

Background and rationale

Caramazza and Zurif (1976) suggest that Broca's aphasics fail to comprehend semantically reversible relative clause (RC) constructions, in which both of the actors can act equally well as an agent or a patient. They attribute this deficit to the non-canonical nature of these structures. Similarly, Grodzinsky's (1986-1989) *Trace Deletion Hypothesis* (TDH) predicts that these patients have difficulty assigning theta-roles to transformationally-derived structures since the syntactic chains combining the trace and the moved element are deleted in their comprehension. So, they use a *default strategy* that assigns the agent role to the first noun phrase (NP) without a theta-role. To form this heuristic, Grodzinsky consults the movement rules of the Government and Binding Theory (Chomsky, 1981).

- (1)

 - (a) NPs in theta-positions have theta-roles assigned to them.
 - (b) A NP in a non-thematic position can inherit the theta-role of a theta-position if it heads a chain that has a theta-position as a member.
 - (c) Default Principle: A NP which has not been assigned a theta-role by (a) or (b) should be assigned a theta-role according to a list that universally associates default values to positions.

According to *TDH*, for (2), agrammatic patients, being unaware of the theta-role assigned to the NP (the man) by the chain (following the rule b), apply the *default strategy* and come up with an agent role. On the other hand, the other NP (the woman) is assigned an agent role according to the rule (a). Having two agents, those patients apply the *default strategy* by choosing one of them without committing to any syntactic knowledge of traces. That is, they perform at chance level in constructions involving transformational movement but at above chance level in canonical structures.

The current study tested whether *TDH* would correctly account for the nature of deficit in comprehension of Turkish RCs.

Kornfilt (2000) holds that Turkish RCs are, from a structural point of view, clausal like RCs in English. There is no overt wh-element in Turkish but an empty operator corresponding to it. The movement of this operator leaves a phonologically null bound variable in the modifying domain of an RC construction. In simple RCs, to relativize the non-subject NP, -DIK morpheme is used as a complementizer, the subject is marked with genitive case, and the complementizer is followed by a possessive suffix marking the agreement with the subject (3). In subject RCs, complementization is carried by the morpheme -(y)AN with no agreement morphology (4).

Considering head-final characteristic of Turkish, *TDH* would expect Turkish patients to perform at chance level in subject RCs, which is exactly the opposite reaction as compared to English patients. To illustrate, assume that an agrammatic patient uses the *default strategy* and

linearly assigns the first NP the agent role. If the sentence includes an object RC, the *default strategy* should be successful determining the correct theta-roles since the first NP is already an agent (3). However, it should fail in a subject RC as the first NP heads a chain that has a patient role, which has been inherited by the head (4).

- (3)
Adam-in t_i öldürdüğü kadın.
Man-GEN kill-DIK-POSS-3sg woman
(AGENT) (PATIENT)
'The woman whom the man killed'

- (4)
 t_i Adam-1 öldür-en kadın.
Man-ACC kill-EN woman
*(AGENT) *(PATIENT)
'The woman who killed the man'

Method

Participants: Eleven agrammatic patients participated in this study. They were both neurologically (CT scan) and neuro-psychologically (Western Aphasia Battery) diagnosed as Broca's aphasics, with at least three months post-onset. Their age ranged between 30 and 71, and they had at least five years of education. Ten healthy participants, matched for age and education participated as a control group.

Stimuli: A standard sentence-picture matching task was used. There were three sets of sentences (all semantically reversible) including subject RCs, object RCs, and canonical structures (ten for each set). There were three pictures for each sentence. Only one picture represented the correct theta-roles, another showed the reversed theta-roles, and the other depicted an irrelevant activity. For instance, for the sentence "The man killed the woman", one of the pictures showed a man killing a woman, another a woman killing a man, and the other showed a man and a woman having a lunch together.

Procedure: The participants (all tested individually) were instructed to look at the pictures and listen to each sentence to choose the correct picture depicting the sentence.

Results

To show the effects of sentence type, Repeated Measure Multivariate Analysis of Variance (MANOVA) was conducted. Having 100 % success and zero variance, the control group was excluded from the analysis. Multivariate tests revealed a statistically significant effect of sentence type; $F(1, 9) = 5.95$, $p < .05$. Univariate tests revealed that subjects responded correctly to subject RCs more than object RCs; $F(1, 10) = 13.21$, $p = .005$, and they chose the reversed pictures for object RCs more than subject RCs; $F(1, 10) = 10.81$, $p < .01$. The difference

between correct responses to object RCs and canonical structures approached significance; $F(1, 10) = 5.95$, $p = .061$. There was no significant effect of sentence type on subjects' choosing the irrelevant pictures; $F(2, 9) = 1.21$, $p = .34$ (Table 1).

Percentages of participants with above accuracy performance were derived. To compare the success rate between Broca's and normal groups, chi-square test was applied. The control group performed with 100 % accuracy in all three types of sentences. There was no significant difference between the groups in their comprehension of subject RCs; $\chi^2(1) = 2.744$, $p > .05$. However, Broca's patients performed relatively poorly in object RCs; $\chi^2(1) = 16.156$, $p < .01$, and in canonical sentences; $\chi^2(1) = 8.870$, $p < .05$ (Table 2).

Discussion

Contrary to our expectations, Turkish patients assigned reversed theta-roles to the NPs in object RCs. This might be due to agreement morphology or genitive case these structures require rather than trace deletion. To prove this, further research is called for to show these patients have difficulty in comprehending canonical structures with morphological markers. Thus, the present study is inconclusive about whether traces are deleted in mental representation of Broca's aphasics. To account for the underlying nature of this comprehension problem, more detailed analyses including real-time tasks and f-MRI studies are required.

However, even if the traces were deleted, the *default strategy TDH* proposes does not work for Turkish patients, which renders this part of the theory cross-linguistically incompatible. The present data suggest that subjects' knowledge about canonical word-order might be at work. That is, they might be committing to the OV ordering in verb phrases, and assigning the *patient* role to the NP in preverbal position, hence the name *pre-verbal strategy*. The *pre-verbal strategy* is incompatible with Grodzinsky's *default strategy* as the patients do not assign the first NP an agent role. Thus, this study suggests that although there might be a universal deficit underlying the Broca's aphasia, the type of the default strategy must be determined by parametric features of each language, and that the *pre-verbal strategy* must be what Turkish agrammatic patients use to compensate for their deficit in comprehending the non-canonical structures.

References

- Caramazza, A. and E. Zurif (1976). Dissociations of algorithmic and heuristic processes in sentence comprehension: Evidence from aphasia. *Brain and Language*, 3, 572-582.
- Chomsky, N. (1981). *Lectures on Government and Binding*. Foris, Dordrecht.
- Grodzinsky, Y. (1986). Language deficits and theory of syntax. *Brain and Language*, 27, 135-159.
- Grodzinsky, Y. (1989). Agrammatic comprehension of relative clauses. *Brain and Language*, 37, 480-499.
- Kornfilt, J. (2000). Some syntactic and morphological properties of relative clauses in Turkish. In Syntax of Relative Clauses. *Linguistics Today*, 32.

Table 1: The mean frequency rates of the patients' responses for 10 items for each sentence type.

Sentence Type	Picture Nominated		
	Correct	Reversed	Irrelevant
Canonical	6.73	2.91	0.36
Object RCs	5.18	4.0	0.82
Subject RCs	7.36	2.18	0.46

Table 2: Pair-wise comparisons: the effect of sentence type on the comprehension of sentences.

(I) Sentence Type	(J) Sentence Type	Mean Difference (I,J)	Std. Error	Sig.
Canonical	Object RC	1.554	.284	.000
	Subject RC	.102	.201	1.000
Object RC	Canonical	-1.554	.284	.000
	Subject RC	-1.453	.262	.000
Subject RC	Canonical	-.102	.201	1.000
	Object RC	1.453	.284	.000