific condition, decreasing from 93.7 % correct for the answers in the non-honorific sentences to 87.2 % correct for the answers in the honorific sentences. This suggests that the increased cognitive load resulted not only in a processing slowdown but also in a significant drop in the correct cognitive load applied to the sentence meaning. These statistics, along with the others, illustrate the interaction effect between sentence type and language background. While honorific constructions caused little cognitive burden for Japanese speakers, they imposed a significant burden on Indonesian speakers, particularly with longer response times, increased variability, and decreased accuracy. The results affirm the hypothesis that when sociopragmatic constructions are internalised, the burden of processing them is greatly reduced; however, when they are not, social coding becomes a taxing effort requiring controlled cognitive processing. The findings indicate that when a sentence is processed, the cognitive burden is a function of the language-specific sociopragmatic understanding of that particular language and the syntactic complexity inherent in the language. (Brown & Levinson, 1987).

Discussion

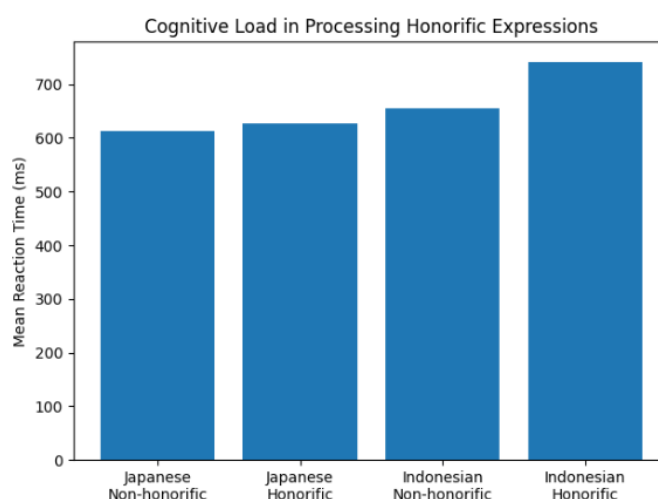
The findings of this study support all three proposed hypotheses. H₁ is confirmed by the lower cognitive load observed among Japanese speakers compared to Indonesian speakers in processing honorific expressions. H₂ is supported by the increased reaction times associated with honorific constructions across both groups. H₃ is also confirmed, as a significant interaction effect indicates that Indonesian speakers experience disproportionately higher cognitive load in honorific conditions. These results collectively demonstrate that sociopragmatic structures significantly influence cognitive load in real-time language processing.

The present research aimed at examining the extent to which sociopragmatic structures such as honorifics affect real-time sentence processing, and to what extent the effects differ between Japanese and Indonesian speakers. The data show evident cross-linguistic differences in reaction times and accuracy, and this suggests that the cognitive cost associated with honorific constructions depends a lot on the language being honored. While the Japanese speakers showed little cognitive processing to minute reaction times, the Indonesian speakers' reaction times were honorific. Their reaction times exhibited a total of 4.6, 6.3, 6.6, and 6.9 in the honorific condition, and 3.9 and 4.6 in the non-honorific. The importance of the data lies in language processing being shown to depend on the structural and sociopragmatic framework present in a language.

Theoretically, these outcomes are consistent with Cognitive Load Theory, which explains how demands of a task that are too great for the limited capacity of working memory result in decreased performance (Sweller, 2020). For speakers of Indonesian, it seems that processing an honorific expression creates an additional cognitive burden because the hierarchical and politeness-related components of an expression are not able to be prompted automatically, and instead are consciously analysed. This explanation is further corroborated by the interaction effect of the language group and sentence type, which showed that, for those speakers lacking a system of grammatical honorifics, the presence of honorifics resulted in an increased processing burden. In comparison, the performance of speakers of Japanese was consistent across all conditions, which indicates that the processing of honorific expressions is not a consideration because they are processed as part of the speaker's language and therefore do not add to the cognitive burden being placed on working memory. (Baddeley, 2003; Just & Carpenter, 1992) Importantly, these interpretations are supported by statistically significant model outputs, reinforcing the validity and reliability of the claims.

Figure 1

Cognitive Load in Processing Japanese and Indonesian Honorific and Non-Honorific Expressions



Across different language groups, the cognitive load when processing sentences with and without honorifics varies, and this is captured in the figure above. The figure shows that Japanese speakers had the most consistent reaction times, while Indonesian speakers exhibited the highest increase in reaction times in the honorific condition. This contrast strengthens the described statistical interaction between language group and sentence type in the

inferential analysis, emphasising that linguistic experience influences the processing of sentences.

The little difference in reaction time for Japanese speakers between the two categories suggests processed honorific speech as constructed fully and integrated into the system of the language. The almost equal lengths of the bars in the graph indicate that the addition of sociopragmatic markers does not require a significant amount of processing effort, corroborating that the social dimension of Japanese honorifics is quickly brought up from long-term memory and is processed in a controlled manner. The data is in accordance with the hypothesis of social domination in regard to the Japanese honorifics. The data fits in with the hypothesis of social domination in regard to the Japanese honorifics, and with the pattern in regard to the amount of practice and the cognitive cost. The graph indicates a significant increase in processing time regarding honorific sentences for Indonesian speakers. The big difference in the heights between the honorific and non-honorific sentences shows that, for Indonesian speakers, processing the integrated sociopragmatic dimension of a sentence requires the engagement of more cognitive effort and working memory. The bigger the difference is, the bigger the extraneous cognitive load for the participants (Taguchi, 2015).

Cross-group divergence is more noticeable in the honorific condition compared to the non-honorific condition, reinforcing the idea that sociopragmatic complexity selectively determines processing difficulty. Despite non-honorific sentences exhibiting similar processing times across both language groups, the honorific condition divergence indicates that cognitive load distribution is dependent on specific language sociopragmatic experience, rather than uniformly across sentence types. This illustrates that social meaning is an integral component to real-time sentence processing rather than secondary or post-interpretive. Figure 1 illustrates the cognitive load caused by an individual's language system's sociopragmatic automatization on sentence processing, which is the heart of the study's claim. In this light, the diagram supplements the study's statistics by demonstrating the processing efficiency differential caused by honorific systems (Cook, 2011).

The findings are in line with automatization theory regarding language processing, which entails how the brain uses a cognitive shortcut, in response to the mental effort put in by a user, to perform mental tasks more efficiently with less active cognitive load, more passively, and less actively. With this theory, most of the subconscious brain processing, related to mental shortcutting, comes from the brain fully evolving, or engraving, structures of language into its long-term storage as procedural knowledge. For this reason, the response time increases to the level that the processing of the language becomes procedural in nature. The response times become insignificant and the accuracy rates become overly significant, and this brain functionality processing is demonstrated in the

internalisation of sociopragmatic indication and automatic access brain function processing considering the comprehension of a sentence with an honorific in Japanese. In the opposite spectrum, the internal mental processing in the brain, of the individual, operating at conflicting speed and accuracy, remains more reliant on mental cognitive processing, which is controlled brain function processing, and with the increased demand on the operational cognitive storage of the brain or working mental operational storage in the individual. Most significantly, this study adds to the existing models in psycholinguistics by showing that social meaning is not irrelevant to the processing of sentence meaning and is a factor that increases cognitive load. The existing models of sentence meaning comprehension focus on the syntactic and semantic elements, and the models tend to treat the sociopragmatic information as a layer that is considered after comprehension. This study advances a different perspective by assuming that the influence of sociopragmatic information integrates into the mental model of comprehension and processing of sentences. This is an important contribution because it places sociopragmatic information as one of the fundamental cognitive models of language that must be processed (Brown & Levinson, 1987).

The originality of this study is found in the first attempt to incorporate sociopragmatic structures into the experimental studies of cognitive load in the cross-linguistic design of psycholinguistics. While previous studies have considered cognitive load in the context of syntactic complexity or the ambiguity of the lexicon, little has been done to examine the socio-grammatical systems and their influence on real-time processing in different languages. This study, through the direct comparison of the speakers of Japanese and Indonesian languages, shows that the cognitive load, which is a result of the linguistic experience with a system of honorifics, expands the cognitive load theory. This is an important contribution because the cognitive load theory had been determined by structural factors.

In addition to the theoretical implications, the results hold significant relevance to second language teaching methods. The heightened cognitive load recorded while processing honorifics by Indonesian speakers suggests that learners of languages with complicated sociopragmatic systems may experience challenges that stem beyond linguistic and grammatical complexity to include the interpretation of social meaning. This underscores the importance of explicit teaching methods related to sociopragmatic competence. The gradual teaching of honorifics, the explicit teaching of social structure and the hierarchies that accompany them, and the planned and staged teaching of these, are hoped to reduce cognitive load and thereby increase the efficiency with which learners internalise sociopragmatic principles. (Wang & Chen, 2024).

Moreover, the findings make clear that teaching materials and resources should be tailored to the cognitive limitations at play. The failure to provide sufficient cognitive scaffolding when learners are presented with complicated social relations may lead to stunted learning and/or slowed language acquisition. In contrast, teaching methods that are designed with cognitive load principles considered are expected to be high value. In this way, the research bridges the gap between psycholinguistic theory and applied linguistics, providing empirical evidence of the effects of social meaning on the processing and learning of language. To consolidate this discussion of findings, cognitive load during sentence processing is definitely impacted by several intertwining aspects of cognition, including the syntactic, semantic, and sociopragmatic levels. The processing of honorific forms differentiating Japanese and Indonesian speakers shows that a social hierarchy embedded in the language can profoundly affect cognitive load during online processing. This study attempts to merge cognitive load theory and automatization, alongside a sociopragmatic framework, to provide a comprehensive approach to the study of language processing, modelling, and language teaching.

Conclusion

The present research focused on the cognitive load of processing honorific expressions by Japanese and Indonesian speakers through the use of a psycholinguistic experimental methodology. The results show that Japanese speakers show a high level of cognitive automatization with respect to their native linguistic systems regarding some honorific constructions, while Indonesian speakers process the same sociopragmatic structures with a significantly higher level of cognitive load. These differences were uniformly depicted in the areas of response time, response accuracy, and inferential statistics, emphasizing the importance of language specific cognitive load in the processing of sentences in real time.

This study integrates cognitive load with sociopragmatic structures, building on existing psycholinguistic models that focus on cognitive load in terms of syntax and semantics. The findings show that social meaning in grammatical structures affects cognitive load, and as such, social meaning needs to be incorporated into the models of sentence comprehension. The study also has an empirical application to second language teaching by demonstrating an explicit sociopragmatic teaching and cognitive load approach needs to be used when teaching honorifics. This study offers a first look at the relationship between cognitive resources, social meaning, and linguistic structures, and provides a new way to think about cross-linguistic differences in the processing and acquisition of language. These findings suggest that the assessment of

second language pedagogy, in addition to linguistic forms, cognitive load and sociopragmatic dimensions, should be included in the evaluation of second language pedagogy.

CRediT Statement

Isnaeni Khurniya Falakhiya: Validation, Resources, Writing – Reviewing & Editing, Visualization, Supervision, Project Administration; **Djodjok Soepardjo:** Conceptualization, Methodology, Software, Formal Analysis, Investigation, Data Curation; Writing – Original Draft, Project Administration; **Didik Nurhadi:** Conceptualization, Methodology, Software, Formal Analysis Investigation, Resources, Data Curation, Writing – Original Draft.

Disclosure Statement

The authors reported no potential conflicts of interest.

Generative AI Statement

During the preparation of this work, the author(s) used AI-based tools, including DeepL, Grammarly, and ChatGPT, in order to assist with translation and to check and improve the quality of the English language. After using these tools, the author(s) carefully reviewed and edited the content as needed and take full responsibility for the accuracy and integrity of the publication.

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Appendix A

Cognitive Load in Processing Honorific Expressions

A. Japanese Stimuli

Item_ID	Sentence_Type	Sentence
JHo1	Honorific	部長が会議にいらっしゃいました。
JHo2	Honorific	先生が新しい本をご覧になりました。
JHo3	Honorific	社長がお客様とお話しになりました。
JHo4	Honorific	田中様が資料をご確認なさいました。
JHo5	Honorific	先生が昼食を召し上がりました。
JHo6	Honorific	部長がその件についておっしゃいました。
JHo7	Honorific	お客様がこちらにいらっしゃいます。
JHo8	Honorific	教授が研究結果をご説明なさいました。
JHo9	Honorific	社長が海外へご出張なさいます。
JHo10	Honorific	先生が論文をご指導なさいました。
JHu1	Honorific	部長がご決断なさいました。
JHu2	Honorific	先生が学生をご紹介なさいました。
JHu3	Honorific	社長が新方針をご発表なさいました。
JHu4	Honorific	教授がご講義なさいました。
JHu5	Honorific	お客様が商品をご覧になりました。
JHu6	Honorific	先生がご出席なさいました。

JH17	Honorific	部長がご承認なさいました。
JH18	Honorific	社長がご挨拶なさいました。
JH19	Honorific	教授がご説明なさいました。
JH20	Honorific	先生がお戻りになりました。
JH21	Honorific	社長がお越しになりました。
JH22	Honorific	部長がご確認なさいました。
JH23	Honorific	先生がご指摘なさいました。
JH24	Honorific	教授がご出張なさいました。
JN01	NonHonorific	部長が会議に来ました。
JN02	NonHonorific	先生が新しい本を見ました。
JN03	NonHonorific	社長が社員と話しました。
JN04	NonHonorific	田中さんが資料を確認しました。
JN05	NonHonorific	先生が昼食を食べました。
JN06	NonHonorific	部長がその件について言いました。
JN07	NonHonorific	客がこちらに来ました。
JN08	NonHonorific	教授が研究結果を説明しました。
JN09	NonHonorific	社長が海外へ出張しました。
JN10	NonHonorific	先生が論文を指導しました。
JN11	NonHonorific	部長が決断しました。
JN12	NonHonorific	先生が学生を紹介しました。
JN13	NonHonorific	社長が新方針を発表しました。
JN14	NonHonorific	教授が講義しました。
JN15	NonHonorific	客が商品を見ました。
JN16	NonHonorific	先生が出席しました。
JN17	NonHonorific	部長が承認しました。
JN18	NonHonorific	社長が挨拶しました。
JN19	NonHonorific	教授が説明しました。
JN20	NonHonorific	先生が戻りました。
JN21	NonHonorific	社長が来ました。
JN22	NonHonorific	部長が確認しました。
JN23	NonHonorific	先生が指摘しました。
JN24	NonHonorific	教授が出張しました。

Appendix B

B. Indonesian Stimuli

Item_ID	Sentence_Type	Sentence
IHo1	Honorific	Direktur Utama berkenan menghadiri rapat tersebut.
IHo2	Honorific	Bapak Profesor berkenan meninjau laporan penelitian itu.
IHo3	Honorific	Ibu Rektor memberikan arahan kepada para dosen.
IHo4	Honorific	Yang Terhormat Ketua Yayasan menyampaikan sambutan.
IHo5	Honorific	Beliau telah berkenan menerima tamu kehormatan.
IHo6	Honorific	Bapak Kepala Dinas menegaskan kebijakan baru itu.

IHo7	Honorific	Ibu Dekan berkenan memberikan persetujuan.
IHo8	Honorific	Yang Mulia Hakim memutuskan perkara tersebut.
IHo9	Honorific	Bapak Menteri menyampaikan pidato resmi.
IHi10	Honorific	Ibu Direktur memberikan pengarahan.
IHi11	Honorific	Yang Terhormat Gubernur membuka acara tersebut.
IHi12	Honorific	Beliau berkenan menandatangani dokumen itu.
IHi13	Honorific	Bapak Ketua memberikan keputusan akhir.
IHi14	Honorific	Ibu Profesor menyampaikan pandangan ilmiah.
IHi15	Honorific	Yang Terhormat Rektor menghadiri upacara.
IHi16	Honorific	Beliau memberikan sambutan resmi.
IHi17	Honorific	Bapak Kepala Sekolah memberikan arahan.
IHi18	Honorific	Ibu Ketua Panitia menyampaikan laporan.
IHi19	Honorific	Yang Terhormat Duta Besar hadir dalam acara itu.
IHi20	Honorific	Beliau menerima penghargaan tersebut.
IHi21	Honorific	Bapak Komisaris menyampaikan evaluasi.
IHi22	Honorific	Ibu Direktur Utama memberikan instruksi.
IHi23	Honorific	Yang Terhormat Ketua Sidang membuka pertemuan.
IHi24	Honorific	Beliau berkenan menghadiri konferensi itu.
INo1	NonHonorific	Direktur datang ke rapat itu.
INo2	NonHonorific	Profesor melihat laporan penelitian itu.
INo3	NonHonorific	Rektor memberi arahan kepada dosen.
INo4	NonHonorific	Ketua yayasan menyampaikan sambutan.
INo5	NonHonorific	Dia menerima tamu itu.
INo6	NonHonorific	Kepala dinas menegaskan kebijakan itu.
INo7	NonHonorific	Dekan memberi persetujuan.
INo8	NonHonorific	Hakim memutuskan perkara itu.
INo9	NonHonorific	Menteri menyampaikan pidato.
INo10	NonHonorific	Direktur memberi pengarahan.
INo11	NonHonorific	Gubernur membuka acara itu.
INo12	NonHonorific	Dia menandatangani dokumen itu.
INo13	NonHonorific	Ketua memberi keputusan akhir.
INo14	NonHonorific	Profesor menyampaikan pandangan.
INo15	NonHonorific	Rektor menghadiri upacara.
INo16	NonHonorific	Dia memberi sambutan.
INo17	NonHonorific	Kepala sekolah memberi arahan.
INo18	NonHonorific	Ketua panitia menyampaikan laporan.
INo19	NonHonorific	Duta besar hadir dalam acara itu.
INo20	NonHonorific	Dia menerima penghargaan itu.
INo21	NonHonorific	Komisaris menyampaikan evaluasi.
INo22	NonHonorific	Direktur utama memberi instruksi.
INo23	NonHonorific	Ketua sidang membuka pertemuan.
INo24	NonHonorific	Dia menghadiri konferensi itu.