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The psycholinguistics of shining-through effects in translation: cross-linguistic structural priming or serial lexical co-activation?

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Abstract

The manuscript explores the psycholinguistic processes responsible for cross-linguistic influence in translation. In two experimental studies with professional translators-in-training, we investigate the psycholinguistic foundations of *shining-through* effects in translated texts, i.e., cases where the grammatical structure of a source sentence leaves traces in the translated sentence. Experiment 1 reports the results from a translation task investigating the influence of the grammatical structure of the source sentence on structural choices for its translation. The results showed a significant influence of source sentence structure, which gradually decreased with increasing translation competence scores. In Experiment 2, we investigated to what extent the effect of source structure influence found in Experiment 1 can be accounted for through cross-linguistic structural priming. In a cross-linguistic priming experiment in which the source sentences from Experiment 1 were used as primes, participants showed no evidence of structural priming. A cross-experiment comparison revealed significant source sentence influence in the translation task, but no such effect in the priming task, for matched sets of sentences. Our results cast doubt on the claim that shining-through effects in translation are caused by cross-linguistic structural priming. We suggest an alternative account which instead explains structural cross-linguistic influence in translation through serial lexical co-activation.

Introduction

A classical finding from translation research is that translated texts possess specific properties which distinguish them from original, non-translated texts (a phenomenon also referred to as *translationese*, e.g. Santos, 1995). For instance, translated texts have been shown to be more explicit than original texts, to be lexically and grammatically simpler, and to normalize the language (Baker, 1996). Perhaps the most obvious special property of translated texts is *shining-through*, i.e., cases where grammatical

properties of the source language leave traces in the translation. Shining-through effects constitute a specific case of cross-linguistic influence within the bilingual translator, and thus establish a link between research on translation and the psycholinguistics of bilingualism. The key goal of the present manuscript is to explore the psycholinguistic foundations of shining-through effects and to gain insight into the mechanisms of language processing involved.

The term *shining-through* was introduced by Teich ([2003](#)) and refers to the observation that translations tend to show more source-language-specific linguistic features than original texts in the target language. The source language thus *shines through*. Teich investigated shining-through effects in a corpus of popular scientific texts which contained translations from English to German as well as otherwise similar original German texts. She found that German texts translated from English contained more passives—a typical structure in English texts—than German original texts. Teich thus concluded that the source language shines through in the German translations. The concept is similar to Toury's *law of interference* (1995). Taylor ([2008](#)) proposed a distinction between *direct translation effects*, i.e., cases where the structure of a particular source sentence directly affects the structure of its translation, and *indirect translation effects*, i.e., cases where a linguistic phenomenon which is typical for the source language generally occurs more often in translated than in original texts. The present study focuses on the former.

Shining-through has been observed for a variety of different linguistic phenomena, such as passive constructions (Teich, [2003](#)), cognates (Vintar and Hansen-Schirra, [2005](#)), anglicisms (Bernardini and Ferraresi, [2011](#)), and phrasal verbs (Cappelle and Loock, [2017](#)). Interestingly, shining-through does not show to the same degree in all types of translated texts. Several studies showed that the degree of shining-through is influenced by, for instance, the prestige of the source language (Vintar and Hansen-Schirra, [2005](#)), the register (Neumann, [2013](#)), and the degree of a translator's translation experience (Hansen-Schirra, Nitzke, and Oster, [2017](#)). The cognitive foundations of shining-through have only rarely been addressed so far. Halverson ([2003](#), [2010](#), [2017](#)), Oster ([2017](#)), and Hansen-Schirra, Nitzke, and Oster ([2017](#)) suggest that preactivation of certain target-language words and structures takes place and leads to shining-through. The phenomenon is assumed to be limited by a monitoring mechanism, which explains why shining-through is not found to the same degree in all translations. So far, the influence of translation experience on shining-through has only rarely been investigated. Hansen-Schirra, Nitzke, and Oster ([2017](#)) investigated the use of cognates in translations from English into German. The number of cognates found in the translations decreased with increasing semester of study. The authors thus suggested that the mechanisms responsible for shining-through might change with translation experience.

Empirical studies investigating shining-through effects are faced with a number of methodological challenges. At first glance, it may seem as if cross-linguistic influence within the translator should be straightforward to determine on the basis of translation output alone, by simply comparing the grammatical structure of a source sentence with the structure of its translation. Indeed, in studies relying on parallel translation corpora, cases of structural similarity between a source sentence and its translation have often been directly interpreted as evidence for cross-linguistic influence at the structural level during the translation process. However,

structural similarity between a source sentence and its translation can also emerge without any form of cross-linguistic influence within the translator. Consider an English example source sentence such as (1) and its literal German translation (2):

(1) The boy sent Maria a message.
(2) Der Junge schickte Maria eine Nachricht.
    (The.$_{MASC.NOM.SG}$ boy.$_{SG}$ sent.$_{3SG.PST}$ Maria.$_{DAT.SG}$ a.$_{FEM.ACC.SG}$ message.$_{SG}$.)

While sentence (2) constitutes a straightforward example of a case where the double-object (DO) structure from the English source sentence (1) shines through in its German translation (2), it is not entirely clear whether this shining-through effect was caused by a form of cross-linguistic influence within the translator. Note that, while both the DO structure ("*Der Junge schickte Maria eine Nachricht.*") and the alternative prepositional-object (PO) structure ("*Der Junge schickte eine Nachricht an Maria.*") are grammatical in German, the German dative alternation is strongly biased toward the DO structure (see Kholodova and Allen, 2023; Kholodova, Peter, Rowland, Jacob, and Allen, 2023). This general bias may influence structural choices during formulation of the German translation: Assume that the translator completely ignores the grammatical structure of the English source sentence, but instead simply processes the source sentence, derives meaning from it, and then tries to formulate a German sentence which expresses this meaning (a process typically referred to as *vertical* translation). When having to choose a grammatical structure for the translation, it is likely that the translator will go for the DO structure, just because it constitutes the preferred ditransitive structure in the German language. In this way, a translation such as (2) may emerge without any sort of cross-linguistic influence. Another issue is that, due to the general structural similarities between English and German, even a word-for-word translation of a sentence such as (1) into German would yield a grammatically correct German translation. Thus, even a translator who completely ignores any grammatical properties of the source sentence and instead relies exclusively on word-for-word translation would produce translations which superficially look like cases of cross-linguistic influence at the structural level. In sum, a comparison between the structure of a source sentence such as (1) and a target sentence such as (2) alone does not allow for any conclusions about cross-linguistic influence.

Another challenge arises due to the fact that the phenomenon of shining-through is not straightforward to investigate with experimental psycholinguistic methods. In a typical psycholinguistic experiment, a stimulus of interest (such as a written sentence with a particular syntactic structure) is presented or elicited, and measures which are informative with regard to language processing and production (such as reading times, eye movements during reading, or event-related potentials) are obtained while the participant processes this stimulus. For shining-through effects in translation, however, the very phenomenon of interest is not a property of a single linguistic stimulus. Instead, shining-through is characterized by a combination of properties of the source sentence and properties of its translation. Thus, at a psycholinguistic level, shining-through is based on a complex mixture of mechanisms and procedures involved in the processing of the source sentence and mechanisms and procedures involved in the subsequent production of the

target sentence (such as planning, formulation, and articulation). Also, the process of translation involves a complex interplay between early, largely subconscious processes of automatic language processing and late, strategic processes, such as particular decisions made by the translator based on metalinguistic knowledge and translation training (see also Maier, 2022). This represents a challenge for established experimental psycholinguistic paradigms and methods (see Jacob, Schaeffer, Oster, Hansen-Schirra, and Allen, 2021, for a more detailed discussion).

As a result, while the phenomenon of shining-through as such has received considerable attention in translation research, the question of the psycholinguistic underpinnings of such effects and the mechanisms of language processing involved has only rarely been empirically investigated. A notable exception is a seminal study by Maier, Pickering, and Hartsuiker (2017), who investigated to what extent source-structure influence in translation is caused by *cross-linguistic structural priming*. Their experimental study is based on Maier's (2011) observation that the process of translation is structurally similar to the procedure in a cross-linguistic priming study investigating the nature of structural representations in bilinguals. In a typical cross-linguistic priming experiment, bilingual participants are exposed to a *prime* sentence in one language and immediately afterward have to produce a semantically unrelated *target* sentence in a different language (e.g., describe a picture or complete a sentence fragment), with the key question being whether participants are influenced by the syntactic structure of the prime when choosing a structure for the target sentence. Cross-linguistic structural priming has been extensively investigated in bilingualism research, with robust priming effects being reported for a variety of different language pairs and structures (e.g., Loebell and Bock, 2003; Hartsuiker, Pickering and Veltkamp, 2004; Desmet and Declercq, 2006; Schoonbaert, Hartsuiker, and Pickering, 2007; Hartsuiker & Pickering, 2008; Shin and Christianson, 2009; Kantola and van Gompel, 2011; Jacob, Katsika, Family, and Allen, 2017; see van Gompel and Arai, 2018, for a review). This suggests that structural representations in bilinguals are, at least to an extent, shared between languages.

Maier (2011) speculated that cross-linguistic priming may also play a crucial role in translation: Just as in a cross-linguistic priming experiment, translators first process a prime sentence (i.e., the source sentence) in one language, and shortly afterward have to produce a target sentence (i.e., the translation) in the other language. As a result, the grammatical structure of the source sentence may be activated while the translator processes the source sentence, and may subsequently, just as a prime sentence in a typical cross-linguistic priming experiment, influence structural choices made for the target sentence, leading to an increased probability that the structure of the prime sentence is reused in the produced translation. In this respect, cross-linguistic structural priming constitutes a possible candidate for a psycholinguistic mechanism behind shining-through effects. Maier, Pickering, and Hartsuiker (2017) investigated this possibility empirically in a translation experiment. In their study, German/English bilinguals without any translation training were shown German source sentences such as (3a) or (3b), for which they had to produce extemporaneous English translations:

(3a) Das Paar vermietet dem Fürsten das Boot. (DO source sentence)
(The.NEUTR.NOM.SG couple.SG rents.3SG.PRS the.MASC.DAT.SG lord.SG
the.NEUTR.ACC.SG boat.SG.)

(3b) Das Paar vermietet das Boot an den Fürsten. (PO source sentence)
(The.NEUTR.NOM.SG couple.SG rents.3SG.PRS the.NEUTR.ACC.SG boat.SG to
the.MASC.ACC.SG lord.SG.)

Maier and colleagues subsequently analyzed the data in the same way as in a cross-linguistic priming experiment and measured the proportion of PO translations following PO source sentences versus DO source sentences. The results showed a priming effect, with a significantly higher proportion of DO translations for DO source sentences such as (3a) than for PO source sentences such as (3b). In this respect, the translation experiment yielded a very similar pattern of results as typically observed in cross-linguistic structural priming experiments. Based on this finding, the authors suggested that cross-linguistic structural priming indeed plays a crucial role in translation, with the source sentence serving as a prime which influences structural choices during formulation of the translation.

In a second experiment based on the same experimental paradigm, Maier and colleagues investigated whether a similar effect of source-structure influence can even emerge for syntactic structures which have no direct equivalent in the target language. Participants processed and translated German prime sentences with either a shifted DO structure such as (4a) or a non-shifted DO structure such as (4b):

(4a) Das Paar vermietet das Boot dem Fürsten. (shifted DO)
(The.NEUTR.NOM.SG couple.SG rents.3SG.PRS the.NEUTR.ACC.SG boat.SG
the.MASC.DAT.SG lord.DAT.SG.)

(4b) Das Paar vermietet dem Fürsten das Boot. (non-shifted DO)
(The.NEUTR.NOM.SG couple.SG rents.3SG.PRS the.MASC.DAT.SG lord.DAT.SG
the.NEUTR.ACC.SG boat.SG.)

In addition to standard DO constructions such as (4b), German also allows for a shifted DO structure as in (4a), where the theme occurs before the recipient. Unlike the DO and PO structures, this shifted DO structure is not possible in English. As a result, for German sentences such as (4a), there is no literal English translation available. Nonetheless, the results from the translation experiment showed an effect of source-structure influence, with significantly more PO translations for shifted DO primes such as (4a) than for non-shifted DO primes such as (4b). To account for this finding, Maier and colleagues suggest that, in addition to structural priming effects, translators might also be primed by the order of thematic roles in the source sentence (i.e., whether the prime contains recipient-theme or theme-recipient order).

Maier (2011) suggestion that cross-linguistic structural priming may play a key role in translation has since been incorporated into theoretical translation process models. For instance, several translation process accounts (Tirkkonen-Condit, 2005; Tirkkonen-Condit, Mäkisalo, and Immonen, 2008) assume that the translation process starts with the automatic activation of a literal or default translation, which serves as a first candidate for the to-be-produced translation. This candidate sentence is subsequently evaluated by a *monitor*, which, based on metalinguistic

knowledge and translation experience, can modify the initial candidate if necessary. The translation process is thus characterized as a mixture of early, largely automatic processes and later, relatively more strategic adjustments. Schaeffer and Carl (2013) and Bangalore et al. (2016) suggest that cross-linguistic structural priming constitutes a suitable psycholinguistic mechanism to explain how the initial literal translation emerges during processing of the source sentence.

The present study

The account proposed by Maier et al. (2017) constitutes a psycholinguistically informed explanation for shining-through effects in translation and also establishes a connection between translation process research and the psycholinguistics of bilingualism. Nonetheless, a number of key aspects of their study deserve to be discussed. First, Maier and colleagues tested bilingual participants without any explicit translation training. It is at least intuitively plausible that shining-through effects may look different in translators with professional translation training. For instance, shining-through effects may be reduced because professional translators, during formulation of a translation, are also influenced by factors other than the structure of the source sentence, such as metalinguistic knowledge and practical experience with translating sentences of this kind. Second, while Maier and colleagues point out that the process of translation is structurally similar to the procedure in a cross-linguistic priming experiment, an obvious difference between the two is that, in translation, a source sentence and its translation equivalent necessarily have to be related at the lexical level as well, with a typical translated sentence consisting mainly of words which constitute direct translation equivalents of words in the source sentence. In a structural priming experiment, in contrast, priming effects can also emerge without any sort of prime-target similarity at the lexical level (even though structural priming effects can be boosted when prime and target share the same head).

In the following, we report the results from two experiments designed to address these issues. Experiment 1 constitutes a conceptual replication of Maier et al. (2017), but with a sample of professional translators-in-training. In addition, we investigate to what extent the effect of source-structure influence interacts with the individual degree of translation competence. In Experiment 2, we put Maier et al.'s key claim that source-structure influence in translation is based on cross-linguistic structural priming to the test, by investigating whether the particular sentences which show an effect of source-structure influence in Experiment 1 also constitute suitable primes in a classical structural priming experiment with the same sample of participants.

Experiment 1: The influence of source sentence structure in translation

Experiment 1 investigates effects of source-structure influence in translators with prior explicit translation training. To allow for a direct comparison with Maier et al.'s (2017) results for bilinguals without explicit translation training, the experimental materials used in our study are based on those used by Maier and colleagues. Participants were shown source sentences such as (5a) or (5b), for which they had to produce extemporaneous translations:

(5a) Die Bekannte verkauft dem Onkel das Fahrrad. (DO source sentence)
      (The.[FEM.NOM.SG] acquaintance.[SG] sells.[3SG.PRS] the.[MASC.DAT.SG] uncle.[SG] the.[NEUTR.ACC.SG] bike.[SG].)

(5b) Die Bekannte verkauft das Fahrrad an den Onkel. (PO source sentence)
      (The.[FEM.NOM.SG] acquaintance.[SG] sells.[3SG.PRS] the.[NEUTR.ACC.SG] bike.[SG] to the.[NEUTR.ACC.SG] uncle.[SG].)

If translators are influenced by the structure of the source sentence while producing a translation, this should result in relatively more DO translations for DO source sentences such as (5a) than for otherwise identical PO source sentences such as (5b).

The claim that shining-through effects in translation are caused by cross-linguistic structural priming assumes that source-structure influence originates at the level of early, automatic language processing, which is largely unaffected by metalinguistic knowledge or professional skills. Thus, assuming that fundamental mechanisms of syntactic processing are the same in translators and bilinguals without translation training, our participants should in principle show source-structure influence of a similar magnitude as in Maier et al. (2017). That said, translators with professional training may at a later stage of processing, after an initial candidate for a translation has been activated, adjust this initial candidate and move away from a literal translation as part of a self-monitoring process. In this case, we should observe (a) numerically smaller effects of source-structure influence than in Maier et al. (2017) and (b) an interaction between source-structure influence and individual translation competence, with weaker effects of source-structure influence in translators with high translation competence scores.

Method

Participants

A total of 39 professional translators-in-training (33 female, 6 male; average age 23.5) participated in the study for course credit. All participants were enrolled in a translation degree at the University of Mainz. Nine participants already held a Bachelor's degree in translation studies and were studying at Master level, and the other 30 were advanced Bachelor students. A total of 34 participants described themselves as native speakers of German, the remaining five possessed C1 or higher proficiency in L2 German. Proficiency in L2 English was at C1 level or higher for all participants. On average, participants had gone through 2.25 years of professional translation training at University level. All 39 translation students had prior experience with translation work involving German and English.

In addition to the experimental task, all participants also filled out the Translation and Interpreting Competence Questionnaire (TICQ) proposed by Schaeffer et al. (2020), which contained a variety of questions related to specific aspects of translation competence. We relied on Schaeffer's (2022) theoretical framework of translation competence to determine individual translation competence scores for each participant. Schaeffer's framework assumes that individual translation competence consists of two independent components. The first component (TICQ-F1z) represents individual skills related to the translation process itself, while the second

component (TICQ-F2z) refers to individual skills involved in quality control, i.e., evaluating and correcting the product of a prior translation process. Based on the rationale outlined by Schaeffer (2022), we used the TICQ results to determine individual TICQ-F1z and TICQ-F2z scores for each participant, which subsequently served as measures of individual translation competence in the analyses.

Materials

The experiment contained a total of 32 experimental item sets adopted from Maier et al. (2017). Each item set consisted of a PO version (such as (3a)) and an otherwise identical DO version (such as (3b)) of a ditransitive source sentence. The two German verbs *verraten* and *melden*, which occurred in Maier et al.'s original materials, were substituted because their most plausible English translation equivalents *reveal* and *report* are considered to not allow for both a PO and a DO structure by at least some scholars (Levin, 1993). We conducted a short questionnaire study to determine whether English PO and DO sentences containing these two verbs are considered grammatical and decided to substitute the two verbs with *bringen* and *verleihen*, whose English translation equivalents *bring* and *award* can be used with both PO and DO structures.

The PO and DO versions of each item were equally distributed across two presentation lists according to a Latin-square design, ensuring that each participant encountered 16 PO and 16 DO source sentences during the Experiment. Each participant saw either only the PO or only the DO version of each experimental item.

A total of 74 filler sentences with non-ditransitive structures were added to conceal the research question and avoid strategic behavior on the part of the participants. Any two experimental source sentences were separated by at least two filler sentences.

Note that, in order to avoid the possibility that translators rely on stored translations for multiword units (such as combinations of particular verbs and noun phrases which often occur together in everyday language), the materials constructed by Maier and colleagues, while not anomalous, described somewhat unusual events (e.g. "*The writer rents the bag to the hero.*"). We get back to this issue in the discussion below.

Procedure

Participants were tested individually in a quiet laboratory room. Prior to the actual experiment, each participant went through a practice session consisting of five source sentences, which allowed the participant to get used to the experimental procedure.

Each source sentence was presented for 3000 milliseconds on a computer screen, followed by a visual cue which indicated that the participants could speak the translation. Following the production of the translation, participants concluded a trial with a button press in order to proceed to the next trial. If they did not answer within 11.5 seconds, a short tone indicated that the next trial would start automatically.

In order to allow for direct comparisons between our results and those reported by Maier et al. (2017) for untrained translators, we generally kept the time course of the procedure as similar as possible. Note, however, that in Maier et al. (2017),

Table 1. Absolute frequencies of "PO", "DO", and "Other" target translations by source sentence structure

	Structure in translation		
	PO	DO	Other
PO source sentence	482	17	125
DO source sentence	390	101	133

source sentences were presented on screen for only 1400 milliseconds. When we piloted the study, the short presentation duration led to a considerable number of incomplete or ungrammatical translations. The original data from Maier et al. (2017) contained an even higher number of such trials, which eventually led to the exclusion of 54% of all data points in the translation data from the statistical analyses. In order to avoid this for our data, we decided to increase the presentation duration to 3000 milliseconds.

Results

Scoring

The grammatical structure of the produced translations was scored as "DO", "'PO", or "Other", by two scorers who were unaware of the hypotheses for the Experiment. "Other" translations included all cases that are uninformative with regard to a possible influence of the structure of the source sentence, such as ungrammatical translations, incomplete translations, and grammatically correct translations whose grammatical structure was neither a DO nor a PO.

Source structure influence

Table 1 shows the absolute frequencies of "PO", "DO", and "Other" translations, separately for PO and DO source sentences.

As displayed in Table 1, participants showed a strong general preference for PO structures irrespective of the structure of the source sentence, with substantially more PO than DO translations. This general preference is expected given that in English, the PO structure constitutes the preferred ditransitive structure within the dative alternation.

Crucially, the results also showed a numerical trend toward an influence of the source sentence structure on the structure chosen for the target sentence, with relatively more PO translations for PO source sentences than for otherwise identical DO source sentences (482 vs. 390) and relatively more DO translations for DO source sentences than for PO source sentences (101 vs. 17). To test the effect of source structure influence for statistical significance, we conducted an inferential analysis based on a generalized linear mixed-effects model. As in the analyses for a typical structural priming experiment, "Other" responses were excluded from this analysis because they are not informative with regard to the experimental hypothesis. The model predicted the structure of the produced translation (PO vs. DO) as a criterion and contained "source structure (PO vs. DO source sentence)" as a categorical fixed

Table 2. Generalized linear mixed-effects model predicting target structure based on prime type

	Estimate	Std. error	z	p	
(Intercept)	4.2918	0.7737	5.547	**<.001**	***
Source structure	4.3454	1.3566	3.203	**.0014**	**

Formula: target structure ~ source structure + (1 + source structure | participant) + (1 + source structure | item).
Notes. *p < .05; **p < .01; ***p < .001.
p-values below .05 are highlighted in bold.

Table 3. Source sentence structure and degree of translation competence

	Estimate	Std. error	z	p	
(Intercept)	3.6207	0.4561	7.938	**<.001**	***
Source structure	2.9903	0.4573	6.540	**<.001**	***
Translation competence (TICQ-F1z)	−0.4833	0.3805	−1.270	.204	
Source structure * translation competence	−0.8490	0.3654	−2.323	**.020**	*

Formula: target structure ~ source structure * translation competence + (1 | participant) + (1 + source structure | item).
Notes. *p < .05; **p < .01; ***p < .001.
p-values below .05 are highlighted in bold.

predictor. To account for error variance based on individual preferences of particular participants and experimental items, all regression models reported in the following also contained random slopes and intercepts for participants and items. As suggested by Barr, Levy, Scheepers & Tily (2013), the model contained a maximal random-effects structure, with random intercepts and random slopes for "source structure" by participants and items.

The results from the model analysis are reported in Table 2. The model revealed a significant effect of source structure, i.e., significantly more PO translations for PO source sentences than for DO source sentences.

Source structure influence and translation competence

The results reported above reveal a significant influence of the source structure on structural choices for the translations. In a follow-up analysis, we investigated whether this influence of the source structure is modulated by translation competence, i.e., whether the source sentence structure has a stronger effect for individual participants with lower translation competence scores.

Table 3 shows the results from a generalized linear mixed-effects model investigating whether the degree of translation competence interacted with source structure influence. The model contained "source structure (PO vs. DO source sentence)", "degree of translation competence (as measured by z-transformed TICQ-F1z[1] scores)", and the interaction between the two, as fixed predictors. The most complex model that reached convergence also included random intercepts for participants and items and a random slope by item for prime type.

The significant interaction between source structure and translation competence suggests that the influence of source sentence structure is the strongest for relatively
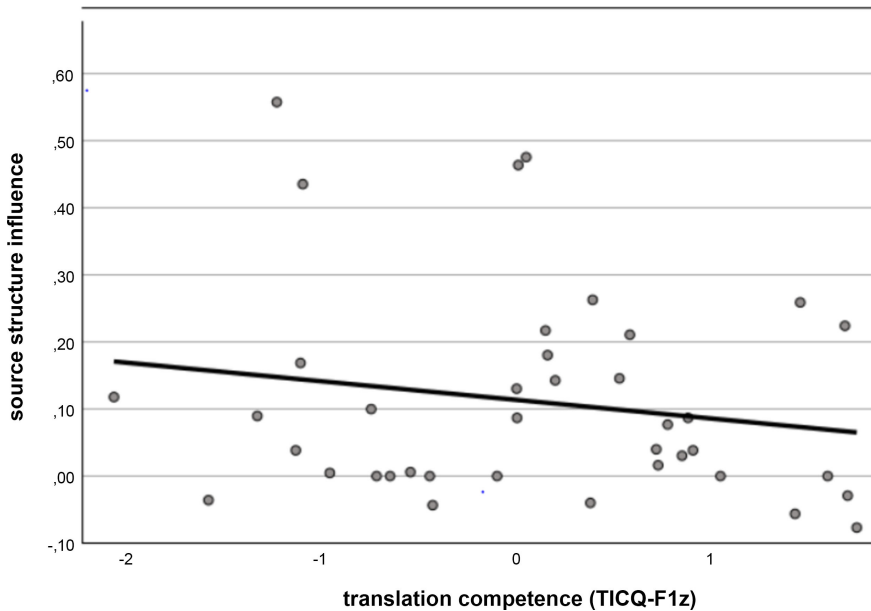
Figure 1. Individual degree of source structure influence (i.e., proportion of PO translations produced for PO vs. DO source sentences) by translation competence (TICQ-F1z scores).

less-trained individuals and decreases with increasing translation competence. The relationship between the individual degree of source-structure influence (as measured by the difference between the individual proportion of PO translations for PO vs. for DO source sentences) and translation competence (as measured by TICQ-F1z scores) is illustrated in Figure 1.

Discussion

The results from Experiment 1 show that participants were influenced by the grammatical structure of the source sentence while choosing a structure for its translation, with significantly more PO translations for PO source sentences than for otherwise identical DO source sentences. In this respect, our results are in line with those from Maier et al. (2017), who, in their study on bilinguals without any explicit translation training, also found an effect of source-structure influence.

Interestingly, the effect of source-structure influence in our study interacted with the degree of translation competence, with a weaker effect of the source structure in translators with higher translation competence. This finding is in line with the claim that translators gradually move away from literal translations with increasing translation training. Note that this result is also corroborated by a comparison of the numerical size of the effect in Maier et al. (2017) on bilinguals without any translation training and our results: While both studies found evidence for source-structure influence, this effect was numerically weaker in our translators-in-training (18%) than in Maier et al.'s untrained bilinguals (31% for L1 German and 39% for L1 English speakers).

The observed effect of source-structure influence is consistent with Maier's key claim that shining-through effects in translations are based on cross-linguistic structural priming. The interaction between source structure influence and translation competence, in contrast, is not explicitly predicted by Maier's account. If shining-through effects in translation are based on the automatic activation of a syntactic structure during processing of the source sentence, which remains active during subsequent formulation of the translation, this automatic process should not be influenced by a higher level individual property such as translation competence. That said, there is at least some evidence that cross-linguistic priming can be affected by individual properties and abilities, such as L2 proficiency (e.g., Bernolet, Hartsuiker and Pickering, 2013). In this respect, while the observed interaction is not explicitly predicted by Maier's account, it is also not fundamentally inconsistent with the claim that source-structure influence is caused by cross-linguistic structural priming. For instance, one possibility to account for the observed interaction is to assume that translation competence only comes into play relatively late in the translation process, after an initial candidate translation has been computed. This account assumes that source-structure influence in principle occurs in all participants irrespective of individual translation competence, and that cross-linguistic priming causes participants to initially formulate candidate translations which resemble the structure of the source sentence. Only after that, participants with higher translation competence may adjust their translations as part of a monitoring process before producing the translation and may occasionally decide to abandon the initial candidate translation. Indeed, theoretical accounts of translation typically assume the existence of a monitor, which may adjust initial candidate translations before they are produced (e.g., Oster, 2017; Schaeffer and Carl, 2017; Schaeffer, Halverson, and Hansen-Schirra, 2019). It is conceivable that the monitor is affected by the individual degree of translation competence, with highly competent translators adjusting candidate sentences and moving away from literal translations, which would reduce shining-through effects in translation output.

Alternatively, however, it is also possible that Maier et al.'s (2017) claim that shining-through effects in translation are caused by cross-linguistic structural priming is not correct. In Experiment 2, we thus investigate to what extent source-language influence involves cross-linguistic structural priming.

Experiment 2: The role of cross-linguistic structural priming in translation

As already mentioned, the account proposed by Maier et al. (2017) assumes that cross-linguistic structural priming constitutes the psycholinguistic foundation of shining-through effects in translation: While processing the source sentence, translators activate a representation of its syntactic structure. This representation remains active during formulation of the translation. If this structure is also a grammatical structure in the target language, this increases the probability that the structure of the source sentence is used for the translation as well.

If the effect of source-structure influence observed in Experiment 1 is indeed caused by cross-linguistic structural priming, the source sentences from Experiment 1 should constitute suitable prime sentences in a traditional cross-linguistic structural

priming experiment. In Experiment 2, we test this key claim empirically by using the source sentences from Experiment 1 as primes in a classical cross-linguistic structural priming experiment.

The experiment is based on a target fragment completion task, an established experimental paradigm used in a number of previous structural-priming studies (e.g., Pickering and Branigan, 1998; Branigan, Pickering, and Cleland, 1999; van Gompel, Pickering, Pearson, and Jacob, 2006; Jacob et al., 2017). Compared with other experimental paradigms for priming studies (such as picture description or confederate priming), this paradigm does not involve the presentation of an additional stimulus (such as a picture) between prime and target and is therefore relatively similar to the task in Experiment 1. Previous research on cross-linguistic structural priming indicates that priming effects may be enhanced when prime and target contain translation equivalents of the same verb. To take this finding into account, we experimentally manipulated whether the verb in the target fragment was a translation equivalent of the verb in its corresponding prime or not.

Participants read German prime sentences such as (6a) or (6b), which were immediately followed by English target fragments such as (7a) or (7b):

(6a) Die Bekannte verkauft dem Onkel das Fahrrad. (DO prime)
(The.$_{\text{FEM.NOM.SG}}$ acquaintance.$_{\text{SG}}$ sells.$_{\text{3SG.PRS}}$ the.$_{\text{MASC.DAT.SG}}$ uncle.$_{\text{SG}}$ the.$_{\text{NEUTR.ACC.SG}}$ bike.$_{\text{SG}}$.)

(6b) Die Bekannte verkauft das Fahrrad an den Onkel. (PO prime)
(The.$_{\text{FEM.NOM.SG}}$ acquaintance.$_{\text{SG}}$ sells.$_{\text{3SG.PRS}}$ the.$_{\text{NEUTR.ACC.SG}}$ bike.$_{\text{SG}}$ to the.$_{\text{NEUTR.ACC.SG}}$ uncle.$_{\text{SG}}$.)

(7a) The farmer sells . . . .

(7b) The farmer sends . . . .

Participants were instructed to read all sentences aloud and to spontaneously complete incomplete sentences in a grammatically correct way. If participants are primed by the structure of the German source sentence, this should affect the grammatical structure of the English target fragment completion, with relatively more DO completions following DO primes than following PO primes. Note that, while this experimental task does not involve translation in any way, it is otherwise very similar to the procedure in Experiment 1, allowing for a direct comparison of effects between the two experiments. With regard to this comparison, a theoretical account assuming that shining-through effects in translation are caused by cross-linguistic structural priming predicts that, particularly given that Experiments 1 and 2 are based on the same participants and closely matched sets of experimental materials, Experiment 2 should reveal a structural priming effect of a similar magnitude as the effect of source-structure influence observed in Experiment 1.

Method

Participants

In order to allow for a direct comparison with the effects of source-structure influence observed in Experiment 1, the same 39 translators-in-training as in

Experiment 1 also participated in Experiment 2. The order of the two Experiments was counterbalanced, with half of the participants going through Experiment 1 and the other half through Experiment 2 first.[2]

Materials

In order to avoid memory effects caused by the fact that the very same sentences were already encountered once before in the previous testing session, but to nonetheless allow for a direct comparison between Experiments 1 and 2, Experiment 2 relied on a closely matched set of experimental materials. These experimental items were also taken from Maier et al. (2017), who had constructed two closely matched sets of experimental materials for their experiment in order to allow for a direct comparison between their translation task and a baseline task in which the source sentences were not translated, but only repeated.

Just as for Experiment 1, the materials for Experiment 2 consisted of 32 item sets, with each item set consisting of a PO and a DO version of an otherwise identical sentence. All sentences contained the same verbs as the items in Experiment 1, and were of the same length. The words used for agent, recipient and theme were also the same as in Experiment 1, but were recombined and moved around between items, so that the sentences were not exactly the same as the source sentences in Experiment 1, but as closely matched as possible.

For each of the 32 item sets, we created two versions of an English target fragment consisting of a subject noun phrase and a verb, followed by three dots to indicate that the fragment was incomplete. The subject noun phrase was the same in both versions of each target fragment. This noun phrase was followed by a ditransitively biased English verb which was either a translation equivalent of the verb used in the corresponding German prime sentence or an unrelated verb.

To conceal the purpose of the experiment, 74 filler prime-target pairs were added. Filler sentences consisted of a variety of different grammatical structures. Structures which resembled the ditransitive structures in the experimental items were not used in the fillers.

Procedure

Participants were informed that they would see a number of complete sentences and incomplete sentence fragments on the computer screen. For complete sentences, participants were instructed to read the sentence aloud. If the stimulus was an incomplete sentence fragment, participants had to read the fragment aloud and to spontaneously complete it in a grammatically correct way.

To allow the participants to familiarize themselves with the task, the Experiment was preceded by a training block consisting of five practice trials.

Presentation of the items and procedure were kept as similar as possible to Experiment 1: The prime sentence was presented on screen for 3 seconds, and was immediately followed by the target fragment. The target fragment remained on the screen until the participants completed the sentence and pressed a button. If the button was not pressed for 11.5 seconds, a tone was played indicating that a

Table 4. Absolute frequencies of "PO", "DO", and "Other" target completions by condition and verb repetition

		Structure in completion		
		PO	DO	Other
Verb repeated	PO prime	161	26	125
	DO prime	152	24	136
Verb not repeated	PO prime	149	21	142
	DO prime	143	22	147

time-out was reached and that the Experiment would proceed with the next trial. The inter-trial interval was 0.5 seconds.

Experiment 2: Results

Scoring

Just as for the translations in Experiment 1, the completions for the target fragments produced by the participants were scored as 'PO', 'DO', and 'Other', by two scorers who were unaware of the hypotheses for the Experiment. The criteria for the scoring process were the same as for the translations in Experiment 1.

Priming effects

Table 4 shows the absolute frequencies of 'PO', 'DO', and 'Other' target completions produced by the participants, by condition.

We again used a generalized linear-mixed effects model for the inferential analysis. The model predicted the structure of the produced sentence completion and contained 'prime type (PO prime vs. DO prime)', 'verb repetition (verb repeated or not repeated)', and the interaction between the two, as categorical predictors. Again, we started the analysis with a maximal model, with random intercepts for participants and items as well as random slopes by participants and items for 'prime type', 'verb repetition', and the interaction between the two. As this maximal model did not reach convergence, we gradually simplified the random-effects structure to determine the most complex model justified by the data. The final model contained random intercepts for participants and items as well as a random slope for 'verb repetition' by items. The results from the analysis are shown in Table 5.

In sum, unlike for the translation task in Experiment 1, the results for Experiment 2 do not show any influence of the structure of the prime sentence. This was the case irrespective of whether the verb was repeated in prime and target or not.

Cross-experiment comparison

In isolation, the results from Experiment 2 showed a null effect, with no structural priming irrespective of whether the verb was repeated in prime and target or not.

Table 5. Generalized linear mixed-effects model for Experiment 2

	Estimate	Std. error	*z*	*p*	
(Intercept)	4.2386	0.7730	5.483	**<.001**	***
Prime type	−0.0422	0.3525	0.120	.905	
Verb repetition	0.4281	0.7326	0.584	.559	
Prime type * verb repetition	−0.1013	0.7172	−0.141	.888	

Formula: Completion ~ prime type * verb repetition + (1 | participant) + (1 + verb repetition | item).
Notes. *p < .05; **p < .01; ***p < .001.
p-values below .05 are highlighted in bold.
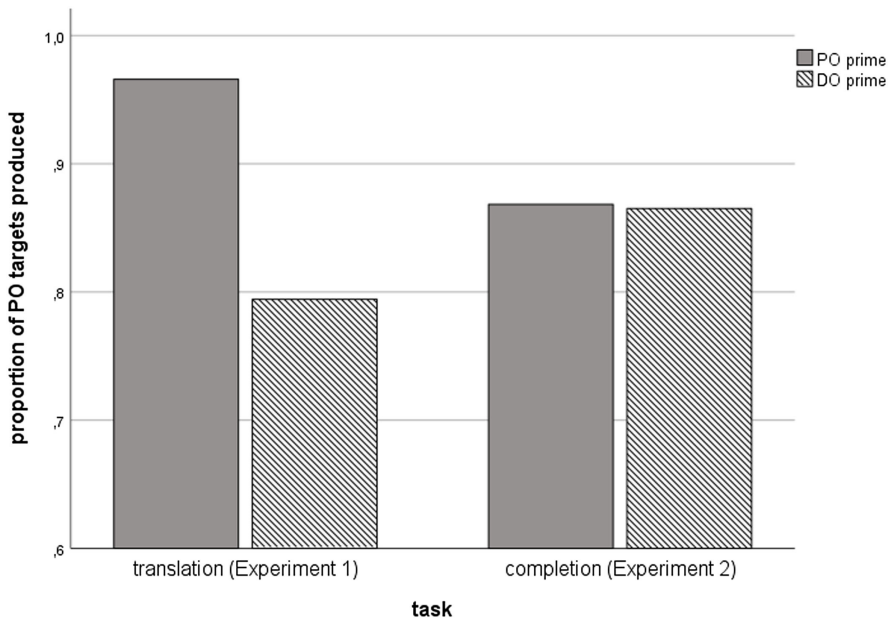
Figure 2. Proportions of PO target responses (relative to the sum of all PO and DO responses) by prime type (PO prime vs. DO prime) for Experiments 1 and 2.

Note again, however, that Experiments 1 and 2 were based on closely matched experimental materials, and crucially also a similar task: In both experiments, participants processed a (PO or DO) prime sentence and immediately afterwards produced a sentence themselves (either a translation or a sentence completion). This structural similarity between the two experiments allows for a direct cross-experiment comparison investigating whether the influence of the prime structure was different for the translation task in Experiment 1 versus the completion task in Experiment 2. Figure 2 shows the proportions of PO target sentences (out of the sum of all PO and DO responses, excluding 'other' responses) produced following PO vs. DO prime sentences, for both experiments.

Table 6. Cross-experiment comparison for the effect of prime type in Experiment 1 vs. Experiment 2

	Estimate	Std. error	z	p	
(Intercept)	3.3897	0.3700	9.160	**<.001**	***
Prime type (DO vs. PO)	1.3586	0.2305	5.893	**<.001**	***
Task (completion vs. translation)	0.1319	0.6494	0.203	.839	
Prime type * task	2.7635	0.4609	5.996	**<.001**	***

Formula: target structure ~ prime type * task + (1 + task | participant) + (1 + task | item).
Notes. *$p < .05$; **$p < .01$; ***$p < .001$.
p-values below .05 are highlighted in bold.

We compared the effects in the two experiments using a generalized linear-mixed effects model. The model predicted target-sentence structure (DO target vs. PO target) and contained 'prime type' (DO prime vs. PO prime), 'task' (completion vs. translation), and the interaction between the two, as fixed predictors. Again, we started with a maximal model and gradually simplified the random-effects structure to determine the most complex model which reached convergence. The final model included random intercepts and random slopes for 'task' by participants and items. The results from the model are shown in Table 6.

The results show a significant interaction between prime type (DO prime vs. PO prime) and task (translation vs. completion), with an influence of source sentence structure in the translation task, but no such effect in the priming experiment.

Discussion

The key goal of our experiments was to investigate to what extent translation by trained translators involves cross-linguistic structural priming. Indeed, the results for the translation task show that the structure of the translated sentences produced by the participants was influenced by the structure of the source sentence, with significantly more PO targets produced for PO source sentences than for otherwise identical DO source sentences. In isolation, this finding is consistent with Maier et al's (2017) claim that cross-linguistic structural priming plays a key role in translation. However, such an effect does not necessarily have to be based on structural priming, but could instead also be caused by either strategic decisions based on meta-linguistic knowledge or by superficial word-by-word translations. In order to distinguish between these accounts, we conducted a classical cross-linguistic structural priming experiment based on a target-completion task using the source sentences from Experiment 1 as primes. Interestingly, despite the fact that prime sentences were matched between the two experiments, the participants did not show any priming at all in the completion task. A cross-experiment comparison revealed a significant interaction between priming and task, with significant effect of prime structure in the translation task, but no effect in the completion task. If the effects observed for the translation task were due to cross-linguistic structural priming, we should have observed a significant priming effect in the completion task as well. Thus, the results for Experiment 2, and especially the significant interaction

in the cross-experiment comparison, are inconsistent with the claim that source sentence influence in translation is caused by cross-linguistic structural priming.

At first glance, the results from Experiment 2 may be considered inconsistent with the findings from previous psycholinguistic studies investigating cross-linguistic structural priming in bilinguals. Cross-linguistic structural priming generally constitutes a highly robust and replicable effect. This is especially the case for the dative alternation investigated in the present study: For other structural alternations, particularly for structures that require a different constituent order in the two languages involved, it is still controversially discussed whether cross-linguistic priming can occur or not (e.g., Bernolet, Hartsuiker & Pickering, 2007; Kidd, Tennant, & Nitschke, 2015; Jacob et al., 2017). For the PO and DO structures investigated in the present study, however, the required constituent order is the same in English and German. In this respect, the structural alternation we investigated represents a particularly straightforward case, for which essentially any theoretical account of structural priming (Loebell & Bock, 2003; Hartsuiker et al., 2004; Hartsuiker & Pickering, 2008; Jacob et al., 2017) predicts a robust cross-linguistic priming effect. Indeed, cross-linguistic priming for the dative alternation between English and German (or other language pairs that require the same constituent order for these structures) has been demonstrated in a considerable number of previous studies (see Loebell & Bock, 2003, and much subsequent work). In this respect, it may seem somewhat unusual that the translators in our experiment did not show any such priming effect in the completion task at all. Recall, however, that the prime sentences in Experiment 2 were not specifically designed for a cross-linguistic priming experiment of this kind, but were used to allow for a direct comparison with Experiment 1, as well as previous research on source structure influence in translation. Indeed, the materials from Maier et al. (2017), on which the experimental materials in the present study are based, possess several properties which may cause readers to focus less on the grammatical structure of the sentence, and more on lexico-semantic properties: In particular, the sentences contain words that, in natural texts, only very rarely occur together (e.g. "*The writer rents the bag to the hero.*'). As a result, the sentences are actually highly unusual with respect to their meaning. (For instance, a bag is not typically rented, and the action of renting is not among the actions typically associated with a hero.) The unusual semantics may have drawn attention away from the syntactic structure of the sentence, reducing structural priming. Also, participants may have refrained from computing a full analysis of the syntactic structure while processing the prime sentences and may have instead resorted to good-enough processing, assigning thematic roles to the constituents directly without a detailed prior syntactic analysis (e.g. Ferreira, 2003; Ferreira & Patson, 2007; and much subsequent work). In any case, the fact that these particular sentences are able to cause effects of source-structure influence in translation, but unable to cause cross-linguistic structural priming effects in a classical priming experiment, is inconsistent with the claim that shining-through effects in translation are based on cross-linguistic structural priming.

Before discussing theoretical implications of our findings, an important unavoidable limitation of our study design deserves to be addressed. The key conclusion that the effects of source-structure influence in Experiment 1 are not

caused by cross-linguistic priming crucially depends on the comparison between the findings from Experiments 1 and 2. This rationale assumes that the tasks in our two experiments are comparable, particularly with regard to how the prime sentences are initially processed in the translation and completion tasks. When designing the study, we tried to keep the procedure and task in Experiments 1 and 2 as comparable as possible. However, for obvious reasons, Experiment 1 necessarily required a translation task, while Experiment 2 required a priming task which does not involve any sort of translation. The resulting unavoidable differences may have had consequences for how the prime sentences in Experiments 1 and 2 were initially processed. For instance, the translation task in Experiment 1 may have theoretically led to deeper processing of the grammatical structure of the prime sentences, and thus to stronger effects than the completion task in Experiment 2, where the prime sentences only had to be read aloud. Note, however, that a number of previous priming studies which have relied on the same type of completion task as in our Experiment 2 have consistently found significant structural priming effects for the dative alternation (e.g. Pickering and Branigan, 1998; Branigan et al., 1999; van Gompel et al., 2006; Jacob et al., 2017). This suggests that processing of the prime sentences in such a completion paradigm is deep enough for structural priming effects to emerge. As a result, if the shining-through effects in Experiment 1 were based on structural priming, we should have at least found some priming in Experiment 2 as well (even if this effect may well be smaller than in Experiment 1, due to the difference between the translation and completion tasks).

If cross-linguistic priming is not responsible for shining-through effects in translation, what else might be driving the effect of source-structure influence observed in Experiment 1? Perhaps the most straightforward alternative explanation for the data pattern is that a translator's decision to produce a particular structure in a target sentence might be based mainly on metalinguistic knowledge about structural similarities between particular source language and target language structures (such as between a German and an English PO structure). This account would assume that source-structure influence in translation constitutes a late, strategic effect, with translators making a conscious decision to produce a particular structure based on metalinguistic knowledge. Indeed, this account could explain why we observed an effect of source-structure influence in Experiment 1, but no structural priming effect in Experiment 2. However, this explanation implicitly assumes that shining-through effects should mainly occur when translators have enough time to utilize their metalinguistic knowledge, and should at least be considerably reduced when translations are performed under severe time constraints. However, effects of source-language influence are well-known to also occur, and are possibly even enhanced, in extemporaneous translation or simultaneous interpreting (e.g. Chmiel, Janikowski, and Cieślewicz, 2020). In simultaneous interpreting, transcoding (i.e., word-for-word translation) is even taught as an emergency strategy to be used when cognitive load exceeds available resources (Gile, 1995: 199; Donato, 2003). Also, the account is inconsistent with the finding that literal translations are particularly easy to produce (e.g., Carl & Schaeffer, 2017) and assumed to constitute the first candidate for a translation (e.g., Toury, 1995; Tirkkonen-Condit, 2005; Tirkkonen-Condit, Mäkisalo, and Immonen,

2008; Schaeffer and Carl, 2013; Halverson, 2019), which is then evaluated and potentially adjusted at a later stage of processing.

If source-language influence is not based on co-activation at the level of grammatical representations (as expressed by cross-linguistic structural priming), it may instead be caused by co-activation at a different level of language processing. A key phenomenon from psycholinguistic research on bilingualism which constitutes a possible foundation for an account which can explain our findings is *lexical co-activation*. Theoretical accounts of bilingual lexical processing largely assume a single, integrated Mental Lexicon, in which lexical entries are connected to entries for their translation equivalents (e.g. Kroll and Stewart, 1994; Dijkstra & van Heuven, 2002; Dijkstra, Wahl, Buytenhuijs, van Halem, Al-Jibouri, de Korte, and Rekké, 2019). Evidence from a considerable number of lexical translation priming studies (e.g. de Groot & Nas, 1991; Dimitropoulou, Duñabeitia, & Carreiras, 2011) suggests that, during lexical word recognition in bilinguals, the associations between translation equivalents lead to the automatic activation of the translation equivalent(s) for the word currently processed. The fact that translation priming effects also occur in masked priming, i.e., when the prime word is masked and presented for such a short time that it cannot be consciously perceived (see Wen & van Heuven, 2017, for a review), suggests that lexical co-activation occurs at an early, automatic stage of lexical access. The effect is also not restricted to bilinguals with low L2 proficiency, but also occurs in highly proficient simultaneous bilinguals (e.g. Duñabeitia, Perea, and Carreiras, 2009; Duñabeitia, Dimitropoulou, Uribe-Etxebarria, Laka, & Carreiras, 2010; Chaouch-Orozco, González Alonso, Duñabeitia, and Rothman, 2023). Finally, lexical co-activation is not specific to contexts where words are presented in isolation, but has also been found in sentence context (e.g. Schwartz and Kroll, 2006; Schwartz and van Hell, 2012; Hopp, 2017).

If we assume that *serial* lexical co-activation occurs for all words within a source sentence while the sentence is processed by the translator, this leads to the activation of a string of target-language words, which constitutes a potential initial candidate for a translation. As already mentioned, existing translation process models (e.g. Tirkkonen-Condit, 2005; Hansen-Schirra, Nitzke, and Oster, 2017) assume a *monitor* process which checks an initial candidate sentence for grammaticality and appropriateness, and can modify it accordingly if necessary. If the respective language pair is structurally closely related, the word string activated through serial lexical co-activation may already constitute a grammatically correct translation, and may thus be produced, leading to substantial shining-through effects. Even if source and target language are not as closely related and the word string does not constitute a grammatically correct sentence in the target language, the monitor may be able to modify it (for instance by adding articles or inflectional affixes to the constituents) so that the resulting sentence meets the grammatical requirements of the target language.

The account sketched above can explain the differential data pattern we observed in the two experiments, and also offers an explanation for the mediating effect of translation competence we observed in the additional analysis for the translation data from Experiment 1: While serial lexical co-activation should occur in highly skilled and relatively less-skilled translators alike, highly competent translators likely possess sophisticated metalinguistic knowledge, which may cause the monitor to move away from the initial candidate for the translation, leading to freer, less literal translations. For example, with respect to the translation of an English PO source

sentence into German, the monitor may be aware that the German dative alternation is strongly biased toward the DO structure. In translators with high competence scores, the monitor may thus move away from the initial PO candidate translation and decide to instead produce a DO translation, reducing shining-through effects in highly skilled translators.

To what extent can an account based on serial lexical co-activation also explain the findings from Maier et al.'s (2017) previous study on source-structure influence in untrained translators? Recall that, in their Experiment 1, Maier and colleagues found a similar, but numerically stronger, effect of source structure influence as in our study. This finding is consistent with the claim that all translators, irrespective of translation training, activate a literal translation based on serial lexical co-activation as an initial candidate for a target sentence. While untrained translators largely stick to this initial candidate, the monitor in trained translators may take into account linguistic properties of the target language (such as the frequency of the respective structure) and, at least occasionally, move away from the initial candidate sentence, preferring a non-literal translation. As a result, trained translators should still show a degree of source-structure influence, but less so than individuals without any translation training. In their Experiment 2, Maier and colleagues found that source sentences with a German shifted DO structure showed an increased number of English PO translations (relative to a control condition with otherwise identical non-shifted DO sentences). The account sketched above offers a straightforward explanation for this finding: For German sentences with a shifted DO structure, the English word string activated through serial lexical co-activation does not form a grammatically correct English sentence (e.g. *The boy gave the bag the man.*). The monitor subsequently checks this initial candidate translation for grammaticality, notices that the word string does not fulfill the requirements of English grammar, and tries to implement minimal corrections which turn the word string into a grammatically correct sentence. Arguably the simplest way to achieve this is to add the preposition *to* to the recipient complement, which leads to the production of a PO translation.

The proposed account is largely consistent with a number of key claims made by current translation process models. For instance, recall that the models proposed by Tirkkonen-Condit and colleagues (2005, 2008) and Schaeffer and Carl (2013) assume that the processor initially activates a literal translation, which serves as the initial candidate for the to-be-produced target utterance. Our account provides an explanation for how this initial candidate for a translation emerges during processing of the source sentence. The second main component of our account, the monitor, is also a key part of these translation process models.

Finally, while our study shows that effects of source structure influence in translation are affected by translation competence as measured by the TICQ (Schaeffer et al 2020), it is not entirely clear to what extent this is also the case for translation experience in bilinguals without explicit translation training. Given that bilinguals often engage in translation tasks in their daily lives, it is possible that individuals with a high degree of practical translation experience show a similar effect of reduced source structure influence as our trained participants. We consider this a valuable field for future research.

Summary and conclusion

The purpose of the present study was to investigate the psycholinguistic foundation of shining-through effects in translations produced by translators with professional translation training and to test the hypothesis that such effects are based on cross-linguistic structural priming from the source sentence. In Experiment 1, a sample of professional translators-in-training showed an effect of source-structure influence. This effect interacted with individual translation competence scores and gradually decreased with increasing translation competence. Also source-structure influence was numerically substantially weaker than in previous studies on bilinguals without any translation training. Experiment 2 investigated to what extent the effect of source-structure influence found in Experiment 1 can be explained through cross-linguistic structural priming. The same participants who had shown an effect of source-sentence influence in Experiment 1 did not show a priming effect in Experiment 2, a priming task which did not involve translation, but was otherwise based on a similar task and experimental materials as in Experiment 1. This suggests that the observed effect of source-structure influence cannot be due to structural priming. We therefore proposed an alternative account which explains source-structure influence in translation through serial lexical co-activation.

While the proposed account can explain our findings and is also consistent with previous findings from research on bilingual language processing and translation research, lexical co-activation has so far been mainly investigated for single words. In this respect, the key assumption that lexical co-activation also occurs for entire word strings during bilingual sentence processing is speculative to a degree. Also, at least to our knowledge, lexical co-activation has so far not been investigated in translators with professional training. Future research may therefore address whether established psycholinguistic effects from bilingualism research, such as lexical co-activation, also occur in bilinguals with sophisticated linguistic training and professional skills. This may ultimately lead to translation process models that are not only psycholinguistically informed but are also based on direct empirical psycholinguistic evidence from translators.

Replication package. Experimental materials, data, and analysis code for the study are available on OSF: https://osf.io/drbck/.

Competing interests. The authors declare none.

Notes

1 We also conducted a complementary analysis for the TICQ-F2z score, the second component of the TICQ, which is associated with skills related to post-translation quality control. This analysis showed no significant interaction between source structure and TICQ-F2z.

2 All analyses for both experiments were checked for possible effects of presentation order (i.e., whether participants went through Experiment 1 or Experiment 2 first). As the analyses did not show any significant interactions with presentation order, we decided against including presentation order in the analyses reported in the manuscript.

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