

## Two types of modal auxiliaries in Japanese: two directionalities in inference

Japanese modal auxiliaries have traditionally been classified into two subclasses: *daroo* (would), *hazuda* (should), *nitigainai* (must), henceforth the *daroo*-class, as opposed to *yooda* (it appears), *rasii* (it seems), and possibly, *sooda* (I hear), henceforth the *yooda*-class; the rest of the modal auxiliaries, such as *kamosirenai* (it is possible) and possibly *noda* (it is that) belong to both subclasses. The distinction is based on the co-occurrence possibility with adverbs *kitto* (most probably), which only co-occur with the *daroo*-class, and *doomo* (apparently), which only co-occur with *yooda*-class (Morimoto (1994), Teramura (1984), Takubo (2001), among others). The nature of the distinction, however, has not been seriously studied.

In this paper, we will first give some new facts concerning the distributional differences between the two sub-classes. We then argue that the distinction among these two types of modal auxiliaries is related to the directionality of inference, which we express as a generalized form of modus ponens (i.e. inference of the pattern,  $P \rightarrow Q, P \models Q$ ), and its inverse.

The auxiliaries in the *daroo*-class can combine with *imagoro* (about this time) to indicate an event in the location removed from the speaker (see (1)), while those in the second group cannot (see (2)), unless a special (prosodic) prominence indicating inappropriateness is placed on *imagoro*, in which case the implication is added that the event expressed occurred later or earlier than was desirable (cf. Takubo & Sasaguri (2001)).

The two subclasses also differ in their scope properties. Modal auxiliaries in the *daroo*-class do not take conditional clauses in their scope, and express conclusions in a conditional inference from the antecedent (see (3)). Those in the *yooda*-class must include the premise in their scope, and thus can only serve as an assertion of a general conditional statement rather than a conditional inference (see (4)). That the two subclasses differ in their scope properties is further supported by the following fact. With *daroo*-class auxiliaries, the antecedent and the consequent in the conditional statement (4) can each be expressed by different speakers as in (5). This is so because with *daroo*-class auxiliaries, the premise is not in the scope of the modal, and therefore is not included in the assertive part of the sentence. With *yooda*-class, the assertion involves the conditional relation between the antecedent and the consequent. So the consequent cannot be uttered independently of the antecedent. Therefore, if they are separately asserted as in (6), the result is unacceptable.

We show that the difference between the two subclasses can be characterized in terms of the directionality of the inference they involve. We express inference based on knowledge as a mapping  $f$  from  $x$  to  $y$ , where  $x$  and  $y$  are eventualities or their spacio-temporal locations, and  $f$  may be any relation that serves to identify  $y$  uniquely, given  $x$ . The inference involved in the *daroo*-class follows the direction of the mapping, and deductive in nature. This class of modal auxiliaries serves to identify  $y$ , given  $x$  and some general knowledge. They are interpreted to mean that the sentence in which they appear is the conclusion of the speaker. In contrast, the inference involved in the *yooda*-class is abductive and identifies  $x$ , given  $y$ , i.e., the inverse function  $f^{-1}$  of  $f$ . Since  $x$  may not be uniquely determined given  $y$ , the inference can only give a most plausible candidate for explaining  $x$  in the context of utterance.

We show that the facts noted in (1–6) can be accounted for if we assume that the conclusion of deductive inference can be conjectural while that of abductive inference must be a proposition whose truth value is settled—i.e., already objectively determined by the actual situation (although the speaker may not know it) (cf. Kaufmann (2005)). This includes general world knowledge. We show that the facts about *imagoro* in (1–2) and the scope facts noted in (3–6) can be explained by assuming that the sentences embedded under *yooda*-type auxiliaries must be settled in this sense, while those under *daroo*-type auxiliaries need not.

Examples:

- (1) John-wa imagoro Seoul-ni tuita {*daroo/hazuda*}  
John-TOP about now Seoul-LOC arrived would/should  
'John would have arrived in Seoul about this time.'
- (2) ??John-wa imagoro Seoul-ni tuita {*yooda/rasii*}  
John-TOP about now Seoul-sc loc arrived appear/seem  
'John appears to have arrived in Seoul about this time.'
- (3) Kootei buai-ga sagar-eba, keiki-ga yokunaru {*daroo/hazuda*}  
Public-interest-NOM fall-if economy-NOM become-good would/should  
'If the public interest rate goes down, the economy would/should look up.'
- (4) Kootei buai-ga sagar-eba, keiki-ga yoku naru {*yooda/rasii*}  
Public-interest-NOM fall-if economy-NOM become-good appear/seem  
'It appears (to be the case) that if the public interest rate goes down, the economy will look up (accordingly)'
- (5) A: Kootei buai-ga sagatta-yo.  
Public-interest-NOM fell-SFP  
'The public interest rate has been cut down.'  
B: Zya, keiki-ga yokunaru {*daroo/hazuda*}.  
then economy-NOM become-good would/should  
'Then, the economy should/would look up.'
- (6) A: Kootei buai-ga sagatta-yo.  
Public-interest-NOM fell-SFP  
'The public interest rate has been cut down.'  
B: ??Zya, keiki-ga yokunaru {*yooda, rasii*}.  
then economy-NOM become-good appear/seem  
'(Lit.) Then, the economy appears to look up.'

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