CHAPTER IV

DEFINING THE VERBS FOR "UNDERSTANDING AND INTERPRETATION" OF JAPANESE SAKE

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In this chapter, the author attempts to define the verbs in the description of Japanese sake taste by employing: 1) a usage-based approach, 2) "encyclopedic semantics" rather than a "dictionary view," and 3) sense-making theory (Fukaya & Tanaka, 1996; Tanaka & Fukaya 1998), drawing on data from a "sake tasting description corpus" (approximately 120,000 words). The chapter selects 8 verbs of high frequency (e.g., hirogaru 'spread') and defines their sense(s) in a bottom-up and abductive fashion, based on a score indicating the strength of co-occurrence between terms. In this study, we deal with the verbs for "Understanding" or "Interpretation" (Verstehen, (Dilthey, 1900)); it means, verbs that contribute to narrating the personal, individual story (contents) of the tasters. This study suggests the verbs for understanding have senses related to [Timeline] and [Space]. On the other hand, verbs do not tend to collocate with [Movement] and interestingly, the [Structure], as same as the tendency of adjectival-nouns.

INTRODUCTION

In this study, the author attempts to give encyclopaedic definitions to the verbs in a Sake corpus based on Sake tasting related terminology. This study is in a series of Sake terminology studies. In the previous study (Fukushima 2020b), the author tried to give encycropaedic definitions to adjectives and adjectival-nouns. In this terminology series, the author emphasizes the importance of predicates (verbs, adjectives, and adjectival nouns). They are the starting point of our cognition of taste or flavor as an "event".

As is often the case with wine sommeliers, the expression or description in Sake tasting tends to be regarded as a reductional 'flavor-finding' process. However, in this study series, the author respect Sake tasting expressions as the fruits of the dynamic event construction and sense-making process.

There are some Japanese linguistic studies on Sake taste terms (e.g., (Matsuura, 1992; Otsuka, Suwa, & Yamaguchi, 2015; Utsunomiya, Isogai, Iwata, & Nakano, 2006), but the investigation is in its infancy, largely because of the historical context of the Sake brewing industry.

As the flavors of Sake have expanded, more expressions have been required. However, the study of the development of verbal expressions for Sake has been neglected. Technical terms for brewing and descriptive terms used to indicate some of the off-flavors of a *Sake* are emphasized, leaving terms to describe appealing flavors unstudied. In response, Fukushima (2014) compiled a small encyclopedia listing Sake taste words. Considered epoch-making in the Sake industry,[1] this work has inspired other work, leading to the development of a method of defining Sake taste terms.

BACKGROUND

[1] In 2014, this work received the Good Design Award in Japan.

Theoretical background

The author regards cognitive content generation of taste as a kind of aesthetic appreciation process. Sake, wine, coffee, cigarettes or other items have communities of lovers, from professional tasters to amateur enthusiasts. They express differences in taste or flavor by brands and vintage years, and many comment-supporting tools have been proposed. One typical example is "flavor wheels".
The process of aesthetic appreciation of these items is as follows:

Aesthetic experience → reflection → expression (primarily by language)

For this process, the phenomenological background theory, from the aesthetic experience to the reflection and explanation ("emergence-motivated event construction"), is explained in Fukushima (2020a, 2020b).

Sense-making theory

To define the aesthetic Sake taste terms, I draw on "sense-making theory"(Fukaya & Tanaka, 1996; Tanaka & Fukaya, 1998), arguing that the meaning of a word is determined through various levels of interaction. The interaction includes the relationships among words (i.e., co-occurrence), between words and sentence or context, and even between people (i.e., communication level). Fukaya and Tanaka claim the sense of a single word cannot be determined a priori; rather, the sense is cooperatively "made" during the communication process. This chapter concurs with sense-making theory on this dynamic aspect of word sense.

Emergence-motivated event construction

The author proposes to define Sake taste by focusing on adjectivals and verbs, as an alternative to a dominantly used method focusing on nouns. The author calls this latter way of verbalization an "object-motivated event construction" where the experiencer primarily uses nouns to describe the event of tasting. This is commonly found in English tasting comments by wine sommeliers, as in "I feel a note of black cherry, cassis, and the rich flavor of the oak," where the sommelier detects the elements of the flavor and verbalizes them, perhaps selecting the terms from his or her list of tasting words.

This is analogous to an "audio" or a "visual event construction," where an event is reported objectively. As an alternative event construction, Fukushima (2020a, 2020b) proposed the theory of "emergence-motivated event construction."
The way of constructing the event of tasting (or smelling) differs from the process of vision. When we taste something—that is, when we have an event construction of tasting or when we conceptualize what we taste in our mouths—what we feel first is not the element of taste, such as sweetness, acidity, apple flavor, or other flavors in Sake (as expressed by nouns), but the emergence of the tasting event itself.

Supporting emergence-motivated event construction means that adjectives, adjectival nouns, and verbs (but not nouns) take the leading role in the taste description. The recognition of the emergence of an event is primarily expressed by predicates (verbs, adjectives and adjectival nouns).

Linguistic background

This chapter's proposed method of defining taste terms has the following characteristics, in harmony with the themes of cognitive linguistics:

- the dynamic aspect of word senses
- usage-based
- "sencyclopaedic semantics" rather than a "dictionary view"

The meaning of a taste term is often different from the word's general definition. For example, when *tōmei* 'clear' is used to express the taste of Japanese Sake, it could represent (or modify) the lightness of the body, or clean sweetness, or a quick fading of the aftertaste. However, 'light body', 'sweetness', or 'aftertaste' would never be listed in the definition of *tōmei* 'clear' in general dictionaries. As illustrated in this example, I am emphasizing the dynamic aspect of word senses. The "sense of a word" is not fixed and static as in a dictionary. It varies, depending on the context; it is *made* dynamically in communication. This is the dynamic aspect of a word's meaning.

Narratological Background: Narrative Generation and Narrative Analysis

The approaches in narratology are roughly classified into two kinds: narrative generation and narrative analysis. (Ogata, 2020) The primary approach in content generation study is to develop a computational (or computer-assisted) content generation system. In this book, the chapters in Part 2 are illustrative examples. As an applicational domain of content generation, the author has carried out some studies focusing on "cognitive content" as a story, which is called "Cognitive Content Generation" (Fukushima 2020a). The cognitive content is, in short, the symbolic expression (including non-verbal representations) of a mental image of the five senses.

As a case of the study of the cognitive content, the author has been studying the domain of taste. Over the past few years, the author has conducted studies on cognitive content *generation* of taste. In (Fukushima, 2020a), the author presented a methodology for bridging the gap between the mental representation of taste and the external representation (i.e., words, drawing) as content *generation*.

In this study, the author attempts to *analyze* the cognitive content of taste, with a tasting comments corpus. There are some text types expressing the sense of taste: recipes, essays, advertisements and food packaging, online restaurant reviews, and so on. At this stage, the author does not define how much of these are in the scope of narratology.

Among these genres, this study deals with tasting comments concerning *Sake*. Japanese Sake, which is also called rice wine, has recently become more characterful in its flavor and taste.

MAIN FOCUS OF THE CHAPTER

Verbs for describing the taste of Sake

This study aims to define the sense of verbs in Sake tasting description, asking the question, what kind of verbs are used in the Sake corpus?

Appendix 4 shows the top 100 verbs in the Sake corpus. Note that the table does not include a number of functional verbs (e.g., *naru* 'be', *suru* 'do').

Figure 1 shows the hierarchical clustering chart of the top 29 words (word frequency of over 100). From the hierarchy branching, Cluster 01 appears to be independent of other clusters (Clusters 02-05). As a general trend, verbs in Cluster 01 and Clusters 02-05 seem to differ in usage tendency.

Cluster 01 consists of the following verbs: *tsukuru* '(Sake) making,' *kamosu* 'brew,' *hiyasu* 'chill,' *motsu* 'have,' and *tanoshimeru* 'enjoy(able).' These words seem not to be the expressions for the taste or flavor, from the viewpoint of describing the quality of the experience. Here, in order to clarify the role of the verbs, let us take a look at a standard example of Sake reviewing in books (Sentence 1) and co-occurrence networks with nouns (Figure 2).

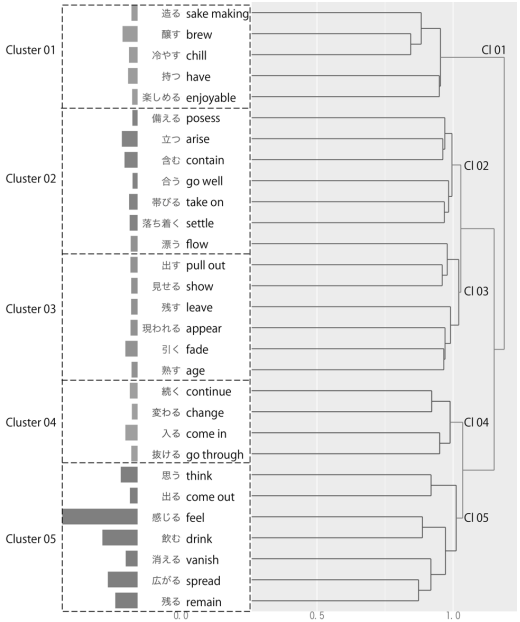

Figure 1. Hierarchical Clustering Chart of verbs in the Sake description. Note, the bar graph on the left of the figure shows the frequency of word usage.

1.

The "Azuma-ichi" which aims at the optimum quality of Sake during meals uses Yamada-nishiki, cultivated by the brewer himself. **[Ingredients]**
The privately-incubated Kumamoto yeast is used. Azuma-ichi constantly produces the fine junmaiginjo (pure rice premium Sake) by fermenting Kumamoto yeast for a long time at low temperature where the yeast is difficult to be active. **[Brewing Techniques]**
The harmony of calm fragrance and umami, refreshing sourness and light taste is splendid. **[Flavor and Taste]**
The sharpness of the aftertaste and the faint feeling of gas are impressive. **[Flavor and Taste]**
You can enjoy the taste for a long time even after opening. It is a Japanese Sake that goes well with foods. **[How to enjoy]**

For Azuma-ichi, Yamada-Nishiki Junmai-ginjo,
(Sake Competition, 2019); translated by the author, **[Caption]** *added by the author)*

Figure 2 shows the MDS (Multi-Dimensional Scaling) chart (drawing nouns and verbs, word frequency of over 100)

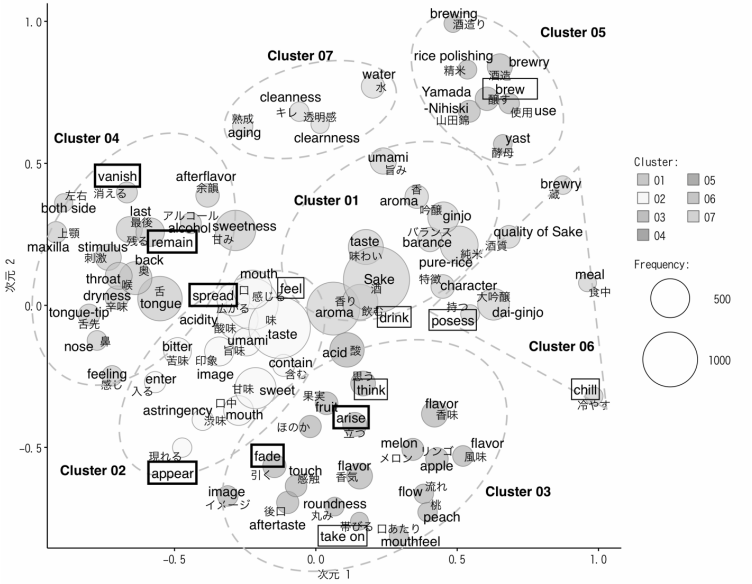

Figure 2. Multi-Dimensional Scaling chart (nouns and verbs, word frequency 100+ times)
Note. Verbs are framed, and the bold frames are the verbs for "understanding" the taste of Sake.

Cluster 01 contains words for the general taste and flavor of Sake. Sake, taste, aroma and other words in Cluster 01 are common words in Sake tasting comments. Some words like umami, balance, *ginjo* and pure-rice (cf. Appendix 1) describe some quality of the taste, but these words can be used in almost any context in Sake descriptions.

Clusters 02 and 03 seem to be clusters for the domain of taste and flavor. Cluster 04 consists of words for the [Space] or [Parts of the mouth] tag, including some words for the [Timeline] tag (e.g., last, after flavor).

Clusters 01 to 04 can be roughly divided into the "taste / flavor" category, which describes the sensory impression in the tasting comments.

On the other hand, Clusters 05 and 06 seem to have another role in the tasting comments (Cluster 07 is for 'other words' or 'un-clustered words.'). Words in Cluster 05 mainly concern Sake brewing (Yamada-Nishiki is a brand of special rice for Sake). And Cluster 06 concerns words of classification (designation) of *Sake* ('dai-ginjo'), drinking situation ('chill'), food pairing ('meal'). Clusters 05 and 06 can be divided into the "brewing" category.

The verbs to be defined in this study

If divided in terms of narratology, verbs in Clusters 05-06 are regarded as verbs for "explaining (Erklaren)", and verbs in Clusters 01-04 can be considered as verbs for "understanding" or "interpretation" (Dilthey, 1900).

In this study, the author focuses on the verbs that contribute to describing the *understanding* of the tasters' experience. The verbs for the understanding are, in other words, verbs for e xpressing some quality of the taste or flavor. The quality of the taste of flavor is personal and is a private sensation felt in the mouth. It cannot be objectively (or scientifically) *explained* with a 'taste-sensor machine'.

More concretely, the verbs to be defined in this study are the following (see also Figure 2.): *hirogaru* 'spread', *nokoru* 'remain', *tatsu* 'arise', *hiku* 'fade', *arawareru* 'appear', and *kieru* 'vanish'. In addition to these verbs from Figure 2, the following frequently used verbs are investigated: *tsuduku* 'continue' and *fukuramu* 'swell'.

METHOD

Corpus and text coding (mining) tool

CORPUS

For this analysis, the author uses a Sake corpus, a corpus of Japanese Sake tasting expressions primarily taken from Sake-reviewing books and magazines written in Japanese. The Sake corpus also includes tasting comments and expressions provided by six tasters, myself included. Table 2 summarizes the details. Note that the paragraphs refer to the different Sake brand descriptions. In total, the Sake corpus consists of 120,789 words.

Table 1. Details of the Sake corpus

	Details
Tokens	120,789
Types	6,018
Type Token Ratio	20.07
Sentences	5,582
Paragraphs (brands of *Sake*)	2,388
Average Frequency Standard Deviation	10.50 64.55

The Sake corpus draws on data from 14 books and magazines, as well as data from a tasting experiment. At first glance, the number of consulted books may seem limited. However, the books or magazines for Sake tend to introduce the brewing method of Sake brands, not the taste or flavor. Thus, eliciting the "tasting comment data" from published material is a difficult task. Sentence 1 below is a typical example of a flavor description in a Sake magazine. Figure 3 shows an image where such descriptions appear (basic translations are given in the bottom part of the image).

2. a. kajitsukei no hanayaka-na kaori to,
'Fruity, elegant flavor and'

b. pukkuri-to-shita umami ga kōchū de fukurami,
‘pulump-umami swells in the mouth,’

c. taoyaka ni nagare-te iku. hōrei na Sake o jikkan.
‘then it calmly flows. (I) realized the rich, splendid taste.

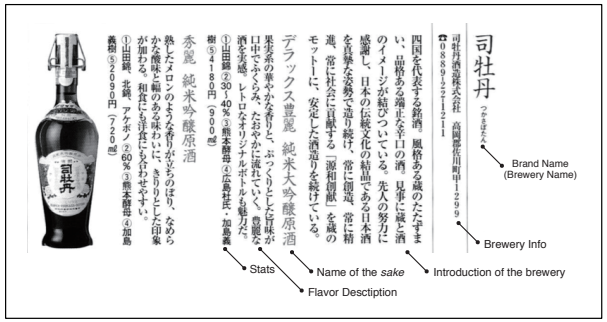

Figure 3. A standard style of tasting comment description in Japanese Sake books and magazines. Captured from Sake Catalog 755 (Umehara, 1999)

Coding tool

As a text-mining tool, the author used KH Coder (Higuchi, 2004). For the entire process of corpus analysis (i.e., word extraction with ChaSen, PoS tagging, listing word frequency, making KWIC concordance, and drawing word networks), KH Coder was used. KH Coder is free software for quantitative content analysis or text mining. It is also used for computational linguistics and can be used to analyze Catalan, Chinese (simplified), Dutch, English, French, German, Italian, Japanese, Korean, Portuguese, Russian, Slovenian, and Spanish text (“KH Coder Index Page,” 22-09-2019).

How to define verbs

Calculation of the co-occurrence score with KWIC

Using KWIC, we can calculate the “score” for determining which words most frequently co-occur with the target term. The calculated “score” is used to indicate the strength of co-occurrence relationships. For a detailed explanation of KWIC, see Appendix 2; the protocol for calculating a score is shown in Appendix 3. In this analysis, I considered the words with a score of over 1.000 in defining the target term (i.e., approximately the top 30 words in the concordance list).

Defining the target terms

The terms to be used to define the target term are selected from the list of the top words in the concordance. This task relies on the knowledge and skill of the individual producing the definition. If the person knows very little about Sake or lacks tasting skill or does not understand the meaning of the words in the list, he or she will clearly be unable to define the target term properly. Moreover, people are likely to define the same term differently.[2]

Although the method is not fixed or rigidly defined, I set the following tags (in square brackets and bold text) as the points to be defined.

[Flavor] or [Taste]: [Flavor] or [Taste] terms tend to modify taste or flavor (e.g., Words for [Taste] include: taste, sweetness, bitterness, acidity, etc.; Words for [Flavor] include: flavor, scent, floral, fruity flavor, etc.).

[Dominance]: [Dominance] describes which tastes among the basic tastes (i.e., sweet, acidity, umami, bitter, astringency, and dry[3]) are more likely to co-occur with the target term.

[Structure]: [Structure] terms include words for the structure or physical texture of the Sake (e.g., *bodī* ‘body’, *waku* / *wakugumi* / *kokkaku* ‘frame’, *rinkaku* ‘contour’, *katamari* ‘lump’, *futoi* ‘bold’). Examples of the usage of **[Structure]** terms include instantiations of a “conceptual metaphor” (Lakoff & Johnson, 1980), “TASTE IS BUILDING” or “TASTE IS BODY.”

Sentence (3) Shows an example of the two conceptual metaphors.

3. kokkaku ga shikkari-shita, futoi umami
‘(I feel) the firm framed, bold umami’

In (3), the first part of the phrase *kokkaku ga shikari-shita* ‘firm framed’ involves the equation of “building” with “taste”, where the elements of “taste” are conceptualized as corresponding to (or “mapped onto”) those of “building.” Stated differently, the taste is conceptualized as having a frame, just like a building has a frame, and the stability of the “frame” of the taste is expressed by *shikari-shita* ‘firm’. Similarly, the latter part of (3) involves the equation of “human body” with “taste”, where the elements of “taste” are conceptualized as corresponding to those of the “human body”. Because of this correspondence, the taste term *umami* can accompany a modifier *futoi* ‘(lit.) fat’.

[Organoleptic Feelings]: [Organoleptic Feelings] terms include terms on **[Texture]**. The majority of [Organoleptic Feelings] are words for [Texture] or mouthfeels (e.g., *kanshoku* ‘feeling’, *tacchi* ‘touch’, *sofuto* ‘soft’, *kurīmī* ‘creamy’). Words like *marui* ‘round’, *tsutsumu* ‘wrapping’, *naderu* ‘stroking’, and other words for stimulus are not tagged as [Texture], but as [Organoleptic Feelings]. For [Organoleptic Feelings], onomatopoeic terms are often used (e.g., *zara-zara* ‘rough texture’, *suru-suru* ‘smooth’).

[Space] or **[Parts of the mouth]:** [Parts of the mouth] terms refer to the words for the parts of mouth used to indicate the point or the place where the taste or flavor is felt (e.g., *kuchi* ‘mouth’, , *hanasaki* ‘nose tip’, *shita* ‘tongue’). These words can be found in expressions like the one in (4), an instance of *shitasaki* ‘tip of the tongue’. [Space] is a tag for the words that indicate the place (but not the part of the mouth), like *oku* ‘back (of the mouth)’, *sayu* ‘right and left’, and so on.

4. Shitasaki de amami o kanjiru
‘(I feel) sweetness on the tip of the tongue.’

[Timeline]: [Timeline] terms describe the timeline of the tasting experience, from beginning to end (i.e., in my “emergence-motivated event construction” model, from the emergence of the taste to its disappearance). In a tasting comment, describing the way the taste or flavor appears and disappears is very

[2] This type of subjective approach may be avoided in some research fields such as experimental psychology and cognitive science. However, the sense of taste itself is firmly in the subjective domain. It cannot be shared directly with another person, nor can it be represented by sensor information from a “tasting machine,” as the sense of taste cannot be reduced to the sum of its component elements.

[3] Astringency and dryness are not basic tastes in an anatomical context (they are algesthesia), but in this chapter, I regard them as “basic tastes.” Note that a salty taste will almost never be noted in the taste of *Sake*.

important. Words for appearance are, for example, *saisho* 'beginning', *arawareru* 'appear', *tatsu* 'stand' (cf. Section 4.2.6), and *hanasaki* 'tip of the nose'. Words for disappearance include *kieru* 'fade', *kireru* 'finish', *nokoru* 'remain', and *atokuchi* 'aftertaste'. It is notable that some words for the part of the mouth often (indirectly) refer to the point of the timeline (e.g., 'nose tip' = 'the starting point', or 'back of the mouth' = 'the last point').

[Movement]: [Movement] terms include verbs modified by adjectivals expressing the movement of the taste. Representative examples include: *fukuramu* 'swell', *hirogaru* 'spread', *nagare* 'flow', *tadayō* 'drift', and *osamaru* 'subside'.

[Characteristic Words]: [Characteristic Words] terms include words that supplement the information of the target terms but are important to describe the characteristics of the taste, such as *sukoshi* 'a little'.

[Related Words]: If the PoS of the word is the same as the PoS of the target term (i.e., adjectives or adjectival nouns in the concordance list), and if the word has an intralinguistic relationship with the target term, such as synonymy, antonymy, hyponymy, or gradable antonymy (cf.(Lehrer, 2009)), then the word should be included. For example, if the description includes *yawarakaku marui* 'soft and round', and the target term is *yawarakai* 'soft', *marui* 'round' should be listed as a related word, as it expresses a synonymous meaning as 'soft' in the Sake tasting context.

RESULTS

Hirogaru 'spread'

Table 2. Concordance list for hirogaru 'spread'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	味	aji	taste	noun	48	29	19	22.57
2	口	kuchi	mouth	noun	52	42	10	16.18
3	口中	kōchū	mouth	noun	37	32	5	14.97
4	甘み	amami	sweetness	noun	33	24	9	12.25
5	舌	shita	tongue	noun	34	16	18	10.13
6	全体	zentai	entire	adv.	23	20	3	9.53
7	香味	kōmi	flavor and taste	noun	17	14	3	9.00
8	香り	kaori	flavor	noun	21	15	6	8.88
9	甘味	amami	sweetness	noun	22	15	7	8.47
10	旨み	umami	umami	noun	15	11	4	6.13
11	優しい	yasashii	tender	adj.	12	9	3	5.73
12	左右	sayū	right and left	noun	15	11	4	5.50
13	旨味	umami	umami	noun	13	8	5	5.48
14	酸味	sanmi	acidity	noun	14	6	8	5.43
15	最後	saigo	last	noun	11	1	10	4.42
16	丸い	marui	round	adj.	6	5	1	3.78
17	上顎	uwaago	maxilla	noun	11	7	4	3.70
18	横	yoko	side	noun	9	9	0	3.57
19	甘い	amai	sweet	adj.	14	11	3	3.57
20	薄い	usui	thin	adj.	8	4	4	3.57
21	感じ	kanjiru	feeling	noun	4	1	3	3.50
22	飲む	nomu	drink	verb	7	0	7	3.33
23	その後	sonoato	later	adv.	7	0	7	3.25
24	奥	oku	back	noun	12	5	7	3.20
25	米	kome	rice	noun	10	4	6	3.20
26	酒	Sake	Sake	noun	9	3	6	3.08
27	きれい	kirei	clean	AN	5	4	1	2.75
28	印象	inshō	impression	noun	8	3	5	2.73
29	味わい	ajiwai	taste	noun	7	5	2	2.65
30	香気	kōki	aroma	noun	6	5	1	2.53

Note. From left to right, the columns in the table give the ranking (1 through 21) of the score (N) of the co-occurring words (Word), the English translation of the co-occurring words (English Trans.), pronunciation of the co-occurring words (pronunciation), the part of speech (PoS) of the words, the total number of co-occurrences (Total), the number of occurrences to the left of the target term (LT), the number of occurrences to the right side of the target term (RT), and the scores.

As Table 2 shows, hirogaru 'spread' co-occurs with the following words;

[Taste]
Among the five basic tastes, the term *hirogaru* 'spread' often co-occurs with *amami* 'sweetness' [4, 9, 19], umami 'umami' [10, 13], and *sanmi* 'acidity'[14]. As stated above, these three tastes are all the primary tastes for Sake. Thus, *hirogaru* 'spread' describes the essential and desirable taste of Sake.

[Flavor]
In the concordance list, only two words for flavor are listed: *kōmi* and *kaori* 'flavor' [7, 8]. The words *kōmi* and *kaori* are rather abstract words, and no specific flavor words (e.g., apple, melon, etc.) are seen in the concordance list.

[Dominance]
The term *hirogaru* 'spread' is used more frequently to describe "taste" than "flavor," as indicated by the higher token frequency of the taste terms for 'sweetness' [4, 9, 19], 'umami' [10, 13], and 'acidity' [14] versus the flavor terms [7, 8].

[Space and Body-part]
Hirogaru 'spread' is originally a word for spatial nuance. Naturally, hirogaru 'spread' frequently collocates with words ofthe [Space] and {Parts of the Mouth] tag, as seen in kuchi 'mouth' [2], kōchū 'mouth' [3] and zentai 'entire' [6], sayū, 'right and left' [12], uwaago, 'maxilla' [17], yoko, 'side' [18], oku, 'back' [24]. These collocating words include almost all areas of the mouth cavity. Note that hirogaru 'spread' can be used for describing aroma diffusing in the nose cavity, though words about 'nose' are not seen in the concordance list.

Nokoru 'remain'

Table 3. Concordance list for nokoru 'remain'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	味	aji	taste	noun	46	31	15	18.65
2	最後	saigo	last	adv.	27	19	8	11.30
3	舌	shita	tongue	noun	28	15	13	10.15
4	少し	sukoshi	a little	adv.	19	8	11	9.12
5	余韻	yoin	aftertaste	noun	16	11	5	6.33
6	長い	nagai	long	adj.	9	7	2	6.03
7	苦味	nigami	bitterness	noun	12	10	2	5.45
8	印象	inshō	impression	noun	14	12	2	5.23

9	口	kuchi	mouth	noun	15	10	5	5.03
10	薄い	usui	thin	adj.	12	8	4	4.93
11	奥	oku	back	noun	17	12	5	4.70
12	雑味	zatsumi	odd taste	noun	8	6	2	4.50
13	酸味	sanmi	acidity	noun	11	6	5	4.37
14	刺激	shigeki	stimulus	noun	11	11	0	4.27
15	口中	kōchū	mouth	noun	8	3	5	3.83
16	香り	kaori	flavor	noun	11	3	8	3.82
17	甘み	amami	sweetness	noun	12	7	5	3.73
18	酒	Sake	Sake	noun	8	0	8	3.67
19	甘い	amai	sweet	adj.	10	4	6	3.45
20	先	saki	tip	noun	10	8	2	3.35
21	丸い	marui	round	adj.	5	3	2	3.20
22	感じ	kanjiru	feeling	noun	9	5	4	3.15
23	上顎	uwaago	maxilla	noun	9	1	8	3.07
24	甘味	amami	sweetness	noun	6	4	2	3.03
25	その後	sonoato	later	adv.	5	1	4	3.00
26	舌先	shitasaki	tip of tongue	noun	8	3	5	2.83
27	渋味	shibumi	astringency	noun	8	6	2	2.78
28	渋み	shibumi	astringency	noun	6	6	0	2.58
29	味わい	ajiwai	taste	noun	4	1	3	2.45
30	消える	kieru	disappear	verb	7	3	4	2.37

[Taste]
In the taste domain, *nigami* 'bitterness' [7], *zatsumi* 'odd taste' [12], and *sanmi* 'acidity' [13] and even *shibumi* 'astringency' [27] are characteristic collocational words for *nokoru* 'remain.' These tastes are not the primary tastes for Sake. Too much astringency, bitterness, and acidity spoil the balance of Sake, but the proper quantity of secondary tastes can give richness to the taste of Sake.

[Dominance]
Though both flavor and taste terms can co-occur with *nokoru* 'remain', from the concordance list, the frequency dominance is clearly given to the domain of taste.

[Timeline]
Nokoru 'remain' is originally a word for describing the last part of the taste. Therefore, some words for indicating the latter period can be seen in the concordance list: *saigo* 'last' [2], *yoin* 'aftertaste' [5, 34], *sonoato* 'later' [25], *nagai* 'long' [6].

[Space]
Nokoru 'remain' seems to often co-occur with the parts of the mouth: *shita* 'tongue' [3], oku 'back of the mouth' [11] *kōchū* 'mouth' [15], *uwaago* 'maxilla' [23], *shitasaki* 'tip of the tongue' [26].
These words have a role in pointing out where the taste "remains." The remaining tastes (i.e., bitterness and odd taste) tend to be felt at the back [11] of the tongue.

[Organoleptic Feelings]
For organoleptic feelings, *shigeki* 'stimulus' [17] is seen in the list. The word 'stimulus' generally means (undesirable) *dryness* of the alcohol.

[Aesthetic Terms]
Yoin 'aftertaste' [5], usui 'thin (weak)' [10], and *marui* 'round' [21]

[Verbs]
For the co-occurring verbs, *kieru* 'vanish' [30] and *hirogaru* 'spread' [31] are listed.

Tatsu 'arise'

Table 4. Concordance list for tatsu 'arise'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	香り	kaori	flavor	noun	61	48	13	31.70
2	昇る	noboru	rise	verb	22	0	22	22.00
3	香気	kōki	aroma	noun	26	24	2	12.58
4	華やか	hanayaka	gorgeous	AN	16	9	7	8.53
5	湧く	waku	well up	verb	7	7	0	7.00
6	口中	kōchū	mouth	noun	15	7	8	6.92
7	酸	san	acid	noun	12	5	7	5.40
8	味	aji	taste	noun	17	4	13	5.38
9	甘い	amai	sweet	adj.	15	9	6	5.23
10	果実香	kamika	fruit fragrance	noun	11	10	1	4.83
11	リンゴ	ringo	apple	noun	8	3	5	3.77
12	酸味	sanmi	acidity	noun	5	1	4	3.20
13	甘味	amami	sweetness	noun	8	5	3	3.03
14	上げる	ageru	raise	verb	3	0	3	3.00
15	クリーミー	kurīmī	creamy	AN	5	1	4	2.95
16	全体	zentai	entire	AN	5	0	5	2.87
17	鼻先	hanasaki	nose tip	noun	5	5	0	2.50
18	香味	kōmi	flavor and taste	noun	6	4	2	2.28
19	爽やか	sawayaka	freshness	AN	8	6	2	2.08
20	ふくよか	fukuyoka	plump	AN	9	3	6	2.05
21	苦味	nigami	bitterness	noun	4	2	2	2.00
22	先	saki	tip	noun	4	4	0	2.00
23	シャープ	shāpu	sharp	adj.	5	2	3	1.83
24	軽妙	keimyō	light and easy	AN	3	0	3	1.83
25	芳香	hōkō	fragrance	noun	4	4	0	1.83
26	軽い	karui	light	adj.	5	2	3	1.75
27	イチゴ	ichigo	strawberry	noun	4	1	3	1.73
28	アルコール	arukōru	alcohol	noun	4	2	2	1.67
29	含む	fukumu	contain	verb	7	2	5	1.60
30	スムーズ	sumūzu	smooth	AN	2	0	2	1.50
31	辛味	karami	dryness	noun	3	2	1	1.50
32	舌先	shitasaki	tip of tongue	noun	3	2	1	1.50
33	桃	momo	peach	noun	2	0	2	1.50

The literal English translation of *tatsu* is 'stand.' However, if the verb *tatsu* is used for describing some quality of taste, it means 'arise' or 'appear.'

Typical usage of *tatsu* ‘arise’ is seen in example (5).

5. A citrus type (lime) flavor gently arises.
   Raimu kei no kaori ga hikaeme ni tatsu

For Wakaebisu Junmai-Daiginjo, (JS, 2001)

[Flavor]
The verb *tatsu* ‘arise’ significantly co-occurs with words for flavor. In addition to ‘flavor’ itself [1, 3, 18], phrases for fruity flavor should be specially mentioned. In the concordance list, many names of fruits [10] are listed; *ringo* ‘apple’ [11], *ichigo* ‘strawberry’[27, *banana* ‘banana’ [34] and *meron* ‘melon’ [39].

[Taste]
As well as the flavor words, tastes relating to fruits collocate with *tatsu* ‘arise’; *sanmi* ‘acidity’ [7, 12], *amami* ‘sweetness’ [13]. Among the primary tastes for Sake (i.e., sweetness, acidity, and umami), umami is not listed in the collocation of *tatsu* ‘arise.’ This wo_uld be because of the types of Sake. There are mainly four or more types of Sake, including the fruity type and the umami type (others are the clear ‘tasteless’ type, matured type, and so on). From the concordance list, *tatsu* tends to be used for the fruity type, rather than the umami type of Sake.

For the secondary taste, *nigami* ‘bitterness’ [21] and *karami* ‘driness’ [31] are listed, but their rank is rather low.

[Space]
The verb *tatsu* ‘arise’ often describes the first part of one experience of tasting Sake, but interestingly, there are no words for the [Timeline] tag in the concordance list. Instead, there are some words for the front part of the mouth and nose; *hanasaki* ‘nose tip’ [17], *shitasaki* ‘the tip of the tongue’ [32] and simply *saki* ‘tip’ [22]. Note that some words for the entire space of the mouth are also seen; *kōchū* ’mouth’ [6] and *zentai* ‘whole’ [16].

[Aesthetic Concepts]
Tatsu *‘arise’* significantly co-occurs with aesthetic concepts: *hanayaka* ‘gorgeous’ [4], *kurīmī* ‘creamy’ [15], *sawayaka* ‘freshness’ [19], *fukuyoka* ‘plump’ [20], *shāpu* ‘sharp’ [23], *keimyō* ‘light and easy’ [24], *hōkō* ‘fragrance’ [25], *karui* ‘light’ [26], *sumūzu* ‘smooth’ [30], *katai* ‘firm’ [37], *wakawakashii* ‘youthful’ [41]

These aesthetic concepts listed above tend to modify the flavor, rather than the taste. Let’s take a look at an example (6).

6. An elegant ginjo-flavor (fruity flavor) arises.
   Yuuga na ginjō ka ga kaori tatsu

For Shiki-zakura, (SSI, 2019), underlined words indicate the aesthetic concepts.

Tsuduku ‘continue’

Table 5. Concordance list for tsuduku ‘continue’

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	長い	nagai	long	adj.	17	17	0	16.50
2	余韻	yoin	aftertaste	noun	20	16	4	9.58
3	味	aji	taste	noun	6	1	5	3.70
4	感触	kanshoku	feel	noun	5	4	1	2.45
5	看板	kamban	signboard	noun	2	0	2	2.00
6	苦味	nigami	bitterness	noun	3	2	1	2.00
7	最後	saigo	last	noun	4	1	3	2.00
8	銘柄	meigara	brand	noun	3	0	3	2.00
9	酸	san	acid	noun	3	1	2	1.75
10	純米	junmai	pure rice	noun	5	2	3	1.75
11	印象	inshō	impression	noun	5	4	1	1.53
12	その後	sonoato	later	adv.	3	3	0	1.50
13	口	kuchi	mouth	noun	3	1	2	1.50
14	舌先	shitasaki	tip of tongue	noun	3	0	3	1.50
15	流れ	nagare	flow	noun	4	1	3	1.50
16	上顎	uwaago	maxilla	noun	4	2	2	1.40
17	甘み	amami	sweetness	noun	4	3	1	1.33
18	感じる	kanjiru	feel	verb	6	3	3	1.30
19	最初	saisho	first	noun	3	1	2	1.25
20	香り	kaori	flavor	noun	4	2	2	1.20
21	痺れ	shibire	numbness	noun	3	3	0	1.17
22	甘味	amami	sweetness	noun	3	1	2	1.08
23	後口	atokuchi	aftertaste	noun	3	2	1	1.08
24	舌	shita	tongue	noun	3	0	3	1.08
25	苦み	nigami	bitterness	noun	3	1	2	1.03
26	強い	tsuyoi	strong	adj.	1	1	0	1.00
27	後に	atoni	after	adv.	1	1	0	1.00
28	山田錦	Yamada-Nishiki	Yamada-Nishiki	noun	1	0	1	1.00
29	弱い	yowai	weak	adj.	1	1	0	1.00
30	精悍	seikan	virile	AN	1	0	1	1.00
31	創業	sōgyō	establish	noun	3	3	0	1.00
32	太い	futoi	bold	adj.	1	0	1	1.00
33	濃密	nōmitsu	dense	AN	1	0	1	1.00

[Taste]
In the taste [3] domain, the typical collocation is found in words for the secondary taste; *nigami* ‘bitterness’ [6, 25], and *san* ‘acid’ [9]. ‘Sweetness’ [17, 22] is listed as always, but the rank is relatively low.

[Timeline]
As shown in Table 5, various words for describing the timeline are listed; *saigo* ‘last’ [7], *sonoato* ‘later’ [12], *saisho* ‘first’ [19], *atokuchi* ‘aftertaste’ [23], *atoni* ‘after’ [27]. Other words than *saisho* ‘first’ are words for indicating “later” or “after in the timeline.

[Space]
As well as the timeline domain, words for the space domain also co-occur with the verb *tuzuku* ‘continue.’ The listed words are: *kuchi* ‘mouth’ [13, *shitasaki* ‘the tip of the tongue’ [14], *uwaago* ‘maxilla’ [16], and *shita* ‘tongue’ [24].

[Organoleptic Feelings]
The word *shibire* ‘numbness’ [21] is a unique word for *Tsuzuku* ‘continue.’ It describes the drying sensation or rough ‘mouthfeel’[4].

Numbness has a relation to astringency, as well as the feelings associated with tannin in wines. As for the taste of Sake, the *shibire* 'numbness' can represent the sensation of the astringency, acidity, maybe bitterness, and dryness of the alcohol.

[Characteristic words]
The words *junmai* 'pure rice,' *meigara* 'brand' [8], *kambam* 'signboard' [5] are characteristic. However, these words are not for describing some quality of taste, but for mentioning the background of the Sake being reviewed.

[Aesthetic Terms]
Tsuyoi 'strong' [26] and *yowai* 'weak' [29] are listed.
Futoi 'bold' and *nōmitsu 'dense'* represent the way the thick taste 'continues.'

Fukuramu 'swell'

Table 6. Concordance list for fukuramu 'swell'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	味	aji	taste	noun	29	23	6	13.08
2	厚い	atsui	thick	adj.	15	7	8	10.83
3	感じる	kanjiru	feel	verb	11	2	9	4.53
4	香り	kaori	flavor	noun	12	9	3	3.72
5	丸い	marui	round	adj.	5	4	1	3.53
6	口中	kōchū	mouth	noun	8	7	1	3.37
7	味わい	ajiwai	taste	noun	8	1	7	3.00
8	吟醸香	ginjō-ka	ginjo-flavor	noun	7	7	0	2.95
9	香味	kōmi	flavor and taste	noun	8	4	4	2.75
10	旨み	umami	umami	noun	6	5	1	2.70
11	優しい	yasashii	tender	adj.	4	4	0	2.53
12	香気	kōki	aroma	noun	6	5	1	2.45
13	広がる	hirogaru	spread	verb	6	3	3	2.33
14	良い	yoi	good	adj.	5	1	4	2.03
15	引き出す	hikidasu	take out	verb	4	1	3	2.00
16	厚み	atsumi	thickness	noun	4	3	1	2.00
17	太い	futoi	thick	adj.	3	1	2	2.00
18	有す	yūsu	possess	verb	4	0	4	2.00
19	きれい	kirei	clean	AN	6	3	3	1.95
20	幅	haba	width	noun	4	2	2	1.83
21	後口	atokuchi	aftertaste	noun	7	1	6	1.77
22	丸み	marumi	roundness	noun	4	3	1	1.70
23	持つ	motsu	have	verb	4	1	3	1.70
24	甘み	amami	sweetness	noun	5	3	2	1.67
25	穏やか	odayaka	calm	AN	3	2	1	1.50
26	保つ	tamotsu	keep	verb	3	0	3	1.50
27	良好	ryōkō	good	AN	3	0	3	1.50
28	立つ	tatsu	stand	verb	5	3	2	1.40
29	純米	junmai	pure rice	noun	6	3	3	1.38
30	張り	hari	tension	noun	3	1	2	1.33

[Taste]
The words for the taste domain are umami [10], sweetness [24], and acidity [33, 41]. These are the primary tastes of Sake and are often listed in the concordance list. Judging from Table 6, the rank of these primary taste words is relatively low.

[Flavor]
The unique words for the flavor domain are *ginjōka* 'ginjō-flavor' [8]. *Ginjōka* is the aroma that is produced by a special brewing process (*ginjō*-brewing, see Appendix 1). *Ginjōka* generally contain fruity flavors, such as melon [36], apple, green apple, pear, or banana.

[Dominance]
Fukuramu 'swell' can co-occur both with the domains of taste and flavor. In comparison to other verbs, the concordance list (Table 6) tells us that the flavor domain [4, 8, 9, 12, 36] relatively dominates over the taste domain [1, 7, 10, 24, 33, 41].

[Timeline]
Words for the timeline domain: *atokuchi* 'aftertaste' [21]

[Space]
Words for the space domain: *kōchū* 'in the mouth' [6]

[Aesthetic Terms]
Atsui/*atsumi* 'thick(ness)' [2, 16] is a unique term for fukuramu 'swell'. Thickness is the experience of Sake with a rich, full-bodied, or umami taste (or flavor). *Futoi* 'bold' [17] or *haba* 'width' [20] have a similar nuance to *atsui*.
Other aesthetic terms in the concordance list are: *marui*/*marumi* 'round(ness)' [5, 22], *yasashii* 'tender' [11], *kirei* 'clean' [19], *odayaka* 'calm' [25].

Hiku 'fade'

Table 7. Concordance list for hiku 'fade'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	後	ato	after	noun	36	36	0	17.75
2	尾	o	tail	noun	24	24	0	12
3	甘味	amami	sweetness	noun	23	11	12	10.933
4	旨味	umami	umami	noun	16	5	11	7.367
5	軽い	karui	light	adj.	9	0	9	5.917
6	後口	atokuchi	aftertaste	noun	7	3	4	3.067
7	切れ	kire	clearing	noun	5	1	4	3.033
8	味	aji	taste	noun	8	5	3	3
9	感触	kanshoku	feel	noun	7	2	5	2.7
10	優しい	yasashii	tender	adj.	4	3	1	2.667
11	穏やか	odayaka	calm	AN	5	2	3	2.583
12	きれい	kirei	clean	AN	6	5	1	2.333
13	後に	atoni	after	adv.	5	5	0	2.333
14	印象	inshō	impression	noun	5	1	4	2.233

15	香り	kaori	flavor	noun	8	5	3	2.15
17	浅い	asai	shallow	adj.	2	2	0	2
18	丸み	marumi	roundness	noun	4	1	3	1.833
19	酸	san	acid	noun	6	4	2	1.833
20	奥	oku	back	noun	5	2	3	1.7
21	感じる	kanjiru	feel	verb	7	3	4	1.633
22	香味	kōmi	flavor and taste	noun	3	0	3	1.583
23	なめらか	nameraka	smooth	AN	2	1	1	1.5
24	余韻	yoin	aftertaste	noun	4	2	2	1.5
25	甘酸っぱい	amazuppai	sweet and sour	adj.	3	2	1	1.4
26	酸味	sanmi	acidity	noun	5	2	3	1.35
27	タッチ	tacchi	touch	noun	4	4	0	1.333
28	深い	fukai	deep	adj.	2	0	2	1.333
29	味わい	ajiwai	taste	noun	4	2	2	1.333
30	太い	futoi	thick	adj.	2	0	2	1.25

The verb *hiku* 'fade' is literally translated as 'pull.' However, in a tasting description, 'fade' or 'go down' would be the better translations.

[Taste]
Words for sweetness [3], umami [4], and acidity [19, 25, 26] are listed. These are the primary tastes for Sake, therefore, *hiku* 'fade' illustrates the manner of fading or the going down of a comfortable and desirable taste.

[Dominance]
We can accept the dominance of [Taste]. As for the [Flavor] category, *kaori* 'flavor' [15] and *kōmi* 'flavor' [24] are listed, but the ranking is low, and no specific flavor names are seen in the list.

[Timeline]
Hiku 'fade' describes a decreasing or vanishing. Consequently, the [Timeline] words, especially words for the latter timing tend to collocate: *atokuchi* 'aftertaste' [6], *kire* 'clearing' [7], *atoni* 'after' [16], *yoin* 'after flavor' [24].

Kieru 'vanish'

Table 8. Concordance list for kieru 'vanish'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	味	aji	taste	noun	13	12	1	6.25
2	印象	inshō	impression	noun	11	11	0	4.867
3	余韻	yoin	aftertaste	noun	12	6	6	4.633
4	口	kuchi	mouth	noun	10	2	8	3.35
5	甘み	amami	sweetness	noun	8	5	3	3.2
6	感じる	kanjiru	feel	verb	9	8	1	3.117
7	奥	oku	back	noun	10	5	5	2.967
8	舌	shita	tongue	noun	9	0	9	2.8
9	上顎	uwaago	maxilla	noun	7	1	6	2.75
10	口中	kōchū	mouth	noun	8	3	5	2.7
11	スッ	su'	quickly	onoma	5	5	0	2.5
12	喉	nodo	throat	noun	9	2	7	2.433
13	苦味	nigami	bitterness	noun	7	3	4	2.4
14	残る	nokoru	remain	verb	7	4	3	2.367
15	軽い	karui	light	adj.	6	3	3	1.817
16	後味	atoaji	aftertaste	noun	3	0	3	1.667
17	甘味	amami	sweetness	noun	4	3	1	1.583
18	残す	nokosu	leave	verb	4	4	0	1.583
19	舌先	shitasaki	tip of tongue	noun	5	1	4	1.533
20	すーっ	sū'	smoothly	adv.	3	3	0	1.5
21	透明	tōmei	transparent	AN	4	0	4	1.4
22	香り	kaori	flavor	noun	3	2	1	1.333
23	現れる	arawareru	appear	verb	3	2	1	1.25
24	最初	saisho	first	noun	3	0	3	1.25
25	渋み	shibumi	astringency	noun	2	1	1	1.25
26	先	saki	tip	noun	3	1	2	1.25
27	溶ける	tokeru	dissolve	verb	2	2	0	1.2
28	引っかかる	hikkakaru	stuck	verb	4	3	1	1.117
29	感じ	kanjiru	feeling	noun	3	3	0	1.083

[**Taste**]
We can recognize [Dominance] in [Taste], rather than [Flavor]. Then, what kind of tastes vanish during Sake tasting? In the concordance list, we can find "stimulating tastes" for Sake; *nigami* 'bitterness' [13], and *shibumi* 'astringency' [25]. These words sometimes appear in other concordance lists, but the frequency is characteristically high in the list for *Kieru* 'vanish'.

Note that too much of these stimulating tastes is generally thought to create "odd tastes" in Sake. However, a moderate amount of bitterness or astringency often gives the feeling of outline or structure to a Sake.

[Space (Parts of the mouth)]
Bitterness and astringency tend to be felt around the root of the tongue or the peripheral area of the mouth cavity (i.e., hard palate, soft palate, or gums). In Table 11, there are some words of the parts of the mouth; *oku* 'back' [7], *shita* 'tongue' [8], *uwaago* 'maxilla' [9], *kōchū* 'mouth' [10], *nodo* 'throat' [12], *shitasaki* 'tip of the tongue' [19], *saki* 'tip' [26].

As shown above, there are a large number of words for the root of the tongue, or the peripheral area of the mouth cavity. This implies that the bitter taste or astringency determines the final impression of the Sake taste.

[Timeline]
Kieru 'vanish' is an event in the last part of one tasting attempt. In the concordance list, we can find some words for describing the last part of the timeline; *yoin* 'aftertaste'[3], *nokoru* 'remain' [14], *atoaji* 'aftertaste' [16] *nokosu* 'leave' [18].

Collocating with the words for [Space] (especially the back area of the mouth), these words are applied for describing the bitter taste and astringency in the Sake.

On the one hand, some words for the first part of the Timeline; *arawareru* 'appear' [23], *saisho* 'first' [24]. *Arawareru* or *saisho* are often collocated with words of the front parts of the mouth (i.e., *shitasaki* 'tip of the tongue' [19], *saki* 'tip' [26]) in the [Space] domain. These words can be regarded as antonyms for *kieru* 'vanish', but they are often collocated together. Take a look at example (7).

7. Chiizu no aji ga kieru koro, umami no yoin ga arawareru
When the taste of cheese disappears, the rich aftertaste appears.

This example illustrates the vanishing of one taste, and the contrasting appearance of another taste. In this way, antonyms for *kieru* 'vanish (disappear)' are often collocated in order to give some contrast between the vanishing taste and the appearing or remaining taste.

[Onomatopoeias]
Onomatopoeic expressions are the most distinctive modifiers for vanish. In general, making a taste description can be rephrased to point out the existing taste on the tongue. The way of 'vanishing' or finishing of a taste is hard to recognize and cannot be seen visually.

In a previous study (Fukushima, 2017), the author raised the theory that onomatopoeic expressions in taste descriptions are employed to describe breaking points, turning points, and changing processes of taste, rather than stable states. *Kieru* 'vanish' is a typical example of the "breaking points" or "turning points" of a taste.

Tadayou 'flow'

Table 9 Concordance list for tadayou 'flow'

N	Word	Pron.	Eng. Trans.	PoS	Total	LT	RT	Score
1	香り	kaori	flavor	noun	19	16	3	7.317
2	かすか	kasuka	faint	AN	6	5	1	3
3	香気	kōki	aroma	noun	8	4	4	2.95
4	酒	Sake	Sake	noun	10	6	4	2.933
5	酸味	sanmi	acidity	noun	7	5	2	2.65
6	香味	kōmi	flavor and taste	noun	6	6	0	2.5
7	リンゴ	ringo	apple	noun	4	2	2	2.4
8	きれい	kirei	clean	AN	6	1	5	2.283
9	鼻腔	bikū	nasal cavity	noun	4	3	1	2
10	風味	fūmi	flavor	noun	4	4	0	2
11	気品	kihin	dignity	noun	3	2	1	1.833
12	甘味	amami	sweetness	noun	4	2	2	1.667
13	奥	oku	back	noun	4	3	1	1.5
14	鼻先	hanasaki	nose tip	noun	4	4	0	1.5
15	舌	shita	tongue	noun	5	3	2	1.483
16	味	aji	taste	noun	5	2	3	1.417
17	甘み	amami	sweetness	noun	4	2	2	1.4
18	清々しい	sugasugasii	refreshing	adj.	2	1	1	1.333
19	鼻	hana	nose	noun	4	2	2	1.25
20	ブドウ	budō	grape	noun	2	1	1	1.2
21	酸	san	acid	noun	3	0	3	1.033
22	スマート	sumāto	smart	AN	1	0	1	1
23	プレミアム	puremiamu	premium	AN	1	0	1	1
24	果実	kajitsuka	fruit	noun	1	0	1	1
25	果実香	kamika	fruit fragrance	noun	1	0	1	1
26	感じ	kanjiru	feeling	noun	1	0	1	1
27	甘辛い	amakarai	salty-sweet	adj.	1	0	1	1
28	厚い	atsui	thick	adj.	1	1	0	1
29	香木	kōboku	fragrant wood	noun	1	0	1	1
30	桃	momo	peach	noun	1	0	1	1
31	雰囲気	fun'iki	atmosphere	noun	2	2	0	1
32	余韻	yoin	aftertaste	noun	1	0	1	1

[Dominance]
Tadayou 'flow' has an exceptional feature of dominance. While other terms tend to indicate their dominance for Taste, *Tadayou* 'flow' shows its dominance in the Flavor domain. In the concordance list, words for the flavor domain are ranked higher: 'flavor' (*kaori* [1], *kōmi* [6], *fūmi* [10]), *kōki* 'aroma' [3],

[Space]
Except for the [Taste] or [Flavor] words, the major part is in the [Space] domain, especially body parts: *bikū* 'nasal cavity'[9], *oku* 'back'[13], *hanasaki* 'nose tip' [14], *shita* 'tongue' [15], *hana* 'nose' [19].

Within the co-occurrence of *tadayou* 'flow', these body parts terms are used for indicating the place the flavor or taste is felt. The feeling of *tadayou* 'flowing and retaining' is a sensation of gas (not liquid). Thus, 'the nose' or 'the nasal cavity' is seen in the list.

[Aesthetic Terms]
In the concordance list, the following terms are thought of as aesthetic terms for Sake; kirei 'clean', kihin 'elegance,' *sugasugasii* 'refreshing.' These terms have some clean and clear qualities in common. Kihin is one of the best complimentary words for the taste of Sake. It refers to the elegant, polished, and refined quality of Sake.

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

In this study, the author attempted to give encyclopaedic definitions to the verbs in a Sake corpus based on Sake tasting related terminology. In this terminology, the author emphasized the importance of the predicates (verbs, adjectives, and adjectival nouns). They are the starting point of our cognition of taste or flavor as an "event".
Through the terminological studies, the author proposed a defining method using collocation tags (Taste, Flavor, Timeline, and so on). With the collocation tags, we can analyze what types of words tend to co-occur with the target terms.

The author examined the meanings of 16 adjectives and adjectival nouns (Fukushima, 2020b)), and eight verbs (this study). In conclusion, this terminology is summarized in the following table.

Table 10*. Tag-collocation with the Target Terms*

	Target Terms (Defined Terms)	Taste	Flavor	Dominance	Movement	Timeline	Structure	Space (Parts of the mouth)	Organoleptic Feelings
Adjectives	Yawarakai 'soft'	●	○	T				●	●
	Karui 'light'	●		T					●
	Katai 'firm'	●		T				●	●
	Marui 'round'	●		T	●	●	●		
	Futoi 'bold'	●		T	●		●		

	Kobashii ‘roasted aromatic’	●	●	F/T				●	
	Yasashii ‘tender’	●		T					●
	Chikaraduyoi ‘powerful’	●		T		●			
Adjective-Nouns	Kirei ‘clean’	●	●	F/T	●	●			●
	Odayaka ‘calm’	●	●	F/T		●			
	Sawayaka ‘fresh’	●	●	F/T					
	Tomei ‘clear’	●		T					
	Fukuyoka ‘plump’	○	○				●		●
	Hanayaka ‘gorgeous’		●	F		●			
	Maroyaka ‘mellow’	●							
	Fukuzatsu ‘complex’	●		T					
Verbs	Hirogaru ‘spread’	●	●	F/T				●	
	Nokoru ‘remain’	●		T		●		●	●
	Tatsu ‘arise’		●	F				●	
	Tsuduku ‘continue’	●				●		●	●
	Fukuramu ‘plump’	●	●	F		○		○	
	Hiku ‘fade’	●		T		●			●
	Kieru ‘vanish’	●		T		●		●	
	Arawareru ‘appear’	●	○	T		●		●	
	Tadayou ‘flow’	○	●	F				●	

Note. ●: strong collocation, ○: weak collocation, T: Taste dominant, F: Flavor dominant, F/T: Both Flavor and Taste collocate with the target term. Adjectives and Adjectival-Nouns are studied in (Fukushima, 2020b).

As a brief summarization of this Sake terminology study, let us compare the overall tendency of each PoS (part of speech, i.e., adjectives, adjective-nouns, and verbs) based on Table 10. Table 10 shows two tendencies: first, each PoS has its unique role, as well as each word. Secondly, among one PoS, there can be seen some functional differentiation.

As a general tendency, adjectives can collocate with broad categories. Concerning adjectival-nouns, *kirei* ‘clean’ collocates with many kinds of categories, but the others’ primary function seems to modify the taste or flavor itself. Adjectival nouns seem to hardly collocate with the [Movement] or [Structure] domain. The collocations of the verbs seem to concentrate on the [Timeline] and [Space] domain. On the other hand, verbs do not tend to collocate with the [Movement] or [Structure] domains, the same as the tendency of adjectival nouns.

Adjectives

Common features for adjectives

While they commonly occur with Taste, the co-occurrence frequency with fragrance is low (cf. adjective verbs). On the whole, adjectives seem to co-occur with various domains (i.e., [Tags]), and there is no specific tag specific modification function.

Differentiation among adjectives

There are two groups among adjectives: first, terms that tend to co-occur with the [Space] tag and [Organoleptic Feelings] tag (i.e., *yawarakai* ‘soft’, *Karui* ‘light’, *Katai* ‘firm’). Second, terms that tend to co-occur with the [Movement], [Timeline], and [Structure] tags (i.e., *marui* ‘round’, *futoi* ‘bold’, *kobashii* ‘roasted aromatic’).

Adjective-Nouns

Common features for adjective-nouns

Adjective-nouns tend to collocate not only with the [Taste] tag but also with [Flavor] tag. Concerning adjectives, the [Movement] tag and the [Timeline] tag often share the target terms. On the one hand, in the case of adjectival-nouns, few terms collocate with Movement but some words collocate with Timeline.

Differentiation among adjectival-nouns

For adjectival-nouns, grouping the terms by tags seems difficult, because of the less frequent collocating between the target terms and tags. But if roughly divided, we can see a group of ‘tag-collocating terms’ and ‘less tag-collocating terms.’ Tag-collocating terms include; *kirei* ‘clean’, *odayaka* ‘calm’, *fukuyoka* ‘plump’, and *hanayaka* ‘gorgeous’. As with adjectives, these terms work as modifiers of taste or flavor in the collocation with the tags.

‘Less tag-collocating terms’ (i.e., *sawayaka* ‘fresh’, *tōmei* ‘clear’, *maroyaka* ‘mellow’, and fukuzatsu ‘complex’) are terms that are less likely to collocate with other tags. The primary function of these terms is not modifying tastes. Rather, these terms express some aesthetic quality by itself. Thus, ‘less tag-collocating terms’ work as predicates (not modifying words) in taste description sentences.

Verbs

Common features for verbs

The co-occurrence frequency between the listed verbs and the [Movement] tag or the [Structure] tag is relatively low. On the one hand, the [Timeline] and [Space] tags seem to co-occur frequently.

While adjectives and adjectival-nouns indicate a property (or some quality) of the taste, verbs describe the motion of the liquid (or flavor gas), appearance/disappearance, and the changing process of the taste. Thus, verbs tend to collocate with [Timeline] and [Space] tag words, that are the markers of chronological time flow or the place movement, appearance, or disappearance occurs.

Differentiation among verbs

Similar to adjectival-nouns, there is differentiation in the dominance of Taste and Flavor. Taste-dominant terms are: *nokoru* ‘remain’, *tsuduku* ‘continue’, *hiku* ‘fade’, *kieru* ‘vanish’, and *arawareru* ‘appear’. Flavor-dominant terms are: *tatsu* ‘arise’ and *tadayou* ‘flow’.

Another differentiation among verbs are seen in the collocation with [Organoleptic Feelings] tag. *Nokoru* ‘remain’, *tsuduku* ‘continue’, *hiku* ‘fade’ tend to collocate with [Organoleptic Feelings] tag.

Future Studies

In this study series, the author has defined the co-occurrence unit size as one sentence (‘sentence co-occurrence’). In future studies, collocational tendencies should be more microscopically investigated from the viewpoint of more close word collocation, such as ‘dependency’ or ‘modification’ relationships.

As well the analyzing unit size, the genre or domain of the corpus is important. Since the meanings of the aesthetic terms depend on the domain, the comparison among various domains such as wines, whiskeys, perfumes, or others would be worth investigating. As well as the diversity among domains, the variety among the speaker groups would be impressive. There would be significant term usage variation between professional tasters and novices. Likewise, variations between languages (e.g., comparing the wine descriptions in English and in French), book genre (e.g., comparing the commercial magazines and critique

essays), generation, or gender would reveal the novel features of the aesthetic terms. In any case, success or failure largely depends on the quantity and the quality of the corpus.

Another future research direction is on grammar theory. In this study, we analyzed the co-occurrence relationship between [Tags] and each part of speech (PoS), as summarized in figure 10. We found some differences in co-occurrence characteristics among PoS and within PoS, as stated above. However, it should be noted that this analysis employs a particular grammatical theory or PoS classification method. There is an influential grammatical theory called "four major grammar" in Japanese grammar. The classification and the way of the perspective of the PoS are different, respectively. In this study, we could not give a sufficient explanation as to why adjectives are difficult to co-occur with [Flavor] tag, whereas adjective verbs are easy to co-occur with [Flavor] tag. In order to give a clear answer to this question, it may be necessary to review the grammatical theory that we stand on.

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KEY TERMS AND DEFINITIONS

Sake: *Sake* (Japanese *Sake*, also spelled *saké*) is a fermented alcoholic beverage made from rice, commonly referred to as Japanese rice wine. For more information, see Appendix 1.

Sense-making theory: A semantic theory advocated by Fukaya and Tanaka (Fukaya & Tanaka 1996; Tanaka and Fukaya 1998). Fukaya and Tanaka claim that the sense of a single word cannot be determined a priori; rather, the sense is cooperatively "made" during the ongoing communication process.

APPENDIX 1

Sake (Japanese *Sake*, also spelled *saké*) is a fermented alcoholic beverage made from rice, commonly referred to as Japanese rice wine. *Sake* is a fermented food product like soy sauce, miso, and *katsuobushi* 'dried bonito', standard seasonings for Japanese foods. Premium *Sake* uses special rice called *Sake* rice, suited for brewing premium *Sake* (Gauntner, 2011).

There are various types of *Sake*, just as there are various types of wine. Red wine can be roughly broken into three categories: full bodied, medium bodied, and light bodied. For white wine, the gradation from sweet to dry is generally used. In the case of Japanese *Sake*, sweet types (*amakuchi*) and dry types (*karakuchi*) are the most common categories. Light, pale types (*tanrei*), and full, rich types (*nōjun*) also appear. In the 1980s and 1990s, pale and dry (*tanrei-karakuchi*) types of *Sake* were popular (and remain so). However, around 2000, there was a boom in *ginjō-shu* (premium *Sake* made from highly polished rice using a special technique). *Ginjō-shu* has a floral and fruity flavor.

APPENDIX 2

In order to clarify which words co-occur with the target words (the adjectives and adjectival nouns listed above), KWIC (Key Words in Context), or simply "concordance," is used. With KWIC, we can analyze how a target word is used in a corpus. In this appendix, an example of KWIC using KH Coder, a text mining application, is shown. Figure AP-2 illustrates the KWIC for the word "say" in a sample corpus.

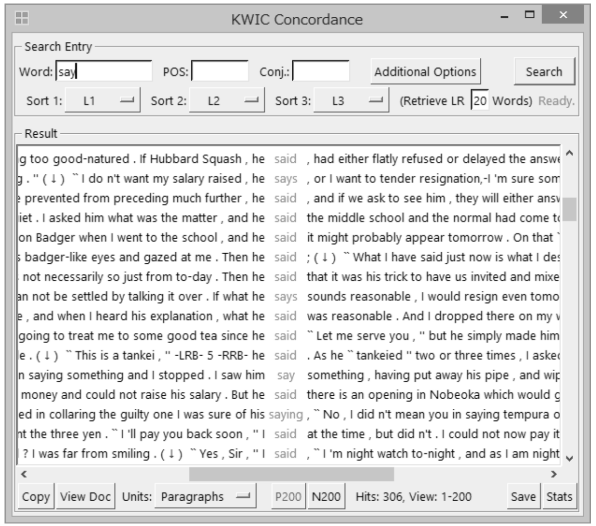

Figure 4. Window showing KWIC concordance results for the word "say" (Higuchi 2017)

KH Coder is a very useful text mining tool. It provides statistics, multi-dimensional scale (MDS), word networks, and other helpful visuals.

Using the Collocation Stats window in KH Coder (Figure AP-2), it is easy to determine which words frequently appear before and after the target word (or node word). In Figure AP-2, the statistics show that the word "hear" appears thrice in a position two words before (L2) and twice just before (L1) the node word "say." In addition, we see clearly that words like "Red," "Shirt," and "Porcupine" are often used in association with "say" in this corpus.
(*KH Coder Reference Manual*: Higuchi, 2017, Revised)

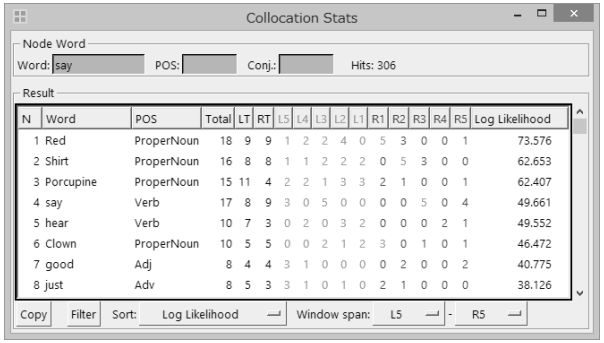

Figure 5. Collocation statistics window (Higuchi, 2017)

APPENDIX 3

Concordance *score* is calculated using the function *f(w)* shown below, where l_1 is the frequency of a certain word *w* that appears just before the node word; l_2 is its frequency, two words before the node word; r_1 is its frequency just after the node word; and r_2 is its frequency, two words after the node word.

$$f(w) = \sum_{i=1}^{5} \frac{(li + ri)}{i}$$

In general, the greater the frequency that a certain word *w* appears before or after the node word (l_i+ r_i), the larger the value of *f(w)*. In calculating the value of *f(w)*, frequencies (l_i + r_i) are divided by "*i*," which weighs the frequencies according to their distance from the node word. Thus, words that appear nearer to the node word (i.e., with a smaller "*i*") have greater weight than those that occur five words before or after the node word. In this formula, the frequencies of words that appear just before and after are simply added, since they are divided by unity.

("KH Coder Reference Manual": Higuchi, 2017)

APPENDIX 4

Table 11. Frequency of the verbs in Sake Corpus

N	word	pron	Eng. Trans	freq.
1	感じる	kanjiru	feel	890
2	飲む	nomu	drink	416
3	広がる	hirogaru	spread	352
4	残る	nokoru	remain	264
5	思う	omou	think	199
6	立つ	tatsu	stand	186
7	醸す	kamosu	brew	178
8	含む	fukumu	include	155
9	ふくらむ	fukuramu	swell	150
10	引く	hiku	draw	145
11	入る	hairu	enter	145
12	消える	kieru	vanish	141
13	現れる	arawareru	appear	120
14	持つ	motsu	have	113
15	冷やす	hiyasu	chill	102
16	帯びる	obiru	take on	101
17	落ち着く	ochituku	settle down	94
18	続く	tsuduku	continue	92
19	出る	deru	come out	91
20	出す	dasu	put out	85
21	漂う	tadayou	drift	82
22	残す	nokosu	leave	77
23	見せる	miseru	show	76
24	抜ける	nukeru	slip out	75
25	造る	tsukuru	make	73
26	熟す	jukusu	age	72
27	まとまる	matomaru	come together	70
28	変わる	kawaru	change	68
29	楽しめる	tanosimeru	enjoyable	65
30	備える	sonaeru	equip	62
31	合う	au	match up	60
32	できる	dekiru	I can.	60
33	引き出す	hikidsasu	pull out	59
34	合わせる	awaseru	match	59
35	進む	susumu	proceed	59
36	まとう	matou	take on	59
37	練れる	nereru	knead	58
38	もつ	motsu	have	57
39	使う	tsukau	use	56
40	磨く	migaku	polish	53
41	たたえる	tataeru	praise	53
42	楽しむ	tanoshimu	enjoy	52
43	増す	masu	increase	51
44	流れる	nagareru	flow	50
45	仕込む	shikomu	train	49
46	保つ	tamotsu	keep	47
47	立ち上がる	tachiagaru	stand up	47
48	もたらす	motarasu	bring	45
49	行う	okonau	do	42
50	伴う	tomonau	come with	42
51	上げる	ageru	raise	41
52	目指す	mezasu	aim for	41
53	戻る	modoru	Back	41
54	用いる	mochiiru	use	41
55	覆う	oou	cover	40
56	でる	deru	come out	39
57	押す	osu	push	38
58	取る	toru	take	38
59	取れる	toreru	come off	37
60	言う	iu	say	36
61	入れる	ireru	put in	36
62	引き締める	hikishimeru	tighten	35
63	味わう	ajiwau	taste	34
64	与える	ataeru	give	34
65	向く	muku	face	32
66	混じる	majiru	mingle	32
67	似る	niru	resemble	32
68	示す	shimesu	denote	32
69	膨らむ	fukuramu	swell	32
70	こだわる	kodawaru	stick to	32
71	まとめる	matomeru	put together	32
72	飲み込む	nomikomu	swallow	31
73	際立つ	kiwadatsu	stand out	31
74	知る	shiru	know	31
75	伝わる	tsutawaru	pass	31
76	比べる	kuraberu	compare	31
77	枯れる	kareru	wither	30
78	引き締まる	hikishimaru	tighten up	29
79	搾る	shiboru	squeeze	29
80	開く	hiraku	open	28
81	誇る	hokoru	boast	28
82	思える	omoeru	feel	28
83	置く	oku	place	28
84	撫でる	naderu	stroke	28
85	つける	tsukeru	attach	28
86	押し上げる	oshiageru	push up	27
87	伸びる	nobiru	grow	27
88	包む	tsutsumu	wrap	27
89	ざらつく	zaratsuku	gritty	27
90	引っかかる	hikkakaru	get stuck	26
91	仕上げる	shiageru	finish off	26
92	焦がす	kogasu	burn	26
93	食べる	taberu	eat	26
94	抑える	osaeru	curb	26
95	すべる	suberu	slip	26
96	効く	kiku	do good	25
97	仕上がる	shiagaru	finish	25
98	上がる	agaru	rise	25
99	醸し出す	kamoshidasu	brew	25
100	成す	nasu	make	25
101	来る	kuru	come	25

APPENDIX

Multi-dimensional scaling

Performing multi-dimensional scaling with many (50 to 100) words results in a plot that may be difficult to interpret. To make interpretation easier, KH Coder can perform a cluster analysis of words and present these clusters using different colors. Given that only 12 colors can be used at a time to identify clusters on the screen, a maximum of 12 clusters can be specified. This function is not available for three-dimensional plots.

If [Adjacent clusters] is checked under the “Multi-Dimensional Scaling Options” area on the right, cluster analysis is performed based on the score obtained in multi-dimensional scaling. This cluster analysis uses the Ward method based on Euclidian distance. Thus, words plotting close to each other are classified in the same cluster. Clearly, clustering can assist interpretation of the results of multi- dimensional scaling. This type of cluster analysis is also applied in “Concept Mapping” proposed by W. M. K. Trochim (1989), and is thought to be an effective method for exploring data with an unknown group or category structure (Afifi & Clark 1996).