

## Chapter 7

# Thesaurus with Predicate– Argument Structure to Provide Base Framework to Determine States, Actions, and Change–of–States

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### **ABSTRACT**

*The goal with this chapter is to discuss the possibility of language resources in determining the states, actions, and change-of-states of characters in narratives. An overview of previous work on linguistic theory and language resources is given then the Predicate-Argument Structure Thesaurus (PT), a Japanese language resource constructed based on the extended framework of the Lexical Conceptual Structure (LCS), is proposed. The PT provides hierarchical clusters of synonyms for 11,900 predicates and 22,000 example sentences annotated with semantic role labels. Each concept has an abstracted LCS, and example sentences are attached to each concept. By virtue of the structure, a correlation of the arguments between other clusters can be determined. The semantic structure of the PT is investigated to enrich generated texts of narratives, and the high possibility of lexical semantics contributing to narrative processing is revealed.*

### **INTRODUCTION**

In narratives, characters will take actions and cause events, and the results of the events cause other events, so that a sequence of events forms a story. Since events comprise change-of-states, actions, and states that can be expressed using verbs and adjectives, analyses of predicates and their arguments are a key issue for constructing a narrative processing system. In narrative studies, the story structure, e.g., Propp (1968), and discourse structure, e.g., Genette (1972), have been extensively discussed by e.g.,

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Ogata and Kanai (2010); however, lexical semantics, i.e., the semantic structure of predicates and their arguments, has not been thoroughly discussed in narratology. One of the state-of-the-art systems of AI-based narrative generation is constructed using a case frame lexicon as a base unit of story grammar. The case frame structure is good for making simple sentences designated by the story grammar; however, the case frame lexicon does not have a mechanism to generate grammatical paraphrases (e.g., causative alternation). The predicate-argument structure in the study of lexical semantics can provide grammatical paraphrases because the goal with lexical semantics is to analyze interactions between grammatical paraphrases and lexical meanings. The predicate-argument structure has also the potential for evaluating the consistency of generated event sequences in accordance with shallow physical constraints of the story world. This function can be effective for *catalyzers*, which are the descriptions of trivial incidents inserted between the core story events for conveying the moods of the scenes (Barthes, 1966). Arai (1985) pointed out the mood as well as the story of the narrative is an essential reason the reader wants to read the narrative more than once. Therefore, the goal with this manuscript is to show the possible contribution of lexical semantics to narratology.

Gruber (1965) proposed describing shared meanings between verbs as a pre-dictionary structure, and this idea is extended as a lexical conceptual structure (LCS) (Jackendoff, 1990; Kageyama, 1996) that can describe the compositional structure of shared meanings of predicates with arguments. The LCS has a transparent structure of not only syntactic derivations, such as the causative, transitive, and intransitive forms of a verb, but also semantic derivations such as between change-of-state and state expressions e.g., *He put the book on the shelf* suggests the book is on the shelf; thus, the LCS is suitable for describing a core conceptual meaning of a predicate, especially for change-of-state.

Large-scale examples are quite useful for constructing language processing systems, e.g., thesauruses of words (i.e., WordNet (WN)), annotation data of predicate-argument relations for texts (e.g., Prop-Bank), and detailed predicate-argument databases (i.e., FrameNet (FN)) that are available in English. These English language resources are used in practical language processing systems (see Background); however, they do not provide decompositional features directly; thus, reconstructing another resource by taking into account the relations between change-of-states and state for predicates is necessary. In addition, Japanese language resources of predicate-arguments are not sufficient compared with English language resources.

Because of such background, a thesaurus of a predicate-argument structure for Japanese is proposed on the basis of an extended framework of the LCS. The thesaurus contains hierarchical concepts of shared meanings for about 11,900 predicates with 22,000 example sentences annotated with semantic role labels. Each of the concepts has an abstracted conceptual structure that enables the description of compositional features of shared meaning. The hierarchical conceptual labels enable users to obtain shallow to detailed concepts, and the upper concepts entails the lower concepts. Thanks to the conceptual structure, our thesaurus can provide flexible modifications to a sentence. For example, if we would like to add a causer to *the door opened*, the thesaurus suggests that it can take a subject-verb-object construction as *a strong wind opened the door*. The modification corresponds with the controlling plot in narratives. The conceptual structure also allows users to obtain semantic relations crossing the hierarchy of concepts. This function can be applied to a consistency evaluation of generated sentences with shallow physical restrictions in the narrated world. For example, the following two sequential sentences *Dr. N made a robot* (*Generate* concept) and *he kept the robot at his side* (*Ongoing* concept) (Hoshi, 1975) are validated with the thesaurus concepts. This is because the existence of the robot is consistent between the two sentences, that is, the *Generate* concept indicates that the robot came into existence, and the

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