Reinventing the Flavor Wheel

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Abstract

In this paper, the author proposes a new type of flavor wheels. The tasting words of former flavor wheels are arranged based on the taxonomical classification of the objects. In this study, the author proposes the new structure of flavor wheels: a) arrange tasting words based on the co-occurrence relationships, and b) not a hierarchical structure, but the network structure.

Keywords: flavor wheel, taste, odor, sake, luxury grocery items

1. Introduction

1.1. *General Flavor Wheels*

A flavor wheel, or a fragrance circle is a chart that is used in the domain of evaluating alcohol drinks or other luxury grocery items. There are various patterns of flavor wheels in the various domain, such as wine, coffee, whiskey, beer, and so on. The flavor wheel for chocolate shown in Figure. 1 is a typical example of flavor wheels, that has the hierarchical structure of the expression words.
As for Japanese sake, a flavor wheel based on the classifications of scientific flavor components was presented recently(Utsunomiya, 2012) (Figure. 2).

1.2. *Drawbacks of the Traditional Flavor Wheels*

The author points out mainly two drawbacks of ordinal flavor wheel: a) the lack of the relationships among the words and genres. And b) the hierarchical structure does not reflect the cognitive process of our representation of the tastes.
This study aims to overcome these two drawbacks and propose a new type of flavor wheel.

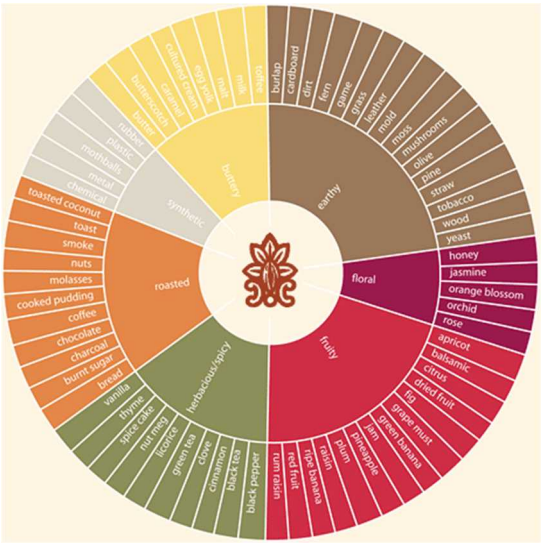

Figure. 1

An example of a general form of flavor wheels. This wheel is made by Chocolopolis – a famous chocolate company in Seattle. Various expression-words for flavors in chocolate is arranged in the outer circle, and abstract genres are set as the inner circle.

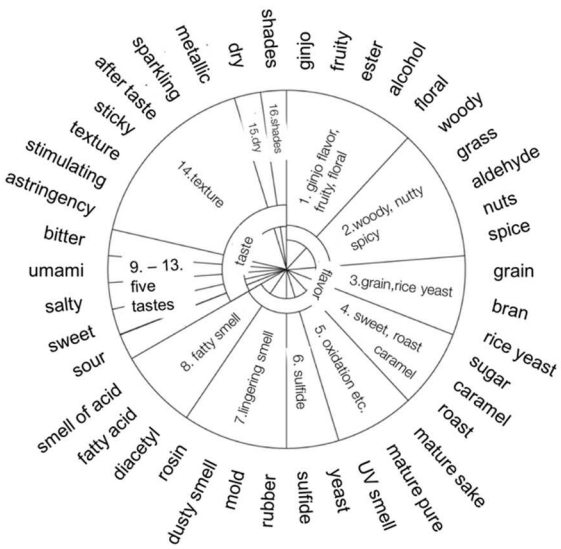

Figure. 2

A flavor wheel for sake, presented by Utsunomiya (2012). Translated by the author from Japanese to English for this paper.

1.3. *Reinventing the Flavor Wheels*

In order to overcome the drawbacks of the traditional flavor wheels, the author proposes a new format of the flavor wheel, applying natural language processing technologies.

The features of the new format are: a) arrange tasting words based on the co-occurrence relationships, and b) not a hierarchical structure, but the network structure.

2. Method

2.1. *Corpus*

In this study, the author used Sake Corpus: the corpus of Japanese sake tasting expressions. The corpus is based on books and magazines written entirely in Japanese, and Table 1 summarizes the details of each. Note that paragraphs refer to the different sake brand descriptions. The size of the Sake Corpus was 120,789 words.

The corpus is based on the (a) sake-reviewing books and magazines sold in Japan, and (b) the tasting comments and expressions provided given by 6 tasters including the author.

Table 1. Details of Sake Corpus

	Details
Tokens	120,789
Types	6,018
Sentences	5,582
Paragraphs (brands of sake)	2,388
Average Frequency	10.50
Standard Deviation	(64.55)

2.2. *Selecting Basic Tasting Words*

From the nouns in the corpus, the author picked up the basic tasting words. The conditions of the selection are: a) name of concrete foods (or objects) for expressing the tastes; b) the frequency is over three.

Under these conditions, following words are selected as the tasting words of sake: *white cedar, plum, caramel, cacao, chocolate, liche, grape fruit, lactate, raw cream, yoghurt, raisin, muscat grape, banana, vanilla, melon, grape, apple, peach, strawberry, pear, flower, nectar, truffle, cheese, cream, plum, maple syrup, candy, mineral, nut, Yubari king melon, hazelnut, almond, milk, cashew, walnut, butter, kaki (persimmon*

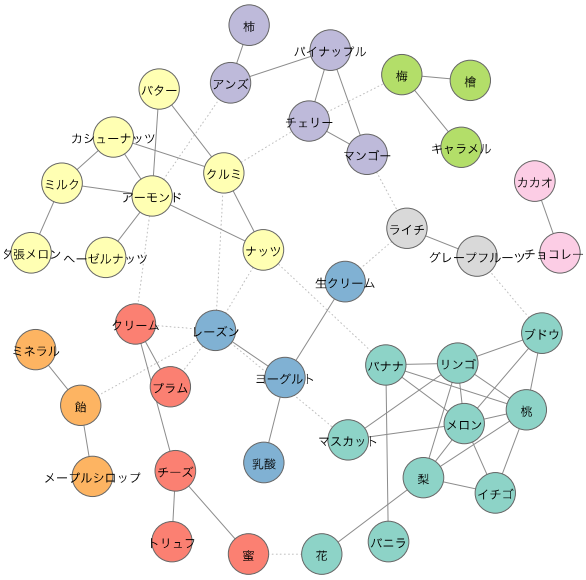

Figure. 3

The co-occurrence network of the basic tasting words in the sake corpus.

fruit), apricot, pineapple, mango, and *cherry*.

2.3. *Analyzing Co-occurrence networks*

Co-occurrence networks are generally used to provide a graphic visualization of potential relationships between people, organizations, concepts or other entities represented within written material. The generation and visualization of co-occurrence networks have become practical with the advent of electronically stored text amenable to text mining.

In this study, in order to determine the order and arrangement of the tasting words on the flavor wheel, the author uses the strength of co-occurrence relationships among the tasting words.

Based on the Jaccard index, the author made the co-occurrence network. Note that the Jaccard index is the correlation index in the corpus content words.

For drawing the co-occurrence networks and calculating the Jaccard index, the author used KH Coder (Higuchi, 2004) as a coding tool.

2.4. *Arranging the Basic Tasting Words*

In this section, the author presents the new type of flavor wheel with the basic tasting words and the co-occurrence network.

Clusters

In the former style of the flavor wheels, the clusters of the expression words are determined based on the hierarchical structure of scientific features or the taxonomical classifications.

In this study, the author tries to generate the new style of flavor wheel, in which the words and the clusters are arranged based on the relationships of co-occurrence networks.

Thus, in the new flavor wheel, the cluster reflects not the taxonomical classifications, but the relationships of the words in the reviewing sentence. This means that this study stresses the importance of human expressions rather than scientific measurement.

The composition of the word clusters may differ from our knowledge: the *cream* and *raw cream* are set in a separate category, on the other hand, ume-*plum* and *caramel* are set in the same category. These categorizations would never occur as long as we accept the taxonomical classifications. However, in the real context of the tasting reviews, *ume-plum,* and the *caramel* is used for the same sake in order to express the complex flavor of sake.

The Structure: Inner Circle and Outer Circle

In the new flavor wheel, the tasting words are arranged on the double layer. The words of the inner circle are prototype members of the category. And the words of outer circle are peripheral members of the category.

The prototype member is determined based on the numbers of the links each word has in the co-occurrence network. More links a word has, more typical the word would be in the category.

3. Result

As a result, the author produced the reinvented Flavor Wheel for sake, as shown in Figure. 4.

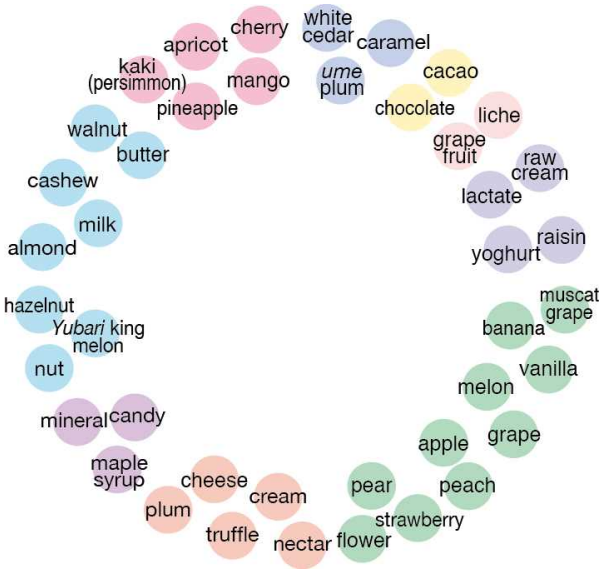

Figure. 4

Newly reinvented Flavor Wheel of Sake. This flavor wheel is based on the sake tasting expression corpus (120,000 words in Japanese). The category (cluster) and the arrangement of the words are determined by co-occurrence relationships (Jaccard index). Inner words are prototype members of the category, and the outer words are peripheral members of the category.

Categories

The flavor wheel consists of nine clusters, but it would be almost nonsense to give an abstract name to each category. The category is the "result" of the expressions, and only we have to do is not naming it but considering the hidden relationships and guessing why the two words are arranged side by side on the base of our sense of taste.

The Composition of the Categories

As same as the distance and connections of the words, the composition of the nine categories reflects the distance of the usage tendency (co-occurrence frequency).

4. Discussions

Our sensory domain of taste or odor is not the carbon copy of the sensor machine. And the taxonomical classifications and the perceptual category of taste do not share the same structure.

The taxonomical classifications and the category of the natural language have the hierarchical structure. This would be because the natural language is a vision and auditory-dominant system (Fukushima, Imai, & Tanaka, 2017).

The author has argued that the cognitive system of the taste is not the hierarchical process from basic level to upper/lower level, but the gradational categorization on the plain surface (Fukushima, 2018). The nouns of the natural languages have the hierarchical concept structure. On the other hand, verbs, adjectives, and adverbs have the gradational category (Tanaka & Fukaya, 1998). Thus, the author presumes that the category of the sensory domain of taste is the adjective category. From this viewpoint, the supporting tools for expressing the sense of taste should be focused on adjectives rather than nouns. The future development of the flavor wheel would be the reflection of the co-occurrence relationships between the tasting words and adjectives.

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