North East Linguistics Society

Volume 31
Issue 2 *NELS 31: Volume 2*

Article 11

2001

Agrammatic Aphasic Comprehension of Thematic Role Assignment in Indonesian

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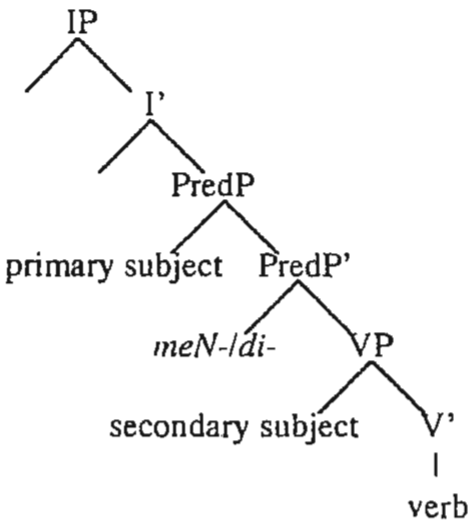
0. Asyntactic Thematic Role Assignment

Cross-linguistic studies of sentence comprehension by people with agrammatic aphasia have provided evidence for a disruption of thematic role assignment. In particular, problems occur involving syntactically complex structures and sentences with non-canonical word order (Caplan 1992, Grodzinsky 1990, Hagiwara 1993). This paper raises the question of whether, given the distinctive features of Indonesian grammar and usage, Indonesian-speaking people with agrammatic aphasia would experience the same comprehension pattern as in previously studied languages.

1. Active and Passive Verbs in Standard Indonesian

Standard Indonesian has no tense, agreement or case morphology. Active and passive voices are indicated by verbal prefixes *meN-* and *di-*, respectively. The basic SVO clausal structure of Indonesian, as proposed in Adisasmito-Smith (1998), is represented in (1). It is adapted from the Predicate Phrase Hypothesis in Bowers (1993). The external theta role is assigned to the primary subject and internal theta role to the secondary subject. Prefixes *meN-* and *di-* are base generated in the head of PredP ('Predicate Phrase'):

(1) Basic clause structure of Indonesian (from Adisasmito-Smith 1998)

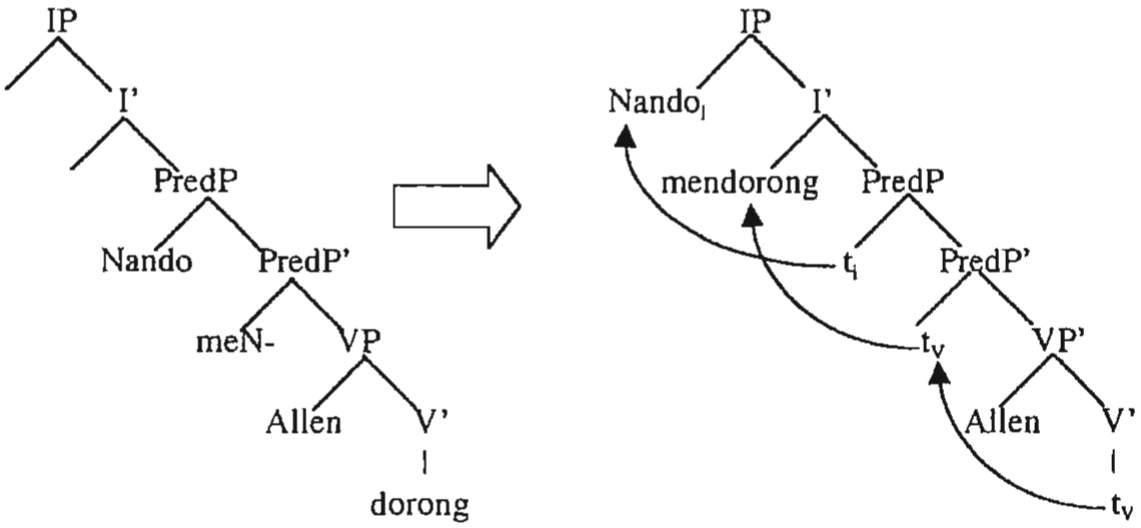


1.1. Simple Active Clauses in Standard Indonesian

The Agent Topic (here labeled 'AT') is marked by the prefix *meN-*, as in (2a). As skeched in (2b), the verb *dorong* ('push') raises to Pred° to merge with *meN-* and assigns object case to *Allen*. The agent *Nando* raises to [Spec,IP] and *mendorong* moves to I° to check subject case.

(2a) Nando mendorong Allen
Nando AT-push Allen
'Nando pushes Allen'

(2b)

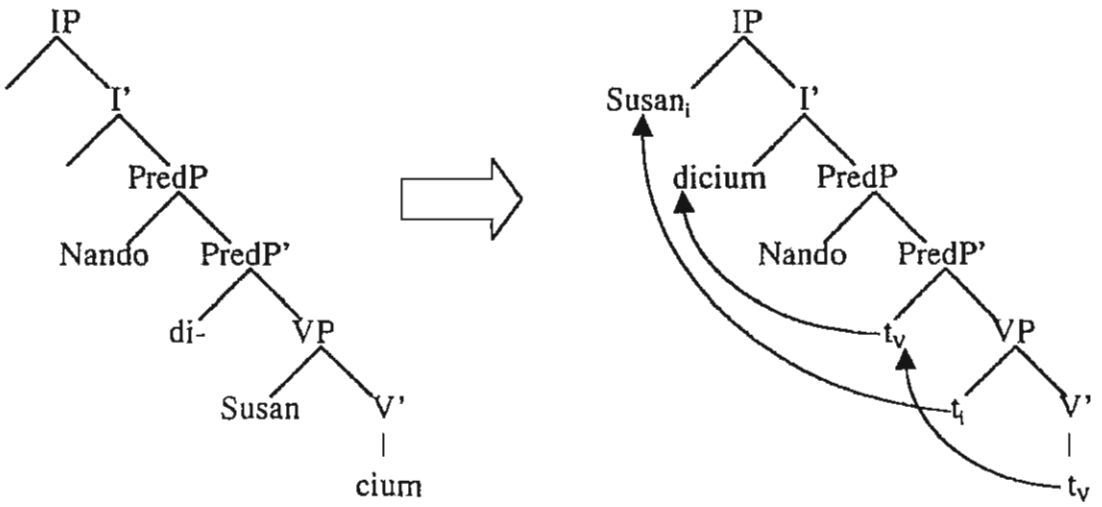


1.2. Simple Passive Clauses in Standard Indonesian

The Patient Topic (here labeled 'PT') is marked by the prefix *di-*, as in (3a). As sketched in (3b), *di-* absorbs the case of the internal argument. *Susan* then moves to [Spec,IP] to receive case. It is assumed that *Susan* can move past *Nando* since verb raising renders both NPs equidistant from [Spec,IP] (see Chomsky 1995).

(3a) Susan dicium Nando
Susan PT-kiss Nando
'Susan is kissed by Nando'

(3b)



Comparison of sentences (2a) and (3a) shows that in Indonesian, passive sentences are not morphologically more complex than active ones. No by-phrase or auxiliary is required in the Indonesian passive[1].

Still, the representation of the passive in (3b) is more syntactically complex than its active counterpart in (2b). The trace left in object position in (3b) is further from its antecedent than the trace left in [SPEC,PredP] in (2b). In addition, the agent NP *Nando* intervenes between the passivized object *Susan* and its trace. This configuration could be a source of ambiguity for aphasics, since the trace could potentially be coindexed with either agent or patient (following Mauner, Fromkin and Cornell (1993)).

The discourse pragmatics of Indonesian also need to be considered. Indonesian has been described as a topic-tomment, discourse-oriented language (Martohardjono 1993). SI may have ergative properties like Tagalog and other Austronesian languages (as observed by Verhaar (1978) and Wolff (1981)). In contrast to languages like English, the agent role in Indonesian is not correlated with subject or topic position. In fact, both in natural speech and in written text, passive forms are quite frequent and are often more pragmatically felicitous (see Kaswanti Purwo 1991, Poedjosoedarmo 1986).

Another plausible reason for the relatively higher frequency of passives in Indonesian may be structural rather than pragmatic. As shown in (4a), object extraction is disallowed (see Martohardjono 1993, Comrie 1989). Therefore, relativizing a direct object must be done through passivization, as shown in (4b).

(4a) *bolpoin yang Lita meminjam
pen that Lita AT-borrow

(4b) bolpoin yang dipinjam Lita
pen that PT-borrow Lita
'the pen that Lita borrowed' (literally, 'the pen that was borrowed by Lita')

[1] The preposition *oleh* ('by') may appear optionally before the agent noun. The form without *oleh* may be more common in natural speech.

2. Hypotheses

Given that passives in Indonesian are prevalent, functionally important, and relatively simple morphologically, Indonesian speakers with agrammatic comprehension may find passive sentences at least as easy to understand as actives, in contrast to comparable populations in previously studied languages. Conversely, since the underlying structure of the Indonesian passive is syntactically more complex than the active one, they may find passive sentences more difficult to compute and process than actives. Such a result would be consistent with findings concerning patients who spoke other languages.

3. Case study: HS

HS was a 68 year old male from Manado, Sulawesi (Northeastern Indonesia) who had a stroke 7 years prior to testing. Embolic occlusion of the middle cerebral artery affected his left hemisphere, and as a consequence HS had right hemiparesis. Premorbidly he spoke Standard Indonesian and Manado Malay, a local dialect.

His basic cognitive and linguistic abilities were evaluated in a recorded session in his home in Manado. He scored at ceiling on most comprehension, memory and arithmetic tasks, but his language production was slow and effortful. He produced short sentences which, compared to intact Indonesian speech, were morphologically and syntactically oversimplified. His auditory perception was impeccable.

4. Experimental Methodology and Design

Sessions with HS were video- and audio-taped in his home by the author, who alternated with fluent SI speakers as experimenter. HS was instructed to act out sentences with three wooden, jointed mannequins placed on a table before him. Letters 'A', 'N' and 'S' on the mannequins' torsos referred to their names 'Allen', 'Nando' and 'Susan' respectively. HS was read each test sentence once, and was allotted as much time as he needed to complete enactments[2]. He could also ask for a sentence to be repeated if he wished. After he completed a response, the mannequins were rearranged in a preset order by the experimenter, to control for any effects the display may have had on his enactments.

Two Indonesian-speaking control subjects from Manado, matched to HS for age and education, also participated in this experiment. They were tested in separate, individual sessions at their respective homes.

On a pre-trial run, HS scored perfectly on simple, one-verb sentences with *meN-* and *di-*. Thus he was considered eligible for this more demanding test, which consisted of 2-clause coordinate, center-embedded and right-branching sentences. All 3 major types had 2 variations: verbs were prefixed with either *meN-* or *di-*. Five token sentences (balanced for length: 13 syllables, 6 words) were designed for each type, giving a total of ((2x5)(2x5)(2x5)) 30 sentences[3]. The test was divided into 5 batteries in which the order

[2] Due to his right hemiparesis, HS manipulated the dolls with his left hand only. The experimenters explained to him that what was important for the task was not so much illustrating the specific action of a doll (for example, hitting or pushing) as making clear who performed and who received the action, whatever it was.

[3] 10 other types of sentence structures were included in this experiment, but are not discussed here.

of sentences was randomized. One example of the five tokens for each sentence type is given in the table in (5).

(5) Sentence types for act-out task

Structure Types	Verb 1 Prefix	Verb 2 Prefix	Token Sentences
Coordinate Clauses	meN-	meN-	Allen mendorong Nando dan mencium Susan. Allen AT-push Nando COORD AT-kiss Susan 'Allen pushes Nando and kisses Susan'
	di-	di-	Nando dicium Susan dan dipukul Allen. Nando PT-kiss Susan COORD PT-hit Allen 'Nando is kissed by Susan and is hit by Allen'
Center-Embedded Relative Clauses	meN-	meN-	Allen yang memeluk Susan menggaruk Nando. Allen REL AT-hug Susan AT-scratch Nando 'Allen who hugs Susan scratches Nando'
	di-	di-	Susan yang digaruk Allen disentuh Nando. Susan REL PT-scratch Allen PT-touch Nando 'Susan who is scratched by Allen is touched by Nando'
Right-Branching Relative Clauses	meN-	meN-	Nando menyentuh Allen yang memeluk Susan. Nando AT-touch Allen REL AT-hug Susan 'Nando touches Allen who hugs Susan'
	di-	di-	Susan dicium Nando yang ditendang Allen. Susan PT-kiss Nando REL PT-kick Allen 'Susan is kissed by Nando who is kicked by Allen'

5. Results

5.1. Sentences with *meN-* Verbs

Since control subjects' results were virtually identical to each other, they formed a group against which HS's results were compared[4]. Like the controls, HS acted out coordinate and center-embedded sentences with *meN*-verbs with the first (sentence-initial) NP as agent of both verbs (as illustrated in the table in (6)).

In contrast, the majority of his enactments of right-branching sentences with *meN*-verbs contained. In the correct interpretation (indicated by a check mark in the table in (6)), the second (middle) NP is agent of the second verb, since the relative clause modifies the object of the matrix clause. He acted out one example of this sentence type correctly. In another response, he made the second NP patient of the second verb. In 60% (3 of 5) of his responses, the first NP was agent of both verbs. Only this latter enactment is illustrated in Table (6).

(6) Summary of Enactments by HS of Sentences with meN- Verbs

Sentence Type	Token Sentence	Enactment	
		Action 1	Action 2
Coordinate with *meN-* (CMM)	A mendorong N dan mencium S. A AT-push N COORD AT-kiss S 'A pushes N and kisses S'	A pushes N	A kisses S
Center-Embedded with *meN-* (CEMM)	A yang memeluk S menggaruk N. A REL AT-hug S AT-scratch N 'A who hugs S scratches N'	A hugs S	A scratches N
Right-Branching with *meN-* (RBMM)	N menyentuh A yang memeluk S. N AT-touch A REL AT-hug S 'N touches A who hugs S'	N touches A	**N*** hugs S ✓A hugs S

5.2. Sentences with *di-* Verbs

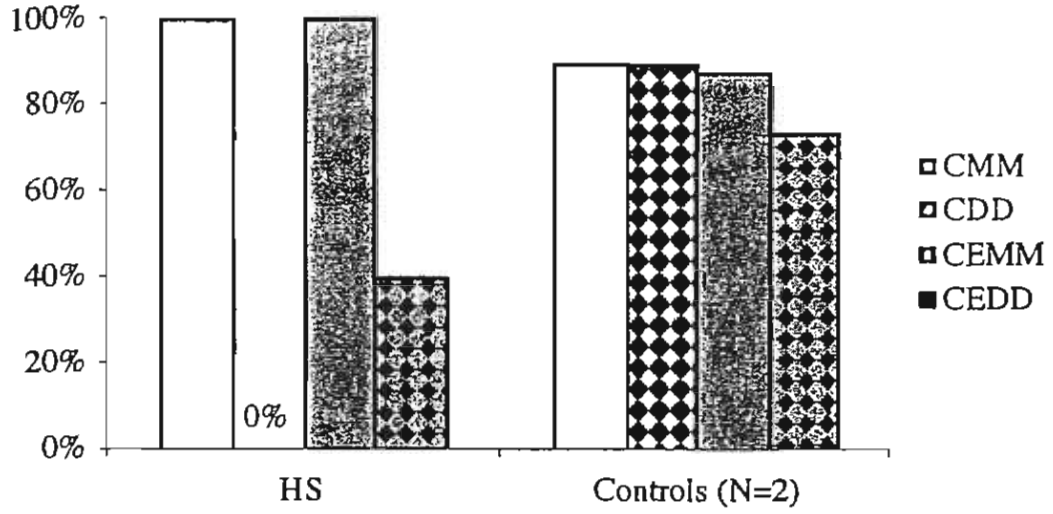
The table in (7) indicates that in coordinate and center-embedded sentences with *di*-verbs, HS did not preserve the first NP as patient of both verbs, as did the controls. Instead, he almost always mistakenly made the second NP recipient of the second verb's action.

Results on right-branching sentences with *di*-verbs are hard to evaluate, since even controls claimed they were ambiguous. In 66% of HS's interpretations (2 of 3), the first NP was patient of both verbs. In the remaining one, the second NP was patient of the second verb.

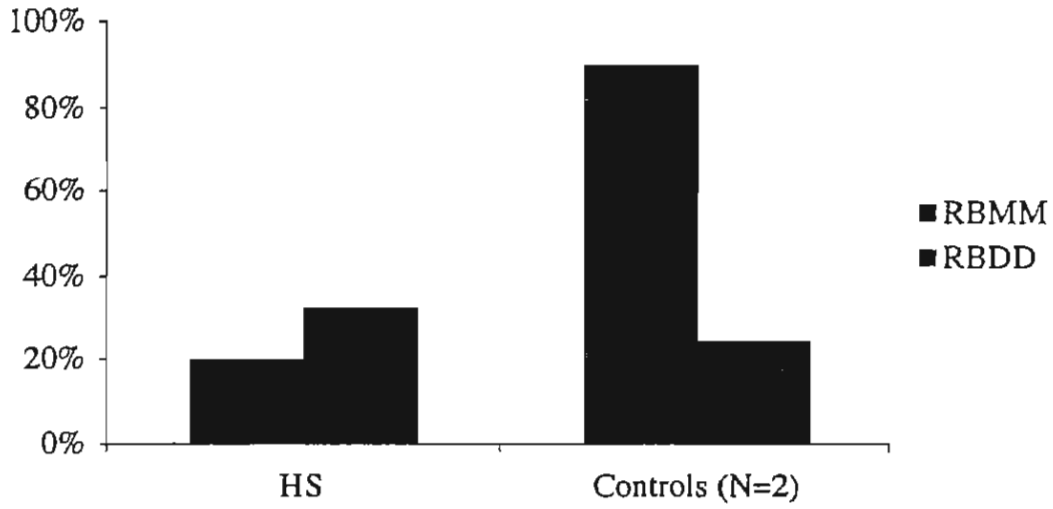
(7) Summary of Enactments by HS of Sentences with di- Verbs

Sentence Type	Token Sentence	Enactment	
		Action 1	Action 2
Coordinate with *di-* (CDD)	N dicium S dan dipukul A. N PT-kiss S COORD PT-hit A 'N is kissed by S and is hit by A'	S kisses N	A hits **S*** ✓A hits N
Center-Embedded with *di-* (CEDD)	S yang digaruk A disentuh N. S REL PT-scratch A PT-touch N 'S who is scratched by A is touched by N'	A scratches S	N touches **A*** ✓N touches S
Right-Branching with *di-* (RBDD)	S dicium N yang ditendang A. S PT-kiss N REL PT-kick A 'S is kissed by N who is kicked by A'	N kisses S	A kicks S OR A kicks N

The results from HS and the control subjects on all sentence types are compared in Figures (8) and (9). In the legend for Figure (8), active and passive coordinate test items are indicated as 'CMM' and 'CDD' respectively, while active and passive center-embedded test items are indicated as 'CEMM' and 'CEDD' respectively. In the legend for Figure (9), 'RBMM' refers to active right-branching items and 'RBDD' refers to passive ones.



(8) Correct Enactments of Coordinate and Center-Embedded Sentences



(9) Comparison of Enactments of Right-Branching Sentences

6. Discussion

HS always acted out the meaning of the first clause of each test sentence correctly. With *meN-* verbs, the first NP was agent and the second NP was recipient of the action of first verb. Likewise, with *di-* verbs, the first NP was patient and the second NP was agent of the verb in the first clause. HS's errors consisted primarily of his wrong choices of agent or patient for the second verb.

The analysis of HS's performance presented here involves a two-pronged approach. First, HS had a linguistic deficit: he could not successfully link two clauses syntactically. While he could process simple clauses, he had difficulty integrating them into a larger complex structure, be it coordination or subordination.

Moreover, HS attempted to compensate for this deficit by employing specific strategies. He showed a tendency to use 2 separate heuristics for clauses with *meN-* and *di-*. With *meN-* verbs, he tended to assume that the sentence-initial NP was agent of both verbs. With *di-* verbs, he usually took the second NP to be the patient of the second verb.

6.1. HS's Response Strategy for Active Sentences

HS's performance on coordinate and center-embedded sentences with *meN-* verbs was virtually identical to that of controls. Does this finding indicate that he processed these sentences in the same way as the controls did? Not necessarily, since it must be considered in light of the other finding for right-branching sentences with *meN-* verbs. HS's varied responses reveal his difficulty with this type of embedding. The majority of his errors consisted of assigning the role of agent of the second verb to the sentence-initial NP when it should have gone to the second (middle) NP. This error pattern could be due to a default strategy employed by HS. If he could not use the syntactic structure of the sentence to determine which NP was agent in the second (embedded) clause, he assumed it was the same as the agent in the first (matrix) clause, namely the first NP.

HS's tactic of taking the sentence-initial NP as agent of both clauses in right-branching sentences undermines the conclusion that he processed coordinate and center-embedded sentences with *meN-* verbs normally. It raises the possibility that he acted out the correct responses to the latter types accidentally. In other words for all active sentences, HS used the same strategy, which led him to the right answer in the case of active coordinate and center-embedded sentences, but to the wrong answer in the case of active right-branching sentences.

6.2. HS's Response Strategy for Passive Sentences

HS's predominant interpretation of coordinate and center-embedded sentences with *di-* verbs, in which the second NP was recipient of the action of the second verb, is ungrammatical in Indonesian. Given his pattern of response for active sentences, one might ask why HS didn't use a similar strategy for passive sentences. Specifically, why didn't HS take the patient of the first verb and make it patient of the second verb, too, analogous to the way in which, in active sentences, he took the agent of the first verb to be agent of the second one as well?

To answer this question, one must appeal to a difference in the processing of *di-* and *meN-* verbs. We propose that for HS, finding the grammatical subject of the second verb in passive sentences places more demands on the syntactic processor than for active sentences. The reason is that after assigning roles to arguments of the *di-* verb in the first clause, HS faced multiple problems. As in active sentences, the syntactic link (coordination in the case of coordinate sentences and subordination in the case of center-embedded sentences) between the two clauses broke down. The upshot is that the passive verb in the second clause lacked a patient argument. To fill this absence, HS was forced to look back to the first clause.

Thus HS needed to reconstruct the first clause to recall the patient of the first verb. This step of reconstruction is the locus of HS's processing limitation. It is not obvious at first why in a language like Indonesian, characterized by the primacy and frequency of patient-topic sentences, constituents containing a passive verb should be more vulnerable to breakdown than those with an active verb. However, recall from the discussion in Section 1.2 that passive verbs are more computationally taxing than actives, because of the additional operation(s) involved in raising the NP from object to subject position. For this reason, while HS could recover the syntactic structure of the first clause in active sentences, he could not recover that of the first clause in passive sentences to

find a patient for the second verb. The full syntactic representation of the first clause in passive sentences had already disintegrated by the time HS needed to recall it.

To remedy this situation, HS employed a new default strategy, which crucially made use of the linear position of NPs, and not of their structural and/or thematic relations to the verbs in the sentence. For HS, the patient of the second verb was the adjacent preverbal NP, which was the second (middle) NP.

Results from right-branching sentences with *di-* verbs are inconclusive, since as mentioned in Section 6.2, even controls found these sentences ambiguous. Interpretations in which either the first or second NP was patient of the second verb were both acceptable to them. One plausible reason for this ambiguity is that sentences were read with a pause before the relative clause (*yang* phrase). It may have been that this prosodic cue allowed for an analysis in which the *yang* phrase was a right-dislocated relative. Apparently, HS guessed between the first and second NPs as patient of the second verb.

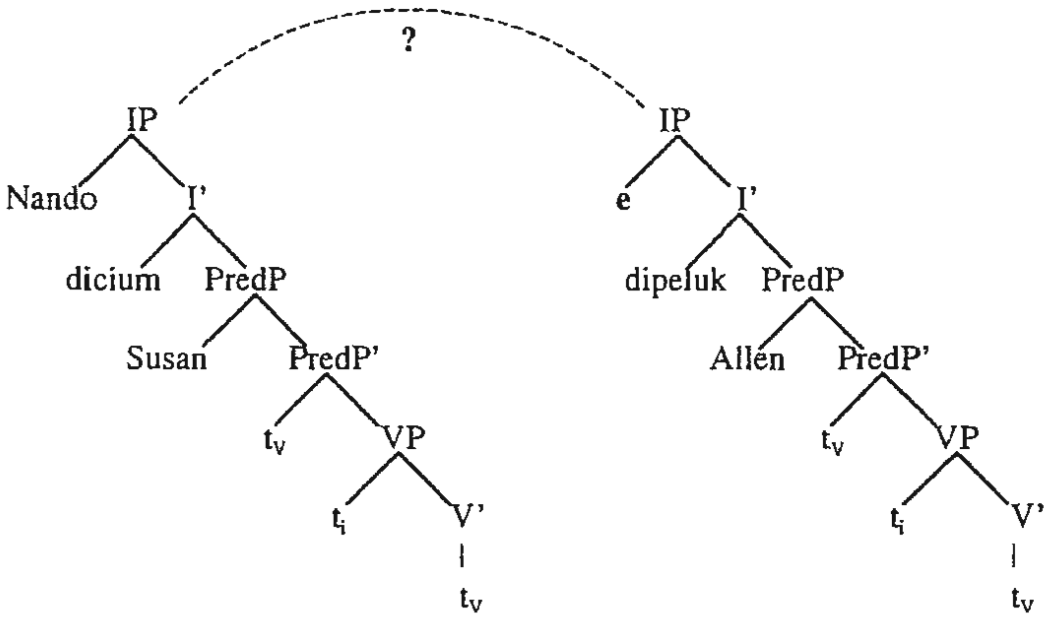
7. Implications

If simple clauses correspond syntactically with IP constituents, HS's performance confirms that he had grammatical competence for structure below and including IP. However, this study shows that he had difficulty computing additional structure above IP. This result is consistent with the Tree-Pruning Hypothesis proposed by Friedmann & Grodzinsky (1997) to account for agrammatic production. A similar idea for agrammatic comprehension was developed by Hagiwara (1995).

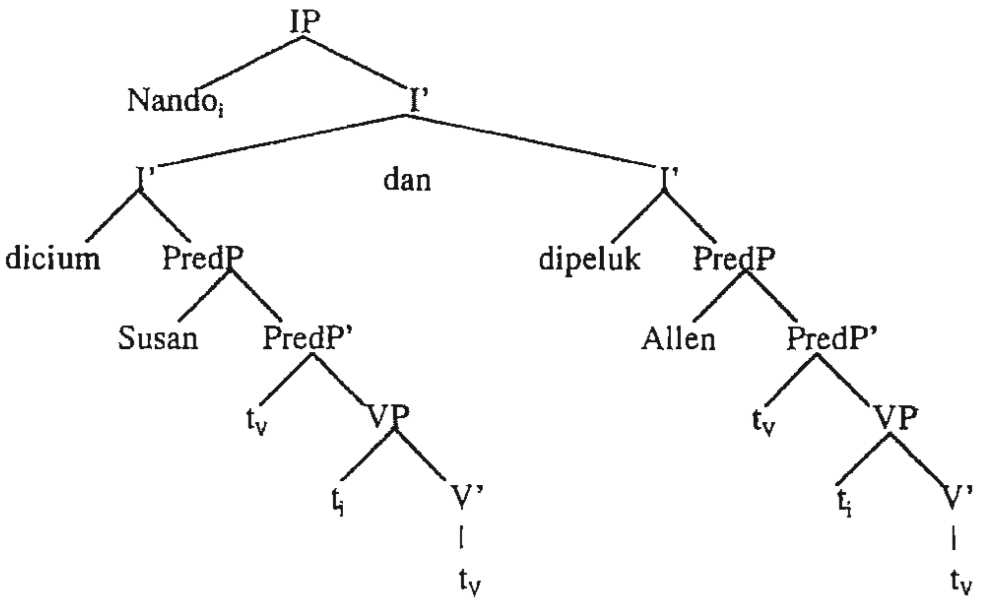
Specifically, HS's representations of complex sentences differed from those of the controls in that they were "pruned" at the level of IP. For example in sentence (10a), HS disregarded the syntactic relationship of coordination between the 2 clauses, but preserved the internal structure of each clause. The "pruned" representation imparted to HS is given in (10b). The dashed arc and question mark illustrate the missing syntactic link between the 2 clauses. The empty category in [SPEC,IP] of the second clause ilustrates the lack of a grammatical subject due to the lack of syntactic integration of this clause with the first. The phrase structure in (10c) sketches the complete representation assumed for controls, in which the patient NP c-commands both verbs.

(10a)	Nando dicium	Susan	dan	dipeluk	Allen
	Nando PT-kiss	Susan	COORD	PT-hug	Allen
	'Nando is kissed by Susan and is hugged by Allen'				

(10b) Incomplete representation attributed to HS



(10c) Full representation attributed to linguistically intact control subjects



To make up for his difficulty with complex sentences, HS resorted to two distinct strategies. With active sentences, he was able to recover the agent from the first clause and use that as agent of the second clause. The extra processing load of object raising prevented him from employing an analogous tactic with passive sentences. He could not recover the patient in the first clause to use it as patient of the second clause, too. Instead, HS turned to a linear adjacency strategy, and made the second noun the patient of the second verb.

The evidence that HS's performance depended upon relative syntactic complexity corroborates accounts of agrammatic aphasic performance based on limited computational resources. One such account is the Complexity Limitation Hypothesis proposed by Frazier and Friederici (1992) for German-speaking Broca's aphasics. Frazier and Friederici attributed comprehension errors by people with Broca's aphasia to an

inability to maintain a complete syntactic representation in mind long enough to analyze it and carry out the task. Consequently they were forced to parse an incomplete representation.

A similar approach is taken by Kolk and Van Grunsven (1985), who regard agrammatic aphasia as essentially a disorder of the timing of lexical and syntactic activation. People with agrammatic aphasia may suffer from a reduction in memory resources dedicated to syntactic parsing. This reduction leads to premature decay of structural information, especially for more complex forms such as passives. In the case of HS, the cause of his greater difficulty with passive sentences may have been that his representation of the first passive clause decayed too rapidly for him to use it when it came time to act out the second passive clause.

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