

# Japanese Students' Difficulties with Metadiscursive Nouns in Argumentation Essays

Nobuko Tahara<sup>1</sup>

<sup>1</sup> Graduate School of Humanities and Social Sciences, Okayama University, 3-3-1 Tsushima-naka, Kita-ku, Okayama, Japan

Correspondence: Nobuko Tahara, Graduate School of Humanities and Social Sciences, Okayama University, 3-3-1 Tsushima-naka, Kita-ku, Okayama, Japan.

Received: April 13, 2022

Accepted: May 18, 2022

Online Published: May 20, 2022

doi: 10.5539/elt.v15n6p88

URL: <https://doi.org/10.5539/elt.v15n6p88>

## Abstract

The present study attempts to identify difficulties that Japanese students encounter with metadiscursive nouns in writing second language (L2) argumentation essays. Metadiscursive nouns are abstract and unspecific nouns which can serve as cohesive markers by retrieving their meanings in the text where they occur. Using a selected number of nouns (i.e., *problem*, *reason*, *thing*, *fact*, *idea*, *decision*), this study examines how the nouns, occurring in several syntactic patterns, expressed their meanings in the text and served as metadiscursive devices in L2 essays written by Japanese students, in comparison with essays by American students as a benchmark. The study also discusses the use of *problem* and *reason* in relation to rhetorical patterns such as cause-effect clauses and the Problem-Solution text pattern that occurred in the two corpora. A comparison of the ways in which the Japanese and American students use these nouns points to several difficulties the Japanese cohort faces in using metadiscursive nouns in argumentative essays: providing a focus in describing information, making an explicit meaning link, and using particular English rhetorical patterns. Suggestions are made for further inquiries which could broaden our understanding of the behavior of this class of nouns and inform the teaching of L2 argumentation essays.

**Keywords:** corpus-assisted discourse analysis, L2 argumentation essays, metadiscursive nouns, rhetorical patterns

## 1. Introduction

A great deal of research has been conducted in order to identify the difficulties English non-native speaking (NNS) students encounter in writing English essays. The present study addresses this question from the perspective of metadiscursive noun usage. Metadiscursive nouns are abstract and unspecific-meaning nouns (e.g., *advantage*, *problem*, *way*), which tend to occur frequently in academic and expository texts. Referred to in various ways (e.g., anaphoric nouns, carrier nouns, shell nouns, signalling nouns), this class of nouns can serve as markers of the discourse by packaging (encapsulating) the referred content and characterizing (evaluating) it with noun labels. In other words, their roles are twofold: textual roles that can form a cohesive and coherent flow of information, and interactional and stance-taking roles that express the writer's stance to the referred content. While some studies (e.g., Charles, 2007; Jiang & Hyland, 2017, 2018) analyze the use of these nouns from both perspectives, many of the studies have discussed the roles of these nouns by mostly focusing on textual functions.

### 1.1 Review of Past Studies

The metadiscursive functions of this class of nouns have been studied extensively in professional writing (PW) (e.g., published articles, news articles, theses), mostly by an automated and pattern-based approach (e.g., J. Flowerdew, 2003; Gray & Cortes, 2011; Cortes, 2013; Flowerdew & Forest, 2015). Concerning the use of these nouns in student essays, the number of studies is considerably less than those focusing on PW. In addition, the research has been conducted on discipline-specific student writing, or non-native argumentative writing in general. The former (e.g., L. Flowerdew, 2003; Caldwell, 2009; Aktas & Cortes, 2008; Nesi & Moreton, 2012; Benitez-Castro, 2021) aims to find features of the use of nouns in specific disciplines, and the latter (Hinkel, 2001, 2003; J. Flowerdew, 2010; Schanding & Pae, 2018; Patch-Tyson, 2000) is mostly to find difficulties that NNS students encounter with the use of these nouns in L2 argumentation writing (refer to Benitez-Castro &

Thompson, 2015). These studies on student essays are also conducted mostly from the perspective of the textual dimension of the noun functions.

A comparison of these studies is not straightforward because of the different research contexts of the inquiries, such as divergent writer variables (e.g., L1, age, proficiency level) and aims and focuses of the studies (e.g., errors, syntactic patterns, deictic elements). Nevertheless, the findings point to some tendencies in the NNS students' writing; such as a limited range of vocabulary, but competence in core items (e.g., L. Flowerdew, 2003; Caldwell, 2009; Patch-Tyson, 2000; J. Flowerdew, 2010). In L. Flowerdew (2003), which examined the use of vocabulary that signals functional segments of the problem-solution pattern text pattern, a limited range of vocabulary was exhibited through the overreliance on vocabulary that is inherently evaluative, accompanied by significantly less use of vocabulary which can be evaluative only in the context where it occurs. In Patch-Tyson (2000), metadiscursive nouns in L2 student writing were often nominalizations of verbs, which resulted in a small range of metadiscursive nouns. Another feature in L2 student writing, which is more relevant for the present study, is vague meanings in the referents. For example, the lexicalized content for this class of nouns was often general information with limited contextual information (Hinkel, 2001; Caldwell, 2009). Also, in Caldwell (2009), cataphoric expansion of noun meaning was often conducted by using nouns whose meanings are vague. Past studies on student writing have often examined the use of metadiscursive nouns from the perspective of overall frequency and their behavior in individual sentences (e.g., lexical bundles, phrasal and clausal complexity), but failed to describe the discourse patterns on a broader scope than the local sentence.

### 1.2 Aims of the Study

The present study attempts to describe features of Japanese student argumentation essays more comprehensively in reference to larger text construction patterns. This study employs a manual discourse analysis of the use of nouns (i.e., *problem, reason, thing, fact, idea, decision*), in order to examine lexicalization patterns and interpret the metadiscursive roles of the nouns in L2 argumentation essays written by L1 Japanese speakers, in comparison with L1 essays by American L1 English students. Although Jiang and Hyland (2017, 2018) use the term metadiscursive noun to investigate the roles of the nouns in the dual perspectives, metadiscursive roles investigated in the present study focus on their textual roles.

The target nouns of the present study are high frequency nouns identified in Tahara (2017) (Note 1). After outlining the present study in reference to Tahara (2017), this paper will highlight some difficulties or weaknesses encountered by the Japanese students in lexicalization, and how these difficulties affect the construction of the argumentation discourse. The paper concludes by considering the pedagogical implications for the teaching of argumentation essays.

## 2. Method

The research questions for the present study are the following: 1. How are the nouns lexicalized in the L2 argumentation essays? 2. How do the lexicalization patterns influence the argumentation text structures? This section explains the methodology employed in order to explore these questions, beginning with a discussion of the theoretical basis of the methodology.

### 2.1 Theoretical Base

Lexical items carry meanings, but they can also 'convey information about the organization of the text where they occur' (Coulthard et al., 2000: 125). This concept is realized in the form of several types of discourse-organizing vocabulary. An example is general nouns (Halliday & Hasan, 1976), which function almost as pronouns referring to more specific nouns. Just as pronouns refer to specific nouns, metadiscursive nouns are pro-text items referring to specific chunks of texts. These nouns encapsulate, or package, whole chunks of texts, and characterize, or evaluate, the encapsulated chunks, so as to help structure, or comment on, the discourse (Coulthard et al., 2000: 127). This class of nouns is called by various names (e.g., *enumerative*, Tados, 1985; *anaphoric noun*, Francis, 1986; *carrier noun*, Ivanič, 1991; *shell noun*, Schmid, 2000; *signalling noun*, J. Flowerdew, 2006; *metadiscursive noun*, Jiang & Hyland, 2017), which emphasize one or two of the elements related to their cohesive functions, such as directions (i.e., anaphoric, cataphoric), referents (i.e., within-, or across-the sentence), or syntactic patterns where the nouns occur.

Another type of lexical item that can convey textual information is Vocabulary 3 (Winter, 1977). Comprised of verbs, adjectives, and nouns, Vocabulary 3 can work similarly to coordinators (e.g., *and, but*) or subordinators (e.g., *although, because*), forming a logical sequence between clauses (e.g., phenomenon-reason, cause-consequence, instrument-achievement) (Winter, 1977; McCarthy, 1991; Coulthard et al., 2000). By extension, these lexical items can be considered to signal a functional component of larger textual structures (e.g.,

Problem-Solution, Argument-Counterargument, General-Specific) (McCarthy, 1991; Hoey, 1994). The present study uses this type of concept concerning Vocabulary 3 to examine a shift in the functional segments of the texts.

### 2.2 L1 and L2 Corpora

The present study analyzes L2 student essays, in comparison with L1 student essays. The choice of L1 student essays as a reference corpus, rather than essays by professional writers, is because student essays are more comparable with each other in terms of task variables and writer variables (Gilquin et al., 2007: 322). The L2 essays in the present study are taken from the Japanese subcorpus of the International Corpus of Learner English (henceforth JICLE) (Granger et al., 2009). The L1 student essays are by American students, and taken from the US subcorpus of the Louvain Corpus of Native English Essays (henceforth US). The size of the corpora in JICLE and US is 202,099 and 150,530 word tokens, respectively, recounted by AntConc (Lawrence, 2012). JICLE is a collection of 366 texts with average text length of 542 words, and US contains 176 essays with average text length of 850 words. Also essay topics are often corpus-specific. Table 1, shown below, is an overview of the JICLE and US corpora:

Table 1. Overview of JICLE and US corpora

Corpus	Word token	No. of texts	Ave. text length	Corpus-specific topics	Common topics in JICLE and US
JICLE	202,099	366	542	maiden name, learning of English, seniority system, future career	death penalty, nuclear energy
US	150,530	176	850	euthanasia, abortion, life prolonging medical practice, religious and racial discrimination	

### 2.3 Host Syntactic Patterns

The present study draws on Schmid's (2000) construct of shell nouns, which emphasize the cohesive functions of the nouns in several host-syntactic patterns: N-be-CL, N:CL, th-N, and th-be-N (N is noun; CL is clause; see examples below in this section).

With regard to N:CL, it is a noun complex where N is lexicalized in the adjacent clause (e.g., *fact + that*-clause), by including, in the present study, a case where the CL is not adjacent to N but within the sentence (e.g., *the **idea** is not correct that the strong countries rule the weak countries*). N:CL also include a pattern, where the CL is placed across the sentence boundary after a period or semi-colon as in Sentence 1, below (any errors in the original texts in JICLE and US are left uncorrected; metadiscursive noun is in bold, and the referent is underlined; in the examples cited in this paper):

1. The real **problem** lies deeper than this. The parents are expressing the conflict that happened before the divorce. (US)

By extension, N whose meaning stretches into more than one clause immediately after the period is also included in N:CL as in Sentence 2:

2. ... we often hear the **problem** about TV. In dinner table, each of members of family is absorbed into TV. They are laughing at talking of guest of TV program. They don't talk with their own family. A child who are looking at TV alone in... (JICLE)

Accordingly, this paper considers two types of N:CL: Appositive N:CL, where the CL is within the same sentence, if not necessarily adjacent to N, and Cross-sentential N:CL, where the CL is across the sentence boundary (e.g., Sentences 1 and 2). Thus, the present study examines the use of the nouns occurring in the following syntactic patterns:

**N-be-CL** (Lexicalization in the complement clause): *The **purpose** is that/to-clause*

**Appositive N:CL** (Lexicalization the adjacent clause): ... ***fact** that-clause*

**Cross-sentential N:CL** (Lexicalization across-the sentence boundary): ... *we hear the **problem** about TV.* [referent]

**th-N** (Lexicalization in the preceding segment): [referent]... *The **advantage** is...*

**th-be-N** (Lexicalization in the preceding segment): [referent]... *It was a good **idea***

To note, ‘th’ in th-N and th-be-N includes a number of elements such as the, this, that, same and such (Schmid, 2000: 23).

#### 2.4 Target Nouns Analyzed

This study examines the use of the following nouns: *problem*, *reason*, *thing*, *fact*, *idea*, and *decision*. They are high-frequency nouns that occurred in Tahara (2017), which analyzed the use of 33 nouns drawn from Ivanič (1991) (Note 2). Some of these nouns occurred with greater frequency in either of the corpora. For example, *reason* (N=64:31) was preferred in JICLE as demonstrated by its occurrences for N-be-CL and th-N. (Figures are normalized to a base figure of per 100,000 words.) *Thing* was also preferred in JICLE occurring in an anaphoric function for th-N and th-be-N. On the other hand, *fact* (N=29:58) and *decision* (N=2:19) occurred significantly more in US, attributable to N:CL, as can be seen in Table 2, below (N:CL is a combined figure for Appositive N:CL and Cross-sentential N:CL):

Table 2. Frequencies of the target nouns in the host syntactic patterns

	<i>reason</i>	<i>problem</i>	<i>thing</i>	<i>fact</i>	<i>decision</i>	<i>idea</i>
N-be-CL	36:22	10:12	19:6	2:3	0:1	1:3
N:CL	4:1	6:6	1:0	15:50	0:7	8:9
th-N	13:5	23:17	17:3	11:4	1:6	8:7
th-be-N	8:3	8:3	10:1	0:1	0:5	0:1
SUM	62:31	48:39	47:11	29:58	2:19	18:19

Note. Figures are normalized

#### 2.5 Procedures

In the present study, nouns are defined as metadiscursive when they occur in the host syntactic patterns, and their variable meanings are supplied by the clause (i.e., *that/to/wh*-clause) or a larger segment. Firstly, nouns functioning as metadiscursive are sorted out of all the tokens of individual nouns, by examining the surrounding text gained with the Text View function of AntConc. At the same time, metadiscursive nouns are categorized by the types of the host syntactic patterns by examining the concordance lines.

How these nouns are functioning as markers of the discourse is interpreted by examining to what extent they are lexicalized, and how the referred segment is related to the neighboring, either preceding or succeeding, segment, through relationships which are exemplified as clause relations and larger text patterns (Winter, 1977; McCarthy, 1991; Hoey, 1994) (see Section 2.1).

### 3. Results

Turning to the analysis of the data, this section examines lexicalization patterns and cohesive roles of the nouns (i.e., *problem*, *reason*, *thing*, *fact*, *decision*, *idea*) in the JICLE and the US corpora. From this section on, frequency ratios of the nouns are interpreted with the log-likelihood (LL) test. Using the 0.05 significance level for rejecting the null hypothesis, the critical value for the log-likelihood ratio test will be 3.84 (Note 3).

#### 3.1 Nouns for N-Be-CL

For N-be-CL, *reason* and *thing* occurred significantly more in JICLE than in US (refer to Table 2). *Reason* occurred at the ratio of 36 to 22, in JICLE and US, respectively, with the log-likelihood (LL) score at 7.65 (hereinafter expressed as N=36:22, LL 7.65), and *thing* occurring at the ratio of 19:6 (LL 11.72).

The higher frequency of *reason* in JICLE than in US is accounted for by the use of ordinal adjectives (e.g., *first*, *second*, *third*). The text span between reasons is short, and the meaning in the CL is little expanded in the following discourse. In US, *reason* is often modified by restrictive adjectives (e.g., *one*, *another*, *some*), which seem to allow a focus on a specific aspect, and the text span between *reasons* is made longer by explaining the meaning of the noun in the CL in more detail. Accordingly, in JICLE, the discourse seems to suggest a preferred text construction type that is heavily reliant on explicit topic shifting devices, while in US, the discourse seems formed, more based on meaning description in the text.

Regarding *thing*, significantly more occurrences in JICLE than in US (N=19:6, LL 11.72) is accounted for by its use in the sentence, *The most important is that*-clause, which can conclude the discourse by expressing

generalized, uncontested comments in the CL, without drawing from the preceding argument, as shown below, in Example 1 (underlined is the lexicalized content of *thing*):

Example 1.

Finally, in the future, for we flourish not only in Japan, but also in foreign country, Japanese students need to master English as a second language. It is never easy, but someday our efforts will be paid off. The most important **thing** is enjoy to learn English. I think it is good for Japanese to use English as a second language. I want to let foreigners know about Japan. <text end> (JICLE)

The paragraphs preceding *thing* (only the last paragraph of which is shown in the excerpt) express several advantages for Japanese students to study English, but the content is summarized as *The most important thing is enjoy to learn English* by expressing a generalized statement in the CL. With little meaning connections, the sentence terminates the discourse abruptly. This type of generalized conclusion in JICLE seems similar to the way Japanese editorials and expository texts are concluded (Ushie et al., 1997: 146), suggesting a possible L1 transfer.

### 3.2 Nouns for Appositive N: CL

The present study shows a stronger preference for Appositive N:CL in US than in JICLE, as suggested in frequency ratios of the nouns (see Table 2). Considering Appositive N:CL is a device that can subtly manipulate the discourse by presenting *new* information as if *given* in the CL, higher frequencies of the nouns, in general, for this syntactic pattern in US may suggest that the US students prefer constructing the discourse by using discourse-manipulating strategies. This tendency may be seen clearly with *fact* (N=15:50, LL 35.10), as it is a general-purpose shelling device which expresses what the writer knows or believes is true as if it were a truth (Schmid, 2000: 242).

The use of *decision* (N=0:7, LL 17.03) also illustrates a US preference for discourse maneuvering in writing argumentation, occurring significantly more in US than in JICLE. To note as a caution, however, *decision* is used with different meanings in each of the corpora, and the variance in usage may have affected frequencies: *Decision* in US occurs as a Mental noun, portraying a psychological state of ‘deliberating... a future course of action’ (Schmid, 2000: 213) for such topics as abortion and life-prolonging medical practices, with the meaning expressed in the *to*-clause (e.g., *the decision to have an abortion or not...*). *Decision* in JICLE expresses what is decided and is not a Mental noun; in addition, its meaning is in the adjacent *that*-clause (e.g., *The recent decision that the university makes its evaluation of pupils more rigorously...*).

Another high frequency noun for Appositive N:CL is *idea* (N=8:9, LL 0.01), which occurs with similar frequencies in the two corpora. However, the similarity seems only in appearance because of the information status in the adjacent *that*-clause. In US, *idea* presents new information as if *given* in the CL, and functions as a discourse manipulating device, as seen in Example 2, below:

Example 2.

I honestly ran out of my room after I read the above quote to ask my fellow neighbors if they too thought tobacco was the most destructive drug in the United States. We came up with the **idea** that it was not the most destructive, and the most destructive was most likely alcohol... (US)

In JICLE, half of all the occurrences of *idea* for Appositive N:CL are in *given* status, which is found very rarely in English texts (Schmid, 2000: 330). What accounts for *given* status in JICLE was a near repetition of an earlier statement in the N:CL, where *idea* is not clearly functioning to as a discourse maneuvering device, as can be seen in Examples 3 and 4 (earlier statement is underlined with a wavy line):

Example 3.

I am basically against the death penalty because I think that a man has not the right to judge other persons. If the right to judge criminals exist, only the victims has it. Only the victims know ache that criminals gave them, but not judges in court. I just disagree the **idea** that other human beings have power to judge life or death of criminals, human beings.... (JICLE)

Example 4.

I don't like the idea that we human have to treat animals kindly. It is because the idea bases on that human are different from animals and that we have a higher position than the other animals. It is not only about animals but also every creature. I think we should not forget human is a kind of animal. The **idea** we should treat the earth kindly have spread these days.... (JICLE)

In brief, the use of the three nouns, *fact*, *reason*, and *idea* for Appositive N:CL seems to indicate the US students' preference for the use of a subtle discourse-maneuvering, while this preference is less evident among the JICLE students.

### 3.3 Nouns for Cross-Sentential N: CL

For Cross-sentential N:CL, *problem* (N=6:6, LL 0.13) and *reason* (N=4:1, LL 3.47) were high frequency nouns. The use of these nouns seems similar in frequency ratios, however, the lexicalization patterns are different. In US, the meaning is expressed in a short segment, immediately after the period. Having a clearly perceivable meaning link between the noun and the meaning, the noun seems to serve as a clear springboard in the discourse as in Examples 5 (*problem*) and 6 (*reason*):

Example 5.

... there is a **problem** that must be fixed. An abundant amount of families are on the brink of being without a home. Some are only one pay check away from being homeless. The cause of homelessness involves a combination of factors (US)

Example 6.

In addition to this is one main **reason** why pot should be legalized - Not a single death has ever been credibly attributed directly to smoking or consuming marijuana in the 5,000 years of the plant's recorded use <R>. This is simply amazing considering... (US)

Another difference in JICLE and US can be seen in the use of post-modifiers. In US, *problem* and *reason* in Examples 5 and 6 are post-modified: *problem* is post-modified by the phrases *that must be fixed*, and *reason* by *why pot should be legalized*. Such modifiers in US seem to provide a focus on a topic to be argued in the following discourse.

In JICLE metadiscursive nouns are rarely post-modified. Also, cataphoric lexicalization tends to be in a longer segment, almost always in two stages: Firstly, an initial short comment states 'what N is about' (e.g., It's about pets), and this is followed by longer explanation of the initial comment, as shown below (Example 7 shows *problem* and Example 8 *reason*):

Example 7

There is one **problem**. It's about pets; they are sometimes called companion animals, too. A lot of human keep animals as their family and friend. Some masters and pets may be surely happy. But it's not ordinary. Some masters' devotion to their pets verge on abnormality, and some masters use violence. It's terrible... (JICLE)

Example 8.

... there is another **reason**. It is about the attachments for their lands. If people lose their lands, people are compelled to change their lives and to look for another domicile. When people move away from their residence to another place, people will lose intimate human relationship and people may feel anxieties and sadness. It is occurred mere move, but when people are taken their lands away, people will feel the stronger anxieties and angers. To avoid colliding the governments and the people, ... (JICLE)

The initial comment is too short to explain the meaning of the noun, and the following explanation is long and a direct link between the noun and its meaning is difficult to perceive. Accordingly, *problem* and *reason* in Examples 7 and 8, respectively, may not serve as clear a springboard to shift the discourse to a new focus. Instead, discourse shifting functions of the nouns seem to be more in existential-*there* where the nouns occur. Existential-*there* can explicitly shift topics by asserting the existence of some entity, marking an isolated topic shift, or marking enumeration (Hackin & Pesante, 1988; Ivanič, 1991; Jiang & Hyland, 2020). The data in this study reveal a greater preference for this syntactic pattern, particularly with *reason*, in JICLE than in US. The Japanese students may use the existential-*there* to compensate for a weak signposting role of the noun.

To summarize, the nouns in cataphoric functions in US function as explicit discourse shifting devices, by forming a clear meaning link to the relatively short referent. In JICLE, the topic shifting roles of the nouns are less clear, and it may be more readily facilitated by using the nouns in existential-*there*.

### 3.4 Nouns for th-N

The th-N syntactic pattern tended to be more preferred in JICLE than in US with the nouns in the present study (see Table 2). The examination of high frequency nouns (e.g., *reason*, *problem*, *thing*) shows insufficient and vague lexicalization in JICLE, a finding which supports many of the past studies (e.g., Hinkel, 2001; Caldwell,

2009) conducted on the use of this class of nouns in texts by students of varying L1s. This section will show causes of insufficient lexicalization in JICLE exhibited in multiple-aspect lexicalization, and the use of *the same thing*.

Firstly, in the case of multiple-aspect lexicalization, it occurred with each of the aspects of the noun meaning not explained in detail, as can be seen in Example 9, below:

Example 9.

The Treaty of Waitangi in 1840 was based on the principle of equality for both European and the Maori, But English version of the Treaty talked about landownership. A **difference** of opinions was born. **Inequality** and **misunderstanding** quickly developed. War broke out, and consequently the Maori were punished. In addition to the highhanded attitude of settlers, the **problem** consists in lack of correct information, ... (JICLE)

The meaning of (*the*) *problem* is expressed by several problem-related terms (e.g. *difference*, *inequality*, *misunderstanding*), but each of the concepts is used without explaining it in detail. Accordingly, the discourse seems to take a sudden turn at (*the*) *problem*, producing an unnatural development of the discourse.

In the US corpus, lexicalized information is more sufficient and also consistently focused on a single topic, as in Example 10, shown below (/ indicates a paragraph shift):

Example 10.

The media plays a large part in the altering of a real woman's appearance. Society and media shouldn't persuade us as to what true beauty is. From the beginning of adolescence, girls are faced with **implications** from the news, television, and magazines to have the perfect body, skin, and hair. Because of the **standards** that society place on women, teenagers, and young girls, there are many **disorders** which alter these females' state of mind, health, and body. Disorders so severe that there is such a strong **dissatisfaction** with one's appearance that they interfere with living healthy.//Of course this **problem** is not the model's fault, they are doing their job of being beautiful. (US)

The meaning of (*this*) *problem* is the way the media covers women's beauty, affecting their body and minds, and it is elaborated by tying together the main points on a theme. Also, by using post-modifiers of different types (e.g., relative pronouns that modify *standard* and *disorders*, *with*-phrase that modifies *dissatisfaction*), the meaning of *problem* is elaborated while maintaining a focus on the topic. Discourse shifting at *problem* seems not to be as abrupt as it is in JICLE, but more implicit.

*Thing* (N=17:3, LL 17.34) is used with vague lexicalization in JICLE in the form of *the same thing*, as in Example 11:

Example 11.

Also it is because at Nikkou apes accessed to and attacked man that man gave apes foods and apes learned that man had delicious food. Possibly the case of Koro was also **the same thing**. If I kept Koro with my selfish convenience that a child dog was dear, koro did not need to be taken to a health center... (JICLE)

The antecedent of *thing* is a situation in which apes attacked people, and the following segment is another situation in which a dog was abandoned. *The same thing* can connect the two situations without explaining how they are the same by means of words. This may be an influence of the high-context culture of Japan (Hall, 1976). This *thing*-phrase did not occur in US.

This section illustrated a lack of detailed information in the referents of the nouns in JICLE. However, in seemingly contradictory cases nouns work more effectively by retrieving a short piece of information, rather than more elaborated information.

### 3.5 Nouns for th-be-N

*Reason* (N=8:3, LL 4.61), *problem* (N=8:3, LL 4.61) and *thing* (N=10:1, LL 12.27) were high frequency nouns for th-be-N. Compared with th-N, the referents of these nouns for th-be-N are often shorter in both corpora; however, each of the nouns exhibits noun-specific lexicalization patterns.

*Reason* and *problem* in anaphoric functions demonstrate their roles to form English rhetorical patterns in both corpora, as discussed later in Section 4. With regard to *thing* for th-be-N, it is mostly a JICLE-only pattern (N=10:1, LL 12.27), and it occurs in the form of 'adjective + *thing*', as shown below:

Example 12.

They should make the murderers pay the expense by making them suffer for their horrible acts and doing something good for the society. The murderers should have to live with the guilty feeling of taking another person's life away. It is a more **proper thing** to do.//Third..., (JICLE)

The referent is short and insufficient information, and the adjective *proper*, which expresses the writer's evaluation to the referent, functions to terminate the discourse. The termination is sudden, and the discourse is shifted to a new focus. The use of 'adjective + *thing*' is similarly identified for N-be-CL in JICLE, which almost always occurred as *The most important thing is that...* to conclude the discourse. These examples indicate a significant preference for *thing* and also evaluative adjectives. The use of *thing* may reflect a lack of vocabulary, and evaluative adjectives a preferred style of Japanese essays, where a skillful use of modifiers is valued to impress and emotionally move readers (Shinmura, 1998, in Kimura & Kondo, 2004).

This section has examined lexicalization patterns and how the nouns serve as markers of the discourse in each of the corpora. In the next section, the roles of the nouns *reason* and *problem* are discussed in relation to major English rhetorical patterns in the next section.

#### 4. Discussion – Nouns for Rhetorical Patterns

*Reason* and *problem* seem to contribute to causal relations and the Problem-Solution pattern in the essays, but in different ways in JICLE and US.

##### 4.1 Reason for Cause-Effect Patterns

*Reason* is a causative noun that can express causal relations that involve cause/reason and effect/result elements (Xuelan & Kennedy, 1992). In anaphoric functions, either for th-N or th-be-N, *reason* occurred significantly more in JICLE than in US at the ratio of 13:5 (LL 6.05) and 8:3 (LL 4.61), respectively.

In US the referent (cause/reason segment) (underlined) is short, and there is an immediate meaning tie between *reason* and the referent. Then (*the*) *reason* explicitly directs the cause/reason to the following segment, which is an effect/result segment. In the following excerpts drawn from the US corpus, Example 13 illustrates its use for th-N, and Example 14 for th-be-N:

Example 13.

No one can tell if euthanasia will cause the same problems as abortion did. But because euthanasia involves the same ethical questions as abortion, similar problems may arise. For that very **reason**, the law on euthanasia should be modified to restrict its practice, ... (US)

Example 14.

... Actually, the flag was set up the day after the civil rights movement started. This clearly shows that the battle flag stands for nothing more than hatred. This is probably the single largest **reason** why the battle flag should be brought down. (US)

In JICLE, (*the*) *reason* often refers to a long segment and clear causal relations are hard to perceive, as can be seen in Examples 15 and 16 for th-N and th-be-N, respectively.

Example 15.

//America is important for Japan. We conclude the Japan-U.S Security Treaty, the Japan-U.S. Administration Agreement and so on. And we have the Japan-U.S. Joint Committee, the Japan-U.S. framework Talks on bilateral trade and so on. America is the central country all of the world. It shows America have the United Nations Headquarters. America is the biggest a great economic power. It shows American gross national product is the highest in the world. Like this America is the greatest country, and English spoken by American is worth to studying. Like this I explain about foreign language, American and English until now, it is important for us who carry next generation on our shoulder to study English. Like this **reason** Japanese students certainly need to master English as a second language. <text end> (JICLE)

Example 16.

//Concerning Japanese ability, we often hear that young people nowadays cannot utilize it as correctly as they are supposed to. This means what students knowledge on the Japanese language itself. Who could command English without correct knowledge and well-trained ability of their mother tongue? This is another **reason** I suggest the importance of the education of the Japanese language. (JICLE)



Thus, *reason* in anaphoric functions in JICLE often fails to function as a clear causative noun. In US, it occurred significantly less, but is almost always used for explicit causal relations.

#### 4.2 Problem for the Problem-Solution Pattern

*Problem* in anaphoric functions, either for th-N or th-be-N, shifts the discourse from the Problem to a Response segment in the Problem-Solution pattern, but in a different way in JICLE and US. Firstly, *problem* in relation to th-N is examined, followed by a discussion of its use in the th-be-N pattern.

##### 4.2.1 Problem for th-N

For th-N, the referent of *problem* – which stretches into several sentences in both corpora – often forms the Problem segment in the Problem-Solution pattern, with (*the*) *problem* functioning to shift the discourse from Problem to a Response. Although frequencies are similar in the two corpora (N=23:17, LL 1.53), the Problem-Solution pattern is expressed differently; that is, *problem* in the US corpus mostly occurs in a sequence similar to the typical sequence: Situation – {Problem – Response} – Evaluation ({} means a repetition) (Hoey, 1994). This is shown below in Example 17:

##### Example 17.

<text initial> A basic right of a human being living in a democratic society is that they are entitled to life. Food and shelter are fundamental needs a person must have in order to survive. A percentage of the population of the citizens of America **lack** these necessities. **Homelessness** has become an intense problem in the United States that must be solved. There is an **agreement** between all opposing viewpoints in government that something must be done that (sic) to **combat** homelessness. The necessary **method** to be used to understand homelessness is under careful **scrutiny**. Advocates for people without homes tend to get so wrapped up in the size of the homeless population that they **ignore** the fact that it is not right that this **discrepancy** exists. What is true is that in the United States it is continually growing, and **action** must be **taken** immediately to **alleviate** the **problem**// (US)

The segment preceding (*the*) *problem* seems to have a sequence of: Problem (signalled by *lack*, *homelessness*) – Response (by *agreement*, *combat*, *method*) – Problem (by *discrepancy*, *ignore*). Then (*the*) *problem* shifts the discourse to a Response (signaled by *action*, *taken*, *alleviate*).

In JICLE, a Problem-Solution can be perceived, but it often has a distinct pattern, featuring a very insufficient explanation of the problem in question, followed by explicit opinions of the writer as shown below (Opinion is italicized):

##### Example 18.

It is seen from the train and it is pressed by the trains' trails and the will be soon broken. The people who lives there seem not to give up the house and the land, but the habitant must pass the land and house to build trails. I think *this is one of **compulsion** and the habitant can't help leaving their land. I think that the train company thinks only their profit and **neglects** people's will.* // Whenever the **problem** happens between people and official organization, people will lose. I think... (JICLE)

The referent of (*the*) *problem* is separated from the noun. The referent, or the Problem segment, is short and provides little information, and followed by strong and explicit evaluative words (e.g., *compulsion*, *neglects*) expressing the writer's opinion. This paper considers this sequence as [(vague) Problem – (emphatic) Opinion] pattern, rather than Problem – Solution.

Sometimes, the Opinion segment in JICLE functions to terminate the poorly organized, inconsistent discourse, as in the following example:

##### Example 19.

... Minority who have unique culture seem to be **hated**. So, some Maoris make like a **slum**. Their kmliving is not good. The government tries to return the land of Maori. But some people don't **agree**. If they are told that their land is the Maori's in fact, they cannot **recognize** it. It is sure that New Zealand pertisipates in the United Kingdom and a constitutional monarch Queen Elizabeth II is the head of state. But in New Zealand, there are European and the Maori who try to keep their culture and try to adapt the society.// *Governments should not neglect the Maori people and European either. Trade of land should be decided between the Maori and European, the person concerned. Government don't have rights to take land away from the people without permission.* Could the **problem** of land happen in Japan? (JICLE)

The referent of *(the) problem*, the Problem segment (signalled by *hated, slum*), is followed by a segment whose meaning and function is not clear. Then, the following Opinion segment functions to terminate the discourse, before *(the) problem* shifts the discourse to a new topic.

#### 4.2.2 Problem for th-be-N

For th-b-N (e.g., *This is a problem*), the referent that forms the Problem segment tends to be short in both corpora. In JICLE, the Problem is immediately followed by a Response in the Problem-Solution, as shown below:

Example 20.

<text initial> In Japanese class, teachers take too much time to teach English grammar. I think that it is too enough. However, students aim an entrance examination of Japanese university. It is a big **problem**. In order to **increase** the number of children who can speak English well, the government has to change... (JICLE)

Although the referred content of *(the) problem* may not be clearly perceivable as a problem without knowing the relationship between grammar teaching and entrance examinations in Japanese English classes, *(the) problem* is used to shift the discourse to a Response (signalled by *increase*).

In contrast, in US *(the) problem* is almost always followed by a Reason segment as shown below in Example 21:

Example 21.

... If a student has the desire to pray at any moment during the school day he or she should not encounter any deterrent. Only when students (or faculty) force any students to join in the prayer does it become a **problem**. The act of trying to force an unwilling person to digest the religious philosophy of another may lead to an uncomfortable educational setting that would hinder learning and social growth. Prayer in public schools may **continue** to **gain** more popularity in the United States. (US)

The Problem segment is *students... force any students to join in the prayer*, and the following segment is a Reason segment, explaining why the referent is a problem (*The act of trying to force...*). There is a causal relation between the Problem and the Reason segments.

To note, although *(the) problem* in US forms a causal relation, it still serves to form the Problem-Solution, with the Reason followed by a Response segment. In other words, the Reason segment is embedded in the Problem-Response as in: Problem – Reason – Response. In Example 21, above, the Response that follows the Reason is *Prayer in public schools may continue to gain more popularity...* (signalled by *continue, gain*). The Problem – Reason – Response sequence in US can also be clear in Example 22:

Example 22:

However, most of the traditional household roles formerly performed by women exclusively (but now handled by people of both sexes) have never been compensated by the dollar. This poses a **problem**, since undoubtedly those at-home tasks contribute services to society equally valuable in comparison to marketplace "jobs". Therefore, **in order** for society to fully **acknowledge** the value of both types of jobs... (US)

The Problem (signaled by *never compensated*) is followed by a reason why the referent is a problem (signaled by *since*), and then by a Response (signalled by *in order to, acknowledge*).

## 5. Pedagogical Implications

This paper has examined the lexicalization of the nouns and discussed their roles as metadiscursive devices in the argumentation essays, emphasizing differences between JICLE and US. This section summarizes the findings by pointing to three principal implications for classroom teaching which are: a) providing sufficient information, b) forming an explicit meaning link, and c) using English rhetorical patterns.

### 5.1 Providing Sufficient Information

A feature in the JICLE essays is vague lexicalization of the nouns. This conclusion supports similar findings in previous studies on NNS essays (e.g., Hinkel, 2001; Caldwell, 2009). In JICLE, some vague lexicalization patterns were as follows:

- Multiple-aspect lexicalization: With each of the aspects not explained or connected with each other in a consistent way, nouns in anaphoric functions appear to mark the discourse overly explicitly (Section 3.4).

- High frequency of *thing* with some types of modifiers: One manifestation was *the same thing* (Section 3.4), and another manifestation was ‘evaluative adjective + *thing*’, as in *It is a proper thing* (Section 3.5). *Thing* was also modified by *the most important*, as in *The most important thing is that...*, which served to conclude the discourse without connecting the point being made in the preceding segment (Section 3.1).

It is a broad claim of this paper that there is consistency in the JICLE preference for overly explicit text-structuring strategies, while lexicalization of the nouns not sufficiently developed. In cataphoric functions, the JICLE students often used ordinal adjectives that pre-modify nouns (e.g., *first/second/third reason is that...*) and served as explicit discourse markers (Section 3.1).

Conversely, there are strategies that the JICLE students used much less than the US students. These strategies are subtle discourse-maneuvering devices, such as:

- restrictive adjectives (e.g., *one, another*) which allow the writer to describe information on a focused aspect; the Appositive N:CL syntactic pattern, which can subtly direct the discourse in the way the writer intends; and
- post-modifying phrases (e.g., relative pronouns, prepositional phrases), which help the students to elaborate the information on a focused topic (Examples 5, 6, 10).

A lack of the use of these devices may have hindered them from logically elaborating the meanings of the nouns. Japanese students may have knowledge about how to use these grammatical devices, but not be able to use them in a textual context. This suggests a need to teach these devices by providing a textual context.

### 5.2 Explicit Meaning Link

It may seem contradictory to the need for detailed information in the referents of the nouns, but in one way, metadiscursive nouns work effectively by forming a clear meaning link to a short and concise piece of information expressed in the referent. In cataphoric use of the nouns, the JICLE students lexicalized the nouns in a longer segment that lacked precise information, in which case the nouns tended not to make an explicit link to the referent. The Japanese students may have relied more on the use of the nouns in existential-*there* (Section 3.3). As regards the anaphoric use of the nouns, *reason* (e.g., *for this reason, this is a reason*) referred to a short segment and formed explicit causal relations in the discourse in US, but not in JICLE (Section 4.1).

The JICLE students will need to be taught how to form a clear meaning link to a short and concise piece of information in the referent. Whether or not this type of lexicalization is applicable to other nouns than *reason* and *problem* is yet to be determined through future study.

### 5.3 English Rhetorical Patterns

The JICLE students did not use *reason* and *problem* to express explicit causal relations in their essays. For argumentation, causal relations are considered important to convince the reader, and should be explicitly taught in relation to argumentation essays.

Japanese students also seem to lack knowledge of the Problem-Solution pattern in English essays. Although they used the pattern intuitively, the pattern was often shaped irregularly, as can be inferred from the [(vague) Problem – (emphatic) Opinion] pattern in JICLE (Section 4.2.1). English has some distinct text patterns. NS students appear to have acquired them, growing up in English-speaking society, but NNS students may not have. This seems to suggest it is advantageous for NNS students to be explicitly taught major rhetorical patterns in L2 essay writing.

## 6. Limitations and Further Study

This paper examined argumentation essays written by Japanese students, in comparison with L1 essays by American students from perspective of the use of metadiscursive nouns. Although the study has made explicit several difficulties Japanese students face when using these nouns as discourse-markers as the L1 students do, it is a qualitative analysis with a small number of nouns using relatively small corpora. Further study should be conducted on a larger number of nouns with larger corpora, to confirm, refine, or negate the results, possibly facilitating a wider generalization of the findings. Also, while the present study is conducted based on the belief that L2 writing should approximate L1 writing style, there seems to be no established norms regarding the extent to which features in L2 essays can be evaluated as a legitimate L2 style of English. This is a direction worth exploring in L2 argumentation essays.

## 7. Conclusion

This paper has provided evidence of the difficulties L2 students can encounter in their attempts to use metadiscursive nouns in argumentation essays. Use of these nouns to their full potential would help the students to carry forward their argument, write succinct texts providing justification of arguments, and use English rhetorical patterns more effectively. Although this class of nouns is an important resource for writers, the data in this study would suggest that greater attention needs to be paid to teaching students how to use them in argumentation essays. Not only is further research on the behaviour of this class of nouns required, but modifications, which reflect the findings, should be made to classroom pedagogy. This research and its application has the potential to help L2 writers, advanced-level ones in particular, develop skills enabling them to write English argumentation that is internationally acceptable in quality.

## Acknowledgement

This work was supported by JSPS KAKENHI Grant Number 21K13001.

## References

- Aktas, R. N., & Cortes, V. (2008). Shell nouns as cohesive devices in published and ESL student writing. *Journal of English for Academic Purposes*, 7(1), 3-14. <https://doi.org/10.1016/j.jeap.2008.02.002>
- Benitez-Castro, M. A., & Thompson, P. (2015). Shell-nounhood in academic discourse: A critical state-of-the-art review. *International Journal of Corpus Linguistics*, 20(3), 378-404. <https://doi.org/10.1075/ijcl.20.3.05ben>
- Benitez-Castro, M. A. (2021). Shell-noun use in disciplinary student writing: A multifaceted analysis of problem and way in third-year undergraduate writing across three disciplines. *English for Specific Purposes*, 61, 132-149. <https://doi.org/10.1016/j.esp.2020.10.004>
- Caldwell, C. (2009). *Lexical Vagueness in Student Writing: Are Shell Nouns the Problem?* VDM Verlag Dr. Muller.
- Charles, M. (2007). Argument of evidence? Disciplinary variation in the use of the noun that pattern in stance construction. *English for Specific Purposes*, 26(2), 203-218. <https://doi.org/10.1016/j.esp.2006.08.004>
- Cortes, V. (2013). The purpose of this study is to: Connecting lexical bundles and moves in research article introductions. *Journal of English for Academic Purposes*, 12(1), 33-43. <https://doi.org/10.1016/j.jeap.2012.11.002>
- Coulthard, M., Moon, R., Johnson, A., Caldas-Coulthard, C., & Holland, B. (2000). *Written Discourse*. Department of English Centre for English Language Studies, University of Birmingham.
- Flowerdew, J., & Forest, R. W. (2015). *Signalling Nouns in English: A Corpus-based Discourse Approach*. Cambridge, UK: Cambridge University Press. <https://doi.org/10.1017/CBO9781139135405>
- Flowerdew, J. (2006). Use of signalling nouns in a learner corpus. *International Journal of Corpus Linguistics*, 11(3), 345-362. <https://doi.org/10.1075/ijcl.11.3.07flo>
- Flowerdew, J. (2010). Use of signalling nouns across L1 and L2 writer corpora. *International Journal of Corpus Linguistics*, 15(1), 36-55. <https://doi.org/10.1075/ijcl.15.1.02flo>
- Flowerdew, L. (2003). A combined corpus and systemic-functional analysis of the problem-solution pattern in a student and professional corpus of technical writing. *TESOL Quarterly*, 37(3), 489-511. <https://doi.org/10.2307/3588401>
- Francis, G. (1986). *Anaphoric Nouns: Discourse Analysis Monographs, 11*. Birmingham: English Language Research, University of Birmingham.
- Gilquin, G., Granger, S., & Paquot, M. (2007). Learner corpora: The link in EAP pedagogy. *Journal of English for Academic Purposes*, 6(4), 319-335. <https://doi.org/10.1016/j.jeap.2007.09.007>
- Granger, S., Dagneaux, E., Meunier, F., & Paquot, M. (2009). *International Corpus of Learner English (Version 2)*. Louvain-la-Neuve: Presses Universitaires de Louvain.
- Gray, B., & Cortes, V. (2011). Perception vs. evidence: An analysis of this and these in academic prose. *English for Specific Purposes*, 31(1), 31-43. <https://doi.org/10.1016/j.esp.2010.06.004>
- Hall, E. (1976). *Beyond Culture*. New York: Anchor Press.
- Halliday, M. A. K., & Hasan, R. (1976). *Cohesion in English*. Harlow, Essex: Longman.
- Hinkel, E. (2001). Matters of cohesion in L2 academic texts. *Applied Language Learning*, 12(2), 111-132.

- Hinkel, E. (2003). Simplicity without elegance: Features of sentences in L1 and L2 academic texts. *TESOL Quarterly*, 37(2), 275-301. <https://doi.org/10.2307/3588505>
- Hoey, M. (1994). Signalling in discourse: A functional analysis of common discourse pattern in written and spoken English. In M. Coulthard (Ed.), *Advances in Written Text Analysis* (pp. 26-45). London: Routledge.
- Huckin, T. N., & Pesante, L. H. (1988). Existential there. *Written Communication*, 5(3), 368-391. <https://doi.org/10.1177/0741088388005003006>
- Ivanič, R. (1991). Nouns in search of a context: A study of nouns with both open- and closed-system characteristics. *International Review of Applied Linguistics in Language Teaching*, 29(2), 93-114. <https://doi.org/10.1515/iral.1991.29.2.93>
- Jiang, F., & Hyland, K. (2017). Metadiscursive nouns: Interaction and cohesion in abstract moves. *English for Specific Purposes*, 46, 1-14. <https://doi.org/10.1016/j.esp.2016.11.001>
- Jiang, F., & Hyland, K. (2018). Nouns and academic interactions: A neglected feature of metadiscourse. *Applied Linguistics*, 39(4), 508-531. <https://doi.org/10.1093/applin/amw023>
- Jiang, F., & Hyland, K. (2020). "There are significant differences...": The secret life of existential there in academic writing. *Lingua*, 233, 1-17. <https://doi.org/10.1016/j.lingua.2019.102758>
- Kimura, K., & Kondo, M. (2004). Effective writing instruction: From Japanese danraku to English paragraphs. *Proceedings of the 3rd Annual JALT Pan-SIG Conference*, 8-13. May 22-23, 2004. Tokyo, Japan: Tokyo Keizai University.
- Laurence, A. (2012). *AntConc, version 3.2.4w*. [Computer Software]. Tokyo, Japan: Waseda University. Retrieved from <https://www.laurenceanthony.net/software>
- McCarthy, M. (1991). *Discourse Analysis for Language Teachers*. Cambridge: Cambridge University Press.
- Moreno, A. I. (2004). Retrospective labelling in premise-conclusion metatext: An English Spanish contrastive study of research articles on business and economics. *Journal of English for Academic Purposes*, 3(4), 321-339. <https://doi.org/10.1016/j.jeap.2004.07.005>
- Nesi, H., & Moreton, E. (2012). EFL/ESL writers and the use of shell nouns. In Tang, R. (Ed.), *Academic Writing in a Second or Foreign Language: Issues and Challenges facing ESL/EFL Academic Writers in Higher Education Context* (pp. 126-145). London: Continuum.
- Patch-Tyson, S. (2000). Demonstrative expressions in argumentative discourse: A computer corpus-based comparison of non-native and native English. In S. Botley & T. McEnery (Eds.), *Corpus-based and computational Approaches to Discourse Anaphora* (pp. 43-64). Amsterdam, Netherlands: John Benjamins. <https://doi.org/10.1075/scl.3.02pet>
- Schanding, B., & Pae, H. K. (2018). Shell noun use in English argumentative essays by native speakers of Japanese, Turkish, and English – Frequency and rate of noun-pattern attraction. *International Journal of Learner Corpus Research*, 4(1), 54-81. <https://doi.org/10.1075/ijlcr.16014.sch>
- Schmid, H. (2000). *English Abstract Nouns as Conceptual Shells: From Corpus to Cognition*. Berlin: Mouton de Gruyter. <https://doi.org/10.1515/9783110808704>
- Shinmura, I. (Ed.). (1998). *Koojien* (5th ed.). Tokyo: Iwanami Shoten.
- Tadros, A. (1994). Predictive categories in expository text. In M. Coulthard (Ed.), *Advances in Written Text Analysis* (pp. 66-82). London: Routledge.
- Tahara, N. (2017). *The Use of Nouns in Japanese and American Student Writing*. Retrieved from <https://theses.bham.ac.uk/7201>
- Ushie, Y., Nagatomo, D. H., Schaefer, E., & Nishio, M. (1997). The usage of generalization in EFL writing of Japanese university students. *Ochanomizu University Studies in Arts and Culture*, 50, 139-153.
- Winter, E. (1977). A clause-relational approach to English texts: A study of some predictive lexical items in written discourse. *Instructional Science*, 6(1), 1-92. <https://doi.org/10.1007/BF00125597>
- Xuelan, F., & Kennedy, G. (1992). Expressing causation in written English. *RELC Journal*, 23(1), 62-80. <https://doi.org/10.1177/003368829202300105>

## Notes

Note 1. Tahara (2017) uses the term shell nouns to refer to metadiscursive nouns, the term used in the present study.

Note 2. The 33 items are as follows (in alphabetical order): *advantage, aim, aspect, benefit, cause, comment, criticism, decision, difference, difficulty, effect, element, example, explanation, fact, factor, feature, function, idea, intention, interpretation, issue, justification, opinion, principle, problem, purpose, question, reason, result, solution, thing, view*.

Note 3. The log-likelihood score is measured by using the log-likelihood calculator developed by the University Centre for Computer Corpus Research on Language (UCREL), in which the asymptotic distribution for the log-likelihood  $G^2$  is the Chi-squared distribution with one degree of freedom. See <https://ucrel.lancs.ac.uk/llwizard.html>

## Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).