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Research Article

Conceptual Dictionaries for Adjective Concepts and Adjective Verb Concepts in an Integrated Narrative Generation System

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ABSTRACT

In our narrative generation study, we chiefly use the verb and noun conceptual dictionaries in the narrative generation system. Moreover, other conceptual dictionaries are also necessary for generating more interesting stories. In this study, we present basic methods for developing an adjective conceptual dictionary and adjective verb conceptual dictionary in an integrated narrative generation system (INGS). We refer to antonym relationships between adjective concepts and adjective verb concepts. Furthermore, as an approach to the application based on the above types of dictionaries, we introduce an attempt to use both the description of antonym relationships for the adjective & adjective verb concepts and our "coloring" technique for giving a certain atmosphere to a story to be generated.

1. Introduction

According to narratology, an academic discipline that studies the function and structure of narrative, a narrative is a sequence of events with a specific theme [1]. The content of a narrative is called a story. A story is a chronological sequence of events that occurs within a narrative, and an event is composed of nouns and verbs. In our study on the narrative generation system INGS [2], [3] (described later in this section), we take the approach of describe events as case structures [4], [5].

Our narrative generation system includes both noun-verb concepts as case structures and nouns and verbs in written expressions; nouns and verbs are used both as concepts and as surface words. Therefore, we created a dictionary of concepts and a dictionary of surface representations to link these two. Adjectives and adjectival verbs that modify nouns and verbs are the parts of speech that express the nature and state of things and are essential components of a story. Nouns and verbs must have meaning as concepts (noun and verb concepts) and not just as superficial linguistic expressions. The level of a particular case structure is distinguished by its written expression. Our narrative generation system includes both noun and verb concepts as case structures and nouns and verbs in written expressions, and nouns and verbs are used both as concepts and superficial words. Therefore, we created a lexicon of concepts and superficial expressions and linked them.

Adjectives and adjectival verbs that modify nouns and verbs are the parts of speech that express the nature and state of things and are essential components of a story. In this case, too, the adjectives and adjective verbs as concepts and those as surficial words should have both aspects. For example, if an adjective concept describes a character in a case structure as "brave," it is used to describe an aspect of the character's personality. It is also possible for the adjective "brave" to be used in superficial textual expressions.

The main theoretical underpinnings of our narrative generation systems research (described above) are

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narratology, AI, and cognitive science. Currently, Chat GPT [6], based on machine learning with neural networks, has achieved great success as dialogue AI. In this context, research on making computers talk about some things is an area that has attracted considerable attention. For example, the Buncho [7] can be considered as part of this type of generative AI research. Early narrative studies that, like ChatGPT, were generated through dialogue include the following. Artificial intelligence that interacts with humans and robots equipped with such AI are of great significance in today's society, starting with ELIZA, which was released by Weizenbaum [8] and fascinated people at that time. Recently, catering robots have been in full operation in some restaurants, and robots will be required to interact more with humans in the future. It would be interesting to see more advanced story generation systems integrated with dialog generation systems in the future.

As mentioned above, we are developing a narrative generation system that organically integrates the knowledge of narrative structures with artificial intelligence techniques. We call this an integrated narrative generation system (INGS) [2], [3]. Regarding the knowledge of a narrative's structure, the INGS has conceptual dictionaries that are used to generate the narrative. Thus far, we have developed noun and verb conceptual dictionaries for events that constitute a narrative [9]. Therefore, we prepared a modifier conceptual dictionary containing adjective concepts, adjective verb concepts, and adverbial concepts as its components [10]. In this study, we focus on adjective and adjective verb concepts among the components of the modifier dictionary.

The purpose of this paper is to present the structure of the adjective and adjective verb conceptual dictionaries and study how to store and use antonym concepts. In the case structure and superficial sentence representations associated with it, the traditional system's central use of noun-verb concepts and noun-verb words has been the main focus, but if this research allows the flexible use of adjective-verb concepts and adjective-verb words, the results of narrative generation will be more concrete and can be accompanied by images. This would also create a greater impression on the reader in future conversational story generation, which is currently expected to be effective.

Section 2 describes the integrated narrative generation system that is the background of this study. Section 5 discusses the problems and expansions of adjective and adjective verb conceptual dictionaries and Section 6 concludes this study.

2. Integrated Narrative Generation System

This section describes the architecture of INGS and shows a story structure in the INGS.

2.1. Architecture of INGS

The INGS has a story generation mechanism and surface expression mechanism. The story generation mechanism represents the relationship between events in a story in a tree structure. The surface expression mechanism generates sentences, music, and images based on the story structure generated by the story generation mechanism.

Next, we describe the knowledge base of INGS. The INGS has a story content knowledge base for story generation. This knowledge base stores both the fragmentary structure and the larger structure of a story, such as the beginning and end of a story. Story generation refers to the merging and editing of stories. Using conceptual dictionaries, these story structures are associated with various meanings by means of a concept dictionary.

A conceptual dictionary provides systematic meanings to the elements that appear in a story. We developed noun and verb conceptual dictionaries [9]. Here, we focus on the verb conceptual dictionary related to the adjective and adjective verb conceptual dictionaries described in Section 3 and Section 4. The noun conceptual dictionary share the same hierarchical structure and are connected to the verb conceptual dictionary in that they are connected to the linguistic dictionaries described below.

The verb conceptual dictionary has a hierarchical structure. The dictionary contains both the intermediate and terminal concepts. Intermediate concepts represent the semantic categories of verbs. Terminal concepts are the verb concepts that appear in a story.

Fig. 1 shows the description format of the verb concept frame. The “sentence pattern” slot indicates the basic form of the sentence expression, and the “case structure” slot indicates the case required by the verb concept. “Constraint” slot indicates the possible noun concepts for each case. “Is-a” slot indicates an intermediate concept that the verb concept corresponds.

```
((name <verb>)
  (sentence-pattern <sentence pattern>)
  (case-cons-set
    ((case-frame ((agent nil) (counter-agent nil) (location nil)
(object nil) (instrument nil) (from nil) (to nil)))
      (constraint (<constraints>))))
       (is-a (<intermediate concept>)))
```

Fig. 1 Description format of terminal concepts in verb conceptual dictionaries.

Verb concepts are associated with linguistic dictionaries. The linguistic dictionary stores the notation of concepts. The linguistic dictionary stores the description patterns. The Japanese language has kanji, hiragana, and katakana characters, which are used in combination to describe words and sentences.

Fig. 2 shows a part of the hierarchical structure of the adjective and adjective verb conceptual dictionary. The hierarchical structures of the two dictionaries are based on the verb conceptual dictionary. Only a few tentative intermediate concepts in these dictionaries are set up using intermediate concepts from the verb conceptual dictionary [9]. The verb conceptual dictionary includes 36 types of categories.

2.2. Story structure in the INGS

A story is represented by a conceptual structure. An event in a story is described using a case structure. Each case contains instances that appear in the story. Each instance contains an attribute frame that describes the properties of a character, object, or place.

Fig. 3 shows the case frame of an event based on a verb concept “食べる 2[eat],” and a part of an attribute frame in the event. The case structure represents “A boy eats a raisin-bread.” In the case frame, “age%boy#1” and “obj%raisin-bread#1” are instances. Each instance has an attribute frame. The frame of “obj%raisin-bread#1” is shown in the Fig. 3. The attribute frame of has the property “delicious” in “taste” slot. Fig. 4 shows an example of sentence generation based on the case frame

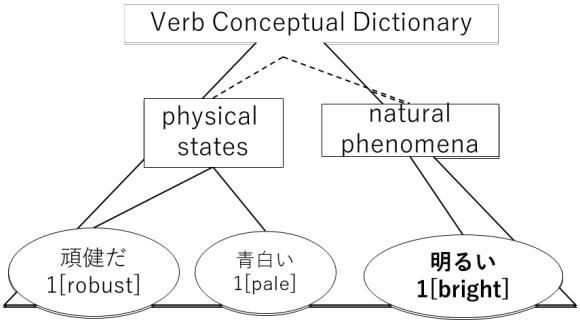

Fig. 2. A part of a hierarchical structure in the adjective and adjective verb conceptual dictionaries

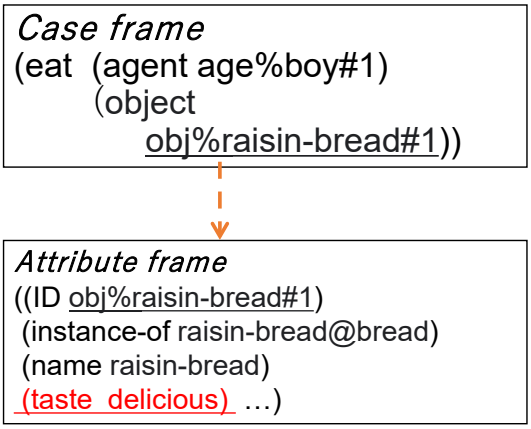

Fig. 3 An example of a case frame

shown Fig. 3. In sentence generation, the process generates an internal representation from the case frame. The internal representation has “description” slot. The slot is made by “taste” slot in the frame of “obj%raisin-bread#1.” In the result, the sentence “A boy eats a raisin bread.” is generated.

3. Adjective Conceptual Dictionary

Fig. 5 shows the hierarchical structure of the adjective concepts in the adjective conceptual dictionary. The adjective conceptual dictionary includes 735 adjective concepts. An adjective concept corresponds to one of the following nine types of intermediate concepts: attributes, possessions, relative relations, perceptual states, emotional states, thought states, physical states, natural phenomena, and emotional actions. Table 1 shows the categories of intermediate concepts and the number of each category. Moreover, this table describes the names of the adjective concepts included in each category as examples.

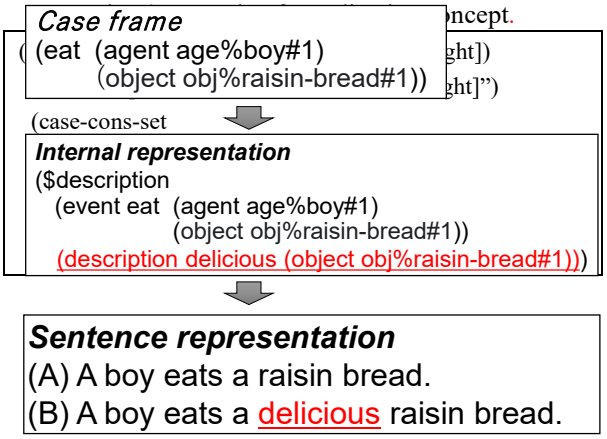

Fig. 4 Sentence generation based on a case frame

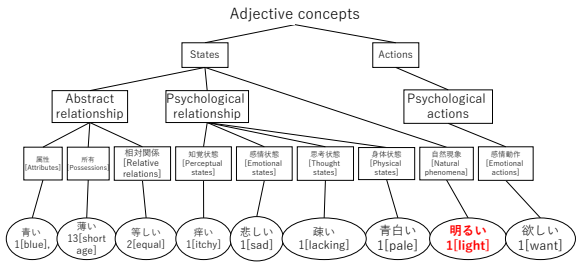

Fig. 5 Hierarchy in the adjective conceptual dictionary

Each adjective concept's representation form directly uses the structure of a verb concept as shown in Fig. 1. On the other hand, Fig. 6 is the example for an adjective concept. Although the slots in the form were explained in Section 2.1, we focus on the slot of "constraint." "Constraint" slot corresponds to one or more noun concept(s). A noun concept is the target modified by the adjective concept. For instance, as "明るい 1[bright]" in Fig. 6 modifies "屋外[outdoor]," the sentence of "屋外は明るい (Outdoor is bright)" can be generated using information written in the "sentence pattern" slot.

4. Adjective Verb Conceptual Dictionary

Fig. 7 shows the hierarchical structure of the adjective verb concept. The conceptual dictionary of adjective verb has 908 adjective verb concepts. An adjective verb concept is corresponded to one of the following eight types of intermediate concepts: existence, attributes, relative relations, perceptual states, emotional states, thought states, physical states, and natural phenomena. Table 2 shows the categories of intermediate concepts and the number of each category. Moreover, this table describes the names of the adjective verb concepts included in each category as examples.

Table. 1 Categories and examples of the adjective concepts

Intermediate concepts	Amount	Adjective concepts
属性 [Attributes]	634	高い 8[sonorous], 冷たい 1[cold], いやらしい 1[disagreeable], ひどい 2[severe], 華々しい 1[brilliant], 浅い 6[inexperienced], 緩い 4[gentle], 甘い 9[loose], 平たい 1[flat], 苦しい 6[awkward], 荒い 3[extravagant], 高い 3[high-pitched], 限りない 2[endless], 乏しい 1[poor], 若い 3[young], 速い 1[fast], そそっかしい 1[careless], 危ない 3[insecure], 飽きっぽい 1[fickle], 荒々しい 1[rough], 偉い 1[great], 手厳しい 1[severe], 苦しい 4[tight], 夥しい 1[large], みっともない 2[shabby], 芳しい 2[favorable], 明るい 3[cheerful], 惜しい 2[a pity], 早い 3[quick-witted], 乏しい 3[poor]
所有 [Possessions]	1	薄い 13[have a minimal relation]
相対関係 [Relative relations]	6	等しい 2[equal], 相等しい 1[equal], 悪い 16[do not get on well], 遠い 2[distantly related], 薄い 9[have little to do], 近い 3[close]
知覚状態 [Perceptual states]	26	痛い 1[have a headache], 痛い 2[have a toothache], 寒い 1[cold], 息苦しい 1[breathe with difficulty], 痒い 1[feel itchy], だるい 1[feel heavy], 弱い 8[have weak eyesight], 弱い 9[have weak eyes], 珍しい 1[unusual], きつい 1[tight]
感情状態 [Emotional states]	44	甘い 1[indulgent], 悲しい 1[sad], 恥ずかしい 1[ashamed], 重い 5[depressed], 嬉しい 1[glad], 恐ろしい 1[afraid], 気まずい 1[N2 feel awkward], 好ましい 1[desirable], 寂しい 1[lonely], つらい 1[painful]
思考状態 [Thought states]	1	疎い 1[ignorant]
身体状態 [Physical states]	7	青白い 1[pale], おかしい 1 [wrong], 苦しい 1[breathe heavily], 逞しい 1[have a strong], 良い 12[have a healthy complexion], 悪い 19[unwell], 弱い 1[week]
自然現象 [Natural phenomena]	9	明るい 1[light], 濃い 1[dense], 少ない 1[little], 深い 1[dense], 強い 5[windy], 多い 14[we have much snow], 眩しい 2[dazzling], 激しい 1[violent]
感情動作 [Emotional actions]	7	狭い 6[feel ashamed], 欲しい 2[want], 欲しい 1[want], 重い 8[have a heavy heart], 良い 9[feel comfortable], 悪い 9[uncomfortable], 重い 6[feel low]

Same as the case of adjective concepts, each adjective verb concept also has the form shown in Fig. 1. The meaning of each of the frames included in the form is also equal to the explanation for Fig. 1. Fig. 8 is the example for an adjective verb concept. We explain the "constraint" slot here. This slot corresponds to one or more noun concept(s). The "constraint" slot in "頑健だ 1[robust]" corresponds to "人[human]," "動物[animal]," and "動物{部分}[animal{part}]." Using one of the possibilities, we can a sentence of "動物は頑健だ (Animal is robust)." Furthermore, "動物[animal]" can be exchanged with concrete concepts. For instance, we can make another sentence, such as "サイ[Rhinoceros]は頑健だ (Rhinoceros is robust)."

5. Problem, Expansion and Application

This section summarizes the problem and the development of the adjective conceptual dictionary and the adjective verb conceptual dictionary, and shows an application of the dictionaries.

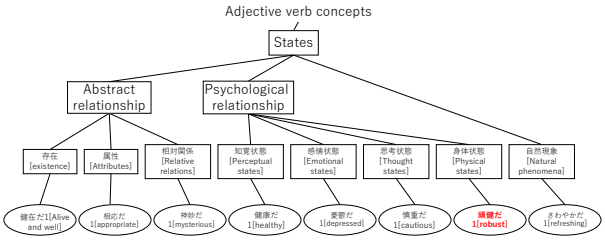

Fig. 7 Hierarchy in the adjective verb conceptual dictionary

5.1 Problem of the dictionaries

The adjective conceptual dictionary and the adjective verb conceptual dictionary concentrate the terminal concepts on the intermediate concept "attribute," and there is room for more fine-grained classification using linguistic studies. By making the granularity of the intermediate concepts finer, the INGS can control narrative generation more flexibly. In this study, we first focus on the adjectival concept dictionary and discuss its potential for development. The National Institute for Japanese Language and Linguistics (NINJAL) and Nishio [11] focused on semantic expressions and developed a classification of adjectives. Table 3 summarizes these classifications.

Table. 2 Categories and examples of the adjective verb concepts

Intermediate concepts	Amount	Adjective verb concepts
存在[Existence]	1	健在だ 1[be well]
属性[Attributes]	878	突飛だ 4[eccentric], 不自然だ 1[unnatural], 濃密だ 3[strong], 地味だ 3[conservative], 雅やかだ 1[elegant], 大変だ 5[splendid], 法的だ 1[legal], 積極的だ 2[positive], 不正だ 1[unjust], 密だ 2[dense], 単一だ 1[single], 閑静だ 1[quiet], 斬新だ 1[original], 身軽だ 1[light], 頑固だ 2[persistent], 秀逸だ 1[excellent], 急だ 3[steep], 垂直だ 1[vertical], 人並みだ 1[average], 奇妙だ 3[funny], 慎重だ 2[careful], 不調だ 1[in bad condition], 単調だ 1[monotonous], 崇高だ 1[noble], 温暖だ 1[mild], 幸運だ 1[lucky], 確かだ 2[reliable], 雑だ 1[rough], 下等だ 2[mean], 馬鹿正直だ 1[naively honest]
相対関係[Relative relations]	1	神妙だ 1[docile]
知覚状態[Perceptual states]	4	不調だ 1[in bad condition], 正気だ 1[sane], 元気だ 1[fine], 健康だ 1[healthy]
感情状態[Emotional states]	8	憂鬱だ 1[gloomy], 平静だ 1[calm], 不安だ 1[insecure], 闘志満々だ 1[full of fight], 上機嫌だ 1[in a good humor], 孤独だ 1[lonely], ハッピーだ 1[happy], ショッキングだ 1[shocking]
思考状態[Thought states]	4	慎重だ 1[cautious], 賛成だ 1[agree], 反対だ 1[opposed], 無関心だ 1[indifferent]
身体状態[Physical states]	8	不健康だ 1[unhealthy], 薄弱だ 1[feeble], 蒼白だ 1[deathly pale], 真っ青だ 1[deadly pale], 丈夫だ 2[healthy], 元気だ 2[healthy], 虚弱だ 1[weak], 頑健だ 1[robust]
自然現象[Natural phenomena]	4	さわやかだ 1[crisp], 永久だ 1[permanent], 気紛れだ 1[volatile], 濃厚だ 1[dense]

Table 3 has been considered for revision in other studies. For example, Utsumi, Hori, and Ohsuga [12] replaced some of the attributive adjectives related to things with the five human senses and organized them into "character," "appearance," "action," and "attribute" for those related to people. In addition, "semantic elements" were extracted for the adjectives in each category as the source of expressing the meanings of the adjectives (e.g., "brightness" from "light" and "dark"). Zhang [13] considered "evaluative adjectives," such as

```
(set '頑健だ 1[robust] '((name 頑健だ 1[robust])
    (sentence-pattern "N1 が 頑健だ[N1 is robust]")
    (case-cons-set
     ((case-frame ((agent nil) (counter-agent nil) (location
       nil) (object nil) (instrument nil) (from nil) (to nil)))
      (constraint (( 人 [human] 動 物 [animal] 動 物 { 部
       分}[animal{part}])))))
      (is-a (d 身体状態[physical states]))))
```

Fig. 8 An example of an adjective verb concept.

"cute, funny, and amusing," which are considered to be intermediate between emotional and attributive adjectives.

Comparing the National Institute for NINJAL and Nishio's classification with our adjective concept dictionary, the general trend is that "emotion adjectives" correspond to perceptual states, emotional states, thought states, and emotional actions, and "attribute adjectives" correspond to "attributes" plus existence, possession, relative relations, physical states, and natural phenomena.

Since "attributes" is a mixture of adjective concepts that modifying "things" and "person" in the conceptual dictionaries (e.g., "new" that modifying an object and "bright" that modifying the person). We need to subdivide the hierarchical structures of the conceptual dictionaries.

In the future, we will continue to study the classification of NINJAL and Nishio as well as other studies, and revise the classification of our adjective conceptual dictionary.

Table 3 Category of adjectives by NINJAL and Nishio [11]

Category	Sub-category		Examples
感情形容詞 [Emotion adjective]	感情[Emotion]		嬉しい[grad], 悲しい[sad]
	感覚[Sence]		痛い[painful], 寒い[cold]
属性形容詞 [Attribute adjective]	広汎なものごとの属性 [Attribute of extensive things]		等しい[equal], 良い[good]
	ものに関する属性 [Attribute of things]	空間的な量 [Spatial amount]	高い[high]
		色[Color]	白い[white]
		音[Sound]	騒々しい[noisy]
		味[Taste]	甘い[sweet]
		におい[Smell]	くさい[stinking]
		その他[Others]	重い[heavy]
	ひとに関する属性[Attribute of humans]		優しい[kindly], ずるい[wily]
	ことの属性 [Attribute of matters]		いちじるしい [remarkable], すごい[wonderful]
	程度[Degree]		すごい[terrific], 非常に[extremely]

5.2 Expanding two conceptual dictionaries

First, using various web dictionaries, we collected words with antonym relationship of adjective concepts and adjective verb concepts in the developed conceptual dictionaries. Next, we expanded the description forms of adjective concepts and adjective verb concepts using the collected words. The following is the detailed explanation of the above description.

1. We collect words with antonym relationships for the adjective and adjective verb concepts in the developed dictionaries using the following web dictionaries, which includes many Japanese words and the corresponding antonym words.

(1) "Weblio Antonyms/Synonyms Dictionary" (https://thesaurus.weblio.jp/antonym/)
(2) "Dictionary of Antonyms/Synonyms Online" (https://taigigo.jitenon.jp/)
(3) "Large Dictionary of Antonyms" (https://hantaigo.com/)

In particular, we manually collect words by using the names, words, describing the adjective concepts and adjective verb concepts in their dictionaries as the retrieval keywords.

2. We expand the adjective and adjective verb conceptual dictionaries using the collected words. In particular, we manually search the description of concepts that are equal to the collected words for the respective dictionaries. If a collected word processing is matched with a concept, the procedure (A) is processed; otherwise, the procedure (B) is processed.

Procedure (A): A "antonym slot" is inserted into the frame of a matched concept and an antonym is described as the value of the slot. Fig. 9 shows the expanded description of a frame. Moreover, the frame name including the described word is inserted

into the concept frame that corresponds to the described word.

Procedure (B): A new concept frame is made based on the collected words. Next, the procedure (A) is called.

We have partially collected 949 words (524 adjectives, 425 adjective verbs) with antonym relationships according to the above process. Each of the 949 words become a pair with an adjective concept or adjective verb concept. Table 4 and 5 respectively show a part of the pairs in the adjective concepts and adjective verb concept. Each value next to the name of intermediate concept is the number of pairs in each intermediate concept.

This applied development leads to the representation of the relationship between concepts as a network. Utsumi, Hori, and Ohsuga [12] showed a diagram of the relationship between semantic elements, and we would like to develop our concept dictionary into such a network of relationships.

5.3 Application of the dictionaries: Coloring

We presented a method called “coloring.” “Coloring” adds words related to the certain atmosphere to a story and changes atmosphere in the story [14]. One of the ways to realize “coloring” is using adjective concepts and adjective verb concepts. For instance, “Coloring” uses the words such as “refreshing,” “cool”, and give the impression of blue to a story. We have implemented a coloring method based on four different approaches [14].

```
(set <Concept> ‘((name <Name>)
  (sentence-pattern <Pattern>)
  (case-cons-set
    ((case-frame <Case(s)>) (constraint <Constraint(s)>)))
      (is-a (<Concept(s)>))
      (antonym <Concept with antonym relationship of
this concept>)
    ))
```

Fig. 9 The form of an adjective or adjective verb concept adding antonym’s element

Two of these methods use adjective concepts and adjective verb concepts.

Methods using adjective concepts select each concept based on color. One method allows the user to specify any color, while the other is based on the distribution of colors in a given image. In both methods, the adjective concepts or the adjective verb concepts are inserted into the attribute frame of a person, object, or place, which is

Table 4 Examples of the pairs based on antonym relationships in the adjective concept

Intermediate concepts	Antonym relationships
属性 [Attributes] (489)	いやらしい 1[disagreeable] ⇔ 好ましい[desirable], 明るい 3[cheerful] ⇔ 暗い[gloomy], 高い 3[high-pitched] ⇔ 低い[low-pitched], 高い 6[tall] ⇔ 低い[short], 高い 7[high nutritional value] ⇔ 低い[low nutritional value], 高い 8[sonorous] ⇔ 低い[low class], 高い 9[valuable] ⇔ 低い[low], 冷たい 1[cold] ⇔ 熱い[hot], 浅い 1[shallow] ⇔ 深い[deep], 浅い 3[slight] ⇔ 深い[deep], 浅い 6[inexperienced] ⇔ 深い[deep experience], 緩い 4[gentle] ⇔ きつい[tight], 甘い 9[loose] ⇔ 厳しい[strict],, 苦しい 3[painful] ⇔ 楽しい[fun], 苦しい 4[tight] ⇔ 楽しい[fun], 苦しい 5[poor] ⇔ 楽しい[fun], 苦しい 6[awkward] ⇔ 楽しい[fun], 荒い 3[extravagant] ⇔ 穏やか[calm], 若い 3[young] ⇔ 老いた[old], 速い 1[fast] ⇔ 遅い[slow], 危ない 3[insecure] ⇔ 安全[safe], 飽きっぽい 1[fickle] ⇔ 粘り強い[tenacious], 荒々しい 1[rough] ⇔ 穏やか[calm], 偉い 1[great] ⇔ 詰まらない[worthless], 手厳しい 1[severe] ⇔ 手緩い[mild], 芳しい 2[favorable] ⇔ 臭い[stinking], 早い 3[quick-witted] ⇔ 遅い[dull-witted], 乏しい 1[poor] ⇔ 豊か[rich], 乏しい 2[short] ⇔ 豊か[rich], 乏しい 3[poor] ⇔ 豊か[rich]
所有 [Possessions] (0)	No antonym words were found for concepts in this intermediate concept.
相対関係 [Relative relations] (3)	等しい 2[equal] ⇔ 異なる[different], 遠い 2[distantly related]⇔ 近い[close], 近い 3[close] ⇔ 遠い[distantly related]
知覚状態 [Perceptual states] (7)	寒い 1[cold] ⇔ 暑い[hot], きつい 1[tight] ⇔ 緩い[loose], 弱い 8[have weak eyesight] ⇔ 強い[strong], 弱い 9[have weak eyes] ⇔ 強い[strong], 痛い 1[have a headache] ⇔ 痒い[feel itchy], 痛い 2[have a toothache] ⇔ 痒い[feel itchy], 痒い 1[feel itchy] ⇔ 痛い[ache]
感情状態 [Emotional states] (9)	悲しい 1[sad] ⇔ 嬉しい[happy], 寂しい 1[lonely] ⇔ 賑わしい[lively], 甘い 1[indulgent] ⇔ 厳しい[strict], 恥ずかしい 1[ashamed] ⇔ 誇らしい[proud], 重い 5[depressed] ⇔ 軽い[feel light], 嬉しい 1[glad] ⇔ 悲しい[sad], 恐ろしい 1[afraid] ⇔ 優しい[kind], 気まずい 1[N2 feel awkward], , 好ましい 1[desirable] ⇔ 疎ましい[unpleasant], つらい 1[painful] ⇔ 楽しい[amusing]
思考状態 [Thought states] (1)	疎い 1[ignorant] ⇔ 詳しい[familiar]
身体状態 [Physical states] (4)	逞しい 1[have a strong] ⇔ ひ弱い[sickly], 青白い 1[pale] ⇔ 赤黒い[dark red], 弱い 1[week] ⇔ 強い[strong], 苦しい 1[breathe heavily] ⇔ 楽しい[pleasant]
自然現象 [Matural phenomena] (7)	明るい 1[blight] ⇔ 暗い[dark], 濃い 1[dense] ⇔ 薄い[thin], 少ない 1[little] ⇔ 多い[a lot of], 深い 1[dense] ⇔ 薄い[thin], 強い 5[windy] ⇔ 弱い[calm], 多い 14[we have much snow] ⇔ 少ない[little], 激しい 1[violent] ⇔ 穏やか[calm]
感情動作 [Emotional actions] (4)	良い 9[feel comfortable] ⇔ 悪い[uncomfortable], 悪い 9[uncomfortable] ⇔ 良い[feel comfortable], 重い 8[have a heavy heart] ⇔ 軽い[cheer], 狭い 6[feel ashamed] ⇔ 広い [wide]

Table 5 Examples of the pairs based on antonym relationships in the adjective verb concept

Intermediate concepts	Antonym relationships
存在 [Existence] (0)	No antonym words were found for concepts in this intermediate concept.
属性 [Attributes] (415)	斬新だ 1[original] ⇔ 陳腐[commonplace], 幸運だ 1[lucky] ⇔ 不運[unfortunate], 濃密だ 1[thick] ⇔ 希薄[thin], 濃密だ 2[deep] ⇔ 希薄[thin], 濃密だ 3[strong] ⇔ 希薄[thin], 地味だ 3[conservative] ⇔ 派手[gaudy], 大変だ 5[splendid] ⇔ 小変[slight change], 積極的だ 2[positive] ⇔ 消極的[passive], 単一だ 1[single] ⇔ 多様[various], 単一だ 2[unitary] ⇔ 複合[compounded], 単一だ 3[simple] ⇔ 複合[compounded], 閑静だ 1[quiet] ⇔ 喧騒[loud], 頑固だ 1[obstinate] ⇔ 従順[obedient], 頑固だ 2[persistent] ⇔ 温順[docility], 急だ 1[urgent] ⇔ 緩やか[generous], 急だ 3[steep] ⇔ 緩やか[gentle], 急だ 4[sharp] ⇔ 緩やか loose], 急だ 5[rapid] ⇔ 緩やか[slow], 垂直だ 1[vertical] ⇔ 水平[horizontal], 慎重だ 2[careful] ⇔ 軽率[thoughtless], 不調だ 1[in bad condition], 単調だ 1[monotonous] ⇔ 多様[various], 温暖だ 1[mild] ⇔ 寒冷[cold], 確かだ 1[certain] ⇔ 不確か[uncertain], 確かだ 2[reliable] ⇔ 不確か[uncertain], 確かだ 3[sound] ⇔ 不確か[uncertain], 確かだ 4[correct] ⇔ 不確か[uncertain], 雑だ 1[rough] ⇔ 純[pure], 下等だ 1[lower] ⇔ 上等[good], 下等だ 2[mean] ⇔ 上等[good], 下等だ 3[inferior] ⇔ 上等[good], ,
相対関係 [Relative relations] (0)	No antonym words were found for concepts in this intermediate concept.
知覚状態 [Perceptual states] (2)	健康だ 1[healthy] ⇔ 不健康[unhealthy], 元気だ 1[fine] ⇔ 病気[sick]
感情状態 [Emotional states] (2)	上機嫌だ 1[in a good humor] ⇔ 不機嫌[in a bad humor], 孤独だ 1[lonely] ⇔ 愛[love]
思考状態 [Thought states] (0)	No antonym words were found for concepts in this intermediate concept.
身体状態 [Physical states] (5)	虚弱だ 1[weak] ⇔ 強壮[strong], 蒼白だ 1[deathly pale] ⇔ 紅潮[blush], 丈夫だ 2[healthy] ⇔ 手弱女[femininity], 元気だ 2[healthy]⇔ 病弱[sickly], 頑健だ 1[robust] ⇔ 柔弱[week]
自然現象 [Natural phenomena] (2)	永久だ 1[permanent] ⇔ 束の間[moment], 濃厚だ 1[dense] ⇔ 希薄[thin]

the final coloring target, thus matching the story content to a specific atmosphere. However, "coloring" by adjective concepts and adjective verb concepts can't deal with words that negative impressions by the limitations of the color image scale. The antonymy relationship can leads negative words from positive ones. So, the antonymy relationship expands "coloring."

6. Conclusion

In this study, we developed the first version of an adjective conceptual dictionary and an adjective verb conceptual dictionary in the INGS.

The developed conceptual dictionaries equally have same problems that the verb conceptual dictionary has (the conceptual dictionaries treated in this paper is based on the verb conceptual dictionary). The first problem is that each of hierarchical structures does not hold an appropriate amount of layer. In particular, "attributes" as one of intermediate concepts has 86~96% adjective concepts and adjective verb concepts. This structure results in the difficulty of adequate concept selection in modifying an element in a narrative generation process. The improvement is a future important work.

In addition, we collected words with antonym relationships for the adjective concepts and the adjective verb concepts. The collected words are used to expand adjective conceptual dictionary and adjective verb conceptual dictionary. In the future, we will continue to collect words with antonym relationships for the adjective and adjective verb concepts and challenge generation experiments using the expanded conceptual dictionaries.

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Authors Introduction

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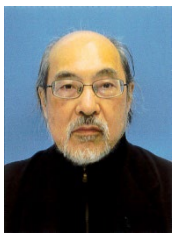

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