fNIRS Shows that Object Relative Clauses are More Difficult to Process than Subject Relative Clauses in Turkish

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Abstract

It was suggested that processing subject relative clauses (SRCs) are universally easier than processing object relative clauses (ORCs) based on the studies carried out in head-initial languages such as English, and German. However, studies carried out in head-final languages such as Chinese and Basque refuted this claim. Turkish is also a head-final language. Existing relative clause processing literature in Turkish is based solely on behavioural metrics. Even though an ORC processing disadvantage was suggested for Turkish, the results were not conclusive. Therefore, we aimed to investigate the neural dynamics of relative clause processing in Turkish. We asked 14 native Turkish speakers to answer Yes/No questions about 24 sentences each containing either SRC or ORC while their prefrontal hemodynamic activity was recorded with fNIRS. Our findings revealed hemodynamic activity in the lateral portions of the left prefrontal cortex in both conditions. However, hemodynamic activity was more widespread in prefrontal regions for ORC than SRC. Even though the behavioural metrics failed to produce a significant difference between SRC and ORC conditions, direct ORC>SRC contrast revealed significant activity in left and right DLPFC, which are known to be involved in language processing and conflict monitoring related processes, respectively. Our findings indicate that processing ORCs are more difficult and require further prefrontal resources than processing SRCs in Turkish, thus refuting the head-directionality based explanations of relative clause processing asymmetries.

1. Introduction

Syntax processing has been investigated with various paradigms such as center-embedded and left- or right-branching sentences (Inui et al., 1998; Sambin et al., 2012; Santi & Grodzinsky, 2010), in which the modified head comes after or before the modifiers, respectively, and garden-path sentences (Dempsey et al., 2020; den Ouden et al., 2016). Relative clauses (RCs) have also been used in syntax research widely (Cilibrasi et al., 2019; Kovelman, Shalinsky, et al., 2008; Levy et al., 2013). Although there are different ways of classifying the RCs, one classification depends on the function of the modified word in the relative clause. If the modified word is the subject of the relative clause, then it is a subject relative clause (SRC); if it is the object of the relative clause, then it is an object relative clause (ORC). Processing difficulties of ORCs and SRCs have been compared with various methods such as electroencephalography (Bulut et al., 2018; Carreiras et al., 2010), eye-tracking (Sung et al., 2016; Traxler et al., 2002), and functional near-infrared spectroscopy (fNIRS) (Ding et al., 2021). Furthermore, different studies found that SRC processing was easier than ORC processing in different languages such as English (King & Kutas, 1995), German (Schriefers et al., 1995), and Dutch (Mak et al., 2002). Initially, it has been suggested that processing SRCs are universally easier than processing ORCs as these languages differ from each other in various linguistic features such as word order. For instance, the canonical word order in English is Subject-Verb-Object, while in Dutch and German it is Subject-Object-Verb. However, other studies carried out in Mandarin Chinese (Hsiao & MacDonald, 2013; Sung et al., 2016) and Basque (Carreiras et al., 2010) revealed easier ORC processing. Thus, it was claimed that head-directionality could be a significant factor, and SRC processing is easier in head-initial languages, in which the head of the phrase precedes the phrase such as English and German, while ORC processing is easier in head-final languages such as Basque and Mandarin Chinese (Bulut et al., 2018). Turkish is a head-final language with some flexibility (Özge et al., 2015), which implies an ORC processing advantage. In Turkish, relative clauses are prenominal structures (i.e., relative clause precedes the modified word or the head). Subject and object relative clauses are produced by adding different suffixes to the relative clause verb; "-en" for SRC (1) and "-dık" for ORC (2).

(1) *Yönetmen-i beğen-**en** dansçıokul-a gidi-yor-du .*

*Director -**Acc** admire-**SRC** dancer school-**Dat** go-**Prog-Past***

The dancer that admired the director was going to school.

(2) *Yönetmen-in beğen-**diğ**-i dansçıokul-a gidi-yor-du.*

*Director -**Gen**admire-**ORC-3rd$_{sing}$poss** dancer school-**Dat** go-**Prog-Past***

The dancer that the director admired was going to school.

However, RC processing studies in Turkish revealed contrary results, showing easier SRC processing (Bulut et al., 2019; Kahraman, 2015; Kahraman et al., 2010; Özge, 2010). It was also found that participants who learn Turkish as a second language process SRCs easier than ORCs (Altan, 2016; Uzundag & Küntay, 2019). On the other hand, it was claimed that there is no difference between processing SRCs and ORCS if they are given in a context (Boran, 2018). Furthermore, Özge et al. (2015) divided the stimuli sentences into different segments and compared the ORC and SRC reading performances in a self-paced reading test. The authors have reported SRC or ORC processing advantages in different segments of the sentences, but no difference between SRCs and ORCs in total reading times. To the best of our knowledge, RC processing has only been investigated with behavioral metrics in Turkish. Thus, the brain dynamics of RC processing in Turkish remained elusive.

On the other hand, RC processing was investigated with neuroimaging methods in other languages. For instance, a functional magnetic resonance imaging study showed left perisylvian cortex activity during relative clause processing tasks and that processing ORCs was more difficult, even though there were no significant differences in accuracy and reaction time measurements (Caplan et al., 2002). Kovelman, Baker, et al. (2008) have reported that activity in left and right inferior cortices (i.e., Brodmann Area (BA) 44, 45) increases during relative clause processing. Moreover, the authors found that ORC processing is more difficult than SRC processing and caused greater neuronal activity in both left and right inferior cortices, as well as BA 46 and 47 in the right hemisphere, while there was no significant difference in terms of reaction times. Another neuroimaging study showed that processing relative clauses compared to processing unintelligible speech causes an increase in the activity of both left and right dorsolateral prefrontal cortex (DLPFC) (Hassanpour et al., 2015). This study also failed to find a significant difference in terms of behavioural metrics. Lastly, Ding et al. (2021) compared syntax processing in monolingual and bilinguals with different sentence types and found that left DLPFC is amongst the active regions for processing relative clauses and ORCs induced greater neuronal activity than SRCs in both left and right DLPFC.

In summary, neuroimaging studies showed that a robust processing difference between SRCs and ORCs in various languages and that both left and right DLPFC are crucial in RC processing. The findings about the relative processing in Turkish depend solely on behavioural paradigms and are not fully consistent. As stated above, behavioural findings can fail to reveal the processing difficulty differences between SRCs and ORCs. Therefore, we aimed to investigate the prefrontal cortex hemodynamics during relative clause processing in Turkish. We hypothesized that the left DLPFC would be the primary region for neuronal activity since it covers the classical language areas (i.e., Broca's). Furthermore, we have expected to observe processing difficulty differences between ORCs and SRCs, especially in the lateral parts of the prefrontal cortex.

2. Methods

2.1. Participants

Fourteen healthy volunteer subjects, ages 21 to 35, participated in the study. There were eight females and six males. Eleven subjects were right-handed. The subjects were informed before the experiment and gave written consent. The Human Research Ethical Committee of Boğaziçi University approved the study.

2.2. Data Collection

22-channel NIRSport system (NIRX Medical Technologies, LLC, Berlin, Germany) consisting of eight near-infrared light sources and seven detectors was used to collect the hemodynamic activity of the prefrontal cortex of the subjects. The source-detector separation was 3 cm, and the sampling rate was 7.8125 Hz. Prefrontal cortex coverage of the fNIRS probe was computed with the NIRS_SPM toolbox (Jang et al., 2009; Singh et al., 2005; Ye et al., 2009) and can be seen in Figure 1 (adapted from Mutlu et al., 2020).

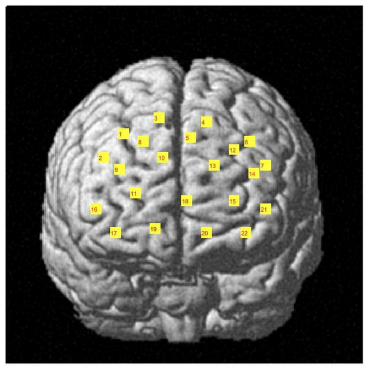

Figure 1. Projected channel locations onto a standard brain template.

2.3. Experimental Stimuli and Design

The subjects were asked to answer a 'Yes/No' question about sentences containing either SRC or ORC. An example sentence-question pair can be seen below (3). The sentences were adapted from Traxler et al. (2002) and translated into Turkish. To ensure that each sentence consists of 10 words, adjectives or adverbs were used, where necessary. The full stimuli list can be found in Appendix A (Full Stimuli List). There were 24 sentence-questions pairs (i.e., trials) in total. The number of SRC-containing and ORC-containing sentences was equal. Furthermore, the questions were arranged in a way that both SRC and ORC conditions required an equal number of 'Yes' and 'No' answers (i.e., 6 'Yes' and 6 'No' in both conditions).

(3) Oyun kurucudan nefret eden defans oyuncusu kötü bir espri yaptı.

The linebacker that hated the quarterback made a bad joke.

Defans oyuncusu oyun kurucudan nefret ediyordu?

The linebacker hated the quarterback?

The experiment was designed with Psychopy 3.0.6 (Peirce et al., 2019) and presented via a 24-inch monitor. Subjects were seated in front of a monitor, the eye-monitor distance was 50 cm, and the stimuli were presented at the center of the screen. The answers were collected via keyboard response. The study was carried out in a silent and dimly lit room.

The experiment began with a 30-second (s) long baseline recording, followed by subjects pressing a key to start the experiment. A plus sign ('+') was presented on the screen for 500 ms before each trial. A randomly chosen sentence was presented on the screen for 4.5 seconds. Subsequently, the question was shown for 3 seconds, within which the subjects had to give their answers. There was a rest period between trials and the inter-stimulus interval was set randomly between 7-10 seconds to prevent the subjects' anticipatory hemodynamic activity (Fig. 2).

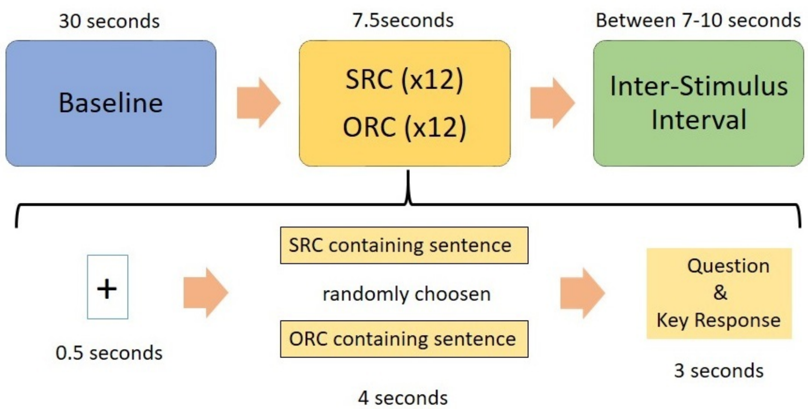

Figure 2. Experiment Design. Baseline fNIRS was recorded for 30 s at the beginning of each experiment. Then, a fixation point was shown for 0.5 s, followed by a presentation of a randomly chosen sentence for 4 s. Subsequently, there was a 3-second long response window, during which the question was presented on the screen and the subjects had to give a response. Each trial concludes with an interstimulus interval chosen randomly within the range of 7-10 seconds.

2.4 Data Preprocessing and Analysis

Hemodynamic data was preprocessed with a combination of nirsLAB (an analysis software that comes with the NIRSport system), Homer2 (Huppert et al., 2009) and custom scripts in MATLAB R2017B. The raw data was converted into optical densities. The channels that fell outside the 80-140 dB optical density range were excluded from further analysis. Motion artefacts were corrected via the wavelet method (Cooper et al., 2012). Subsequently, data was band-pass filtered with a third-order Butterworth filter with cut-off frequencies of 0.05 and 0.2 Hz. Since the system did not feature short-channel separation, a PCA filter was also used to remove non-cortical signals that remained within the band-pass filter frequency range. Lastly, preprocessed optical densities were converted into oxy-hemoglobin (HBO) and deoxy-hemoglobin (HBR) concentrations. Only HBO data was used in further analysis as it was claimed that cortical activation is better reflected by HBO (Dravida et al., 2017; Watanabe et al., 2002).

Accuracy and reaction times were computed for each condition and subject. For trials in which subjects did not give an answer within 3-second long response window, reaction time was set as 3 seconds. A paired sample t-test was used to analyze the accuracy and reaction time data.

To analyze hemodynamic activity, fourteen seconds long segments were generated by using the two seconds pre-stimulus baseline window and twelve seconds post-stimulus activity windows for each trial. Then, the segments were detrended and classified as either SRC or ORC. Subsequently, the average across trials was computed to generate single SRC and single ORC timeseries in each fNIRS channel of each subject. Lastly, the hemodynamic activity induced by conditions was measured by computing the hemodynamic activity strength (HAS) (Mutlu et al., 2020) with the following equation:

$$HAS = \frac{\mathrm{mean}_{\mathrm{act}} - \mathrm{mean}_{\mathrm{base}}}{\mathrm{std}_{\mathrm{base}}}$$

where $mean_{act}$ denotes the average HBO concentration of a three seconds long window created around the peak HBO value found within the post-stimulus 2 and 8 seconds window;$mean_{base}$ and std_{base}denote the average and standard deviation of two seconds long pre-stimulus baseline HBO concentration, respectively. As a result, each subject had a 22 x 2 (*channel x condition*) matrix consisting of respective HAS values.

Two levels of analysis were performed on HAS parameter: within-condition and between-conditions. For within-condition analysis, a channel-based one-sample t-test was used to identify the brain regions showing significant hemodynamic activity for each condition, while a channel-based paired sample t-test was used to compare the brain activity between conditions. Channel-based analysis was preferred, as it was claimed that different brain regions have different optical properties which can lead to systematic bias and may cause non-comparable signal quality and/or intensity across different channels (Kujach et al., 2018; Yanagisawa et al., 2010). All statistical analyses were conducted in MATLAB R2017B.

3. Results

One subject (a left-handed female) was removed from the analysis due to a damaged fNIRS data file.

3.1. Behavioural Results

Accuracy and reaction time findings can be seen in Table 1. Although the subjects were less successful in the ORC condition compared to SRC, paired sample t-test revealed no statistical significance (t_{12}=1.48, P=0.17). The difference between conditions in reaction times was not significant (t_{12}=0.01, P=0.99).

	Subject Relative Clause	Object Relative Clause
Accuracy (%)	75.6 ± 4.6	69.2 ± 5.5
Reaction Time (s)	2.293 ± 0.071	2.292 ± 0.063

Table 1. Behavioural findings. The values are reported in mean ± standard error.

3.2. fNIRS Results

Channel-based one-sample student t-test revealed different activity profiles for subject relative clause (Fig. 3A) and object relative clause (Fig. 3B) conditions. In the SRC condition, a limited significant hemodynamic activity was found in three channels ($P<0.05$). These channels roughly correspond to Brodmann Area (BA) 9 in the middle portions of the prefrontal cortex and the left frontopolar area (BA 10) and DLPFC (BA 46). On the other hand, ORC revealed more widespread hemodynamic activity across the prefrontal cortex ($P<0.05$) as well as greater hemodynamic activity in the left prefrontal cortex including DLPFC.

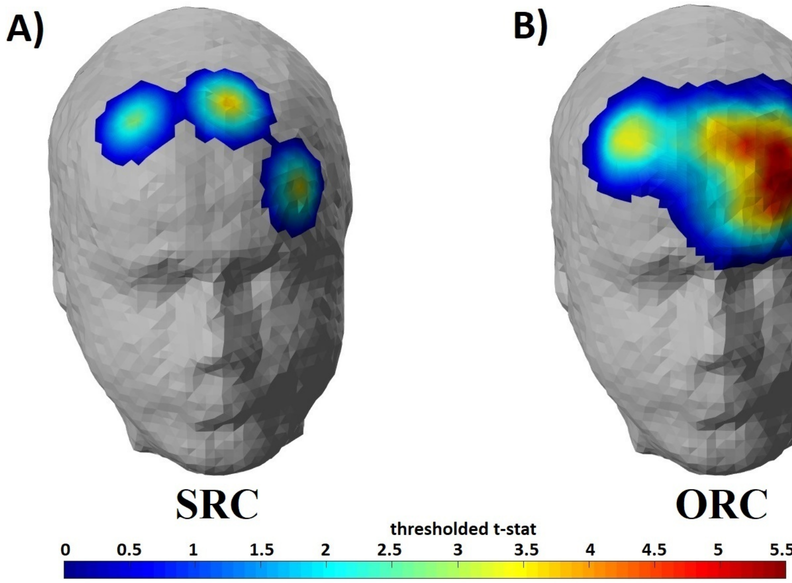

Figure 3. fNIRS channels showing statistically significant activity for within-condition investigation ($p<0.05$) were mapped onto a standard head model with a thresholded t-statistics. Significantly active channels in A) SRC, and B) ORC .

For between-condition comparisons, paired sample student t-test revealed significant activations in channel 2 (t_{12}=2.41, P=0.33); channel 7 (t_{12}=2.35, P=0.37); channel 12 (t_{12}=2.27, P=0.46); channel 20 (t_{12}=2.66, P=0.24) (Fig. 4). These channels correspond to right BA 45 and 46; left BA 9, 10, 11, 45, and 46 (Mutlu et al., 2020). These channels are further explained in the Discussion section.

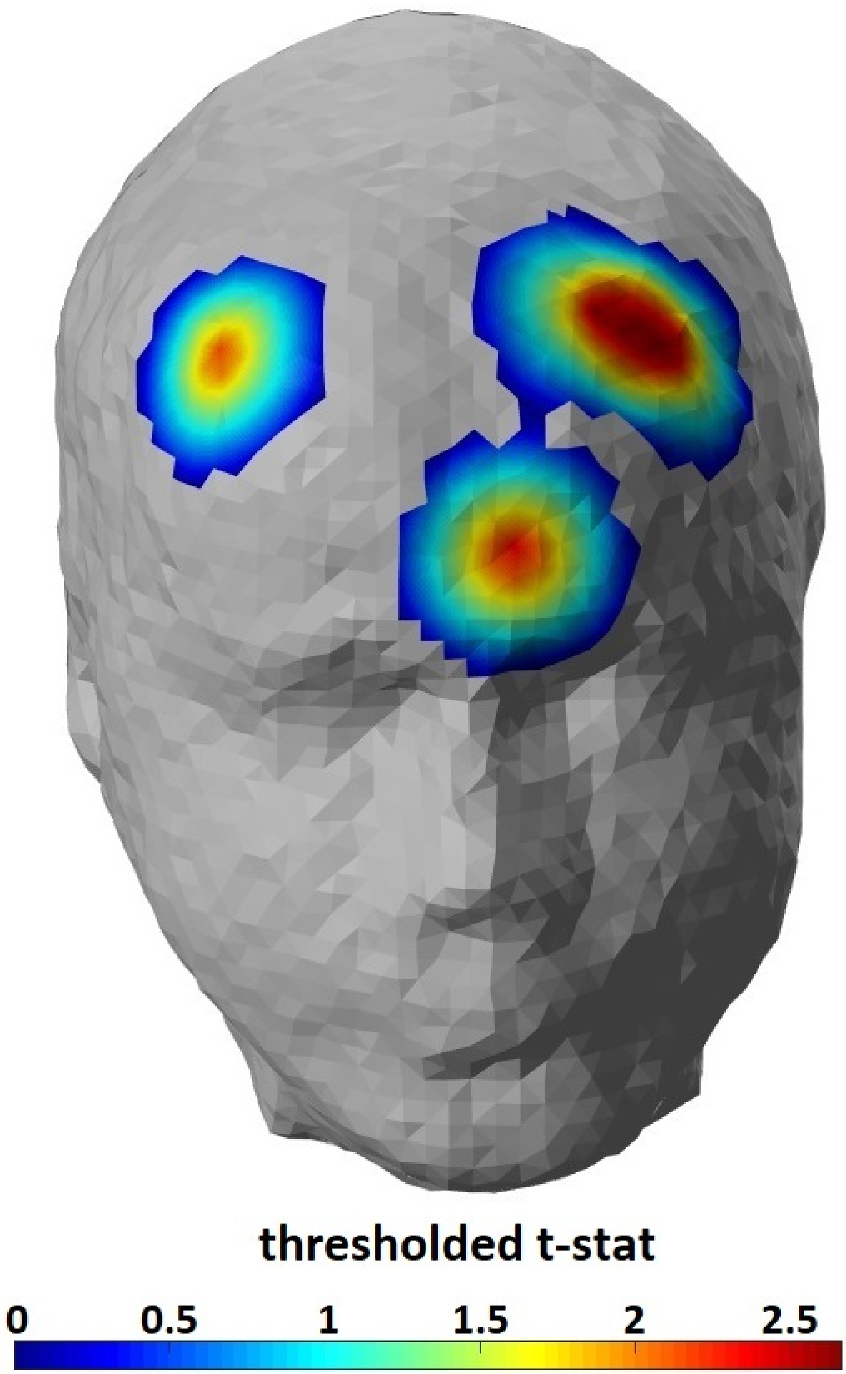

Figure 4. fNIRS channels showing a statistically significant difference ($p<0.05$) for ORC>SRC contrast were mapped onto a standard head model with thresholded t-statistics.

4. Discussion

Even though it has been suggested that processing object relative clauses could be easier than processing subject relative clauses in Turkish due to the head-directionality, studies carried out in Turkish with behavioural metrics showed that ORC processing is more difficult. In the present study, we aimed to investigate the object vs. subject relative clause processing in Turkish with an imaging method. To that end, we asked 14 native Turkish speaker adults to answer a 'Yes/No' question about each of 24 sentences containing either ORC or SRC. Our findings showed that processing ORCs induces more widespread hemodynamic activity in the prefrontal cortex compared to SRCs as well as a significantly greater hemodynamic activity in the left (i.e. Broca's area) and right DLPFC.

4.1. Behavioural

Based on the existing relative clause processing literature in Turkish, we expected to see lower accuracy and longer reaction times in ORC compared to SRC. Contrary to our initial expectations, behavioural findings showed no significant difference between the conditions. However, further investigations revealed some insights. Previous studies had used self-paced reading time tasks, while we measured reaction times. Therefore, a direct comparison with the existing literature can be misleading. As explained in the Methods section, there were trials where subjects could not answer the questions within the given time limit (i.e., 3 seconds). We found that there were 60 unanswered trials in total (combined for 13 subjects), 34 (57%) of which were in ORC and 26 (43%) of which were in SRC conditions. Furthermore, even though the difference in accuracy findings was not statistically significant, subjects tended to make more mistakes in the ORC condition compared to the SRC condition. These findings together imply an ORC processing difficulty in Turkish.

4.2. fNIRS

Overall, the fNIRS analysis revealed a limited prefrontal activity in SRC and more widespread prefrontal activity in ORC condition. Moreover, direct ORC>SRC comparison revealed significant activity both in the left and right DLPFC. Given that the ORC processing was expected to be more difficult than SRC processing in Turkish, this finding was consistent with the initial hypotheses.

In the SRC condition, the middle frontal gyrus (i.e., BA 9) showed significant hemodynamic activity (Fig. 3A). It was found that left BA 9 was active during maintaining or remembering the piece of information just received (Raye et al., 2002). Therefore, activity in these regions can be due to the subjects' need to recall the relationship between the object and subject of the main and relative clauses to answer the follow-up questions correctly. Furthermore, Jörgens et al. (2007) showed that BA 9 is also active during a sentence completion task. The other regions showing significant activity were in the lateral portions of the left prefrontal cortex including BA 46. It was shown that left BA 46 shows activity during semantic processing (Ni et al., 2000; Wang et al., 2008) and syntax processing (Ni et al., 2000) in sentence level. Even though the focus of the present study was to investigate syntax processing at the sentence level, subjects had to process the semantics as well to answer the questions. Furthermore, it was shown that the left DLPFC plays role in various aspects of sentence processing, such as parsing or plausibility (Hertrich et al., 2021).

As can be seen in Figure 3B, the strongest hemodynamic activity was mostly localized in the left DLPFC (i.e., BA 9, 45, and 46) in ORC condition. It was shown that the left DLPFC involves in language processing (Hertrich et al., 2021; Klaus & Schutter, 2018) and syntax processing (Chen et al., 2006; Indefrey et al., 2001; Just et al., 1996; Ni et al., 2000). Therefore, it can be said that the activity in the lateral portions of the left prefrontal cortex occurs due to sentence processing. The other active region was the right DLPFC, covering mostly BA 46 (Fig. 3B), which was also reported for relative clause > noise processing (Hassanpour et al., 2015) and ORC>SRC processing (Kovelman, Baker, et al., 2008). It was suggested that the right DLPFC could be an indicator of greater cognitive control required for processing more difficult sentences (Ding et al., 2021). It is known that both left and right DLPFC are part of the executive control network (Hertrich et al., 2021) and the right DLPFC, together with the anterior cingulate cortex, plays role in error/conflict monitoring and resolution (Badre & Wagner, 2004; Jackson et al., 2022). It was also shown that the right DLPFC is active while processing more complex garden-path sentences (den Ouden et al., 2016).

Several explanations have been put forward for RC processing asymmetry in Turkish (Özge et al., 2010). The authors' first claim was that SRCs are more common in Turkish compared to ORCs, which can lead to SRC processing advantage. The other account was based on the word-order similarity. In Turkish, the canonical word order is as SOV, while ORCs are produced with SVO, and SRCs are produced with OVS word order. As can be seen, the word order of SRC shows higher similarity to the canonical word order of SOV, which can lead to SRC processing advantage in Turkish. The perspective shift was proposed as another explanation for SRC processing advantage. Relative clauses are prenominal structures in Turkish and the focus in SRC is on the agent (subject), while the focus in ORC is on the patient (object). Since the canonical sentence starts with a subject in Turkish, it was expected that starting of a sentence should have the agent role. If it does not coincide with this role, as in ORC containing sentence, then a conflict arises (i.e., shift in perspective is required) and leads to a processing disadvantage. As explained above, SRC and ORC are constructed with different suffixes. Özge et al. (2009) stated that the suffix used in ORCs (i.e., "-dık") could also be seen in other structures in Turkish, such as noun complement clause (Kahraman et al., 2010), while the suffix used in SRCs not. Therefore, it could be said that a direct form-function mapping leads to a processing advantage in SRCs in Turkish, while participants should employ further cognitive resources such as error monitoring to correctly process ORCs.

Direct ORC>SRC contrast revealed a significantly greater hemodynamic activity in three frontal regions (Fig. 4). The first region corresponds to the left DLPFC (i.e., BA 45 and 46). The left BA 45 corresponds to Broca's Area, known to be involved in language processing. Furthermore, multiple imaging studies on English relative clause processing have reported that the activity in BA 45 and BA 46 increases in more difficult condition (Caplan et al., 2002; Chen et al., 2006; Just et al., 1996; Kovelman, Baker, et al., 2008). An EEG study carried out in Basque, in which SRC was expected to be the more difficult condition, revealed that SRCs induced greater P600 amplitudes compared to ORCs, especially in the left dorsolateral regions (Carreiras et al., 2010). Another study showed that the left DLPFC activity could be associated with checking the thematic roles in the sentence as well as with response selection among alternatives (Kovelman, Baker, et al., 2008). The left DLPFC was also associated with working memory (Hertrich et al., 2021), which was also crucial process in the present task as the subjects had to identify the agent and patient in both main and relative clauses to answer the question.

The other active channel collects signal from both left frontopolar cortex and orbitofrontal cortex (i.e., BA 10 and 11, respectively). BA 10 and 11 have not been reported in RC literature, except for one study (Caplan et al., 2008). The authors reported that BA 11 shows significant activity for ORC>SRC comparison. However, the locus of this activity was more in the lateral part of the prefrontal cortex. On the other hand, the active channel in this report was located in the medial parts of the prefrontal cortex. Therefore, it is more likely that the source of this activity was the frontopolar cortex. Even though this region is not specifically associated with language processing, it was shown that it involves many cognitive processes including problem-solving and decision-making (Koechlin & Hyafil, 2007). They proposed that the frontopolar cortex involves in cognitive branching processes, such as computing a complicated math problem by first computing smaller fragments and then combining the results of these fragments. This might also be the case in relative clause processing, during which the participants should identify the role of each noun phrase in both main and relative clauses and then compare them to answer the question correctly. Another study also stated that thematic role control is mostly performed by frontal areas of the left hemisphere (Kovelman, Baker, et al., 2008). Even though we made changes in the stimuli to prevent subjects to take advantage of thematic roles, it is hard to rule out the possibility that subjects employed this strategy in syntactically more difficult sentences.

Lastly, we found a significant activity difference for ORC>SRC in the right DLPFC (i.e., BA 45 and BA 46). The activity of this region was associated with processing more complex sentences (Ding et al., 2021; Kovelman, Baker, et al., 2008). As stated above, the right DLPFC is part of the domain-general executive control network and plays role in many cognitive processes including error/conflict monitoring. It could be the case that the activity in right DLPFC was associated with the perspective-based explanation. To recall, Turkish speakers expect an agent at the beginning of a canonical sentence. On the other hand, encountering an ORC at the beginning of the sentence creates a conflict to be resolved, resulting in greater activity in this region compared to the SRC condition. The other possibility could be that the activity within this region may reflect the evaluation of the alternatives induced by the suffix "-dık" used in ORCs. It was claimed that the right DLPFC shows activity in response selection (Badre & Wagner, 2004). As stated above, the suffix "-dık" is used in other structures in Turkish and the participant should eliminate the alternatives to choose the correct representation, which might require further cognitive control and conflict monitoring/resolution.

5. Conclusion

In conclusion, we found that processing object relative clause causes more widespread activity in the prefrontal cortex compared to processing subject relative clauses. Furthermore, the activity in the left DLPFC, partially including Broca's area, and right DLPFC was significantly greater in ORC than in SRC condition. Our findings show that processing ORCs is more difficult and require greater cognitive resources than processing SRCs in Turkish, thus refuting the head-directionality based explanations suggested for relative clause processing differences. The present study also demonstrates that behavioral measurements might not be conclusive and should be coupled with a neuroimaging or an electrophysiological method, if possible.

Conflict of Interest

The authors declare no conflict of interest.

Data Accesibility

Data used in the present study can be provided by the corresponding author upon request.

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Author Contribution

All authors contributed to the experiment design. MCM carried out the experiments, analyzed the data, and wrote the manuscript. All authors reviewed the manuscript.

Abbreviations

BA, Broadmann Area; **DLPFC,** dorsolateral prefrontal cortex; **fNIRS,** functional near-infrared spectroscopy;**HAS,** hemodynamic activity strength; **HBO,**oxyhemoglobin; **HBR,** deoxyhemoglobin; **ORC,** object relative clause; **OVS,** object-verb-subject; **PCA,**principal component analysis; **SOV;** subject-objet-verb;**SRC,** subject relative clause.

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Appendix A – Full Stimuli List

Bebek bakıcısını kovalayan sarı saçlı çocuk oyun oynarken çığlık attı.

The yellow-haired child that chased the babysitter squealed while playing.

Bebek bakıcısı çığlık attı?

The babysitter squealed?

Oyun kurucudan nefret eden defans oyuncusu kötü bir espri yaptı.

The linebacker that hated the quarterback made a bad joke.

Defans oyuncusu oyun kurucudan nefret ediyordu?

The linebacker hated the quarterback?

Hemşireyi görmezden gelen doktor üstü açılabilen kırmızı bir araba kullandı.

The doctor that ignored the nurse drove a red convertible.

Hemşire doktoru görmezden geldi?

The nurse ignored the doctor?

Yaşlı yazarı öven genç fotoğrafçı ulusal bir dergide çalışmak istemiyordu.

The young photographer that complimented the old writer did not want to work for a national magazine.

Fotoğrafçı dergide çalışmak istemiyordu?

The photographer did not want to work for a magazine?

Yaşlı avukatın kızdırdığı bankacı her cumartesi öğleden sonra tenis oynadı.

The banker that the old lawyer irritated played tennis on Saturday afternoons.

Yaşlı avukat tenis oynadı?

The old lawyer played tennis?

Kabin memurunun iltifat ettiği pilot işten sonra yemek teklifinde bulundu.

The pilot that the flight attendant complimented asked for a dinner after work.

Kabin memuru pilota iltifat etti?

The flight attendant complimented the pilot?

Postacının telefonla aradığı sekreter üç gün önce yeniden hastaneye yattı.

The secretary that the postmen called went into hospital again three days ago.

Sekreter postacıyı aradı?

The secretary called the postmen?

Garsonun boşadığı tamirci çoğunlukla eve geç saatlerde dönmek zorunda kalıyordu.

The mechanic that the waitress divorced often had to get home late.

Tamirci eve geç dönüyordu?

The mechanics got home late?

Editörü kızdıran yazar kararı protesto etmek için bir makale yazdı.

The writer that angered the editor wrote an article to protest the decision.

Editör makale yazdı?

Editor wrote an article?

Yönetmeni beğenen dansçı şehir dışındaki bir okulda özel ders veriyordu.

The dancer that admired the director was teaching at a school outside the city.

Dansçı yönetmeni beğendi?

The dancer admired the director?

Ev sahibine hakaret eden kiracı sonunda gazeteye şikayet telefonu açtı.

The tenant that insulted the landlord finally phoned the newspaper to complain.

Ev sahibi kiraciya hakaret etti?

The landlord insulted the tenant?

Sarışın kovboyu öldüren şerif eski bir viski şişesi gibi kokuyordu.

The sheriff that killed the blonde cowboy smelled like an old whiskey bottle.

Şerif viski şişesi gibi kokuyordu?

The sheriff smelled like a whiskey bottle?

Maharetli hırsızın korkuttuğu yeni polis belinde bir tabanca daha taşıyordu.

The new policeman that skilful thief scared was carrying another gun in his waistband.

Hırsız bir tabanca daha taşıyordu?

The thief was carrying another gun?

Tecrübeli gardiyanın saldırdığı mahkum fırsatını bulup ceza evinde isyan başlattı.

The prisoner that the experienced guard attacked found a way to provoke a riot in the prison.

Gardiyan mahkuma saldırdı?

The guard attacked the prisoner?

Kampçının yürüyerek yanından geçtiği şanslı balıkçı sırtında olta takımı taşıyordu.

The lucky fisherman that the camper walked past was carrying fishing gear on his back.

Balıkçı kampçının yürüyerek yanından geçti?

The fisherman walked past the camper?

Cocuğun yardım ettiği asker savaştan sonra ordudan bir madalya aldı.

The soldier that the child assisted received a medal from the army after the war.

Asker madalya aldı?

The soldier received a medal?

Elektrikçiye yardım eden muslukçu yirmi yıl çalıştıktan sonra emekli oldu.

The plumber that helped the electrician retired after twenty years on the job.

Elektrikçi emekli oldu?

The electrician retired?

Yardımcıdan hoşlanan golfçü profesyonel turnuvada son turu epey zorlanarak geçti.

The golfer that liked the caddy passed the last round in the professional tourne- ment with great difficulty.

Golfcu yardımcısından hoşlandı?

Golfer liked the caddy?

Yeni öğrenciyi eleştiren tarihçi olaydan sonra kendini gerçekten kötü hissetti.

The historian that criticized the new student felt really bad after the incident.

Öğrenci tarihçiyi eleştirdi?

The student criticized the historian?

Kurda yaklaşan geyik çiçeklerle kaplı çayırı boydan boya koşarak geçti.

The deer that approached the wolf sprinted away accross the meadow full of flowers.

Geyik boydan boya koşarak geçti?

The deer sprinted across?

Profesörün eleştirdiği öğrenci dersten sonra kitabın son bölümünü hızlıca okudu.

The student that the professor criticized read the last chapter of the book quickly after the class.

Profesör son bölümü hızlıca okudu?

The professor read the last chapter quickly?

Psikoloğun ulaşamadığı yeşil gözlü danışman o gece sinemaya gitmekten vazgeçti.

The green eyed client that the psychologists could not reach decided not to go to cinema that night.

Psikolog danışmana ulaşamadı?

The psycholog could not reach to client?

Acemi avcının gördüğü kamuflajlı bekçi havaya doğru uyarı ateşi açtı.

The camouflaged game warden that the novice hunter saw fired a warning shot into the air.

Bekçi acemi avcıyı gördü?

The game warden saw the novice hunter?

Yönetmenin ziyaret ettiği aktör yeni filmde yan rollerden birini kaptı.

The actor that the director visited got one of the side roles in the new movie.

Aktör yan rolü kaptı?

The actor got the side role?