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Article abstract

This study investigated the effects of contextual constraint and transitional probability on verb interpreting latency and syntactic restructuring during simultaneous interpreting from Turkish verb-final into English (verb-medial) sentences by trainee and professional Turkish (A)—English (B) interpreters. We found that contextual constraint, but not transitional probability, leads to both a decrease in interpreting latency on the sentence-final verb and a higher degree of syntactic restructuring between the source language input and target language output in both trainee and professional interpreters. Moreover, no between-group differences were observed in the effect of contextual constraint on verb interpreting latency and syntactic restructuring. The present findings suggest that, irrespective of experience, interpreters use contextual cues to restructure the word order between the source input and target output and produce the verb faster in the target output. This provides an argument for examining interpreting latency and syntactic restructuring together, as possible indicators of unvoiced anticipation during simultaneous interpreting between languages with dissimilar structures, such as Turkish and English.

Strategic syntactic restructuring during simultaneous interpreting from Turkish into English

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RÉSUMÉ

Cette recherche examine les effets de la contrainte contextuelle et de la probabilité transitionnelle sur la latence d'interprétation des verbes et la restructuration syntaxique pendant l'interprétation simultanée de phrases turques avec le verbe en position finale vers l'anglais (verbe en seconde position) par des interprètes – étudiants et professionnels – du turc (A) vers l'anglais (B). Nous concluons que la contrainte contextuelle, mais pas la probabilité transitionnelle, conduit à une baisse de la latence d'interprétation sur le verbe en position finale, et aussi à un degré plus élevé de restructuration syntaxique entre la langue source et la langue cible de la part des interprètes professionnels et étudiants. De plus, nous n'avons observé aucune différence entre les deux groupes quant à l'effet des contraintes contextuelles sur la restructuration syntaxique ou la latence d'interprétation du verbe. Ces résultats indiquent que les interprètes, quelle que soit leur expérience, utilisent les signaux contextuels pour restructurer l'ordre des mots entre la source et la cible et produire le verbe plus rapidement dans la langue cible. Cela suggère d'examiner ensemble la latence d'interprétation et la restructuration syntaxique comme éventuels indicateurs d'anticipation non exprimée pendant l'interprétation simultanée de langues avec des structures différentes, comme le turc et l'anglais.

ABSTRACT

This study investigated the effects of contextual constraint and transitional probability on verb interpreting latency and syntactic restructuring during simultaneous interpreting from Turkish verb-final into English (verb-medial) sentences by trainee and professional Turkish (A)—English (B) interpreters. We found that contextual constraint, but not transitional probability, leads to both a decrease in interpreting latency on the sentence-final verb and a higher degree of syntactic restructuring between the source language input and target language output in both trainee and professional interpreters. Moreover, no between-group differences were observed in the effect of contextual constraint on verb interpreting latency and syntactic restructuring. The present findings suggest that, irrespective of experience, interpreters use contextual cues to restructure the word order

between the source input and target output and produce the verb faster in the target output. This provides an argument for examining interpreting latency and syntactic restructuring together, as possible indicators of unvoiced anticipation during simultaneous interpreting between languages with dissimilar structures, such as Turkish and English.

RESUMEN

Este estudio investigó los efectos de la restricción contextual y la probabilidad de transición en la latencia de interpretación de verbos y la reestructuración sintáctica durante la interpretación simultánea de oraciones en turco con el verbo en posición final a oraciones en inglés (verbo-medial) por parte de alumnos e intérpretes profesionales de turco (A) - inglés (B). Encontramos que la restricción contextual, pero no la probabilidad de transición, conduce tanto a una menor demora en la interpretación del verbo al final de la oración como a un mayor grado de reestructuración sintáctica entre la lengua fuente y la producción en la lengua meta tanto en los estudiantes como en los traductores profesionales. Además, no se observaron diferencias entre los grupos en cuanto al efecto de la restricción contextual en la latencia de interpretación de verbos y la reestructuración sintáctica. Los presentes resultados sugieren que, independientemente de su experiencia, los intérpretes utilizan claves contextuales para reestructurar el orden de las palabras entre la lengua fuente y la lengua meta y producir el verbo más rápido en la lengua meta, lo que proporciona un argumento para examinar la latencia de interpretación y la reestructuración sintáctica juntas como posibles indicadores de anticipación no expresada durante la interpretación simultánea entre idiomas con estructuras distintas, como el turco y el inglés.

MOTS-CLÉS/KEYWORDS/PALABRAS CLAVE

interprétation simultanée, anticipation non exprimée, contrainte contextuelle, latence, restructuration syntaxique
simultaneous interpreting, unvoiced anticipation, contextual constraint, latency, syntactic restructuring
interpretación simultánea, anticipación no expresada, restricción contextual, latencia, reestructuración sintáctica

1. Introduction

Prediction is considered an integral part of language comprehension. A number of psycholinguistic studies recording predictive eye movements in the visual world paradigm (VWP) or electrophysiological brain responses have now demonstrated that context information can be used to predict features of likely upcoming words at the phonological (DeLong, Urbach, *et al*. 2005), semantic/conceptual (Federmeier and Kutas 1999; 2001) as well as morphosyntactic levels (Van Berkum 2004; Wicha, Moreno, *et al*. 2004). Van Berkum, Brown, *et al*. (2005) showed that predictions are generated based on the wider context even when these contradict the immediately preceding one. Such findings have led to the conclusion that language is processed incrementally or in a piecemeal fashion and this helps us make predictions about what will follow in unfolding language.

As a way of coping with the multiplicity and simultaneity of efforts involved in simultaneous conference interpreting (SI), interpreters form expectations about words, phrases and ideas in upcoming speech and sometimes even produce these in the target language output *before* they become available in the source language input (Chernov 2004; Gile 2009). This is referred to as anticipation in the interpreting

studies literature. During SI between languages with different sentence structures, such as German, where the verb is often placed in sentence-final position in complex sentences, and English, where the verb is obligatorily placed in second position in the sentence, anticipation can be a crucial strategy of relieving cognitive load (Amos and Pickering 2020).

Given the strategic dimension of anticipation during SI, researchers have asked whether there are any expertise related advantages for anticipation in interpreters. More (exact) anticipations have been observed in professional than in trainee interpreters (Riccardi 1996; Jörg 1997; Özkan, Hodzik, *et al.* 2023; c.f. Chmiel 2021). While most studies on anticipation in SI look at language pairs like English and German, which belong to the same language family and therefore do not differ very much in terms of sentence structure, the current study employed two typologically very different languages, Turkish and English, as its source and target languages, respectively. Examples 1-3 below help illustrate this difference. Unlike German, where verbs can either be placed in second (schützt [protects] in the main/independent clause in [2]) or in clause-final position (nachdenkt [thinks] in the adverbial/dependent clause in [2]), Turkish normally places verbs in final position[1] irrespective of clause type (see **düşündüğü** [thinks] and **koruyor** [protects] in [3]).

1) Because it is concerned about the country's future, the new administration protects democracy.

2) Die neue Regierung schützt die Demokratie, weil sie über die Zukunft des Landes nachdenkt.
[The new administration protects the democracy because she about the future of the country thinks]

3) Yeni yönetim ülkenin geleceğini düşündüğü için demokrasiyi koruyor.
[New administration of the country future he/she thinks because democracy protects]

Moreover, while all three languages allow for the order of the two clauses (main and adverbial) to be switched, centrally embedded structures, where the adverbial clause is placed between the subject and object of the main clause (3), are more common in Turkish than in German, where extraposition is more likely to be used instead (2), and they are uncommon in English. This structural flexibility of Turkish, where extraposition and central embeddedness are equally plausible (Kornfilt 2000), paired with a sentence-final verb, can impose high cognitive demands when interpreting into a syntactically more rigid verb-medial language like English. Thus, SI from Turkish into English pre-supposes a degree of syntactic restructuring (i.e., rearranging of sentence constituents) between the source language input and the target language output, which can be facilitated by certain cues in the context.

Contextual constraint and transitional probability (TP or the statistical likelihood with which words appear together in language) have been found to have a facilitating effect on visual language processing, as observed in predictive eye movements during reading (McDonald and Shillcock 2003a; 2003b; Frisson, Rayner, *et al.* 2005). During SI from Turkish into English, such cues can also facilitate the processing of words in the source Turkish input leading to their faster production in the target English output. Consequently, the present study investigated the effects of contextual constraint and TP on verb interpreting latency and syntactic restructuring

during SI from Turkish into English in trainee and professional Turkish (A)—English (B)[2] interpreters. Effects of contextual constraint have previously been observed on word translation/interpreting latency in SI (Hodzik and Williams 2017; Hodzik 2019; Chmiel 2021). Additionally, the target sentence structure was analyzed in this study to examine effects of contextual constraint and TP on the degree of syntactic restructuring that necessarily takes place when interpreting between syntactically dissimilar languages like Turkish and English. The aim of the study was to examine whether i) a constraining context and/or high TP will affect the verb interpreting latency and degree of syntactic restructuring between the source language input and target language output and ii) there will be any differences in the effect of contextual constraint on verb interpreting latency and degree of syntactic restructuring between professional and trainee interpreters (as a result of interpreting experience).

Even though our study did not measure prediction or anticipation, the use of semantic and/or TP cues to restructure information and decrease latency on the verb between the source input and target output could be indicative of expectations being created about the verb. Those expectations may be voiced (i.e., voiced anticipation) or remain unvoiced until sufficient information is available in the auditory input to confirm and voice them (i.e., unvoiced anticipation). In the present study, the term *prediction* will be used to refer to findings of predictive eye movements in the VWP or during reading. Voiced and unvoiced *anticipation* will be used to refer to expectations observed with a variety of methods in the SI context. Finally, *predictive processes* will be used as a general term encompassing both prediction and anticipation.

1.1. What causes prediction during SI?

Two types of anticipation have been identified in the interpreting studies literature: extralinguistic and linguistic anticipation (Lederer 1981). The former is said to primarily rely on general background or situational knowledge, which is of particular importance during simultaneous conference interpreting given the specific context in which the task is being carried out. So information about the conference topic, speakers, location or the background knowledge of the interpreter is used top-down to anticipate words, ideas or messages (Gile 1992; 2009; Van Besien 1999) at sentence level. Chmiel (2021) found shorter word translation latency on a sentence-final word when this was preceded by a high constraint (i.e., more predictable) context than a neutral or low constraint (i.e., less predictable) context, both in professional and trainee interpreters.

Linguistic anticipation is assumed to rely more on language specific probabilistic information, or the likelihood of words occurring together in a given language (Gile 2009). In an early study on this topic, Wilss (1978: 348) noted the example of the German word Namens [On behalf of], often introducing the standard expression of thanks Namens … darf ich … danken [On behalf of … I would like to thank …]: hearing Namens thus enables the interpreter to anticipate danken, based on the statistical likelihood of the two words co-occurring in German. Setton (1999; 2006) views frequently co-occurring words or fixed expressions as connecting devices at a discursive level. Along with extralinguistic cues, such as background knowledge of the topic, they are used incrementally to draw inferences and anticipate what will follow in the unfolding speech.

Even though early interpreting studies assumed a role for anticipation, in particular in the context of SI (Gerver, Longley, *et al.* 1984; Setton 1999; Moser-Mercer 2000), few of them were empirical (Riccardi 1996; Jörg 1997; Seeber 2001). Anticipation was observed across language pairs (e.g., in German to English SI by Jörg 1997 and Kurz and Färber 2003; in Japanese to English SI by Gile 1992; in German to Italian SI by Riccardi 1996), although such findings were mainly based on analyses of interpreted speech transcripts and post-SI interviews with interpreters.

While interpreters do sometimes produce the anticipated word in the target output before it becomes available in the source input (i.e., the definition of anticipation in the interpreting studies literature), they cannot always afford to do this. Sometimes they postpone production until their hypothesis is confirmed to avoid anticipatory errors. However, this does not mean that they are not creating expectations or pre-activating features on different levels of language processing. It could simply mean that their predictions are not always manifest.

In the more recent predictive processing literature, prediction is viewed less as strategic or all-or-nothing and more as implicit and probabilistic in nature (Huettig 2015). Some researchers have posited a distinction between prediction as a result of higher-order processing of contextual constraint and prediction relying on lower-order processing of transitional probabilities between syllables and words (McDonald and Shillcock 2003a, 2003b; Frisson, Rayner, *et al*. 2005).

TP is the statistical likelihood with which syllables/words appear together in language which is a feature of statistical learning (McDonald and Shillcock 2003a: 2003b). The ability to extract statistical regularities is thought to be linked to an individual's prediction skills (Saffran, Newport, *et al*. 1996; Thompson and Newport 2007). TP effects have also been found on prediction during reading (McDonald and Shillcock 2003a; 2003b). For instance, collocations like *accept defeat*, which have a high statistical likelihood of appearing together, i.e., high TP, were read faster than non-collocates such as *accept losses*, which have a low TP. However, when more context was provided, such effects seemed to disappear (Frisson, Rayner, *et al.* 2005).

Hodzik and Williams (2017) found effects of contextual constraint on verb interpreting latency during SI from SOV German into SVO English sentences, but no effect of TP. In a follow-up study (Hodzik 2019), where SOV German sentences were converted into SVO sentences, an effect of TP was obtained. Based on this, effects of TP seem to be overridden by effects of contextual constraint during SI involving different sentence structures. It is also well worth pointing out that the results obtained by Hodzik and Williams (2017) were based on a small mixed group of trainee (N=7) and professional (N=4) interpreters and a group of bilinguals with no prior experience in interpreting, while Hodzik (2019) only involved bilinguals with no prior interpreting experience. Thus, these studies do not control for or address potential expertise related differences in the use of predictive cues.

1.2. Expertise related advantages for prediction

In the context of interpreting studies, expertise includes more general experience with the interpreter's working languages, but also their specific experience acquired in the professional setting of simultaneous conference interpreting, which is the type of

conference interpreting that most studies on predictive processes focus on. The latter more specific experience is evident in the interpreter's professional profile, including their membership in professional conference interpreting organizations. Professional interpreters have demonstrated behavioural advantages in semantic processing and working memory capacity when compared with other groups, such as trainee interpreters and untrained bilinguals (for a review of these findings see García, Muñoz, *et al*. 2020). Based on such findings, García (2014) claimed that the observed behavioural advantages in professional interpreters are associated with their experience in SI.

Comparisons have been made between professional interpreters and other groups with respect to the rate of anticipations and ratio of exact versus general anticipations and based on directionality or whether the participants are interpreting from or into their native language. While there have been few expertise-based differences in the overall number of anticipations, more instances of exact anticipations have been observed in professional interpreters than trainee interpreters in their final stage of interpreter training in SI from German into Italian (Riccardi 1996) and from German into English (Jörg 1997, and more recently replicated in German-French SI by Pöchhacker and Stögerer 2021), which suggests that professionals' anticipations are more specific than those of students.

Interestingly, the above studies also found more instances of anticipation in interpreters whose A language or L1 was German than those whose L1 was English, Italian or French. By the same token, Chmiel (2021) found more anticipation during SI into the B language (i.e., inverse interpreting) than during SI into the A language (i.e., direct interpreting), although no expertise-based advantages were observed in this study. This suggests that anticipation is more common when interpreting from than into the interpreter's native language. Inverse interpreting was also employed in the present study.

The more recent findings on prediction and anticipation in interpreters/during SI are conflicting. For example, Özkan, Hodzik, *et al.* (2023) found a prediction effect (more looks towards a plausible agent in the VWP upon hearing the accusative than the nominative Turkish case marker), but no such effect in student interpreters in a listening task. However, Chmiel found no differences in anticipation between professional and trainee interpreters, as revealed by word translation latency measurements in an offline sentence processing task. Amos, Seeber, *et al.* (2022) found prediction of an upcoming semantically related discourse referent (relative to an unrelated one) in the VWP during SI by professional French-English interpreters and translators, and no differences between the two groups in the number and time course of the predictions. This led the authors to conclude that prediction occurs during SI irrespective of expertise and training. Additionally, Liu, Hintz, *et al.* (2022) observed a link between predictive eye movements and semantically related upcoming target words in their L1 source language during both consecutive and simultaneous interpreting of sentences in bilinguals with no prior experience in interpreting.

While more recent findings seem to be contradictory, there is still reason to believe that there could be an expertise related advantage for the use of predictive cues during language processing in interpreters (Riccardi 1996; Jörg 1997; Pöchhacker and Stögerer 2021; Özkan, Hodzik, *et al.* 2023).

1.3. Present study

This study examined the effects of contextual constraint and TP on verb interpreting latency and syntactic restructuring during SI by professional and trainee Turkish (A) - English (B) interpreters. We measured the latency between the onset of the sentence-final verb, as our target word, in the Turkish input and the onset of its translation in the English output. This technique is based on a latency measurement method first employed to investigate effects of contextual constraint in sentence shadowing (Marslen-Wilson 1973; 1975). It was found that speech shadowers restored missing phonemes as an effect of contextual constraint even when shadowing at very close latencies.

Hodzik and Williams (2017) found an effect of contextual constraint, but not of TP, on verb interpreting latency during SI from German into English. Moreover, an effect of contextual constraint was also observed on voiced anticipation, i.e., instances of negative latency where the translation of the verb was produced in the target output before this became available in the source input, although the overall number of such instances was low (2.4% of all interpreted sequences). TP effects were not observed in instances of negative latency. This suggests that, during SI, higher order information about the context as a whole facilitates the processing of the verb leading to its faster production in the output (as observed by measures of verb interpreting latency), while phrase-level probabilistic information does not. This is not surprising given that the primary concern of interpreters is to transfer the message from the source into the target language. When those languages have different sentence structures, the word order has to be rearranged from the source into the target language structure. This in turn may result in lower-level probabilistic effects being overridden by higher-order contextual cues.

Hodzik and Williams (2017) employed a latency measurement technique, recording the interpreting latency on a single word, i.e., the sentence-final verb. However, when interpreting between languages with different syntactic structures, such as Turkish and English, latency can vary greatly. For example, interpreters may decide to wait or stall production (Bevilacqua 2009) or reorder information when producing the target output (Chernov 2004), resulting in an increase in overall latency, which could then be compensated by an intentional decrease in latency to keep up with the rate of speech delivery or avoid structural interference from the source into the target language (Gernsbacher and Shlesinger 1997). Therefore, in addition to measuring the latency on the verb in the source input and target output, the present study also examined the degree of syntactic restructuring that takes place during SI between Turkish and English, as syntactically dissimilar languages.

Predictive processes could lead to compensatory strategies. As a way of circumventing the cognitive load imposed by waiting or stalling production, interpreters could use the expectations they form regarding upcoming words to restructure the input. Syntactic restructuring between the source and the target sentences could be the result of voiced anticipation or it could be used to stall the production of the verb until the expectations are confirmed by the source language input, resulting in unvoiced anticipation (see discussion of overt and covert predicted representations in Amos and Pickering 2020). The latter phenomenon is sometimes referred to as structural prediction in the interpreting studies literature (see Seeber 2001; Van Besien 1999).

Even though the present study does not measure predictive processes, some hypotheses can be postulated based on previous findings on the use of predictive cues in SI/by interpreters. In line with previous findings on German-English SI obtained with the same experimental design (Hodzik and Williams 2017), we expected shorter verb interpreting latency and a higher degree of syntactic restructuring than in neutral contexts. We did not expect an effect of TP on either. Based on previous findings of expertise-related advantages for prediction and anticipation (Riccardi 1996; Jörg 1997; Özkan, Hodzik, *et al.* 2023), we expected a stronger effect of contextual constraint on verb interpreting latency and syntactic restructuring in professional than in trainee interpreters.

2. Methods

2.1. Participants

Two groups of native Turkish speakers with different levels of interpreting experience were recruited for the SI task. The first group consisted of 36 interpreting trainees, who were either senior year undergraduates in the translation and interpreting studies departments of Boğaziçi, Yeditepe, Okan, Bilkent and Hacettepe universities (N = 34) or MA students enrolled in the European Master of Conference Interpreting Program at Boğaziçi University (N = 2). The age of the trainee interpreters varied between 22 and 26 years (M = 22.7; SD = 0.9) and 69% were female. All these universities have screening tests in their interpreting programs and all trainees had passed a screening test, either for the fourth year as undergraduate students or an entrance exam for MA students. Thus, they possessed the necessary language and interpreting skills to qualify as prospective conference interpreters. However, four of the undergraduate trainees had to be excluded due to excessive omissions and lag, resulting in a group of 32 trainee interpreter participants (30 undergraduate trainees and 2 MA students). The second group consisted of 33 professional Turkish (A) - English (B) interpreters, all of whom were contacted through the Conference Interpreters' Association of Turkey (TKTD). The age of the professional interpreters varied between 28 and 56 years (M = 42.4; SD = 7.6) and 82% were female. They had all received translation and interpreting training. As per the membership requirements for the TKTD, all had completed at least 150 days of conference interpreting. In addition, a post-experimental questionnaire further inquiring about their conference interpreting experience was distributed to six of the professional interpreters who were considered representative of the group. They were selected based on the mean and distribution of our age data, with two interpreters in the 28-37 age bracket, three in the 38-47 age bracket, and one in the 48-56 age bracket. They had self-reported conference interpreting experience of between five and 35 years with 110-150 days per year spent interpreting at conferences. Thus, they had much greater experience than the trainee group.

2.2. Materials

A total of 100 noun-verb pairs were extracted from the trTenTen12 corpus made available by Sketch Engine (Jakubíček, Kilgarriff, *et al.* 2013), half of these had high TP (N = 50) and the rest were their low TP counterparts. Between high and low TP pairs, the noun varied while the verb (i.e., the target word) remained the same. This was done to prevent potential confounding variables created by word frequency and length. This was an improvement from the experimental design in Hodzik and Williams (2017), where the noun remained the same while the verb (i.e., the target word) varied. The noun frequency was obtained in its case marked form. Either accusative or nominative case marked nouns were used in the pairs as these two cases are the most frequently used ones for direct objects in Turkish. All verbs were used in their active form and no light verbs were used, to avoid the noun being the sole meaning carrier in the pair.

An online norming study (Frey 2018) was conducted with 107 Turkish L1 speakers with an advanced level of English. The aim of this study was to remove noun-verb pairs with inconsistent English translations (with a translation consistency threshold of 70%) and resulted in reducing the number of noun-verb pairs to 48 (24 high TP, 24 low TP). TP was calculated by dividing the co-occurrence frequency of the noun-verb pair by the overall frequency of the noun (McDonald and Shillcock 2003a; 2003b; Perruchet and Peereman 2004). Table 1 shows the mean co-occurrence and TP information across high and low TP pairs. A paired samples t-test revealed a significant difference between mean TP values of high and low TP pairs, $p < .001$.

Table 1

Mean co-occurrence and TP values across noun-verb pairs

Noun-Verb Pair	**Mean noun frequency**	**Mean co-occurrence frequency**	**Mean TP (co-occurrence frequency/noun frequency)**	**T-test mean comparison**
High TP e.g., **doğayı koru-** [to protect the environment]	86.889	72.378	.833	$p < .001$
Low TP e.g., **demokrasiyi koru-** [to protect democracy]	158.464	5.883	.037	

Additionally, to replicate the experimental design of Frisson, Rayner, *et al.* (2005), each noun-verb pair was inserted in a constraining and neutral context, resulting in a 2x2 Latin Square design: i) constraining context, high TP (CH); constraining context, low TP (CL); neutral context, high TP (NH); neutral context, low TP (NL) (see sample experimental item in Table 2).

TABLE 2
Sample experimental item across four conditions

Experimental condition	Example in Turkish (with English gloss and translation)
CH: Constraining context, high TP	Yeni yönetim ülkenin geleceğini düşündüğü için **doğayı koruyor**. [New administration of the country future thinks because the nature protects] Translation: The new administration **protects the environment** because it is concerned about the future of the country.
CL: Constraining context, low TP	Yeni yönetim ülkenin geleceğini düşündüğü için **demokrasiyi koruyor.** [New administration of the country future thinks because the democracy protects] Translation: The new administration **protects democracy** because it is concerned about the future of the country.
NH: Neutral context, high TP	Yeni yönetim genel durumdan anlaşıldığına göre **doğayı koruyor.** [New administration from the general situation understood as the nature protects] Translation: As (can be) understood from the general situation, the new administration **protects the environment**.
NL: Neutral context, low TP	Yeni yönetim genel durumdan anlaşıldığına göre **demokrasiyi koruyor**. [New administration from the general situation understood as the democracy protects] Translation: As (can be) understood from the general situation, the new administration **protects democracy**.

Experimental conditions: constraining context, high TP (CH); constraining context, low TP (CL); neutral context, high TP (NH); neutral context, low TP (NL).

Each sentence consisted of exactly 8 words and all items followed a SAOV (Subject-Adjunct-Object-Verb) word order, where the adjunct constituted a centrally embedded adverbial clause (see Table 3). In the constraining condition (see CH and CL in Table 2 above), the adjunct constituted an adverbial clause that establishes a causal thematic relationship with the TP pair. In the neutral condition (see NH and NL in Table 2 above), the adjunct constituted a neutral expression (e.g., as understood from the general situation) that would allow for any continuation, semantically. The subject was maintained the same between the constraining and neutral conditions. Therefore, context was mainly manipulated via the adjunct. But, since the noun forming a noun-verb TP pair was also part of the pre-verbal context, it also contributed to the level of contextual constraint.

TABLE 3
Sample Turkish sentence structure

Turkish sentence	Yeni yönetim	ülkenin geleceğini düşündüğü için	demokrasiyi	koruyor
English gloss	new administration	of the country future thinks because	the democracy	protects
Word order annotation	Subject (S)	Adjunct (A)	Object (O)	Verb (V)

An online gating task, which is a version of a cloze task (Van Petten, Coulson, *et al.* 1999), was conducted with 66 native speakers of Turkish to test the reliability, i.e. predictability, of the items. In each trial, participants were asked to guess the sentence-final verb. After every guess, one letter of the missing verb appeared and the number

of correct responses at each stage of gating was counted. We looked at the effects of contextual constraint and TP on i) first correct guesses (correct guesses with no letters of the missing word revealed) and ii) gating score, which represented the total number of letters that needed to be revealed to make a correct guess across items per condition (which the participants saw 4 times). For example, if a participant needed 1 letter twice and 2 letters twice per condition, the gating score for that condition would be (1x2) + (2x2) = 6. A liner mixed-effects model with subjects as the random effect and context (neutral vs. constraining), TP (high vs. low) and their interaction terms as the fixed effects revealed effects of both contextual constraint (estimate = -0.97, p = 0.000) and TP (estimate = -1.80, p = 0.000) on first correct guesses of the verb (before any letters were revealed). In other words, there were significantly more first correct guesses in constraining contexts and high TP than in neutral contexts and low TP. The mixed effects model also revealed an effect of contextual constraint (estimate = 1.73, p = 0.007) and TP (estimate = 4.84, p = 0.000) on gating score. In other words, the number of letters needed to correctly guess the verb was significantly lower in constraining contexts and high TP than in neutral contexts and low TP. None of the interaction terms were significantly associated with first correct guesses or number of letters needed to correctly identify the verb. Consequently, the results of the gating task confirmed the reliability of the experimental items created for the purpose of the current investigation.

Forty-eight filler sentences were also extracted from the trTenTen12 corpus. These varied from 6-12 words in length and could employ a non-active (i.e., causative or passive) verb form (4).

4) Dün gece Trump için Havaalanı'nda yoğun güvenlik önlemleri alındı.
[Yesterday night Trump for at the airport busy security measures were taken]
Translation: Last night, strict security measures were taken at the airport for Trump.

At an earlier stage in the material creation process (before excluding TP pairs in the norming task), the SI experiment included 48 target items (of four conditions each, so 192 target sentences in total) and 96 filler sentences. This version of the experiment was piloted with five recent graduates of a translation and interpreting studies program. Their feedback was that the task is too long and thus cognitively very demanding. This led us to cut the number of target items in half, resulting in 24 target items (or 96 target sentences) and 48 filler sentences. The above-described norming task criteria were used to reduce the number of TP pairs and consequently target sentences, too. The twenty-four target items (a total of 96 target sentences following the 2x2 design) were divided into 4 lists and the 48 fillers were inserted and interspersed throughout the lists, so that each participant received one of the four lists and one version of each item. All (target and fillers) were recorded in audio version with a native speaker of Turkish for the purpose of the SI experiment.

2.3. Procedure

Before the onset of the pandemic, the SI experiment was administered in a physical setting. Participants were seated across from a computer and asked to sign an informed consent form. They were asked to put on headphones and instructed to interpret sentences from Turkish into English as quickly and accurately as they could,

without waiting for the sentence to end. Following three practice trials, participant responses were automatically recorded by the software. The sentences were presented with OpenSesame (Mathôt, Schreij, *et al*. 2012), an open-source experiment builder, which was launched on the computer in front of them. Five-second breaks had been inserted between sentences and two breaks of 30 seconds each had been inserted a third and two thirds of the way through the experiment.

After the COVID-19 outbreak, the experiment was modified so that it could be administered remotely. Experimental and filler items were randomized and concatenated in R version3.6 (R Core Team 2021), maintaining the duration of the experiment and break length exactly the same. The resulting tracks were uploaded into either Audacity or GarageBand, two software programs that allow for simultaneous listening and recording. Participants were provided detailed guidelines for installing one of the two programmes, depending on the processing system of their personal computer, and extracting their responses, which were recorded offline. Moreover, they were provided guidance through Zoom before the start of the experiment. The experiment length was the same in the physical and remote settings: the SI task lasted 16 minutes and the whole experiment 30-40 minutes.

2.4. Data analysis

We had to remove 220 data points (68 professional and 152 trainee data points) due to omissions of the target word in the interpreted output, which still amounted to 1,340 data points being included in our data analyses. The exclusion of data due to omissions did not prevent us from obtaining statistically significant results (see Results). As translation accuracy was not the primary focus of our study, all acceptable translations of the verb were included in our analyses of latency and target sentence structure. These were translations that a) fit the wider meaning of the sentence context and b) were deemed appropriate for a conference setting by two conference interpreters working in the Turkish-English pair. Translations of the verb that fit the wider context meaning, but were not correct, were also included in our data analysis. For instance, the translation of the verb koruyor into *defend* in the example in Table 3 above was accepted as it fit the meaning of the sentence context, in addition to the correct translation, *protect*.

Next, the data were annotated for latency and word order. Here, latency refers to the time between the onset of the Turkish verb produced in the experimental item and the onset of the English verb produced by the participant. To measure this, four master audio files were created (one for each list created to fit the Latin Square design) and the onset of the verb in each item was marked. Then, the recordings of each participant were parsed and reordered in R to align with the ordering of the master lists. The onsets of the verbs in the translation were tagged and the latency was recorded. No instances of negative latency, i.e., production of the sentence-final verb in the output before it became available in the input, were recorded in our data.

Moreover, the order of constituents in each of the responses was recorded. Corresponding to the annotation of the target sentences in Turkish, the four constituents used to annotate the produced English sentences were subject (S), verb (V), object (O) and adjunct (A). The most frequent word order patterns recorded in our professional interpreter data were SAVO (49% of all produced target language sentences),

followed by SVOA (27%) and ASVO (16%). The rest (8%) were incomplete structures, where constituents other than the verb (i.e., target word) were omitted, such as SVO. Our trainee data also revealed SAVO patterns as the most frequently employed ones (52%), followed by SVOA (24%) and ASVO (6%). Incomplete structures accounted for 18% of all target language structures produced by trainee interpreters. Annotation revealed that our target language structures can be divided into verb-second structures, where the verb was produced in second position in the English sentence, following the subject, and all the rest or non-verb second structures, where the verb was produced later in the target sentence, following the adjunct and subject. Only SVOA structures, where the verb was produced in second position in the sentence (earlier relative to the other two most common structures), were of interest in further investigations, as structures exhibiting a higher degree of restructuring between the source input and target output relative to the rest of our observed target language structures. Thus, only these were included in our statistical analyses. However, potential reasons for the high ratio of SAVO are also considered in the general discussion of our findings.

We applied a linear-mixed effects model with the *lmer* function and *bobyqa* optimizer in the lme4 software package (Bates, Mächler, *et al.* 2015) for R version 3.6 (R Core Team 2021). The random effects were subject and item and the fixed effects were group (with professional interpreters coded as 0.5 and trainee interpreters as -0.5), context (with constraining context coded as 0.5 and neutral context as -0.5) and TP (with high TP coded as 0.5 and low TP as -0.5). We also analysed the interaction between the fixed effects. Our continuous outcome variable was latency. We consider that the difference between conditions becomes significant when the t-value has absolute values exceeding -2 or 2 (Baayen, Davidson, *et al.* 2008). Our binary outcome variable was verb-second structure. The latter was computed by assigning 1 to verb-second (i.e., SVOA) structures and 0 to all the rest. In this analysis, statistical significance was determined based on *z* and p-values.

3. Results and discussion

3.1. Latency analysis

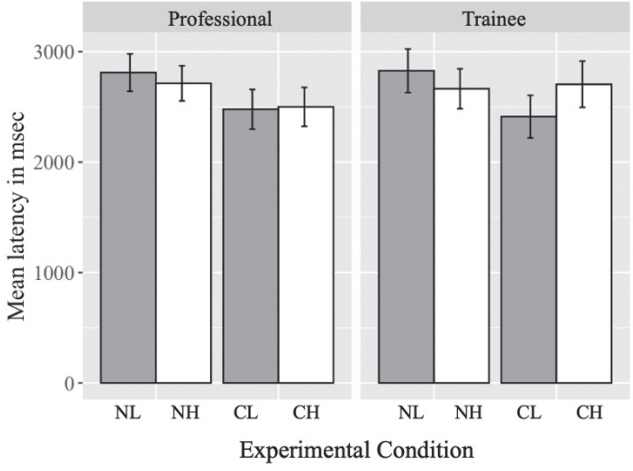
Figure 1 shows the mean verb interpreting latency per condition in professional and trainee interpreters.

A linear-mixed effects model with the fixed effects of group, context and TP, as well as their interaction, revealed no effect of group on verb interpreting latency, (estimate = -0.006, *SE* = 0.056, *t* = -0.107). However, a main effect of context on verb interpreting latency was observed (estimate = -0.120, *SE* = 0.047, *t* = -2.540). There was no effect of TP on verb interpreting latency (estimate = 0.005, *SE* = 0.036, *t* = 0.188). Moreover, no interaction was observed between group and context (estimate = -0.060, *SE* = 0.062, *t* = -0.973) or group and TP (estimate = -0.076, *SE* = 0.053, *t* = -1.429).

A significant positive interaction was found between context and TP (estimate = 0.117, *SE* = 0.054, *t* = 2.183), indicating that in a constraining context there is a larger difference in verb interpreting latency between high and low TP pairs than in a neutral context, which can also be observed in Figure 1. Finally, there was no interaction between group, context and TP (estimate = -0.120, *SE* = 0.107, *t* = -1.123).

Figure 1

Mean verb interpreting latency per experimental condition in professional and trainee interpreters



Experimental conditions: constraining context, high TP (CH); constraining context, low TP (CL); neutral context, high TP (NH); neutral context, low TP (NL)

We also conducted separate analyses per group and found an effect of context, but no effect of TP and no interaction between context and TP in professionals. By contrast, the effect of context only approached significance in the trainees while no effect of TP was observed in this group. However, a significant interaction was found between context and TP. The results are summarised in Table 4.

Table 4

Per-group effects on verb interpreting latency

Group	Effect	Estimate	*SE*	*t*
Professional	Intercept	7.761	0.040	195.836
	Context	-0.150	0.059	-2.507
	TP	-0.033	0.035	-0.928
	Context: TP	0.054	0.070	0.763
Trainee	Intercept	7.767	0.046	168.516
	Context	-0.089	0.047	-1.855
	TP	0.041	0.041	1.011
	Context: TP	0.180	0.082	2.195

Estimated values, standard error (SE) and t-values for verb interpreting latency per intercept, context, TP and the interaction between context and TP in professional and trainee interpreters. We consider that the effect becomes significant when the t-value has absolute values exceeding -2 or 2 (Baayen, Davidson, *et al.* 2008).

Our overall analysis (combining the professional and trainee data) revealed an effect of context on verb interpreting latency, but no effects of group or TP. An interaction was also observed between context and TP. Group did not interact with either of the remaining two variables. A closer inspection of the latency data within

each group revealed an effect of context on verb interpreting latency in the professionals, while this effect only approached statistical significance in the trainee group. In addition, an interaction between context and TP was only observed in the trainee group, but not in professionals. Despite these differences in the per-group latency analyses, the fact that *group* did not interact with any of the other interaction terms in the overall data analysis reveals that there was no statistically significant difference in verb interpreting latency between the two groups of participants, contrary to our expectations.

The numerical differences in mean verb interpreting latency between the two groups (see Figure 1) could explain the interaction between context and TP which was observed within the trainee group, but not in professionals. Unexpectedly, the mean verb interpreting latency was virtually the same between the CH (constraining context, high TP) and CL (constraining context, low TP) conditions for the professionals and even higher in the CH than in the CL condition in trainees. On the other hand, changes in verb interpreting latency followed the expected direction in the neutral conditions (lower in NH than in NL) in both groups. It is unclear why trainees would show *higher* mean verb interpreting latency in the CH than the CL condition. The only difference between the two conditions (CH and CL) was in the noun (i.e., object) preceding the sentence-final verb. A possible explanation is that the retrieval of the high TP target language equivalents took more time than the retrieval of low TP target language equivalents. This could be due to factors that the current study did not control for, e.g., the level concreteness as well as the cognateness status[3] of the noun forming the TP pair.

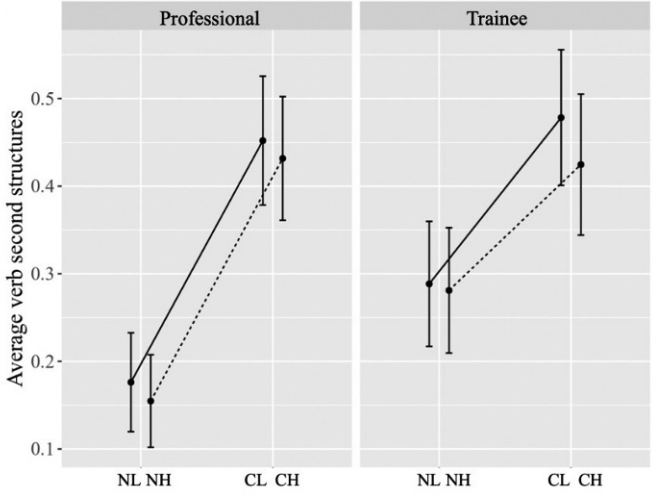
An alternative account may lie in the fact that both high and low TP pairs are semantically related to the context, as a whole. According to the predictive processing literature, during incremental sentence processing a constraining context gradually reduces the possible completions of a sentence as it unfolds, without excluding less possible semantically related completions (Kutas and Hillyard 1984; Van Petten and Kutas 1990). In line with this, predictive processing studies (Federmeier and Kutas 1999; Frisson, Harvey, *et al*. 2017) have found no difference in immediate (but only in late) responses between semantically predictable and unpredictable, but semantically related words in constraining contexts, indicating that the expectations we form are not specific but include semantic neighbours. Given that the low TP nouns in our study were semantically related to the context, even if they did not form collocates with the verb, there would not have been any cost in processing and integrating them within the wider sentence context relative to high TP nouns. This may also account for the overall lack of TP effect on verb interpreting latency in the present study.

3.2. Verb-second structures

Figure 2 shows the mean number of verb-second structures per experimental condition in professional and trainee interpreters.

FIGURE 2

Mean verb-second structures per experimental condition in professional and trainee interpreters



Experimental conditions: constraining context, high TP (CH); constraining context, low TP (CL); neutral context, high TP (NH); neutral context, low TP (NL)

A linear-mixed effects model with the fixed effects of group, context and TP as well as their interaction, revealed no effect of group on verb-second structures (estimate = -0.529, *SE* = 0.404, *z* = -1.309, *p* = .190). However, a main effect of context on verb-second structures was found (estimate = 1.411, *SE* = 0.320, *z* = 4.401, *p* < .001). There was no effect of TP on verb-second structures (estimate = -0.091, *SE* = 0.149, *z* = -0.611, *p* = .541). The interaction between group and context approached significance (estimate = 0.643, *SE* = 0.339, *z* = 1.895, *p* = .058), but there was no interaction between group and TP (estimate = -0.078, *SE* = 0.297, *z* = -0.264, *p* = .792). Moreover, no interaction was found between context and TP (estimate = -0.014, *SE* = 0.300, *z* = -0.047, *p* = .963) or between group, context and TP (estimate = 0.415, *SE* = 0.596, *z* = 0.696, *p* = .486).

We also conducted separate analyses of verb-second structures per group and found an effect of context, but no effect of TP and no interaction between context and TP in professionals. The same pattern of results was observed for trainees. The results are summarised in Table 5.

Table 5
Per-group effects on verb-second structures

Group	Effect	Estimate	*SE*	*z*	*p*
Professional	Intercept	-1.267	0.291	-4.361	< .001
	Context	1.752	0.413	4.241	< .001
	TP	-0.140	0.213	-0.658	.51
	Context: TP	0.147	0.427	0.345	.73
Trainee	Intercept	-0.790	0.354	-2.233	< .05
	Context	1.093	0.323	3.387	< .001
	TP	-0.057	0.216	-0.266	.79
	Context: TP	-0.254	0.434	-0.585	.56

Estimated values, standard error (SE), z-values and probability levels for verb-second structures per intercept, context, TP and the interaction between context and TP, in professional and trainee interpreters. Significance level is determined based on p values.

Similar to the latency analysis, the analysis of target sentence structures revealed no effect of group or TP but a main effect of context on verb-second structures. The interaction between group and context only approached significance and there was no interaction between context and TP or group and TP. Moreover, per-group analyses revealed the same result pattern in both groups: an effect of context on verb-second structures, but no effect of TP or interaction between context and TP. This means that a constraining context resulted in significantly more verb-second target sentence structures than a neutral context and this was the case for both trainee and professional interpreters.

4. General discussion

This study investigated the effects of contextual constraint and TP on verb interpreting latency and syntactic restructuring during SI from Turkish into English in a group of professional and trainee Turkish (A) - English (B) interpreters. As hypothesized, we found that a constraining context leads to both lower verb interpreting latency and a higher number of verb-second structures in the target output (i.e., higher degree of restructuring between the source input and target output). TP did not have an effect on either of our dependent variables. Contrary to expectations, we found no differences between trainee and professional interpreters in the effect of contextual constraint on verb interpreting latency and verb-second structures.

The fact that there was no TP effect on verb interpreting latency suggests that this may have been overridden by the syntactic restructuring between the source and target languages. Other structural changes notwithstanding, the order of the constituents comprising the TP pair had to be rearranged from object followed by verb (i.e., verb-medial) in the source language into verb followed by object (i.e., verb-final) in the target language. This study replicates the findings on verb interpreting latency in Hodzik and Williams (2017), where contextual constraint, but not TP, had an effect on verb interpreting latency during SI from German into English. That study also speculated that TP effects may be overridden by the necessary change of word order in the TP pair between the source input and target output. As support for this account, TP effects on latency were later found between syntactically similar (SVO) German and English sentences (see Hodzik 2019). Thus, the next step in this line of

research would be to examine TP effects during Turkish-English SI involving similar verb-medial structures, although it is worth noting that such structures are far less common in Turkish than verb-final ones (Özge, Küntay, *et al*. 2019).

The present findings are also in line with Chmiel (2021), who found an effect of contextual constraint on word translation latency, but no between-group differences in context-based anticipations between professional and trainee interpreters in an offline visual sentence processing task. Chmiel refers to similar findings in a word translation task conducted with professional and advanced trainee interpreters by García, Ibáñez, *et al*. (2014), who claimed that the strength of the lexical connections between the source and target languages reaches ceiling level before the onset of professional experience.

In what follows, we will provide a speculative interpretation of the present findings as indicative of unvoiced anticipation during SI between syntactically dissimilar languages, such as Turkish and English.

Given that the present study involved interpreting of sentences (rather than speeches, as is normally the case in conferences), it is not surprising that we did not observe any instances of negative latency on the verb. Nonetheless, participants still produced the verb faster (i.e., shorter verb interpreting latency) and earlier (i.e., more verb-second structures) in the target sentence upon hearing a constraining context than a neutral one. Possibly, participants had used semantic cues in the context to form an expectation about the upcoming words, even if this was not specific, and were waiting for their expectation to be confirmed by the information being revealed in the source language input before producing their translation in the output. Since waiting increases memory load, participants restructured the input to produce the verb as early as possible in the target sentence and produce the target SVOA structure. Crucially, such restructuring occurred more frequently in constraining than neutral contexts. This suggests that our participants made strategic use of contextual cues to decrease the space between the subject and verb,[4] and produce the verb earlier in the output (relative to the rest of our observed target structures). We would like to propose that this strategic restructuring could be driven by anticipation, as one possible account.

Thus, we speculate that our participants i) heard the constraining adjunct, which helped them generate an expectation about the general semantic direction of the sentence, including the verb, and ii) after hearing sufficient information to confirm their expectation, iii) produced the translation of the verb in the output. In doing so, they may have decreased the cognitive load imposed by waiting for production. According to the model of prediction in interpreting proposed by Amos and Pickering (2020), interpreters build a covert predicted representation in the source language as a way of circumventing the cognitive load imposed by the difference between the source and target language structures when interpreting between syntactically different languages. This then serves as input for the planning of speech in the target language, where the representation is overtly produced (i.e., voiced). It is the covert source language representation that is believed to decrease cognitive load as this allows for the planning of the target language utterance. Overt production of the prediction in the target language is not always possible, although it is advantageous as it can further decrease the cognitive load imposed by the difference in sentence structure. Even though prediction itself imposes demands on cognitive resources, these are

not as great as in the no-prediction case (Amos and Pickering 2020), i.e., the neutral condition in the current study. In this condition, interpreters tend to resort to other strategies, such as maintaining lower overall interpreting latency (or EVS) as a way of decreasing cognitive demands and produce other types of structures, such as the source-like SAVO structure.

An important limitation of the present study constitutes the use of isolated sentences for the purpose of an SI task, which normally involves speeches. In post-experimental feedback, professional interpreters expressed difficulty in switching from one context to another with every incoming sentence, deeming this unusual for an SI task. The use of isolated sentences may have also led to the unusually high degree of *interpretese* (source-like SAVO patterns accounted for 49% of all produced target sentences in professionals and as many as 52% in trainees). As a further step in this research, an SI task could be carried out with more authentic materials, although it would be very challenging to manipulate contextual constraint with such materials. This is why, other experimental studies that investigate context effects in SI also employ sentences (Chmiel 2021; Amos, Seeber, *et al*. 2022).

At the same time, the fact that contextual constraint effects on verb interpreting latency and verb-second structures *were* observed for isolated sentences, which has now been found for multiple language pairs and participant groups (see also Hodzik and Williams 2017), suggests that interpreters with varying levels of experience in interpreting use semantic cues in the context to restructure information and produce the verb as early as possible in the target output even when they have very little context at their disposal. Although our findings do not provide direct evidence of predictive processes, they indicate that the observed strategic restructuring may be an effect of unvoiced anticipation. To tap into such processes during SI, a more fine-grained technique, such as eye tracking, could be employed alongside latency measures and analyses of target sentence structure.

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NOTES

1. Verb-medial sentence structures do exist in Turkish, but they are far less common than verb-final ones (Özge, Küntay, *et al*. 2019).
2. The A language is the interpreter's L1 or the language they work into from all their other working languages, while the interpreter's B language is one they are fluent in, but is not their L1, which they work into from one or several of their other working languages (International Association of Conference Interpreters, AIIC).
3. Cognates have been found to facilitate translation production in both professional and trainee interpreters as well as in bilinguals with no experience in interpreting (Christoffels, de Groot, *et al*. 2006; Lijewska and Chmiel 2015).
4. Similar findings were obtained in a corpus study by Collard, Pryzbyl, *et al*. (2018), who found that interpreters strategically decreased the verbal brace (i.e., region between the subject and verb) to decrease cognitive load, although this study focused on interpreting into SOV structures.

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