Processing of Reflexive Anaphors in Turkish Aphasia: an Eye-Tracking During Listening Study

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Introduction

People with aphasia (PWA) present impairments working out who pronominal elements refer to (see, Arslan, Devers, & Ferreiro, 2021 for a review). While some studies have shown that reflexive anaphors (i.e., oneself) are rather retained in aphasia (e.g., Grodzinsky et al., 1993) some others have shown that reflexives are similarly impaired on a par with other pronoun variables (Choy & Thompson, 2010; Edwards & Varlokosta, 2007) or are processed at a slower than normal speed (Burkhardt et al., 2008). Turkish has a curious case of two types of reflexives: *kendi* 'oneself' which is assumed to behave as a local reflexive and *kendisi* which is rather unconstrained in its behavior (Kornfilt, 2001). However experimental data reveal that both *kendi* and *kendisi* show a flexible binding relationship as local/long-distance reflexives (Gračanin-Yuksek et al., 2017). This study examines whether and how Turkish reflexive system is affected in aphasia.

Methods

Four individuals with non-fluent aphasia (all male, $age\bar{x}$ = 57) and 22 non-brain-damaged controls were recruited (13 females, $age\bar{x}$ = 42). The cognitive profiles of these individuals were screened with the Turkish version of the Token Test App (Arslan et al., 2020), the Test Your Memory task (Maviş et al., 2015) and the digit span tasks (Wechsler, 2008), see Table1. An eye-movement monitoring during listening experiment was administered in which the participants listened to 48 sentences across four conditions. A two-by-two fully crossed design was used; we manipulated contextual referential bias to local/non-local antecedents being potentially bound by *kendi* and *kendisi* reflexive elements, see (*i*). The participants were asked to click/point to the person referent that the reflexive anaphor refers to (see Figure-1A).

(i)   *Bir [hemşirenin/doktorun] tutuklandığı davada, Hemşire doktorun [**kendini/kendisini**] savunduğu vurguladı.*
        'At the court a nurse/doctor was arrested, the **nurse** emphasized that the **doctor** was defending ***kendini/kendisini**-oneself*'.

Results

The end-of-sentence response data have shown that the PWA had a strong non-local interpretation for both the reflexive conditions, while the controls considered local antecedents for '*kendi*' more frequently than '*kendisi*' reflexives, as evidenced with a significant Group×Reflexive interaction (ß=-1.27, SE=0.42, z=-2.99, *p*=0.002; see Figure-1B). Eye-movement data were analyzed using the growth-curve approach (Mirman, 2017) with separate models for proportion of looks variables to local (doctor), non-local (nurse) and distractor referents (genitor). We found that for *kendi* reflexive, the PWA had reduced target fixations in both local and non-local

antecedents than the controls (*p*<0.025). For *kendisi*, we found no group differences in local fixations (*p*=0.42) while the controls significantly fixated more often on non-local antecedents than the PWA did (*p*=0.037), see Figure-1C.

Conclusions
This study set out to explore moment-by-moment processing of reflexive anaphors in Turkish aphasia. One conclusion we can arrive here is that the PWA resort themselves to a non-local interpretation of reflexive anaphors, signalling that the locality constraint on *kendi* reflexive, is only loosely applied in syntactic comprehension in aphasia. Our data present an opposing picture to the theory which posits that reflexives are retained in aphasia because they refer to local, and hence structurally closer, referents.

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Table 1. Demographic and cognitive screening details of PWA and control participants

Participant	Age	Test Your Memory x/50	Token Test x/36	Digit Span x/8
A01	54	34	11.5	2
A02	78	5	5.5	0
A03	48	14	9.5	3
A04	48	20	26	3
Control x̄	42.08	47	34.41	6

Figure 1. An example trial in the eye-movement monitoring experiment (A), end-of-sentence response proportions indicating whether the participants selected a local or non-local antecedent as appropriate referent for reflexives (B), and proportion of looks to target local, non-local and distractor referents (C) following the onset of the critical reflexive.

A) Example visual stimulus

B) End-of-sentence response proportions
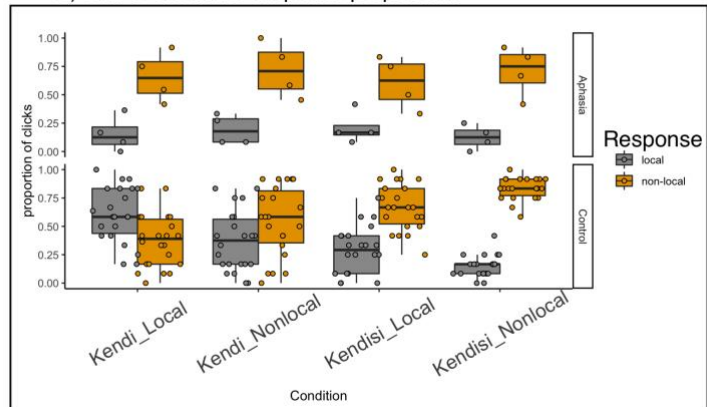
C) Proportions of looks to AOIs