Assigning Impression Rating Information to the 'Balanced Corpus of Contemporary Written Japanese'

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Abstract

This study involved the collection of information on impression ratings from the general public using short-unit verbs, long-unit independent words, and phrases as stimuli in the 'Balanced Corpus of Contemporary Written Japanese'. A six-point scale from 0 (completely disagree) to 5 (agree) was used to measure five aspects 'naturalness', 'understandability', 'obsoleteness', 'innovativeness', and 'figurativeness'. Based on the information on these impression ratings, a linear regression model of existing representative senses was constructed, and we attempted to extract typical examples by fitting them into the corpus. By combining the impression rating information provided, it is possible to extract examples such as 'obsolete metaphors' and 'innovative metaphors.' This paper presents examples of metaphor expression extraction using evaluation.

1 Introduction

In this study, we report on impression rating information assigned to the 'Balanced Corpus of Contemporary Written Japanese' (*Gendai Nihongo Kakikotoba Kikkou Ko-pasu*: hereafter 'BCCWJ') (Maekawa et al., 2014) on crowdsourcing.

'WLSP-Familiarity' (Asahara, 2019) is a word familiarity database for the 'Word List by Semantic Principles' (*Bunrui Goihyou*: 'WLSP') (The National Institute for Japanese Language, 2004) lexicon, which uses dictionary headings as stimuli and collects ratings for five perspectives: knowing, writing, reading, speaking, and listening. Word familiarity is a rating value for a word, and we encountered the issue of not knowing how the word is perceived when actually used. Moreover, it was difficult to determine the intimacy of the sense of each word, for polysemous words.

Therefore, we presented the context of the BCCWJ and collected information on impression ratings. Specifically, we collected 6-point ratings from 0 (completely disagree) to 5 (agree) for the following five perspectives: 'naturalness', 'understandability', 'obsoleteness', 'innovativeness', and 'figurativeness', for short-unit verb words, long-unit content words, and all phrase units (*Bunsetsu*) defined by the National Institute for Japanese Language and Linguistics (NINJAL). In this paper, we explain the method of collecting impression rating information and present the basic statistics of the data. In addition, we report on our attempt to extract typical examples from the corpus, by regressing the information on representative meaning based on these impression ratings.

2 Related Research

2.1 Impression Rating Information

The NTT Database Series: 'Lexical Properties of Japanese' (*Nihongo-no Goitokusei*) (NTT Communication Science Laboratories, 1999-2008) is the world's largest database that examines lexical features from a variety of perspectives, with the aim of clarifying human language functions. In addition, it contains subjective data, such as on word familiarity, orthography-type appropriateness, word accent appropriateness, kanji familiarity, complexity, as well as reading appropriateness, word mental image etc., and objective data based on the frequency of vocabulary as it appears in newspapers. Among these, the Word Familiarity Database (Heisei Era Version) (Amano and Kondo, 1998) is an advanced lexical database that collects information on the familiarity of vocabulary. Further, the Word Familiarity Database (Reiwa Era Version) was created, because it was noted that how people perceive vocabulary had evolved over the years since the first survey, and the world's largest database was made public. Moreover, the word mental image characteristic database collected information on the 'ease of sensory imagery of semantic content' for written and spoken stimuli.

NINJAL has been continuously working on the estimation of word familiarity for the WLSP (Asahara, 2019) and has published several lexical tables. However, these have not been able to clarify how people perceive the vocabulary for polysemous words. To investigate these meanings, we conducted an experimental study that assigned impression rating information to examples from IPAL dictionaries and added semantic information to it in 2021. In this study, we extend the same research design to the BCCWJ and assign impression rating information to Japanese language polysemous words.

2.2 Core Meaning, Basic Meaning, Representative Meaning, and Typical Use Cases

It is generally considered that the meanings of polysemous words as described in the dictionary are those established in the language. When describing polysemy, Seto (Seto, 2019) discussed the establishment of the core meaning, recognition of significance, clarification of significance relations, and organisation of significance. In order to recognise polysemous word semantics, recognition criteria such as correspondence with related words (Kunihiro, 1982; Momiyama, 2002) separation and integration tests for individual sense recognition (Matsumoto, 2010), and other recognition criteria have been considered.

Polysemous words are said to have some inherent meaning, which are referred to as their core meaning, basic meaning, or representative meaning. When considering derivation relations, the chronological order of appearance is considered important based on historical changes. However, as polysemantic structures are reorganised, the typical core meaning assumed by the general public today is not necessarily based on historical changes. Seto (Seto, 2019), for example, cites the following nine characteristics: (i) literalness, (ii) presupposition of other meanings, (iii) highly concrete, (iv) easy recognisability, (v) easy recallability, (vi) exemption from usage restrictions, (vii) usual starting point of meaning development, (viii) early stage of language acquisition, and (ix) frequent use.

As linguistic resources, representative senses were assigned to polysemous words in the WLSP (Yamazaki and Kashino, 2017). It is possible for experts to identify representative senses from the corpus of WLSP labels assigned to the BCCWJ; since the numbers from the WLSP are also assigned to senses in the IPAL dictionary, it is possible to identify representative senses in the latter as well. However, these certifications are made by experts, and it is possible that these differ from the judgement of ordinary readers. As mentioned earlier, the assignment of impression rating information to examples in the IPAL dictionary has made it possible to determine how ordinary readers perceive the examples that experts recognise as representative meanings with the use of linear regression. In this study, we attempted to extract representative and typical examples by applying this linear regression equation to the collected impression rating information assigned to the BCCWJ.

3 Method of Data Collection

This section describes our method of data collection.

The data were collected from the BCCWJ-WLSP (books, newspapers, magazines) (Kato et al., 2018), that contains word sense information based on short units, and the BCCWJ-SPR2 (books, textbooks) that contains information on reading time.

The former, BCCWJ-WLSP, assigns word senses based on the WLSP to short-unit autonomous words (about 330,000 words) in a part of the BCCWJ core data sample of books, newspapers, and magazines. To contrast the word sense information based on the WLSP with the impression rating information, we collected the rating values of 20 people per case for short unit verbs and verbal nouns + *suru* (to do) on a trial basis, from 5th April to 3rd May 2021. Additionally, for long unit independent words, data from 10 people per example were collected, between 17th November and 6th December 2021.

The latter, BCCWJ-SPR2, collects reading time data from BCCWJ core data books and Japanese language textbook samples, using the phrase-by-phrase self-paced reading method. To explain reading time behaviour with respect to rating information, 10 people per example were studied for this sample on a phrase-by-phrase basis, from 17th November to 6th December 2021.

Figure 1 shows the screen for collecting rating information. The example sentences are displayed in units of one at the top of the screen, and the expressions to be judged are indicated by brackets.

The ratings were based on a six-point scale from 0 (completely disagree) to 5 (agree) for five aspects-'naturalness', 'understandability', 'obsoleteness',

Figure 1: Screen of Crowdsourcing

'innovativeness', and 'figurativeness'. Participants of the experiment (aged 20 years or older and having a Yahoo! Japan Crowdsourcing account) were each given an honorarium of 1 yen worth of reward points per answer. Moreover, participants who answered the same question more than once were prevented from answering at any time, in more than 90% of the cases.

4 Data Summary Statistics

Figures 2, 3, and 4 show the histograms of the average ratings for each expression of the short-unit verbs and long-unit content words of BCCWJ-WLSP, and the long unit sentence clauses of BCCWJ-SPR2, respectively. All the samples had been published in books, newspapers, magazines and textbooks, and as such, were presumed to be quite natural and easy for readers to understand. These were published between 2001 and 2005, and the overall trend was neither old nor new. In addition, figurativeness tended to be low.

5 Estimation of Typical Use Cases Based on Rating Information

The same rating information had already been assigned to IPAL dictionary examples, whose basic (representative) meaning information is as per the WLSP word senses. In this study, typical use cases were quantified as a degree of representative meaning and regressed using a generalised linear mixed model with the following equation, based on the IPAL dictionary rating from 5 to 1, wherein impression ratings are fixed effects and examples are random effects. This is an attempt to redefine the core sense property of Seto (Seto, 2019) in the Table 2 as a combination of impression rating information, and estimate the basic and representative meaning, as well as typical usage from the combination of the impression ratings of the general public.

$$\begin{aligned}\texttt{Representativeness (Verb)} &\sim \texttt{Naturalness} \\ &+ \texttt{Understandability} + \texttt{Obsoleteness} \\ &+ \texttt{Innovativeness} + \texttt{Figurativeness} \\ &+ (1|\texttt{Example}) \quad (1)\end{aligned}$$

The estimated fixed effect estimates are shown in Table 3. In relation to the core meaning properties of Seto in Table 2, we assumed that obsoleteness was (+) [(i) literalness, (vii) usual starting point of meaning development] and innovativeness was (-) [ii) presupposition of other meanings, (ix) frequent use] but the estimates obtained were coefficients of (-) for obsoleteness and (+) for innovativeness.

The following paragraphs will attempt to extract more representative 'typical use cases' based on the rating results of short-unit verbs. Specifically, the following linear regression equation obtained in the same study is applied:

$$\begin{aligned}\texttt{Estimated Representativeness (Verb)} &:= 0.012 \times \texttt{Naturalness} \\ &+ 0.033 \times \texttt{Understandability} \\ &- 0.015 \times \texttt{Obsoleteness} \\ &+ 0.018 \times \texttt{Innovativeness} \\ &- 0.024 \times \texttt{Figurativeness} + 1.965 \quad (2)\end{aligned}$$

Table 4 shows the average (macro-average) rating of the polysemous short unit verb *kakaru* (to hang, approach; lemma ID: 6016 in UniDic) by WLSP. The highest number of examples were found in '.16 Relation-Time' with 27, and the degree of typicality was high at 2.114. In contrast, '.31 Activity-Language' which has the highest degree of representativeness, means 'to receive a

Target	Unit	Sentences	Data Points	Date
BCCWJ-WLSP (PB, PN, PM)	SUW	38,004	764,700	2021/4/5 - 5/3
BCCWJ-WLSP (PB, PN, PM)	LUW	122,173	1,227,060	2021/11/17 - 12/6
BCCWJ-SPR2 (PB, OT)	Phrase	135,342	1,358,650	2021/11/17 - 12/6

Table 1: Data Points

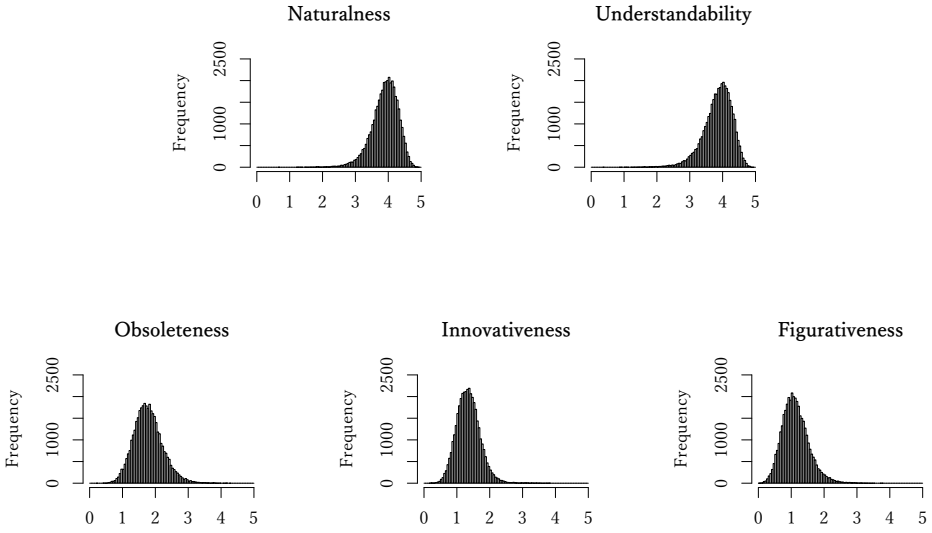

Figure 2: Distribution(BCCWJ-WLSP:SUW:bin 0.05)

Seto's core meaning properties	N	U	O	I	F
(i) Literalness			+		
(ii) Presupposition of other meanings				-	
(iii) Highly concrete		+			
(iv) Easy recognisability		+			
(v) Easy recallability		+			
(vi) Exception from usage restrictions	+				
(vii) Usual starting point of meaning development			+		-
(viii) Early stage of language acquisition		+			
(ix) Frequent use				-	

N: Naturalness, U: Understandability, O: Obsoleteness, I: Innovativeness, and F: Figurativeness

Table 2: Seto's core meaning properties and rating information

Fixed Effects	Estimates	(Std. Err.)
Naturalness	+0.012	(0.008)
Understandability	*** +0.033	(0.008)
Obsoleteness	*** -0.015	(0.004)
Innovativeness	*** +0.018	(0.004)
Figurativeness	*** -0.024	(0.004)
Intercept	*** +1.965	(0.071)
Data Points		56,120

Table 3: GLMM results on IPAL dictionary representative meaning

phone call', but there was only one example of its use. The frequency of phone call use has decreased in recent years, and as the number of examples of this usage is expected to further decrease, the degree of representativeness may eventually diminish.

Table 5 shows the highest and lowest representative senses of *kakaru*. The most representative examples were '.11 Relation-Class' and '.16 Relation-Time'. The less representative examples were '.3370 Activity-Life-Leisure' (a term in the Go boardgame), '.1502 Relation-Effect-Initiation' (*hajimeru* (to begin)), and '.1513 Relation-Effect-Fixation, Tilt, Tumble.' (*ooikabusaru* (to cover)). Interestingly, the representative meaning of PM29_00003 example 'it (hair) [*{kaka} -ta*] ([cover] -ed) shoulder tip' (.1513 Relation-Effect-Fixation, Tilt, Tumble), which is by nature a lexical word meaning without metaphorical sense, is low. Meanwhile, the highly abstract '.1110 Relation-Class-Relation', '.1600 Relation-Time-Time', and '.3730 Activity-Economy-Price and Cost' had high representativeness; moreover, they tended to have low figurativeness, even though they were figurative expressions

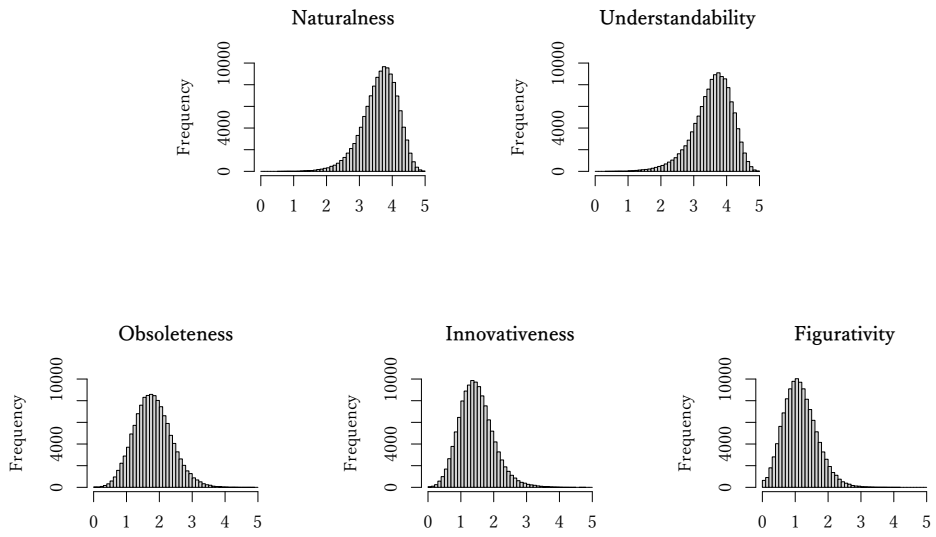

Figure 3: Distribution(BCCWJ-WLSP:LUW:bin 0.10)

originally.

6 Figurative Expression Extraction

In this study, an attempt is made to extract metaphorical expressions using Figurativity ratings from data annotated with impression assessment information. Specifically, we extract 275 instances from the PB (Books) data of the Base-phrase based Corpus (BCCWJ-SPR2) with Figurativity ratings of 3.0 or higher. Subsequently, we further investigate expressions with high Obsoleteness ratings (Obsolete Figurative Expressions) and those with high Innovativeness ratings (Innovative Figurative Expressions).

6.1 Obsolete Figurative Expressions

In the following, we will demonstrate cases with high levels of Obsoleteness.

(1) 『【転石】 苔を つけず。 』
‘ **rolling.stone** moss without.attaching. ’
[Obsoletness: 3.9, Figurativity: 3.2] ‘A rolling stone gathers no moss.’

(1) is originally an old English proverb, and a figurative expression where ‘rolling stone’ is metaphorically to describe a person or individual.

(2) 八月に 【はいると】 海は ほんの少し
August **entering** sea slightly
機嫌を 悪くする 時が ある。
mood worsen time exist.
[Obsoleteness: 3.8, Figurativity: 3.3] ‘In August, the sea tends to be slightly moody.’

The figurative expression in (2) lies in the spatial representation (’entering’) of ’August,’ where the concept of ’August’ is represented as an abstract space. This representation involves associating a sense of entry or transition, typical of spatial contexts, with the commencement of the month of August. The usage of ’はいると’ (entering) to mark the onset of August is a less prevalent and somewhat archaic construction in modern Japanese, contributing to the expression’s obsoleteness.

(3) 【ほたりほたりと】 水滴が
mimetic.word water.drops
落ちている。
falling
[Obsoleteness: 3.7, Figurativity: 3.3] ‘Water drops are falling with a patter.’

In (3), the figurative expression lies in the use of ’ほたほた,’ an older mimetic word. This expression employs ’ほたりほたり,’ the derived form of ’ほたほた,’ to depict the manner in which water drops fall. ’ほたほた’ represents the manner of water drops falling, and it is the archaic form from which ’ほたりほたり’ is derived, conveying a somewhat outdated and formal depiction of the manner of water drops falling.

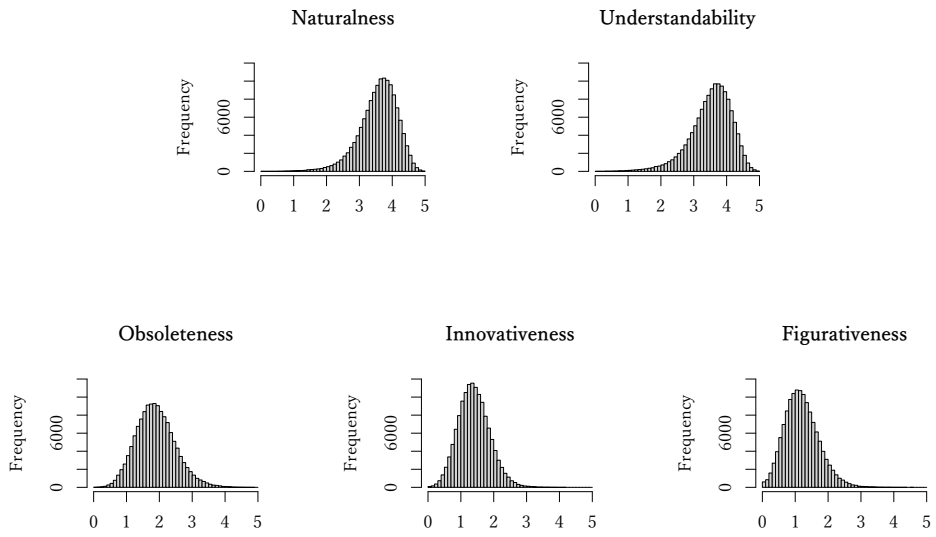

Figure 4: Distribution(BCCWJ-SPR2:phrase:bin 0.10)

6.2 Innovative Figurative Expressions

In the following, we will demonstrate cases with high levels of Innovativeness.

(4) 実際、 【「知識爆発」は】
actually, **'knowledge.explosion'**
とどまるところを 知りませんから、
stopping.point not.know.because
私たちは たいへんです。
we.are troubled.
[Innovativeness: 3.1, Figurativity 3.1] 'In fact, we don't know where the 'knowledge explosion' will stop, so we are troubled.'

The figurative expression in (4) lies in the use of '知識爆発' ('knowledge.explosion') to symbolize a rapid and uncontrolled growth of knowledge or information, akin to an explosion. The innovative aspect is reflected in the introduction of the term '知識爆発' ('knowledge.explosion'), which is not a common or standard phrase in everyday language. It represents a creative way of describing the concept of an exponential growth of knowledge or information, demonstrating originality in expression.

(5) そういう 【闇空間を】 求めてきた。
such **dark.space** sought.
[Innovativeness: 3.1, Figurativity 3.0] 'I have sought such a dark space'.

The figurative expression in (5) lies in the use of '闇空間' ('dark space') to symbolize a metaphorical space or state characterized by darkness, mystery, or the unknown. It does not refer to a literal physical space but rather represents a deeper, intangible concept related to emotions, experiences, or thoughts. The innovative aspect is seen in the creation or utilization of '闇空間' ('dark space'), a phrase that is not conventionally used in everyday language.

7 Conclusions and Future Directions

In this study, we comprehensively collected impressions that people perceive from the Japanese language using a corpus and systematically organized them into a database. Conventional language resources were primarily annotated by linguists based on standards and guidelines, focusing on annotating linguistic structures. However, aspects such as 'natural,' 'understandable,' 'obsolete,' and 'innovative' prove challenging to precisely define even by linguists. Therefore, in this study, we utilized a survey employing crowdsourcing to gather assessments from multiple individuals regarding the perspectives of 'natural,' 'understandable,' 'obsolete,' and 'innovative,' for three levels: short unit word, long unit word, and base-phrase for the parts of BCCWJ with word senses (BCCWJ-WLSP) and those with reading time (BCCWJ-SPR2).

Furthermore, for short unit verbs, we tried to extract typical examples of corpus usage by estimating the degree of representativeness, using linear regression based on the impression rating

WLSP	Na	U	O	Ne	F	Est. Repres.	Frequency
2:Verbal	3.93	3.89	1.88	1.34	1.21	2.108	66
11:Relation-Class	3.92	3.85	2.15	1.37	1.22	2.102	10
1110:Relation-Class-Relation	3.92	3.85	2.15	1.37	1.22	2.102	10
15:Relation-Effect	3.87	3.76	1.94	1.22	1.19	2.100	18
1502:Relation-Effect-Initiation	3.80	3.73	2.05	1.39	1.28	2.097	7
1513:Relation-Effect-Fixation, Tilt, Tumble	3.92	3.78	1.87	1.11	1.13	2.102	11
16:Relation-Time	4.00	3.99	1.77	1.36	1.19	2.114	27
1600:Relation-Time-Time	4.00	3.99	1.77	1.36	1.19	2.114	27
31:Activity-Language	4.20	4.30	2.10	1.80	1.50	2.122	1
3122:Activity-Language-Communication	4.20	4.30	2.10	1.80	1.50	2.122	1
33:Activity-Life	2.35	2.25	2.75	2.00	2.20	2.009	1
3370:Activity-Life-Leisure	2.35	2.25	2.75	2.00	2.20	2.009	1
37:Activity-Economy	4.02	4.05	1.67	1.43	1.13	2.120	8
3710:Activity-Economy-Balance of Payments	4.28	4.23	2.05	1.15	1.10	2.119	2
3730:Activity-Economy-Prices and Costs	3.93	3.99	1.54	1.52	1.14	2.121	6
51:Nature-Matter	3.85	4.00	1.55	0.95	1.55	2.100	1
5152:Nature-Matter-Could	3.85	4.00	1.55	0.95	1.55	2.100	1

Table 4: Estimated Representativeness for WLSP article numbers of Short Unit Word *kakaru* (Lemma ID: 6016)

information obtained. By contrasting the frequency of occurrence in the corpus with the ratings of common readers, it is possible to verify how words are produced and received. In addition, the estimation of the degree of representativeness and the extraction of typical use cases contribute to the clarification of the core and basic meanings of polysemous words, as well as to the determination of grammaticality and ungrammaticality in discourse. With regard to presenting examples of usage to language learners, we believe that presenting typical examples of usage will help build language fluency. In the future, we will contrast the word meanings in the BCCWJ-WLSP to investigate whether ordinary readers perceive figurativeness in cases where a shift in meaning occurs. Furthermore, we would like to clarify expressions with various reading time from the viewpoint of impression rating information, by contrasting the reading time with the impression rating information assigned to each phrase.

We also investigated 'figurativity.' 'Figurativity' has various linguistic definitions, making annotation challenging for the general population. However, we focused on collecting figurative expressions that are understandable to the general population and conducted the survey. By combining the degree of Figurativity' with the survey results for Obsolete' or 'Innovative', we attempted to collect so-called old and stale figurative expressions, as well as novel and innovative figurative expressions. Based on the ratings, we believe we were able to obtain figurative expressions that match the desired level to some extent.

For future directions, we plan to conduct three studies.

The first study will involve a comparison between figurative expressions annotated by experts and impression ratings from the general audience. We will examine how well the general readers can recognize figurative expressions for the parts identified as figurative expressions by experts. This investigation will encompass not only metaphors but also synecdoche and metonymy, exploring the extent to which they are identifiable. Additionally, we will verify whether the figurative expressions annotated by experts are classified as obsolete or innovative.

In the second study, we will explore the relationship between figurative expressions and their impact on comprehension and interpretation. Specifically, we will investigate how the presence of figurative language influences readers' understanding and engagement with the text. Additionally, we will examine how different types of figurative expressions (e.g., metaphors, similes, idioms) affect the overall interpretation and perception of the given context.

As a third study, we will compare impression ratings with reading times in BCCWJ-SPR2 to investigate the impact of naturalness, understandability, obsoleteness, innovativeness, and figurativeness on reading time. In addition to grammatical functions, we aim to elucidate how impressions affect variations in reading time and explore their role as non-grammatical factors.

Sample ID	Offset	Na	U	O	Ne	F	Sentence	Est. Repres.
PB56_00007 WLSP:2.1110	41660	4.65	4.55	1.65	1.45	0.6	あいのり商法の成功はお互いに、ウイン・ウインの関係が構築できるかどうかに【かかっ】ているのだ。 The success of the Ainori sales method [depends] on the ability to build a win-win relationship with each other.	2.1579
PB40_00003 WLSP:2.1600	15100	4.2	4.05	1.35	1.8	0.5	セミナーや講習会を受ける→時間が【かかる】→タイミングが合わない Attending seminars and workshops → [Takes] time → Timing does not fit	2.1492
PB40_00003 WLSP:2.1600	4880	4.5	4.3	1.35	0.95	0.45	さがすのにも時間が【かかる】。 It also [takes] time to find the right person.	2.14695
PM41_00060 WLSP:2.3370	38420	2.35	2.25	2.75	2	2.2	第１譜、白２０と【カカっ】たのは戦いに自信のある表われ。 The first move, [going for] white 20, is a sign of confidence in the battle (related to Go Game).	2.0094
PM25_00084 WLSP:2.1502	1310	2.4	2.1	1.85	1.9	1.5	下手したら回収に【かかっ】てるから。 If one is careless, I will [begin] to collect it.	2.03355
PB29_00003 WLSP:2.1513	6880	3	2.85	2.4	1.55	1.55	明け方にはこちらを向いていた顔が今は枕の向こうに落ち、解いた髪と、それが【かかっ】た肩先がこちらを向いている。 The face that was looking at me at dawn has now fallen behind the pillow, and my unravelled hair and the tips of my shoulders that are [covered] with it are facing this way.	2.04975

Table 5: Highest and lowest estimated typical use examples of the short unit verb kakaru (Lemma ID: 6016)

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