

DUALITY IN ASPECTUAL EXPRESSIONS

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Abstract: One linguistic problem we take into account is the problem of sentential aspects. They could be analysed in terms of 'durativity and momentaneousness'. Then 'durative' and 'momentaneous' sentential aspects are denoted by Σ and Π respectively, which are introduced into logical formulae. In order to express Σ and Π in a language processing model on computers, we need more information about the background of the utterance, and this background is sometimes widening and sometimes narrowing. The quantifier Σ is the abstraction of 'durative', and the durative aspect indicates that the background of the utterance (in time and space) is widening. On the other hand, Π is the abstraction of 'momentaneous' and the momentaneous aspect indicates that the time and space of the background is narrowing. We need a language processing model, which is capable of describing the structure of the background. Such a model, named 'Contextual Language Processing Model' is proposed in this research.

Keywords: Sentential aspects, duality, contextual language model

1. DUALITY

Duality is defined as the correspondence which results in the identity if it is applied twice. It means that duality can be found in phenomena with double structures corresponding to each other. Duality has been used to analyse, crystallise, and classify phenomena in scientific fields, in order to reduce by half diverse treatments. In linguistics, the logical square of opposition, i.e. Aristotle's square which has been used in numerous theories, expresses dual relations through contrary and contradictory links among quantifiers. For example, "all" and "some" are related as duals of each in the square. In a model theoretic approach, Barwise and Cooper (1981) gave the definition of duality among quantifiers in natural language. They treated primarily quantifiers of noun phrases in the model based on the set of entities. Quantifiers in natural language are not limited to

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noun phrases. For example, space-temporal adverbs are conceived as quantifiers of sentences. It seems significant to seek a model for more general quantifiers including sentential's.

One linguistic problem we take into account is the problem (Comrie, 1976) of sentential aspects. Since sentential aspects are tools to express the detailed changes of situations, observations on them, permit general quantifiers to correspond to more closely to linguistic phenomena than on noun phrases. We pointed out that there are two types of temporal sentential aspects (Igarashi and Yamada, 1980), which are durative and momentaneous. There might be different from the negation duality. Negations provide a kind of dual relations under the restricted condition of a binary valued logic model. The condition is too strong for general linguistic phenomena. Such a difference between durative and momentaneous aspects can not be explain within a binary valued logic model, and needs other tools to describe some kind of data structures. At first, we introduce some set theoretical calculus, which is necessary to explain a kind of duality in sentential aspects.

2. CACULUS IN SETS

Given sets X and Y, the summation $X \cup Y$ is represented by arrows "$\rightarrow$", which mean "include" (Fig.1(a)), where any set Z which includes X and Y, includes $X \cap Y$. The intersection $X \cap Y$ is represented by the reversed arrows (Fig.1(b)).

The **duality** between the summation $X \cup Y$ and the intersection $X \cap Y$ is "reversed arrow"(Mac Lane, 1971, p.31). Their iterative uses of " $\cap$ " and " $\cap$ " are called Σ and Π, which are also duals of each.

2. LOGICAL EXPRESSIONS WITH Σ AND Π

Researches in aspects help to clarify common characteristics and help to provide suitable logical expressions of quantifiers. Sentential aspects (Smith, 1991) can be analysed in terms of 'durativity' and 'momentaneousness'. Then 'durative' and 'momentaneous' sentential aspects are denoted by Σ and Π respectively, which are introduced into logical formula. In order to express Σ and Π in a language processing model on computers, we need more information about the background of the utterance, and this background is sometimes widening and sometimes narrowing. The quantifier Σ is the abstraction of 'durative', and the durative aspect indicates that the background of the utterance (in time and space) is widening. On the other hand, Π is the abstraction of 'momentaneous' and the momentaneous aspect indicates that the time and space of the background is narrowing.

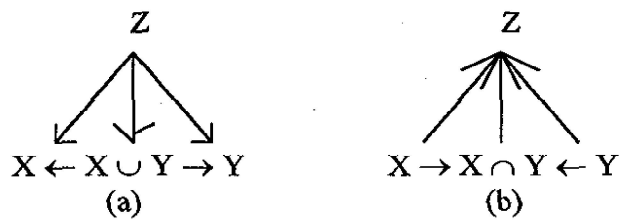

Fig. 1 The summation (a) and the intersection (b) of sets X and Y

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Relations between a sentence and its background are not unilateral but mutually interferential. It can be compared with relations between the figure and the background of a picture. In many cases, information about backgrounds is produced in the process of interpretations of sentences. In order to express such mutual relations between a sentence and its background, instead of an ordinary form P, we use a form W\P, which represents explicitly the background in the W-part of the form, where the symbol W is for the background and P is for the statement. An equation about some kind of summation or intersection is given as follows.

$$EVAL\ (\ (W \cup\cap W')\ \backslash\ P\ ) = EVAL\ (\ W\ \backslash\ P\ ) \cup\cap EVAL\ (\ W'\ \backslash\ P\ )$$

Thus, Σ or Π, which represents widening or narrowing in background, is expressed in the W-part of form.

4. CONTEXTUAL LANGUAGES PROCESSING MODEL

We need a language processing model, which is capable of describing the structure of the background. Such a model, named 'Contextual Language Processing Model' CLPM is proposed (Igarashi, 1992). The characteristics of an aspectual field are described in terms of CLPM.

Dualities, which are dual relations between a particular pair of durative and momentaneous sentential aspects, are described in terms of colimit Σ and limit Π.

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