



Brief article

On the universality of language comprehension strategies: Evidence from Turkish

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Abstract

A fundamental question in psycholinguistic research concerns the universality of comprehension strategies. We investigated this issue by examining the so-called “subject preference” in Turkish, a language which allows for a natural (unmarked) object reading of an initial ambiguous argument. Using event-related brain potentials (ERPs), we observed increased processing difficulty in the form of a broadly distributed positivity when an initial ambiguous argument was disambiguated towards an object reading. This effect was independent of the animacy (i.e. semantic subject prototypicality) of the ambiguous argument. Our results therefore speak in favour of a universal tendency to interpret the first argument encountered as the “subject” of the clause, even in languages providing no obvious structural motivation for such a strategy. However, we argue that the underlying explanation for this preference must be modified in accordance with cross-linguistic considerations.

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A fundamental question in psycholinguistics is whether the processing mechanisms that serve to guarantee incremental comprehension are universal or determined by the specific properties of individual languages. One processing strategy that has hitherto proved very robust and that has been observed in a number of languages (e.g. Dutch, German, English, Italian) is the tendency to analyse an ambiguous first argument as the subject of the clause (e.g. de Vincenzi, 1991; Frazier, 1987; Schriefers, Friederici, & Kühn, 1995). The most common explanation for this “subject-preference” has been to assume that the processing system attempts to minimise working memory costs by either (a) minimising the distance between filler and gap (e.g. Crocker, 1994; Frazier & Flores d’Arcais, 1989), or (b) assuming minimal dependencies (Gibson, 1998, 2000). The filler-gap approach assumes that the ambiguity between a subject- and an object-initial reading is structural in nature and that subjects occupy a higher position in the phrase structure tree than objects. Therefore, the subject-preference allows for an earlier integration/interpretation of an initial argument. The dependency-based approach posits that an initial object introduces the prediction that a subject must be encountered at some later point in the sentence. A “dependency-free” subject analysis of an initial argument is thus to be preferred.

Recently, it was proposed that the “subject-preference” does not arise from any particular properties related to subjecthood per se (e.g. structural position or dependencies), but that it should rather be viewed as an epiphenomenon of a general least-effort processing strategy termed “Minimality” (Bornkessel & Schlesewsky, 2006). In a similar spirit to Fodor and Inoue’s *Minimal Everything* (Fodor, 1998; Inoue & Fodor, 1995), the Minimality principle assumes that minimal representations are preferred at all levels of processing: Minimality (Bornkessel & Schlesewsky, 2006).

In the absence of explicit information to the contrary, the human language comprehension system assigns minimal structures. This entails that only required dependencies/relations are created.

Bornkessel and Schlesewsky (2006, p. 790)

Minimality derives the subject-advantage from a general preference to interpret initial arguments as the sole argument (subject) of an intransitive relation (e.g. *Peter slept*). Note that this approach is quite different from Gibson’s because it does not assume that the intransitivity preference results from the avoidance of predictions for upcoming elements. Rather, it is based upon the idea that a minimal (and thereby preferred) event is one involving only a single participant. As this single participant must (in languages like German or Turkish) be a subject, the subject analysis arises as a consequence of this minimal interpretation.

Importantly, the Minimality-based approach makes the cross-linguistic prediction that a “subject-preference” should also be observable in a language in which an ambiguous first argument can naturally function as either the subject or the object. This is the case in languages that are verb-final (SOV) and do not require an overt realisation of the subject (i.e. allow pro-drop). Turkish is a classic example of a language of this type, because both arguments precede the verb in an unmarked sentence (la) and the subject can be dropped (lb).

- (1)
- a. Dün ben pilot gördüm.
yesterday I pilot see-Past-1st.Person.Sing
'Yesterday I saw (a) pilot'.
 - b. Dün pilot gördüm.
yesterday pilot see-Past-1st.Person.Sing
'Yesterday (I) saw (a) pilot'.

The first argument (*pilot*) in a sentence such as (1b) can also turn out to be the subject (2), thus illustrating that an initial ambiguous argument in Turkish can either be the subject or the object of the clause and that both possible analyses are compatible with an unmarked continuation.¹ A sentence is described as 'unmarked' if it can be uttered in the absence of any constraining context (Siwierska, 1988). The sentences in (1b) and in (2) both clearly fulfill this criterion.

- (2) Dün pilot uyudu.
yesterday pilot sleep-Past-3rd.Person.Sing
'Yesterday (the) pilot slept'.

Turkish therefore differs from all languages that have been shown to exhibit a subject preference, because these either do not allow pro-drop (Dutch, German, English) or are not verb-final (Italian, English). It thus allows us to examine whether the subject-preference still holds when a subject reading is not the only unmarked analysis option for an ambiguous argument. As illustrated above, the second unmarked possibility is to analyse the argument as an object in a structure with a dropped subject (as in 1b).

The present ERP study investigated whether the subject-preference or pro-drop determines interpretation of an initial ambiguous argument. A second question was whether the availability of two alternative unmarked structures would lead to a higher susceptibility for the use of semantic information (animacy) in ambiguity resolution. While the subject preference has been shown to be independent of animacy in German (Schlesewsky, Fanselow, Kliegl, & Krems, 2000), this might not be the case in a language that does not require the overt realisation of a subject. Thus, an inanimate initial argument, i.e. a non-prototypical subject (Comrie, 1989; Hopper & Thompson, 1980), may lead to the pro-drop reading being favoured over the subject reading.

¹ Turkish does have accusative case marking, but this is only used with specific objects. The interpretive difference between objects with and without accusative marking can be illustrated by the following examples (from Comrie, 1989):

- (i) Hasan öküz-ü aldı
Hasan ox-ACC bought
'Hasan bought the ox'.
- (ii) Hasan öküz aldı
Hasan ox bought
'Hasan bought an ox/oxen'.

1. Materials and methods

1.1. Participants

After giving informed consent, 26 participants (8 females and 18 males) from the Turkish community of Berlin participated in the experiment. Their mean age was 27.1 years with a range of 21–40. Nineteen of them were native speakers of Turkish (6 females, 13 males) and seven of them were bilinguals of either Turkish-Bulgarian or Turkish-German (3 females, 4 males). The first language of the bilingual participants (language spoken at home) was Turkish, but – in contrast to the non-bilinguals – they started learning their second language during early childhood. Participants that were not bilingual scored their knowledge of German with a mean rating of 2.37 (std: 0.96; scale: 1–5, with 1 equalling “very well”). All the participants were right-handed and had normal or corrected-to-normal vision. Three further participants were excluded from the final data analysis due to excessive EEG artefacts.

1.2. Experimental design

In accordance with the main questions of the experiment (Is there a subject preference? Can this preference be modulated via animacy?), the experimental conditions were centred around a 2×2 design manipulating the factors AMBIGUITY (initial argument ambiguous vs. unambiguous) and ANIMACY (initial argument animate vs. inanimate):

- (3)
- a. Ambiguous, animate
Dün adam gördüm.
Yesterday man see-Past-1st.Person.Sing
“I saw (a) man yesterday”
 - b. Unambiguous, animate
Dün adamı ben gördüm.
Yesterday man-ACC I see-Past-1st.Person.Sing
“I saw the man yesterday”
 - c. Ambiguous inanimate
Dün taş gördüm.
Yesterday stone see-Past-1st.Person.Sing
“I saw (a) stone yesterday”
 - d. Unambiguous inanimate
Dün taşı ben gördüm.
Yesterday stone-ACC I see-Past-1st.Person.Sing
“I saw the stone yesterday”

The design shown in (3) capitalises upon the fact that accusative case can but need not be marked overtly in Turkish (see Footnote 1). Furthermore, only first person (singular or plural) pronouns (and verb agreement endings) were used, as

these (a) unambiguously rule out a subject reading for the critical NP in the locally ambiguous conditions (3a/c), and (b) do not require any specific context for pro-drop.

The critical position in all the conditions in (3) was the verb, which disambiguates the first NP towards an object reading (via person information) in the ambiguous conditions (3a/c). If there is a subject-preference, this disambiguation should engender increased processing difficulty (3a/c vs. 3b/d). Furthermore, if the preference is influenced by animacy, the effect at the position of the verb should be modulated for inanimates (3c vs. 3d) as opposed to animates (3a vs. 3b).

In order to avoid artificial processing strategies due to a predictable reading of the first NP, we introduced four filler conditions designed to render the materials more variable and thereby minimise strategic influences. Conditions (4a/b) led to a (transitive) subject reading of the ambiguous initial argument, while conditions (5a/b) led to a (transitive) object reading of the ambiguous initial argument.

(4)

- a. Transitive SO animate
Dün adam kadını gördü.
Yesterday man woman-ACC see-Past-3rd.Person. Sing
“The man saw the woman yesterday”
- b. Transitive SO inanimate
Dün taş kadını yaraladı.
Yesterday stone woman-ACC injured-Past-3rd.Person.Sing
“The stone injured the woman yesterday”

(5)

- a. Transitive OS animate
Dün adam ben gördüm.
Yesterday man I see-Past-1st.Person. Sing
“I saw (a) man yesterday”
- b. Transitive OS inanimate
Dün taş ben gördüm.
Yesterday stone I see-Past-1st.Person. Sing
“I saw (a) stone yesterday”

Note that, in absence of a suitable context, (5a/b) are very highly marked and therefore associated with a considerable acceptability drop. However, they were included as to further extend the possible range of readings for the first NP.

1.3. Materials

Sentence materials were constructed on the basis of 80 adverb-noun(animate)-noun(inanimate)-(noun/pronoun/null)-verb combinations, which were used to generate sentences as in (3–5). All adverbs were temporal (e.g. *yesterday*, *last night*). The animate nouns were human common nouns (e.g. *doctor*, *man*, *singer*), while inanimate nouns were nouns like *medicine*, *car*, *rock* etc. Except for the transitive SO

inanimate condition (4b), the (accusative) verbs were compatible with both inanimate and animate objects. The verbs in condition (4b) were only required to select an animate object.

The 640 sentences thus constructed were divided into two lists of 320 sentences such that each list included 40 sentences per condition and four sentences from each lexical set. Overall, each list comprised 160 acceptable sentences (of the types in 3b/d and 4), 80 unacceptable sentences (5) and 80 sentences of potentially degraded acceptability due to a required reanalysis (3a/c). Each list was presented in two different randomised presentation orders and presentation of lists was counterbalanced across participants.

1.4. Procedure

Sentences were presented word-by-word in the centre of the screen with a presentation time of 600 ms per word and an inter-stimulus-interval (ISI) of 200 ms (note that adverbs composed of 2 words like *dün gece* ('last night') were presented together). These presentation times were chosen due to the morphological complexity of Turkish and were perceived as a comfortable reading rate by participants. Each trial began with the presentation of an asterisk (1000 ms plus 200 ms ISI) and ended with a 1000 ms pause, after which the participants completed an acceptability judgement task by pressing one of two push-buttons. Participants were given maximally 3000 ms to respond. The acceptability judgement was followed by a probe detection task, in which the participants decided whether the word shown had occurred in the previous sentence (maximal reaction time again 3000 ms).

Participants were asked to avoid movements and to only blink their eyes between the onset of the judgement task and the presentation of the asterisk preceding the next sentence. Before the main session, 14 additional sentences were presented as a practice session. The presentation of the critical 320 sentences was then carried out in eight blocks of 40 sentences. A session lasted approximately 3 h including electrode preparation.

1.5. EEG recording

The EEG was recorded by means of 25 AgAgCl-electrodes, which were fixed to the scalp by means of an elastic cap (Electro Cap International). AFZ served as the ground electrode. Recordings were referenced to the left mastoid, but re-referenced to linked mastoids offline. In order to control for eye-movement artefacts, the horizontal and vertical electro-oculogram (EOG) was monitored. Electrode resistances were kept below 5 k Ω . All channels were amplified using a Twente Medical Systems DC amplifier and recorded with a digitization rate of 250 Hz.

1.6. Data analysis

The statistical analyses of the behavioural data for the four critical conditions (3a–d) were carried out by means of repeated measures analyses of variance (ANOVAs)

comprising the within participants factors AMBIGuity (Ambiguous vs. Unambiguous) and ANIMacy (Animate vs. Inanimate).

For the statistical analysis of the ERP data, repeated measures ANOVAs for the four critical conditions (3a–d) were calculated for mean amplitude values per time window per condition. Trials for which the probe detection task had not been performed correctly were excluded from the analysis. Analyses additionally included the topographical factor ‘region of interest’ (ROI). Lateral ROIs were defined as follows: left-anterior: F3, F7, FC1, FC5; left-posterior: CP1, CP5, P3, P7; right-anterior: F4, F8, FC2, FC6; right-posterior: CP2, CP6, P4, P8. For mid-line electrodes, the factor ROI comprised the following six levels: FZ; FCZ; CZ; CPZ; PZ; POZ.

2. Results

2.1. Behavioural data

Table 1 shows mean acceptability rates and reaction times for the acceptability judgement task and accuracy rates and reaction times for the probe detection task.

The results of the acceptability judgement task support the prediction that ambiguous initial arguments are initially associated with a subject reading: the ambiguous object-initial conditions gave rise to lower acceptability ratings and higher reaction times than their unambiguous counterparts. This was supported by the statistical analysis of the four critical conditions (3a–d), which revealed main effects of AMB ($F_1(1,25) = 19.13, p < 0.001$; $F_2(1,79) = 119.29, p < 0.001$) and ANIM ($F_1(1,25) = 24.34, p < 0.001$; $F_2(1,79) = 16.86, p < 0.001$) as well as an interaction of ANIM*AMB ($F_1(1,25) = 26.60, p < 0.001$; $F_2(1,79) = 21.63, p < 0.001$) in acceptability ratings. Resolving this interaction by AMB revealed an effect of ANIM for the ambiguous ($F_1(1,25) = 28.20, p < 0.001, F_2(1,79) = 20.26, p < 0.001$) but not for the unambiguous conditions. For the reaction times, the analysis revealed main effects of AMB ($F_1(1,25) = 43.27, p < 0.001$; $F_2(1,79) = 75.47, p < 0.001$) and ANIM ($F_1(1,25) = 10.69, p < 0.01, F_2(1,79) = 11.30, p < 0.01$).

Table 1
Summary of the findings for the two behavioural tasks

Condition	Acceptability judgement		Probe detection	
	Accept. (%)	RT (ms)	Accuracy (%)	RT (ms)
AMB – ANIM (3a)	76.4 (42.5)	760 (478)	98.2 (13.4)	887 (356)
UNAMB – ANIM (3b)	98.0 (14.1)	626 (386)	97.8 (14.7)	878 (357)
AMB – INANIM (3c)	86.8 (33.8)	690 (421)	98.9 (10.2)	840 (328)
UNAMB – INANIM (3d)	98.6 (11.5)	593 (353)	97.1 (16.7)	860 (323)
TRANS. SO ANIM (4a)	97.7 (15.0)	682 (414)	95.4 (20.8)	963 (375)
TRANS. SO INANIM (4b)	94.6 (22.6)	698 (402)	96.9 (17.6)	957 (377)
TRANS. OS ANIM (5a)	16.7 (37.3)	663 (402)	97.4 (15.9)	872 (328)
TRANS. OS INANIM (5b)	21.9 (41.4)	703 (450)	96.8 (17.5)	911 (361)

The table lists mean acceptabilities and reaction times for the acceptability judgement and mean accuracy rates and reaction times for the probe detection task. Standard deviations are given in parentheses.

For the probe detection task, the analysis of the error rates revealed a main effect of AMB ($F_1(1,25) = 7.07, p < 0.05, F_2(1,79) = 4.76, p < 0.05$). The reaction times showed a main effect of ANIM ($F_1(1,25) = 15.90, p < 0.001, F_2(1,79) = 4.01, p < 0.05$).

2.2. ERP data

Fig. 1 shows ERPs relative to the onset of the verb in our critical four conditions (3a–d).

As is apparent from Fig. 1, the conditions disambiguated towards an object-initial reading (3a/c) engender a broadly distributed positivity between approximately 200 and 600 ms post onset of the verb. Visual inspection suggests that this effect does not differ between the animate and inanimate conditions. This impression was confirmed by the statistical analysis, which revealed a main effect of AMB at both lateral

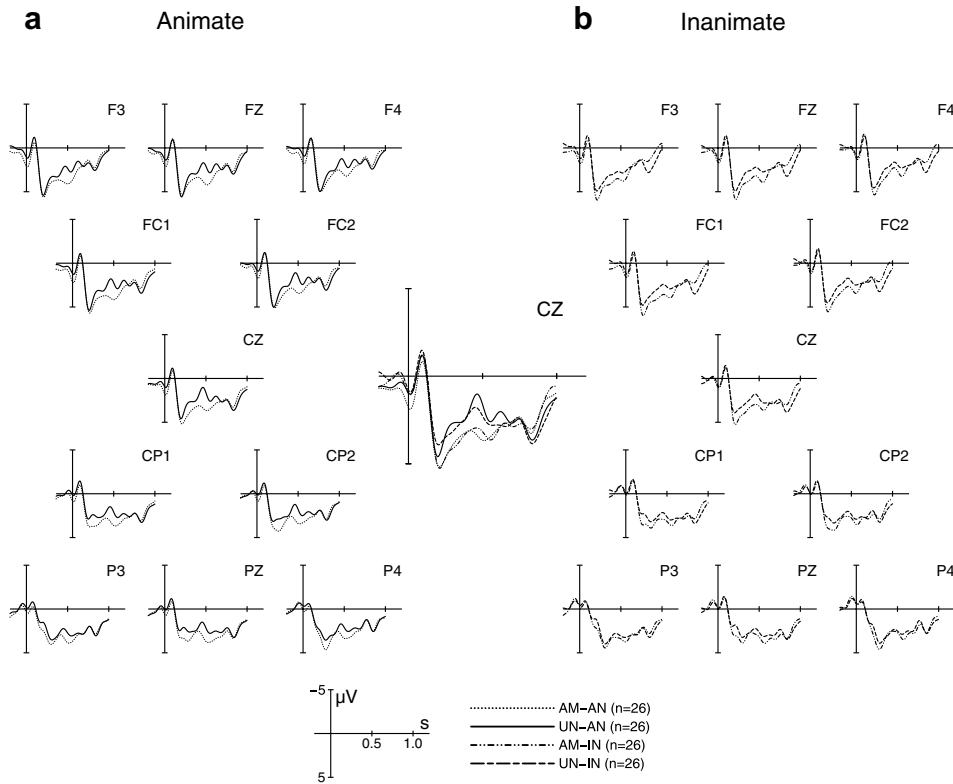


Fig. 1. Grand average ERPs at the position of the verb (onset at the vertical bar) for ambiguous structures requiring a reanalysis towards an object reading of the first NP (3a/3c) and unambiguous structures not requiring such a reanalysis (3b/3d). This comparison is shown for animate initial arguments in (A) and for inanimate initial arguments in (B), while the enlarged electrode provides a direct comparison of all four critical conditions. Negativity is plotted upwards.

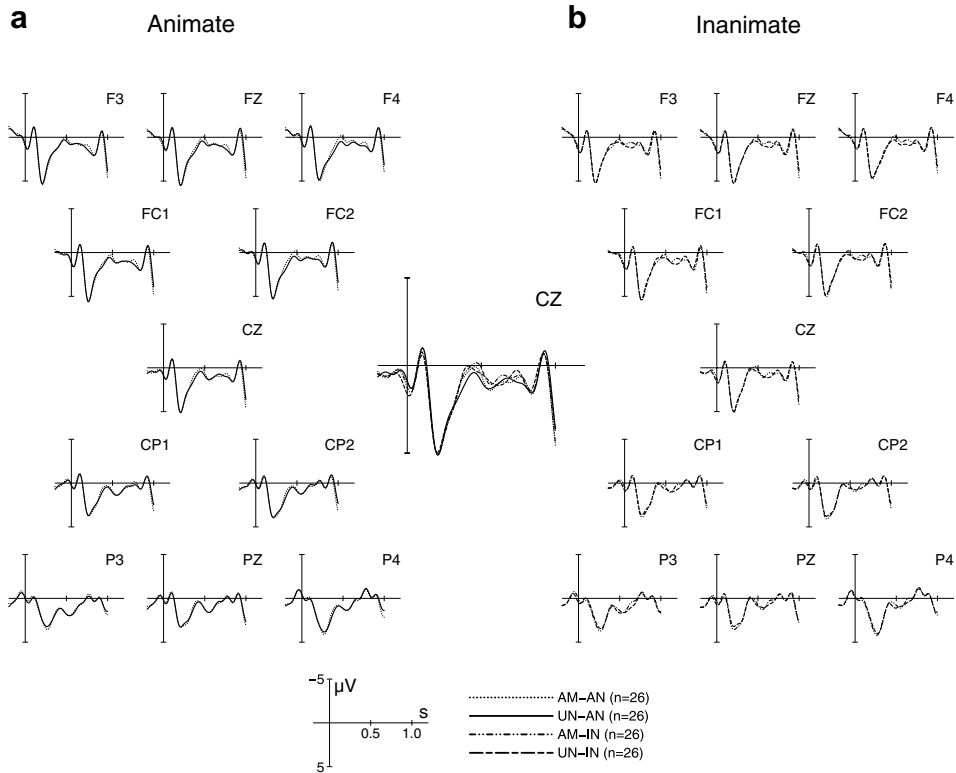


Fig. 2. Grand average ERPs at the position of the first NP (onset at the vertical bar) for case ambiguous initial arguments (associated with a preferred subject analysis; 3a/3c) and initial arguments that were unambiguously marked as accusative objects (3b/3d). This comparison is shown for animate arguments in (A) and for inanimate arguments in (B), while the enlarged electrode provides a direct comparison of all four critical conditions. Negativity is plotted upwards.

($F(1,25) = 29.28, p < 0.001$) and midline sites ($F(1,25) = 36.64, p < 0.001$). The interaction $AMB \times ANIM$ did not approach significance (both $F_s < 1$).

In a second step, we examined ERP responses at the position of the initial argument. As ambiguous arguments were associated with a subject reading (see above), this raised the question of whether the unambiguous initial objects would engender increased processing cost. As Fig. 2 shows, however, there is neither an effect of ambiguity nor an effect of animacy. This was supported by the statistical analysis, which revealed no significant main effects or interactions.²

² In order to examine whether our results were crucially influenced by the inclusion of bilingual participants in the sample, we calculated additional analyses including only the non-bilingual participants. These yielded highly comparable results to the analyses including all participants for both the ERPs and the behavioural data. We therefore believe that the inclusion of bilingual participants did not significantly influence our results.

2.3. Follow-up questionnaire study

One potential caveat arising with respect to the interpretation of our ERP results is that our critical conditions not only differed with respect to the case marking of NP1 but also with respect to the presence or absence of an overt subject pronoun. Thus, only the two ambiguous conditions (3a/c) but not the unambiguous controls (3b/d) involved a dropped subject. In principle, the positivity at the position of the verb might therefore be interpreted as reflecting the costs of subject-drop rather than the costs of reanalysis towards an object reading of NP1. In order to rule out this possibility, we conducted an additional questionnaire study in which we examined the costs of subject-drop.

2.4. Participants

Thirty participants took part in the questionnaire study (12 females and 18 males; mean age: 31.1, range: 16–55). Participants were all native speakers of Turkish and residing in Turkey at the time of the study.

2.5. Materials

A subset of the materials used in the ERP study (24 lexical sets) was used to create the materials for the questionnaire study. These lexical items were used to create six critical sentence conditions, which were assigned to six lists (including 4 sentences per condition each) according to a Latin square design. In addition to the critical ambiguous conditions from the ERP study (3a/c), a minimally differing condition with an unambiguously marked object and a dropped subject and a canonically ordered (subject-before-object) condition without pro-drop were included. All sentence types were realised with either an animate or an inanimate first NP, thus yielding the six critical conditions. The conditions not used in the ERP study are exemplified in (6) and (7) using animate NPs. Note that the object was morphologically marked for accusative case in half of the sentences of the type in (7) and unmarked in the other half other stimuli. However, due to the presence of an initial unambiguous subject pronoun, there was never any ambiguity with respect to the object interpretation of NP2 even in the morphologically ambiguous cases.

- (6) Dün adamı gördüm.
 Yesterday man-ACC see-Past-1st.Person. Sing
 “I saw the man yesterday”
- (7) Dün ben adam(i) gördüm.
 Yesterday I man(-ACC) see-Past-1st.Person.Sing
 “I saw a/the man yesterday”

Within each list, the 24 critical sentences were randomly intermixed with 20 ungrammatical fillers, thus yielding a total of 44 sentences per questionnaire.

Table 2
Mean acceptability ratings in the questionnaire study

Condition	Mean		Standard deviation	
A. AMB – ANIM (3a)	2.52		1.00	
B. UNAMB – ANIM (6)	3.17		0.88	
C. NO PRO-DROP – ANIM (7)	2.68		0.87	
	With acc-marking	Without acc-marking	With acc-marking	Without acc-marking
	2.65	2.70	0.84	0.76
D. AMB – INANIM (3a)	3.10		0.82	
E. UNAMB – INANIM (~6)	3.29		0.74	
F. NO PRO-DROP – INANIM (~7)	2.67		0.83	
	With acc-marking	Without acc-marking	With acc-marking	Without acc-marking
	2.68	2.66	0.77	0.85
Ungrammatical fillers	1.18		0.47	

2.6. Procedure

Participants rated each sentence on a 4-point scale (4 = “perfect”; 1 = “totally excluded”).

2.7. Results

Mean acceptability ratings for the questionnaire study are shown in Table 2.

We analysed the results for the six critical conditions with a repeated measures ANOVA including the factors ANIMacy (2) and CONDition (3). Corrections for multiple comparisons were performed using a modified Bonferroni method (Keppel, 1991). The analysis revealed main effects of ANIM ($F_1(1,29) = 32.17$, $p < 0.001$; $F_2(1,23) = 5.42$, $p < 0.05$) and COND ($F_1(2,58) = 28.16$, $p < 0.001$; $F_2(2,46) = 13.63$, $p < 0.001$) and an interaction of the two factors ($F_1(2,58) = 9.25$, $p < 0.001$; $F_2(2,46) = 6.68$, $p < 0.01$). Resolving this interaction by ANIM revealed an effect of COND for the animate conditions ($F_1(2, 58) = 14.65$, $p < 0.001$; $F_2(2,46) = 10.69$, $p < 0.001$), while this effect was only significant by participants for the inanimate conditions ($F_1(2,58) = 6.27$, $p < 0.05$; $F_2(2,46) = 2.01$, $p > 0.16$). Pair-wise comparison between the animate conditions revealed a significant difference between conditions A and B ($F_1(1,29) = 22.56$, $p < 0.001$; $F_2(1,23) = 24.13$, $p < 0.001$) and conditions B and C ($F_1(1,29) = 12.80$, $p < 0.01$; $F_2(1,23) = 9.41$, $p < 0.01$) but no difference between conditions A and C ($F_1(1,29) = 4.02$, $p > 0.07$; $F_2(1,23) = 1.91$, $p > 0.17$). For the inanimate conditions, the difference between conditions D and E only reached significance in the analysis by participants ($F_1(1,29) = 6.27$, $p < 0.05$; $F_2(1,23) = 2.04$, $p > 0.16$), while there were significant differences between conditions E and F ($F_1(1,29) = 47.63$, $p < 0.001$; $F_2(1,23) = 22.58$, $p < 0.001$) and conditions D and F ($F_1(1,29) = 23.39$, $p < 0.001$; $F_2(1,23) = 10.61$, $p < 0.01$).

The questionnaire results therefore show that there is no general disadvantage associated with pro-drop: (canonically ordered) sentences with an overt subject (C/F) are rated as less acceptable than sentences with an unambiguously marked object and a dropped subject (B/E). Rather, the data suggest that ambiguity of object case marking is costly when the object could also potentially be analysed as a subject. This interpretation is corroborated by the observation that the ambiguity effect reaches significance for the animate conditions (A vs. B) but not for the inanimate conditions (D vs. E). This finding indicates that the acceptability disadvantage for A vs. B does not stem from a purely formal restriction on the distribution of overt case marking, but rather relates to the ease of interpreting the sole NP as an object. In addition, the questionnaire findings show that the presence or absence of accusative case marking does not change the acceptability of Turkish sentences when the morphologically ambiguous noun phrase is clearly in an object position (see Table 2, conditions C and F). Thus the effects of ambiguity reported here indeed appear to be due to the presence of a subject-object ambiguity rather than to the inacceptability of omitting accusative case marking.

To summarise, the results of the questionnaire study suggest that the positivity at the position of the verb in the ERP study was not likely engendered by an acceptability decrease due to subject-drop. Had this been the case, we should have observed an acceptability disadvantage for structures with a dropped subject in our questionnaire ratings, which was not the case.

3. Discussion

The present study investigated whether a language that permits an unmarked object analysis of an initial ambiguous argument (Turkish) nonetheless shows a subject-preference and, if so, whether this preference is modulated by animacy. Both the behavioural findings and the ERP effects at the critical verb position indicate that participants indeed initially adopted a subject analysis of the first NP. When this was disconfirmed by the person marking on the verb, a broadly distributed positivity in the ERP measures and higher reaction times and lower acceptability ratings in the judgement task were observed. Concerning the question of semantic influences, the ERP data suggest that the subject-preference is just as strong for inanimate as for the animate arguments, as the positivity was not modulated by animacy. Strikingly, despite this absence of a difference in the ERPs, the behavioural data show a higher mean acceptability for the ambiguous inanimate as opposed to the ambiguous animate condition, thus suggesting that the object reading is more easily reconstructed for inanimate arguments (see Christianson & Ferreira, 2005, for converging evidence from language production). This observation suggests that, while the initial preference and the conflict resulting from a non-confirmation of this preference are the same in both cases, the probability of reaching an acceptable interpretation is influenced by the semantic information (for similar findings in German based on verb class distinctions, see Bornkessel, McElree, Schleewsky, & Friederici, 2004).

3.1. Possible alternative explanations based on ambiguity and acceptability

One possible alternative explanation of our ERP findings might be that there is a general processing disadvantage for ambiguous as opposed to unambiguous structures. However, several considerations speak against an ambiguity-based interpretation of the early positivity at the position of the verb. In particular, an ERP effect engendered by costs of ambiguity should have manifested itself in the ambiguous region (i.e. at NP1) rather than at the point of disambiguation. Previous ERP evidence in this regard is provided by several studies on grammatical function ambiguities in German (Bornkessel, Fiebach, & Friederici, 2004; Bornkessel, Fiebach, Friederici, & Schlesewsky, 2004; Frisch, Schlesewsky, Saddy, & Alpermann, 2002). All of these experiments observed ambiguity-related ERP effects in the ambiguous region, but never a main effect of ambiguity in the disambiguating region. In addition, costs of ambiguity were never associated with an early positivity such as that found in the present experiment. We believe that these previous results justify the assumption that effects of ambiguity per se – if present – should manifest themselves within the ambiguous region rather than at the point of disambiguation. However, the present study yielded no effect of case marking – and thereby no effect of ambiguity – at the position of NP1. Our critical results therefore do not appear to result from the fact that ambiguous structures are generally more difficult to process.

A second alternative possibility is that the early positivity might reflect an acceptability drop rather than processes of reanalysis towards an object reading of NP1. An interpretation along these lines is rendered unlikely by the additional questionnaire study, which indicated that sentences with unambiguously marked objects and dropped subjects are highly acceptable (i.e. even more acceptable than subject-before-object sentences with an overt subject). Furthermore, the absence of accusative case marking also did not lead to an acceptability drop when an ambiguity between a subject- and an object-analysis of the ambiguous NP was ruled out (i.e. when the non-case-marked object was preceded by an unambiguously marked subject). It therefore appears very unlikely that our critical ERP effect could reflect the unacceptability of “missing” accusative case marking. Rather, when taken together, all of the available evidence points towards an interpretation of our ERP findings in terms of a reanalysis towards an object analysis of the initial argument.

3.2. Accounting for the subject-preference in Turkish

The present findings indicate that an initial argument may preferentially be analysed as the subject of the clause even when there is an alternative unmarked structural possibility (namely an object analysis in a sentence with a dropped subject). Thus, while our results support the idea that the subject-preference is a cross-linguistically valid processing strategy, they are not easily accounted for in classical accounts of this preference. On the one hand, filler-gap-based theories do not apply, because both the subject reading of the initial argument and a reading in which this argument is an object in a sentence with pro-drop are associated with a base-generated structure (i.e. a structure without filler-gap dependencies). On the other hand, a

dependency-based account (Gibson, 1998, 2000) also encounters difficulties, because the presence of an initial object does not entail that a subject must follow in a pro-drop language. Subject- and object-initial structures should therefore yield exactly the same amount of prediction (or memory storage) costs as only a verb is required for a grammatical completion of both sentence types.

A promising alternative is provided by the Minimality-based perspective (Bornkessel & Schlesewsky, 2006). As described in the introduction, this approach assumes that the subject preference arises as an epiphenomenon of “relational” Minimality, which leads to an initial ambiguous argument being analysed as the sole argument of an intransitive verb (hence, the “subject”). When the verb is encountered, this interpretation cannot be upheld because (a) the verb is transitive, and (b) the subject interpretation is ruled out by the agreement information. The revision thus required correlates with the early positivity observed in the present ERP study. This account also derived the absence of an animacy effect: the minimal reading is independent of animacy information.

Finally, a Minimality-based conception of processing is also compatible with the results for the first NP, which showed no effect of case marking. Because an initial accusative rules out an intransitive interpretation, relational Minimality (as an ambiguity resolution strategy) cannot apply. However, as Minimality is assumed to apply at all levels of representation, the level of structural integration must also be considered. Here, two analyses are possible, because the initial object could either have been scrambled or it could be the sole argument in a clause with a dropped subject. Structural Minimality favours the latter analysis, which is simpler. This is the case because we assume phrase structures without empty categories (i.e. no traces, and crucially no pros in the case of subject drop; Bornkessel & Schlesewsky, 2006). Thus, at the phrase structure level, a sentence with an overt object and a dropped subject has exactly the same representation as an intransitive sentence consisting of a subject and a verb (namely an NP-V phrase structure). In contrast to non-pro-drop languages, in which an initial object always signals a non-minimal phrase structure since a subject must occur at some later point in the sentence, languages such as Turkish therefore allow for structural Minimality to be upheld even when the initial NP is clearly an object. We therefore suggest that the difference between the current finding of no increased processing cost for unambiguous initial objects and previous observations of such costs in German (e.g. Rösler, Pechmann, Streb, Röder, & Hennighausen, 1998; Schlesewsky, Bornkessel, & Frisch, 2003) can be accounted for in terms of cross-linguistic differences regarding possible minimal structures. Furthermore, the conception of a Minimality-based processing strategy that applies at all levels of representation can derive the novel finding of a subject preference even under circumstances in which an unambiguous initial object does not yield increased processing costs.

3.3. *The role of frequency of occurrence*

One remaining open question concerns the degree to which our findings correspond to the frequency of occurrence of the different sentence structures under

Table 3

Frequency of occurrence of the critical sentence structures in a subset of 1550 sentences of the METU-Sabancı Turkish Treebank (Atalay et al., 2003; Oflazer et al., 2003)

Ambiguity of NP1		Grammatical function of NP1	
NP1 = case ambiguous	400 (26% overall)	NP1 = subject	260 (65% of ambiguous sentences)
		NP1 = object	140 (35% of ambiguous sentences)
NP1 = case unambiguous	1150 (74% overall)	NP1 = subject	550 (48% of unambiguous sentences)
		NP1 = object	600 [360 accusatives] (52% of unambiguous sentences)

This subset of sentences was selected from an overall sample of 3300 sentences based on the criterion that only sentences beginning with an NP (either in the clause-initial position or following an adverb) were considered relevant. Note that, of the sentences beginning with an unambiguous object NP, only 7% involved a scrambled (OSV) order while the remainder were structures with a dropped subject (OV). In sentences with an initial ambiguous object, <1% were scrambled.

consideration. First, our claim that subject-drop is a very natural option is corroborated by the observation that subjects are omitted very frequently. Existing corpus counts taken from the METU-Sabancı Turkish Treebank³ (Atalay, Oflazer, & Say, 2003; Oflazer, Say, Hakkani-Tür, & Tür, 2003) indicate that subjects are dropped in approximately 70% of all transitive clauses (Çakıcı, 2005). Therefore, in addition to being structurally unmarked, transitive sentences with the object occurring as the first argument due to subject-drop should, in principle, also be highly frequent.

In order to examine the frequency of occurrence of the critical sentence structures used in the present ERP study more closely, we conducted an additional corpus count in a subset of 3300 sentences of the METU-Sabancı Treebank. Of this overall number of sentences, we restricted our analysis to the 1550 sentences beginning with an NP. Overall, the frequency ratio between subject- and object-initial sentences was approximately equal: in 810 sentences (52%), the initial NP was a subject, and in 740 sentences (48%), the initial NP was an object. This finding stands in stark contrast to the ratio of subject- to object-initial sentences in German, which has been estimated at 9:1 for main clauses (Schlesewsky et al., 2000). A more fine-grained analysis of the corpus data, with sentences subdivided according to the ambiguity of NP1, is given in Table 3.

As is apparent from Table 3, there is indeed a frequency advantage (of approximately 2:1) for a subject as opposed to an object reading of an initial NP when that NP is case ambiguous. Of the 260 initially ambiguous NPs that are disambiguated as subjects, 155 (60%) turn out to be the sole argument of an intransitive verb. By contrast, if counts are restricted to sentences with a transitive verb, only 43% of initial ambiguous NPs in these transitive structures are subjects. Thus, if intransitive and

³ The METU-Sabancı Turkish Treebank is a morphologically and syntactically annotated treebank corpus of 7262 sentences (see <http://www.ii.metu.edu.tr/~corpus/treebank.html>). It is a subcorpus of the METU Turkish Corpus, which is a 2 million word corpus of post-1990 written Turkish including text samples from newspapers, magazines and books.

transitive subjects are considered separately, the probability of disambiguation for an ambiguous NPI is as follows: sole argument of an intransitive verb (39%), subject of a transitive verb (26%), object of a transitive verb (35%).

To summarise, frequency of occurrence can correctly predict the general preference for a subject reading over an object reading for initial ambiguous NPs in Turkish. In contrast to languages such as German, however, Turkish shows no overall frequency advantage for subject-initial structures: the frequency data only make the correct prediction if case ambiguity of NPI is taken into account.

4. Conclusions

Our ERP data from Turkish support the cross-linguistic applicability of the “subject-preference”. Importantly, this strategy appears to be largely independent of the possibility for an unmarked object reading and of the semantic subject prototypicality of the ambiguous argument. The properties of Turkish thus suggest that, rather than relating to any particular properties of subjecthood, the universal basis for the subject preference may lie in a general endeavour to “minimise everything”. Whether this Minimality-based processing strategy generally corresponds to a higher frequency of occurrence of minimal structures/interpretations remains to be investigated in further research.

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