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A multi-method approach to estimating subjectivity of causal connectives: The case of 'poetomu' and 'tak chto' in Russian

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Abstract

Cross-linguistic evidence shows that languages often employ specialized causal connectives to express subjective versus objective relations. This evidence mostly comes from corpus studies. However, the phenomenon of connective specialization can also be approached with experimental methods. The present study set out to compare different methods of investigating subjectivity profiles of causal connectives in a language, uncovering the different aspects of connective specialization that they elucidate. A combination of the traditional corpus analysis (Study 1), a connective insertion experiment (Study 2), and a sentence continuation experiment (Study 3) was applied to Russian forward causal connectives *poetomu* 'that's why' and *tak chto* 'so', which have not been studied in this respect. The results of all three methods show that, across discourse types, *tak chto* prefers subjective relations more than *poetomu,* which expresses objective relations. The specialization of connectives is most pronounced in the connective insertion experiment due to the constraining nature of this task and the prototypicality of the stimuli. The corpus study and the sentence continuation experiment show less strong specialization profiles of connectives because they are more sensitive to other contextual factors. Our research illustrates the importance of combining different methods and contributes to the cross-linguistic research in the field.

Keywords: Subjectivity; Causality; Russian connectives; Discourse types

1. INTRODUCTION

Understanding subjectivity, i.e., correctly identifying sources of information and the degree to which these sources are involved in the information representation, is a crucial skill for the correct interpretation of spoken and written texts. Subjective utterances require reference to the speaker for their interpretation, while objective utterances do not (Lyons, 1995; Traugott, 1995). Previous literature suggests that subjectivity is important in the interpretation of causal relations

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(Pander Maat and Sanders, 2001; Sanders et al., 1992; Sanders, 1997; Sanders et al., 2009; Sanders et al., 2012; Sweetser, 1990). In other words, causal relations vary in their degree of subjectivity: objective relations are observable in the real world and are simply reported by the speaker, whereas subjective relations are construed by some conscious mind, most often the speaker. A number of cross-linguistic studies provide evidence that in several languages across the world, such as Dutch (Degand, 2001; Degand and Pander Maat, 2003; Pit, 2007; Sanders and Spooren, 2015), French (Degand and Pander Maat, 2003; Pit, 2003; Zufferey, 2012), German (Pit, 2003, 2007), Turkish (Çokal et al., 2020) and Mandarin (Li et al., 2013; Xiao et al., 2021a, 2021b), specified causal connectives are systematically used to mark subjective versus objective relations. These findings suggest that the distinction between subjective and objective causality is an important cognitive distinction that is reflected on the level of the surface linguistic marking.

This distinction is also reflected in discourse processing: several studies on various languages show that subjectivity in causal relations is associated with an online processing cost (Canestrelli et al., 2013; Traxler et al., 1997a, 1997b): as soon as a causal relation can be identified as subjective, there is a delay in processing. Importantly, in languages with specialized subjective and objective causal connectives, this processing delay related to subjectivity is observed immediately after subjective connectives (Canestrelli et al., 2013; Wei et al., 2019), while, at the same time, the processing of the upcoming relation is facilitated (Canestrelli et al., 2013; Li et al., 2017; Wei et al., 2021). This shows that specialized connectives can serve as cues towards subjectivity or objectivity of the upcoming relation in processing.

In order to identify the subjectivity profiles of certain causal connectives in a language, previous studies mostly consisted of corpus analysis. Corpus analysis involves selecting a number of cases where a certain connective is used and analyzing each case for the type of causal relation it represents. Although this method provides insight into the natural use of causal connectives, it also has several disadvantages. Firstly, it may require time-consuming iterative selection of the cases for analysis, because the causal connectives under investigation are not very frequent or because they have other non-causal meanings. Secondly, certain types of relations may be rare in certain types of corpora, which can result in an ostensible absence of prototypical connectives for these types of relations. Finally, corpus analysis involves laborious manual annotation of the selected relations for their degree of subjectivity by several annotators. The annotation process becomes difficult due to the prototypical structure of subjective and objective causal categories. In real-life examples from the corpus, a certain proportion of causal relations naturally belong to ambiguous “fuzzy edges” that are hard to attribute to one or another relation type (Stukker and Sanders, 2012), especially when the connective is not taken into account.

Several recent studies exploring subjectivity profiles of causal connectives used a different methodology, namely, a connective insertion experiment, as an alternative to expert annotators (Santana et al., 2021; Scholman and Demberg, 2017; Xiao et al., 2021b; Yung et al., 2019). The connective insertion task, where participants are asked to fill in a missing connective between the two parts or a relation, has been proven to be a reliable method of obtaining discourse annotations. Santana et al. (2021) used this method in a study on Spanish causal connectives. They report that the method resulted in a more effective and less time-consuming categorization of causal connectives in terms of subjectivity as compared to the previous corpus studies (Santana et al., 2017, 2018) because it let them quickly gather the data representing actual interpretations of naïve speakers. Moreover, in the connective insertion task, different types of relations (subjective and objective) rather than instances of connectives are selected, which helps to avoid the issues related to the frequency imbalance of relation types discussed above among the disadvantages of corpus analysis.

Although the connective insertion task may appear as a more effective substitute to the traditional corpus analysis, the two methods have not been directly compared. Furthermore, these methods do not inform us whether specialized connectives also serve as cues toward the degree of subjectivity of the relation. In the present study, we approached this issue with a newly developed sentence continuation experiment, which tested what type of relations speakers chose given different causal connectives.

To sum up, although there are both established and emerging methodologies used for investigating the general phenomenon of subjectivity reflected in causal coherence markers, little attention has been paid to discerning the different aspects of the subjectivity in the causality phenomenon that they elucidate. The aim of the present research was to address this issue by developing and testing an integrative multi-method approach to investigating the subjectivity of causal connectives in a language, both in terms of specialization and in terms of processing expectations. This approach was applied to Russian forward causal connectives, specifically *poetomu* and *tak chto*, that have not yet been studied in this respect. Thus, the present study aimed to answer two research questions, namely:

1) What information do the different methods provide about the subjectivity profiles of causal connectives and to what extent do these methods converge?
2) What are the subjectivity profiles of two of the Russian forward causal connectives across discourse types?

To answer these research questions, three studies using three different methodologies were conducted. In addition to the traditional corpus analysis of news and spoken discourse types (Study 1), we approached the problem of specificity experimentally using two paradigms. In the connective insertion experiment (Study 2), we investigated what connectives Russian speakers chose given prototypical subjective or objective causal relations. In the newly developed sentence continuation experiment (Study 3), we tested what types of relations Russian speakers chose given different causal connectives.

1.1. Subjectivity and causality: cross-linguistic evidence

In linguistics, many accounts of subjectivity exist, varying from formal (Lasersohn, 2016) to cognitive-functional (Langacker, 1990; Lyons, 1995; Traugott, 1995). No matter how different the theoretical orientation of these approaches, a common denominator can be identified: obligatory reference to a subject's perspective for the interpretation of subjective utterances. Lasersohn (2016), for instance, argues that a truth-theoretic semantic theory is appropriate even for sentences expressing personal taste (*Licorice is tasty*), but that for such sentences, truth and falsity must be assigned relative to perspectives. Within the cognitive-functional approach, which is adopted in this study, Traugott (1995) and Lyons (1995) argue that an utterance is subjective if it requires reference to the speaker or some other source of information in its interpretation, and objective if it does not. In other words, the interpretation of subjective utterances requires an active *Subject of Consciousness* (SoC). This SoC is the thinking entity in the discourse who evaluates. For instance, *Utrecht is great* is subjective because it involves an evaluation by the speaker who is the SoC. Compare this with an utterance like *Utrecht is a city in the Netherlands*, which is presented as a fact in the world that does not depend on the evaluation by an SoC. In addition, we adopt Langacker's (1990) insight that implicit reference to the SoC (*Utrecht is great*) is more subjective than explicit reference to the SoC (*I think Utrecht is great*; *Lena thinks Utrecht is great*). In doing so, we follow an integrative approach to subjectivity described by Sanders and Spooren (2015).

Besides being a property of utterances, subjectivity can also manifest itself in the relations between utterances (Sanders and Spooren, 2015). For causal relations in particular, different theoretical approaches to causality in discourse distinguish between objective and subjective causal relations (Le groupe λ-l, 1975; Sanders, 1997; Stukker and Sanders, 2012; Sanders et al., 2009; Sweetser, 1990). Applying the general definition of subjectivity from above, objective relations (e.g., 1a and 1b) are those that hold between events in objective reality and are simply reported by the speaker, while subjective relations (e.g., 1c and 1d) are construed by the speaker in the current discourse, and thus can only be interpreted in relation to the speaker, or more precisely, the Subject of Consciousness (Pander Maat and Sanders, 2000), which is the speaker in the most subjective cases. Several approaches propose a more refined distinction between the types of causal relations with respect to subjectivity (Pander Maat and Sanders, 2001; Sanders and Spooren, 2015; Stukker et al., 2009). Within the objective type, they distinguish between non-volitional causal relations that simply report the observed causal connections between the events in the world (1a), and volitional relations that involve volitional decisions of an SoC (1b). Within subjective causal relations, two other types are distinguished: epistemic causal relations that are construed as inferences made by an SoC and should be interpreted as relating to the SoC's conclusions about reality (1c), and speech act relations where an illocutionary speech act is connected to the reason for its utterance (1d).

(1)
a. *It is raining, so the streets are wet.*
b. *It was raining, so we entered a café.*
c. *He does not pick up the phone, so he is probably busy.*
d. *It might rain later today, so please take an umbrella with you.*

The presence of an SoC in volitional relations (for example, the speaker SoC in 2b) as opposed to non-volitional relations that do not have any reference to SoC, makes volitional relations conceptually closer to subjective relations, where an SoC is always present. In general, the degree of subjectivity can be considered a continuum and, in that case, volitional relations can be positioned somewhere between purely factual objective relations (non-volitional) and subjective relations. Treating volitional relations as objective when splitting the subjectivity continuum into two categories (subjective and objective) is a theoretical choice that is adopted in this study and in the previous studies cited above.

Although in the examples in (1) all types of relations were expressed with the same English causal connective *so*, cross-linguistic evidence shows that languages often employ specific causal coherence markers to express different types of causal relations. For example, German backward causal connectives *weil* and *denn* (Pit, 2003, 2007) and French connectives *parce que* and *car* (Degand and Pander Maat, 2003; Pit, 2003) are used to express prototypically

objective and subjective causal relations, respectively. In Mandarin, forward causal connectives *yīn'ér* and *yúshì* prefer non-volitional and volitional domains, respectively, while *kějiàn* mostly expresses epistemic relations (Li et al., 2013). In Dutch, the subjectivity profiles of both forward and backward causal connectives show clear prototype structure: *daar-door* and *doordat* are restricted for non-volitional uses, *daarom* and *omdat* are used predominantly in volitional cases, and *dus* and *want* mostly express subjective relations in general (Degand and Pander Maat, 2003; Stukker and Sanders, 2012; Sanders and Spooren, 2015; Stukker et al., 2009). Thus, subjectivity in general, and more detailed distinctions related to subjectivity, are important parameters of cognitive categorization in the domain of causality. Subjectivity is therefore often reflected in the preferential use of different causal connectives. Here and elsewhere in this paper, we refer to a certain causal connective as "subjective" if it systematically prefers to express subjective causal relations, and we refer to it as "objective" if it systematically prefers to express objective causal relations.

There are also languages that do not show such a systematic categorization of causal connectives based on subjectivity, such as English, where the connective *so* is not systematically biased towards an objective or subjective relation (Andersson and Sundberg, 2021; Knott and Sanders, 1998). Another language that does not have a systematic categorization of causal connectives based on subjectivity is Spanish (Santana et al., 2021). In Spanish, there is only one specific subjective connective *puesto que*, while the connectives *porque* and *ya que* can express both subjective and objective relations (Santana et al., 2021). In English, in addition to the underspecified connective *so*, the connective *therefore* exhibits preference for subjective relations and *as a result* exhibits preference for objective relations (Andersson and Sundberg, 2021). However, as Andersson and Sundberg describe, usage differences between these connectives do not reflect systematic categorization of causal connectives in terms of subjectivity but rather pertain to other variables, such as register and rhetorical purposes. Thus, the conceptual distinction between subjective and objective relations is not reflected in the lexicon of causal connectives of every language. Further cross-linguistic research is needed to understand how subjectivity can be systematically signaled in languages.

1.2. Forward causal connectives in Russian

Although Russian has a large number of coherence markers for forward causality, the present paper focuses on two specific, frequent connectives: *poetomu* and *tak chto*. The absolute frequencies of *poetomu* and *tak chto* in the Russian National Corpus (RNC, 321 million words) reveal that *poetomu* (97 206) is more frequent than *tak chto* (50 702), although the numbers are not very representative as they include non-connective uses. To the best of our knowledge, Russian causal connectives have not yet been studied with respect to their subjectivity/objectivity. Intuitively, *poetomu* fits better in objective causal relations, whereas *tak chto* seems to fit better in subjective causal relations. For example, *poetomu* seems to fit well in non-volitional (2a) and volitional (2b) causal relations, while *tak chto* is naturally used in epistemic (2c) and speech act cases (2d).

(2)
a. *Noch'yu byl dozhd', **poetomu** vezde luzhi.*
'It was raining at night, so there are puddles everywhere.'
b. *Byl sil'nyj dozhd', **poetomu** my zashli v kafe.*
'It was raining hard, so we entered a café.'
c. *On ne beret trubku, **tak chto** on, navernoe, zanyat.*
'He does not pick up the phone, so he is probably busy.'
d. *Segodnya budet dozhd', **tak chto** voz'mi, pozhalujsta, zontik.*
'It will rain today, so please take an umbrella.'

In addition to the hypothesized difference in subjectivity, *tak chto* can also be considered more colloquial and typical for the spoken domain than *poetomu*, which is rather neutral.

1.3. Connectives as processing instructions

Previous experimental studies devoted to the processing of subjective versus objective causal relations provide evidence that understanding subjectivity comes at a cost (Canestrelli et al., 2013; Traxler et al., 1997a, 1997b). In order to understand that the utterance is subjective, the speakers need to add an extra layer to their interpretation that represents the source of information, which is reflected in processing (Wei et al., 2019). For example, it was found that in English, the processing time of the second clause following *because* is slower for subjective relations (3b) than for objective relations (3a) (Traxler et al., 1997b). A subsequent study on the same stimuli (Traxler et al., 1997a) further

clarified that the delay occurs at the main verb region (*left her purse*), i.e., when it becomes clear that the relation is not objective.

(3) a. *Susan lost her money and credit cards because she left her purse at the bus stop.*
b. *Susan was careless with money and credit cards because she left her purse at the bus stop.*
(Traxler et al., 1997b: p. 91)

In languages that distinguish between prototypically subjective and objective connectives, this subjectivity-related delay is observed earlier, namely, at the connective region or immediately after it (Canestrelli et al., 2013; Wei et al., 2021). These findings suggest that specialized connectives serve as processing cues towards the subjectivity of the unfolding relation. Furthermore, experimental studies in Mandarin (Li et al., 2017; Wei et al., 2021) show that clauses following the specialized subjective connective *kějiàn* 'so' are read faster than clauses following a neutral causal connective *suǒyǐ* 'so'. This facilitatory effect of subjective connectives on the processing of subjective relations reflects the incremental nature of processing and the role of specified connectives as processing instructions. Subjective forward causal connectives guide readers to expect subjective content, such as judgements and speech acts (Sweetser, 1990), whereas objective connectives indicate that the upcoming content is objective.

Several corpus studies have shown, however, that subjectivity profiles of causal connectives are not always robust across higher-level discourse categorizations, such as genre (Li et al., 2013; Li et al., 2016; Stukker and Sanders, 2014) or register (Andersson and Sundberg, 2021). For example, the prototypically subjective Dutch connective *dus* 'so' is used more often in non-prototypical objective cases in feature articles as compared to news reports (Stukker and Sanders, 2014). Other examples are the underspecified Mandarin forward causal connectives *yīncǐ* and *suǒyǐ* that tend to express subjective relations in argumentative and informative genres and, on the contrary, objective relations, in the narrative genre (Li et al., 2013). Although the studies cited above suggest that discourse type can influence subjectivity profiles of causal connectives, it is still unclear how this influence is reflected in the effectiveness of connectives as processing cues. Moreover, it is still unclear whether differences in the distribution of various causal relation types across genres (Sanders and Spooren, 2015; Stukker and Sanders, 2014), such as the prevalence of subjective relations in spoken discourse (Sanders and Spooren, 2015; Santana et al., 2018), play an important role in guiding readers' processing expectations. While the online effects of the specialized connectives on reading times can be observed with eye-tracking-while-reading paradigms, the properties of the expectations triggered by the specialized connectives can be studied using other methods, such as the sentence continuation task adopted in Study 3 of the present paper.

1.4. The present study

The goal of the present study is two-fold. Firstly, from a methodological point of view, the study aims to test a multi-method approach to identifying subjectivity profiles of connectives in a language, both in terms of specialization and in terms of processing instructions. This is achieved by combining corpus and experimental methodologies that elucidate different aspects related to distinction in the degree of subjectivity between causal connectives. Secondly, the study aims to contribute to the research field on the cross-linguistic categorization of subjectivity in causality by investigating the phenomenon in Russian, which is typologically different from the languages studied so far. As previous studies suggest, even typologically similar languages can have different profiles of casual connectives with respect to subjectivity. Seeking evidence from typologically diverse languages can shed light on how salient subjectivity-related categorization in the domain of causality is cross-linguistically. Based on preliminary corpus observations, our hypothesis is that Russian forward causal connectives are specialized in terms of subjectivity, with *tak chto* predominantly expressing subjective relations and *poetomu* mostly exemplifying objective relations. Taking into account the dominance of subjective causal relation type in spoken discourse (Sanders and Spooren, 2015; Santana et al., 2018), processing expectations triggered by Russian causal connectives are hypothesized to depend on discourse type.

2. STUDY 1: CORPUS ANALYSIS

2.1. Materials and model of analysis

For the corpus analysis, occurrences of the two Russian forward causal connectives *tak chto* and *poetomu* were selected from two different corpora: the Newspaper corpus (305 million words) and the Spoken corpus (13 million words), both part of the Russian National Corpus (RNC). The choice of different media is important as it represents different types of discourse. Spoken and newspaper discourse varies in the degree of subjectivity and spontaneity, which

can influence the usage profiles of discourse connectives. From each of the two corpora, 100 occurrences of each connective were selected for analysis.

The frequencies of the connectives across spoken and newspaper corpora are presented in Table 1. The figures for both connectives include instances in which the connectives are not used as forward causal connectives linking two clauses. For *poetomu*, those are the instances where *poetomu* is an adverb combined with coordinate conjunction (e.g., *He cannot find it here and poetomu* '*for this reason/therefore*' *goes to search for it elsewhere*) and cases where *poetomu* is an adverb that does not link two clauses (e.g., *– Do you do sports to stay healthy? – And poetomu* '*for this reason*' *as well*). Since these different usage cases of *poetomu* are tagged in the same way in the Russian National Corpus, we cannot estimate which proportion of cases they constitute. As for *tak chto*, despite being marked as a multiword conjunction, some instances of *tak chto* in the Russian National corpus include cases where *tak* 'so' and *chto* 'what/that' are two adjacent pronouns (e.g., *Tak* '*so*' *chto* '*what*'*, are you going to help us or not?*). The exact percentage of such mistagged cases is not available.

Following the previous corpus studies on the subjectivity of causal connectives (e.g., Stukker et al., 2009), we used a paraphrase test for defining one of the four types of relations: non-volitional, volitional, epistemic, or speech act (Table 2).

2.2. Procedure

Of the 400 fragments included in the analysis, 80 fragments (20%) were coded independently by the first author and by another Russian L1 speaker with an educational background in linguistics, following the procedure of partial overlap coding of coherence relations (Spooren and Degand, 2010). The inter-rater agreement measured by Cohen's kappa was 0.76, suggesting that the coding was sufficiently reliable. All discrepancies between the raters were discussed. The rest of the fragments were subsequently coded by the first author.

2.3. Results

The distribution of the connectives across the types of causal relations in the two corpora is presented in Fig. 1 and Table 3.

We analyzed the corpus data using the *glm* function from the built-in statistical package in the R software (R Core Team, 2020). A log-linear analysis of frequency counts was conducted to examine the relationship between the connective, type of relation and discourse type. The two-level variables of connective and discourse type were coded using scaled sum contrasts (−0.5, 0.5). The four-level variable of relation type was coded using treatment contrasts with epistemic type as the reference level. First, the full model containing all main effects and interactions between the three factors was built. Then the model best fitting the data was selected using backward stepwise selection algorithm based on the Akaike information criterion (*step* function). The final model selected contained main effects of connective and relation type and their interaction, suggesting that there was no significant effect of discourse type on the subjectivity profiles. The results of the model are presented in Table 4. There was a significant interaction between the type of relation and connective. In fragments with *tak chto*, there were significantly more epistemic relations than non-volitional ($z = -3.30$, $p < 0.001$) and volitional ($z = -6.08$, $p < 0.001$) relations as compared to *poetomu*-fragments. The distribution of epistemic and speech act relations was similar across both connectives ($z = -0.08$, $p = 0.84$), which was expected since both relations belong to the general subjective domain. Thus, the results reveal that *tak chto* mostly exemplified subjective relations (149 out of 200 or 75%) while the majority of relations with *poetomu* were objective (114 out of 200 or 57%).

Although the analysis of absolute frequencies of causal relation types per connective in the corpus shows that there are certain dependencies, it may seem from the overall subjective/objective ratio that *poetomu* is less specialized than *tak chto*. However, this is partially due to the greater prevalence of subjective over objective relations in the corpus in

Table 1
Frequencies of the Russian forward causal connectives across corpora.

Corpus	**Frequency, instances per million**	
	tak chto	***poetomu***
Newspaper	174	442
Spoken	345	648

Table 2
Paraphrase test for the type of relation.

Type of relation	Paraphrase
Speech act	The fact that P leads to the speaker SoC asking/suggesting/advising/commanding the addressee that Q.
Epistemic	The fact that P leads to the SoC's conclusion/claim that Q.
Volitional	The fact that P leads to the SoC's intentional act that Q.
Non-volitional	The fact that P leads to the fact that Q, no intentionality involved.

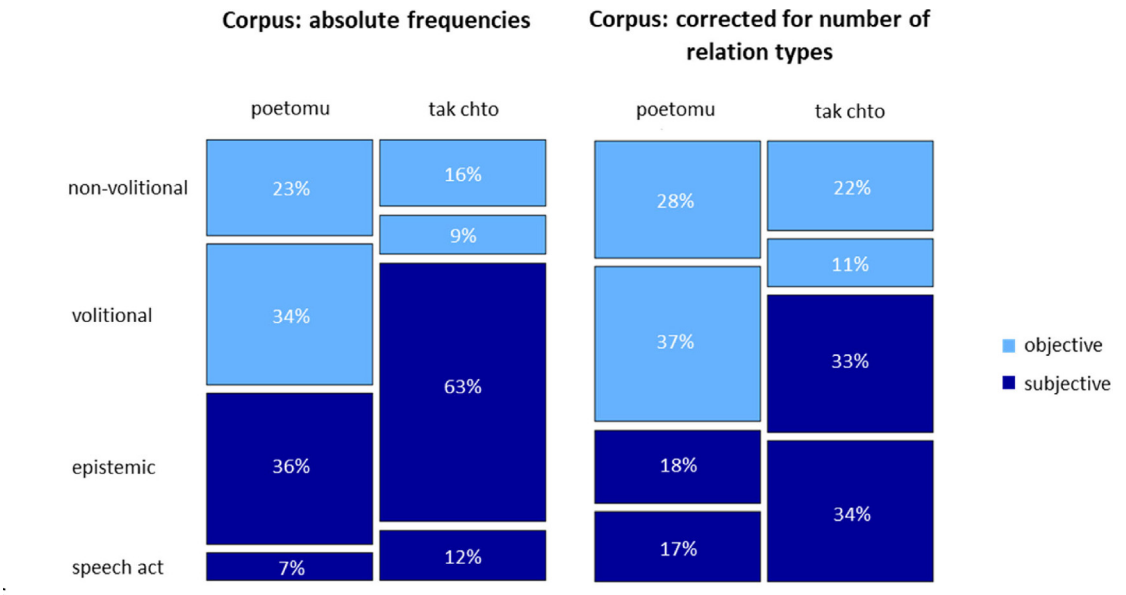

Fig. 1. The distribution of Russian forward causal connectives across different types of causal relations in the spoken and the newspaper corpus.

Table 3
The percentage of occurrences of Russian forward causal connectives across different relations in the spoken and the newspaper corpus.

Corpus		Non-volitional	Volitional	Epistemic	Speech act
Newspaper	*poetomu*	26 (63.4)	35 (77.8)	35 (35.4)	4 (26.7)
	tak chto	15 (36.6)	10 (22.2)	64 (64.6)	11 (73.3)
Spoken	*poetomu*	20 (54.0)	33 (78.6)	38 (38.3)	9 (40.9)
	tak chto	17 (46.0)	9 (21.4)	61 (61.6)	13 (59.1)

Note. The percentages before the brackets sum up to 100 horizontally and reflect the proportion of different relations expressed by each connective in each corpus. The percentages in brackets sum up to 100 vertically for each corpus and show the relative proportions of occurrence of the two connectives for each relation in that corpus.

general (235 to 165 relations, respectively). If absolute frequencies are corrected for the number of relation types (see Fig. 1), *poetomu* turns out to be as specialized (65% of objective relations) as *tak chto* (67% of subjective relations).

2.4. Discussion

The results of Study 1 show that there are significant differences between the two Russian forward causal connectives in terms of subjectivity: the connective *tak chto* is predominantly used in subjective causal relations, while the connective *poetomu* prefers to express objective relations, in line with the hypothesis. The corpus analysis did not reveal

Table 4
The results of the corpus analysis.

Fixed effects	Estimate	SE	z-value	p-value
Intercept	3.87	0.07	52.49	<0.001
Relation: non-vol	−0.91	0.14	−6.68	<0.001
Relation: vol	−0.98	0.15	−6.55	<0.001
Relation: sp-a	−1.69	0.19	−9.01	<0.001
Connective: *tak chto*	0.54	0.15	3.65	<0.001
Relation: non-vol; Connective: *tak chto*	−0.90	0.27	−3.30	<0.001
Relation: vol; Connective: *tak chto*	−1.81	0.30	−6.08	<0.001
Relation: sp-a; Connective: *tak chto*	−0.08	0.37	0.20	0.84

Note. Formula: frequency counts ~ type of relation*connective. *SE* – standard error; *non-vol* – non-volitional; *vol* – volitional; *sp-a* – speech act.

any significant difference in the subjectivity profiles of the Russian connectives between spoken and newspaper discourse types, suggesting that the pattern holds across discourse types.

On the other hand, for *poetomu* in particular, Study 1 showed relatively low specialization for objective relations (57%), which raises the question whether this connective is indeed specialized and whether it serves as a cue for objectivity in processing. We believe that the ostensible underspecification of *poetomu* is largely due to the prevalence of subjective relations in the corpus (59% of all relations; compare with 75% in Santana et al., 2018). Corpus analysis corrected for the frequency imbalance between subjective and objective relations reveals more clear specialization of *poetomu* for objective relations (65%).

In order to investigate how the theory-based corpus analysis compares to the intuitions of Russian L1 speakers regarding subjectivity profiles of the Russian causal connectives, Study 2 was conducted. Study 2 investigated whether prototypical subjective and objective causal relations are expressed with different connectives by Russian L1 speakers.

3. STUDY 2: CONNECTIVE INSERTION EXPERIMENT

3.1. Participants

A total of 43 participants took part in the online experiment (age: *M* = 36, *SD* = 16, range 18–68; 27 female; level of education: 37 higher, 4 incomplete higher, 1 secondary, 1 vocational). All participants were Russian L1 speakers. Before the start of the experiment, all participants read the information letter about the experiment and signed an online informed consent form by ticking the appropriate box. There was no option to proceed with the experiment, if a participant did not give consent. Participants did not receive financial compensation for completion of the experiment. The study was approved by the Faculty Ethics assessment Committee – Humanities (FetC-H) of Utrecht University.

3.2. Materials

The materials for the experiment consisted of 40 experimental items and 40 fillers. The materials were piloted on two Russian L1 speakers not taking part in the main experiment. Their task was to fill in missing connectives, but, in contrast to the actual experiment, there were no answers to choose from. Experimental sentences in which the pilot participants inserted non-causal connectives were changed. Several filler sentences were changed after the pilots in order to get a more balanced distribution of the two types of filler connectives. The experimental items consisted of Russian sentences with forward causal relations, where the causal connective linking the two clauses was omitted. There were four conditions reflecting the four types of causal relations: non-volitional, volitional, epistemic and speech act. In each condition, there were 10 sentences exemplifying prototypical relations of the corresponding type (in contrast to Santana et al., 2021, the prototypical stimuli were invented and not extracted from corpora). Examples of the sentences used in the experimental conditions are presented in Table 5. The fillers consisted of Russian sentences with contrastive and concessive relations, where the connective linking the two clauses was omitted. The connectives that could be used in such sentences were *no* 'but' and *hotya* 'although'. There were 20 sentences for *no*, and 20 sentences for *hotya*, although both connectives could be used in several items due to their similarity in meaning in the context of contrastive-concessive and concessive-contrastive relations. The stimuli, including experimental items and fillers, were manually pseudo-randomized: there were no more than two experimental items or fillers in a row and items of the same condition could not follow one another. Different conditions were equally distributed across the list. Based on this pseudorandom-

Table 5
Examples of the items across experimental conditions translated to English.

Condition	Example
non-volitional	It was raining heavily in the morning, ___ the benches in the park are still wet.
volitional	Kostya does not like to cook himself, ____ he always orders food delivery.
Epistemic	Even our excellent student got 4 in physics, ____ physics is definitely the most difficult subject.
Speech act	Yesterday I went to take out the trash, ____ maybe you can do it today?

ized order, two experimental lists were created by reversing the order of the stimuli. Each participant saw only one experimental list.

3.3. Procedure

The experiment was created and administered online using the Qualtrics software (https://www.qualtrics.com). The participants could access the experiment by clicking on a publicly available link. Following the original connective insertion paradigm (Scholman and Demberg, 2017), the participants were instructed to read sentences consisting of two parts, in which the connectives were omitted, and to insert the connective that, according to their opinion, served best for connecting the parts in each particular sentence. There were four multiple-choice options for every sentence: *tak chto, poetomu, no* and *hotya*. On average, the task took around 15 minutes to complete. The participants could return to the task after partial completion within a one-week period from the start of the experiment. Only two participants used this option.

3.4. Results

The responses of all 43 participants who completed the experiment were included in the analysis. Responses consisting of non-causal (filler) connectives in the causal experimental sentences were excluded from the analysis (78 data

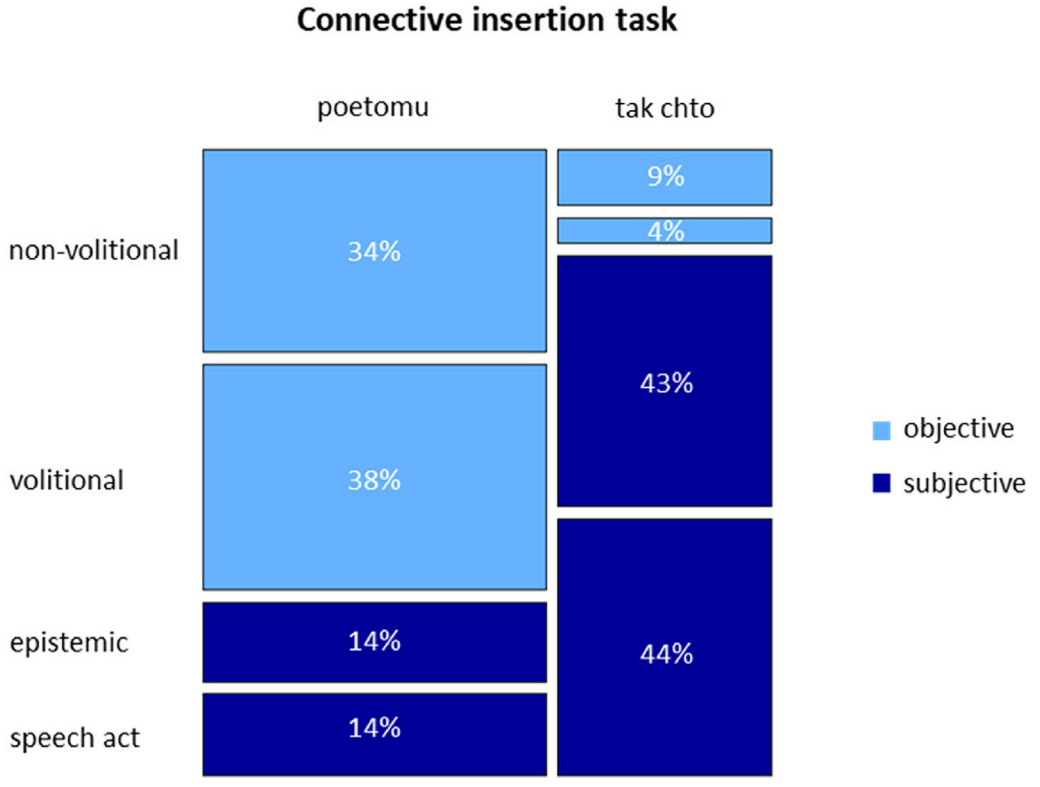

Fig. 2. The distribution of the two causal connectives across experimental conditions.

Table 6
The percentage of insertions of the two causal connectives across conditions.

	Non-volitional	Volitional	Epistemic	Speech act
poetomu	34.3 (85.4)	38.3 (93.3)	13.4 (33.4)	14.0 (33.7)
tak chto	9.3 (14.6)	4.4 (6.7)	42.5 (66.6)	43.8 (66.3)

Note. The percentages before the brackets sum up to 100 horizontally and reflect the proportion of different relations expressed by each connective. The percentages in brackets sum up to 100 vertically and reflect the proportions of choosing one connective over another for each relation.

points, which is 4.5% of the data). The distribution of the two causal connectives across conditions is presented in Fig. 2 and Table 6. The width of the bins in Fig. 2 represents the proportion of insertions of each connective: in general, the participants preferred to insert *poetomu* more than *tak chto* (1009 vs. 633 insertions, respectively).

Data analysis was performed using the *lme4* package (Bates et al., 2015b; version 1.1.26) in the R software (R Core Team, 2020). Considering the choice of a connective as a binary dependent variable, we built two separate generalized linear mixed-effect models: one with the four-level predictor for the type of causal relation and one with the two-level predictor, for which the four conditions were collapsed into two general categories, i.e., subjective versus objective relations. The two-level variables were coded using scaled sum contrasts (−0.5, 0.5). The four-level predictor variable was coded using repeated contrasts with the help of package *hypr* (Rabe et al., 2020; version 0.1.11). This coding scheme allowed for comparison of the neighbouring levels: namely, non-volitional versus volitional, volitional versus epistemic, and epistemic versus speech act relations. Maximal random effect structure was gradually reduced to achieve convergence following the procedure described in Bates et al. (2015a). The results of the two models are presented in Table 7.

In the first model, there was a significant difference between epistemic and volitional conditions ($z = -9.02$, $p < 0.001$), suggesting that *tak chto* was inserted more often in epistemic relations than in volitional relations. The contrasts between the two subtypes of objective relations, i.e., non-volitional and volitional ($z = 1.37$, $p = 0.17$), and the two subtypes of subjective relations, i.e., epistemic and speech act ($z = 0.19$, $p = 0.85$), turned out to be non-significant. This means that the ratio in the usage of the two connectives was similar across the two subtypes within each type of subjectivity. The second model revealed a significant main effect of subjectivity on the connective choice ($z = 11.33$, $p < 0.001$): *tak chto* was inserted more often in subjective relations than in objective relations, as expected.

Table 7
The results of the online connective insertion experiment.

Model 1 – four-level predictor				
Fixed effects	**Estimate**	**SE**	**z-value**	**p-value**
Intercept	−0.95	0.18	−5.30	<0.001
Non-volitional vs. volitional	0.66	0.49	1.37	0.17
Volitional vs. epistemic	−3.90	0.43	−9.02	<0.001
Epistemic vs. speech act	0.06	0.31	0.19	0.85
Random effects	**Variance**	**SD**		
Items (intercept)	0.30	0.55		
Subjects (intercept)	0.54	0.74		
Non-volitional vs. volitional	0.93	0.97		
Volitional vs. epistemic	0.44	0.66		
Epistemic vs. speech act	0.25	0.50		
Model 2 – two-level predictor				
Fixed effects	**Estimate**	**SE**	**z-value**	**p-value**
Intercept	−0.91	0.17	−5.29	<0.001
Subjective vs. objective	3.44	0.30	11.33	<0.001
Random effects	**Variance**	**SD**		
Items (intercept)	0.36	0.60		
Subjects (intercept)	0.53	0.73		
Subjective vs. objective	0.98	0.99		

Note. Formula 1: connective ~ type of relation (4 levels) + (1 | item) + (1 + type of relation | subject). Formula 2: connective ~ type of relation (2 levels) + (1 | item) + (1 + type of relation | subject). *SE* – standard error; *SD* – standard deviation.

3.5. Discussion

The results of Study 2 corroborate the results of Study 1 and show that *tak chto* and *poetomu* differ systematically with respect to subjectivity: *tak chto* is preferred in subjective and *poetomu* in objective causal relations. The profiles of these Russian forward causal connectives seem to be sensitive to the major distinction between subjective and objective causality, rather than the more fine-grained distinctions within each type. In other words, *poetomu* was preferred in both non-volitional and volitional relations, and *tak chto* was preferred in both speech act and epistemic relations.

The strength of the specialization of both connectives did differ between Study 1 and Study 2: the connective insertion task showed more pronounced specialization than the corpus analysis. For *poetomu* in particular, Study 2 revealed relatively high specialization on objective relations (72%) as compared to the corpus analysis (57%). However, *poetomu* was generally inserted more than *tak chto* in the experimental task in Study 2 and accounted for 61% of all insertions. This observation, together with a less pronounced specialization of *poetomu* observed in corpus analysis, could indicate that, despite a preference for expressing objective relations of cause-consequence, *poetomu* is more pragmatically diverse and, consequently, less specialized than *tak chto*.

Poetomu thus seems to have a less strong preference for expressing exclusively objective relations, which is especially interesting with respect to discourse processing. Previous processing studies on Dutch and Mandarin suggest that even those connectives that show inconsistencies in specialization across corpus studies and discourse types (Li et al., 2013; Stukker and Sanders, 2012) can serve as processing cues towards objectivity of the relation (Canestrelli et al., 2013; Wei et al., 2019). For example, the Dutch backward causal connective *omdat* has been shown to have rather inconsistent profile across studies (Stukker and Sanders, 2012): it expressed 95% of objective relations in the newspaper corpus used by Sanders and Spooren (2015), but only 52% of relations expressed by *omdat* were objective in the newspaper corpus used by Degand and Pander Maat (2003). Nevertheless, Canestrelli et al. (2013) showed that *omdat* triggered objective expectations: when *omdat* was used to express subjective relations, readers experienced serious processing difficulties at the end of the second clause. Another example is the Mandarin connective *yīn'ér* (Li et al., 2013), which expressed 65% of objective relations in the informative genre and and 76% in the narratives, but only 44% of relations with *yīn'ér* were objective in the argumentative genre. Although the processing studies on Mandarin did not take into account different genres, *yīn'ér* was found to guide speakers' attention away from the Subject of Consciousness, i.e., to trigger objective expectations, in a visual word paradigm study (Wei et al., 2019). To sum up, based on the previous literature, it is rather difficult to estimate whether the figures from Studies 1 and 2 for *poetomu* indicate that it is not a reliable cue towards objectivity of the relation.

Furthermore, Stukker and Sanders (2012) argue that cross-linguistically, objective causal connectives often have less robust profiles across discourse types than subjective connectives. For example, several studies in German (Keller, 1995) and French (Zufferey, 2012) suggest that objective connectives are prone to subjectification in diachronic development, especially in spoken discourse (Stukker and Sanders, 2012; Zufferey, 2012). This means that discourse type is an important factor that can affect both the subjectivity profiles of causal connectives and the processing instructions triggered by them. Although there was no effect of discourse type on the subjectivity profiles of Russian connectives in Study 1, it could be the case that *poetomu* is still a less strong cue toward objectivity in spoken than in newspaper discourse. On the contrary, *tak chto* showed a strong preference for subjective causal relations across discourse types and is therefore assumed to be a strong cue toward the subjectivity of the relation. These hypotheses are tested in Study 3.

4. STUDY 3: SENTENCE CONTINUATION EXPERIMENT

While Study 2 investigated which connectives Russian L1 speakers choose given the type of relation, Study 3 employed a reverse approach: namely, it investigated which types of relations speakers prefer given the connective. In this way, Study 3 also explored whether the Russian forward causal connectives *poetomu* and *tak chto* can serve as processing cues toward the degree of subjectivity of the upcoming relation across discourse types. For this purpose, we developed a sentence continuation experiment. Using a sentence continuation task to elicit different types of causal relations has also been done in the study of the English connective *so* by Andersson and Spenader (2014). Our experiment manipulated connective (*poetomu* vs. *tak chto*) and discourse type (newspaper discourse vs. spoken conversations) to test whether the expectations triggered by the two connectives differ across discourse types. Taking into account the results of the corpus analysis of absolute frequencies in Study 1 and previous literature on the influence of discourse type on subjectivity profiles (Stukker and Sanders, 2012; Zufferey, 2012), it was hypothesized that the difference between the continuations triggered by the Russian connectives would be smaller in spoken as compared to newspaper discourse.

4.1. Participants

The participants of the online sentence continuation experiment were 40 Russian L1 speakers (age: M = 35, SD = 14.7, range 18–67; 33 female; level of education: 28 higher, 5 incomplete higher, 5 vocational, 2 secondary). As with the connective insertion task, all participants read the information letter and signed an online informed consent form before the start of the experiment. There was no option to proceed without giving consent. Participants were compensated with 450 rubles (5 euros) for the completion of the experiment. The study was approved by the Faculty Ethics assessment Committee – Humanities (FetC-H) of Utrecht University.

4.2. Materials

The experiment employed a two-by-two design with 10 items per condition: there were two different causal connectives (*poetomu* vs. *tak chto*) and two types of discourse (spoken vs. newspaper). The experimental items consisted of 40 three-sentence stories. The last sentence was incomplete in such a way that the second clause directly following the forward causal connective was missing. An example of an experimental item is provided in (4). In the newspaper discourse type conditions, the items resembled extracts from newspapers and were presented in the written modality. In the spoken discourse type conditions, the items were presented as audio recordings. The stories were created in such a way that the participants could think of a possible continuation without much cognitive effort. For example, possible continuations of the spoken item in (4) could be "*it will take me more time than usual to get there*" (objective) or "*please, begin without me*" (subjective). Possible continuations of the newspaper item could be "*buses often miss the schedule*" (objective) or "*the mayor made a good decision*" (subjective). Another important criterion used in the creation of the stimuli was making sure that the most logical possible continuations were not already stated in the preceding context of the story.

(4) **Spoken:**

Privet! Da, ya znayu, chto vy vse uzhe tam. Ya uzhe edu, pravda, navigator pokazyvaet, chto v centre vse stoit. V takoe vremya v gorode vsegda probki, ***poetomu/tak chto*** . . .

'Hi! Yes, I know you are all already there. I'm on my way, though the navigator shows that the center is stuck. At this time of the day there are always traffic jams in the city, **poetomu/tak chto** . . .'

Newspaper:

Mer prinyal reshenie vydelit' otdel'nuyu polosu dlya obshchestvennogo transporta na Dmitrovskom shosse. Eto pomozhet uluchshit' rabotu obshchestvennogo transporta, osobenno v utrennie chasy. V takoe vremya v gorode vsegda probki, ***poetomu/tak chto*** . . .

'The mayor decided to allocate a separate lane for public transport on Dmitrovskoe highway. This will help improve public transport connection, especially in the early hours. At this time of the day there are always traffic jams in the city, **poetomu/tak chto** . . .'

The spoken items were pre-recorded using two female Russian-speaking volunteers. The study also contained 40 filler items (20 spoken and 20 newspaper stories). The filler items copied the structure of the experimental items but used different connectives: *no* 'but' or *hotya* 'although'. The materials were piloted on two Russian L1 speakers not taking part in the experiment. This led to adjustment of several items for which the pilot participants found the stories too difficult to be able to provide continuations. The stimuli were distributed across four experimental lists according to a Latin square design. For each of the four lists, the order of the stimuli was pseudo-randomized in such a way that: 1) there were no more than two experimental items or fillers in a row, 2) items of the same condition could not follow one another, 3) different conditions were equally distributed across the list. By reversing the four pseudo-randomized orders, eight experimental lists were created to avoid an effect of stimulus order. Each participant saw only one experimental list.

4.3. Procedure

The experiment was created using the Qualtrics software (https://www.qualtrics.com) and distributed online via social media platforms. The participants were instructed to read short excerpts from newspapers or listen to short excerpts

Table 8
The distribution of subjective and objective continuations across conditions.

		Objective	Subjective
Newspaper	*poetomu*	253 (63.3)	147 (36.7)
	tak chto	170 (42.8)	227 (57.2)
Spoken	*poetomu*	194 (48.6)	205 (51.4)
	tak chto	138 (34.8)	258 (65.2)

Note. The percentages in brackets some up to 100 horizontally per connective per discourse type.

from spoken conversations and write down a possible continuation of the last sentence in each story[2]. On average, the experiment took 60 minutes to complete. The participants could return to the task after partial completion within 72 hours from the start of the experiment. This option was used by seven participants. After completion of the experiment, the participants were redirected to another Qualtrics survey asking for their personal data and bank account numbers required for financial compensation. This was done to make sure that: 1) only those participants who completed the experiment could be compensated; 2) participants' personal data was not associated with their responses in the experiment.

4.4. Results

Responses of all 40 participants who completed the experiment were included in the analysis. The sentences resulting from participants' continuations were annotated as either subjective or objective following the same procedure as in the corpus analysis (see Table 2). Unintelligible responses and responses in which the participant changed the connective were excluded from the analysis (8 data points, which is 0.5% of the data). The distribution of subjective and objective continuations across conditions is presented in Table 8 and Fig. 3. In general, the participants inserted more subjective than objective continuations (837 vs. 755 continuations, respectively). Across discourse types, *tak chto* triggered more subjective than objective continuations (61%), and *poetomu* triggered more objective than subjective continuations (56%).

To perform the statistical analysis, we built a generalized linear mixed-effect model with the relation type of the continuation as a binary dependent variable using *lme4* package (Bates et al., 2015b; version 1.1.26) in the R software (R Core Team, 2020). The model included an interaction of connective and discourse type, both coded using scaled sum contrasts (−0.5, 0.5). Maximal random effect structure was gradually reduced to achieve convergence following the procedure described in Bates et al. (2015a). The results of the model are presented in Table 9.

There were significant main effects of connective ($z = 4.27$, $p < 0.001$) and discourse type ($z = 2.58$, $p = 0.01$) on the subjectivity of continuations, meaning that the odds of *tak chto* triggering subjective continuations were higher compared to *poetomu* and the odds of spoken extracts triggering subjective continuations were higher compared to newspaper extracts. The interaction between connective and discourse type was non-significant ($z = -0.88$, $p = 0.38$), suggesting that the difference between expectations triggered by the two causal connectives was similar in spoken and newspaper stories. In general, the analysis showed that more subjective continuations were inserted after *tak chto* than after *poetomu* and more subjective continuations were inserted in spoken extracts than in newspaper extracts.

4.5. Discussion

The results of Study 3 revealed no interaction between connective and discourse type suggesting that *tak chto* triggered significantly more subjective continuations than *poetomu* across newspaper and spoken discourse types. Instead, two main effects of connective and discourse type were found, which means that both connective specialization and higher-order discourse characteristics have an independent effect on the speakers' expectations about the subjectivity of the upcoming content. Converging with the findings regarding the specialization profiles of the two Russian connectives reported in Studies 1 and 2, Study 3 showed that *tak chto* evoked more subjective expectations than *poetomu*. At the same time, subjective relations were also provided more frequently in spoken discourse than in newspaper dis-

[2] All the spoken items were recorded individually "in one go", including the connective, to ensure that they sounded as natural as possible. Although there is some evidence that prosody may play a role in signalling subjectivity in case of causal connectives (Couper-Kuhlen, 1996; Hu et al., 2019), the specific prosodic features responsible for this distinction differ largely across the studies. For this reason, we did not control for the role of prosody in our experiment. We will return to this point in the discussion.

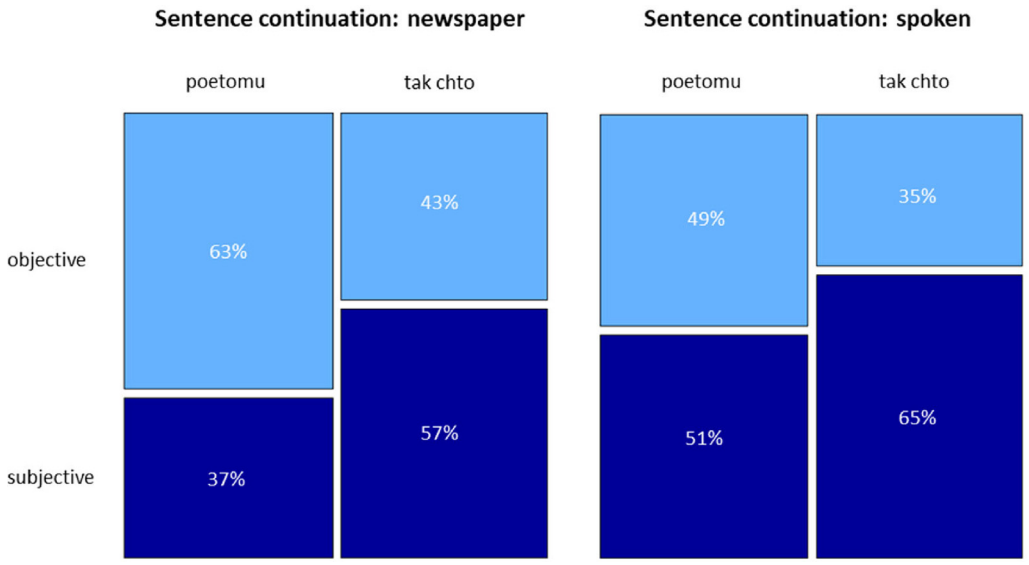

Fig. 3. The percentage of subjective and objective continuations for each connective across discourse types.

Table 9
The results of the online sentence continuation experiment.

Fixed effects	**Estimate**	**SE**	**z-value**	**p-value**
Intercept	0.14	0.12	1.17	0.24
Poetomu vs. *tak chto*	0.93	0.22	4.27	<0.001
Newspaper vs. spoken	0.58	0.22	2.58	0.01
Connective : discourse type	−0.39	0.44	−0.88	0.38
Random effects	**Variance**	**SD**		
Items (intercept)	1.03	1.01		
Items (discourse type)	1.15	1.07		
Subjects (intercept)	0.13	0.36		
Subjects (discourse type)	0.11	0.33		

Note. Formula: relation type ~ connective*discourse type + (1 + discourse type| item) + (1 + discourse type| subject). *SE* – standard error; *SD* – standard deviation.

course (58% vs. 47% of subjective relations, respectively). The prevalence of subjective continuations in the spoken items corroborates the hypothesis developed by Sanders and Spooren (2015) about the difference in salience of the Deictic Center of Communication between spoken and written discourse. While written discourse, such as newspaper articles, is rather detached from the Deictic Center of Communication (Sanders et al., 2009), spoken discourse with its direct availability of speaker and hearer can be considered more "subjectively grounded" (Sanders and Spooren, 2015: p. 65).

Although the difference between *tak chto* and *poetomu* in the percentage of subjective relations evoked turned out to be stable across discourse types, absolute figures for each connective reflect how discourse type impacts the effectiveness of each connective as a processing cue separately. In spoken discourse, with its expected abundance of subjective causal relations, *poetomu* becomes a less effective cue towards objectivity of the relation (only 49% of objective continuations) than in newspaper discourse (63% of objective continuations). In newspaper discourse, on the contrary, more objective relations are expected, and therefore, the expectations for subjectivity triggered by *tak chto* are attenuated (57% of subjective continuations evoked compared to 65% in spoken stories). Even though we did not control for prosody, the fact that there were no significant differences in the subjectivity profiles of the connectives between written (newspaper) and spoken items, suggests that the results for the spoken items are not likely to be explained by prosody.

The sentence continuation task provides some insights into discourse processing by evaluating sentence continuations that speakers create on the spot. However, this method does not allow for a direct investigation of online processing. The participants in this study were asked to write down their responses, which gave them additional opportunity to

process input, think over possible continuations, and edit their responses (Scholman et al., 2020). This means that Study 3 assessed offline preferences rather than online processing, whereas the effect of specialized connectives on the online reading times as measured by eye-tracking (Canestrelli et al., 2013; Li et al., 2017; Traxler et al., 1997a; Wei et al., 2021) could be more salient. Further research employing online processing paradigms, such as eye-tracking while reading, is needed to identify whether this is the case and whether the effects of immediate processing delay and facilitation of the expected type of relation observed for specialized connectives in other languages are also present in Russian. Future research using such paradigms could also shed light on the role of discourse type in online processing effects of connective specialization.

5. GENERAL DISCUSSION

Previous literature on subjectivity in causality shows that languages often employ specialized connectives to express subjective versus objective relations (Degand, 2001; Degand and Pander Maat, 2003; Li et al., 2013; Pander Maat and Sanders, 2000; Pit, 2007; Sanders and Spooren, 2015; Xiao et al., 2021a, 2021b). These specialized connectives serve as processing cues for the degree of subjectivity and, as such, facilitate the processing of the upcoming content (Canestrelli et al., 2013; Li et al., 2017; Traxler et al., 1997a, 1997b; Wei et al., 2019, 2021). Previous cross-linguistic research on this topic mainly employed corpus studies to investigate the subjectivity profiles of causal connectives. However, emerging experimental methodologies, such as the connective insertion task, can address the same research question (Santana et al., 2021; Scholman and Demberg, 2017; Xiao et al., 2021a; Yung et al., 2019). For several languages, there is also some work devoted to processing effects of the specialized connectives. Nevertheless, it remains unclear how the results of all these methods relate to each other and to what extent they converge on providing the same picture with respect to subjectivity profiles of causal connectives in a language. The present study set out to address this issue by testing a multi-method approach to investigation of subjectivity profiles of causal connectives in a language, which involved the traditional corpus analysis, the connective insertion task and the sentence continuation task. The sentence continuation experiment also helped to tap into processing effects of specialized connectives by looking at how causal connectives trigger different expectations with respect to subjectivity of the upcoming content. Testing the multi-method approach on Russian causal connectives, which have not yet been studied in this respect, provided a valuable contribution to the cross-linguistic research on subjectivity in causality.

5.1. Comparison of different methods

The three methodologies used in the present study, i.e., the traditional corpus analysis, the online connective insertion task and the online sentence continuation task, provide converging evidence that the Russian causal connectives *poetomu* and *tak chto* differ with respect to the degree of subjectivity they encode. More specifically, *tak chto* is used in subjective relations more than *poetomu* and evokes more subjective expectations than *poetomu*. Thus, all three methods show that Russian connectives do have different subjectivity profiles, where one is preferred in subjective relations more than another. This is an important conclusion that means that all the methods employed are valid methods of identifying whether certain connectives in a language are specialized in terms of subjectivity.

However, the results of the three methods also differ in the strength of the observed specialization of connectives. Fig. 4 below reflects these differences by combining the results of the three methods. The results of the corpus analysis and the sentence continuation task are split across discourse types.

As Fig. 4 shows, the connective insertion task resulted in the strongest specialization profiles of Russian causal connectives in terms of subjectivity. This clear result could be explained by the nature of the task. Firstly, this task takes clear prototypical subjective and objective cases as stimuli for connective insertions. In contrast, the examples of causal relations in the corpora and the relations built in the sentence continuation task do not represent pure subjective versus objective cases, since they reflect actual language use, where many other linguistic and situational factors are at stake (Graesser et al., 1997; Zwaan et al., 1995; Zwaan and Rapp, 2006).

Secondly, the connective insertion task requires participants to make a forced choice between the two causal connectives for a given causal relation. This procedure allows for little freedom of expression on the participants' part compared to the sentence continuation task, where participants can create continuations based on their interpretation of the context, their world knowledge or other factors that are not related to the given connective. Similarly, corpus examples consist of relations created by language users who are not restricted in their choice of linguistic expressions at all compared to the participants of the connective insertion experiment. Thus, little freedom of expression imposed by the forced binary choice task in combination with the use of prototypical clear cases of relation types as stimuli resulted in relatively large preferences for each connective to express its corresponding type of relation in terms of subjectivity.

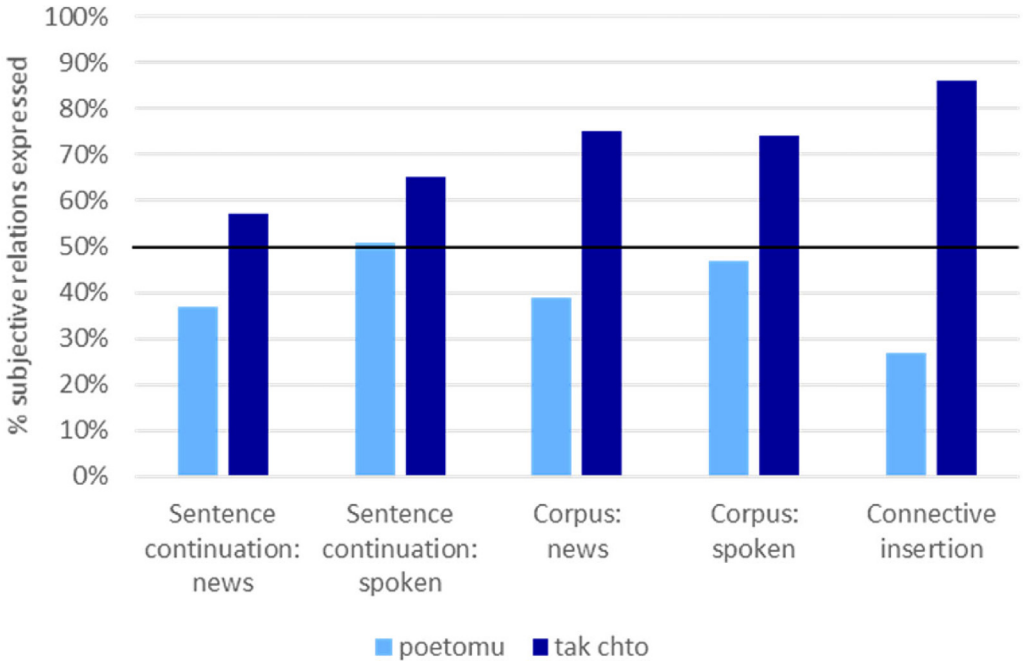

Fig. 4. Specialization of Russian causal connectives across the three methods.

At the same time, both in the corpus and in the sentence continuation task, the specialization of Russian causal connectives turned out to be less pronounced. This is again due to the fact that the relations in these two methods are examples of real-life language use and are not restricted to the most prototypical clear cases. In fact, the prototypical structure of causal categories suggests that there should be some examples of the use of specialized connectives that do not coincide with their category (Stukker and Sanders, 2012). In general, an important difference between the connective insertion task on the one hand, and the corpus analysis and the sentence continuation task on the other hand, is the approach used to investigate connective specialization. The connective insertion task looks into which causal connectives are used in each type of relation, whereas the corpus analysis and the sentence continuation task examine which types of causal relations are typically expressed by each connective. The approach that elicits connective choices for predefined prototypical subjective/objective relations gives much clearer specialization profiles (Fig. 4) for the reasons discussed in the previous paragraph.

The approach in which types of relations are identified for each connective gives a less clear picture, because it is influenced by other factors that are not related to the distinction between subjective and objective connectives. In the sentence continuation task in particular, participants could have based their expectations for the subjectivity of the upcoming relation not only on the given causal connective, but also on the previous context of the story, on their world knowledge, or on higher-order discourse characteristics such as discourse type (Zufferey et al., 2018; Graesser et al., 1997; Zwaan et al., 1995; Zwaan and Rapp, 2006). In fact, the results of the sentence continuation task confirm statistically that discourse type was one of the factors that affected processing expectations. In speech, the information is always presented by the speaker SoC and directly connected to the speaker (Sanders and Spooren, 2015), hence more subjective relations are expected and produced. Due to the relative prevalence of subjective relations in speech, the specialization of *poetomu* in spoken language is less pronounced (57% of objective relations in the spoken corpus) and hence its effectiveness as a cue is decreased (49% of objective relations in the sentence continuation task), as compared to the newspaper discourse. The less clear specialization of the Russian connectives in the outcome of the corpus analysis and the sentence continuation task should not be considered a methodological disadvantage. On the contrary, these two methods provide a distribution pattern that is closer to actual language use, which is influenced by many factors.

In general, an important conclusion of the present study is that no method can be considered the best for investigating the subjectivity of the causal connectives in a language. Different methods shed light on slightly different aspects of connective specialization in a language and have their own advantages and disadvantages. The connective insertion task is a method that allows for the clearest and the fastest estimation of subjectivity-related distinctions in the lexicon

of causal connectives (Santana et al., 2021). It is easily administered, allows for the collection of large datasets, and furthermore, the prototypical subjective and objective stimuli for this task can be easily translated and applied to other languages. Thus, a connective insertion experiment could be considered a good exploratory paradigm to study the subjectivity profiles of causal connectives for a language that has not been studied in this respect. However, one needs to keep in mind that the probable sharp contrasts in preferences between the connectives that will result from this task should be interpreted with caution since they are based on the most prototypical cases.

The corpus analysis and the sentence continuation task, in contrast to the connective insertion task, provide better insights into the influence of other discourse characteristics, such as discourse type, on the usage of causal connectives with respect to encoding subjectivity. Naturally, the subjectivity profiles resulting from these methods are less pronounced. The sentence continuation task in particular appears to be the least sensitive measure for connective specialization. A possible reason for this is that, even though the participants of this task could not change the connective they were presented with, they could adjust their continuations to fit their expected relation type based on other contextual and textual factors, even if this relation type was incongruent with the profile of the given connective. Several excluded cases where participants started their continuation with another causal connective that was not given in the condition support this idea. In contrast, in the corpus and in the connective insertion task, using a certain connective was someone's "deliberate" choice, which partly reflects his or her categorization of the causal connectives in terms of subjectivity. Despite decreased sensitivity to the subjectivity profiles of the sentence continuation method, it can provide insight into processing instructions that are triggered by the causal connectives, which is an important phenomenon related to connective specialization. To sum up, there is a trade-off between proximity to the actual language use with its complex interplay of various factors and a quick evaluation of specialization of connectives on the dimension of subjectivity exclusively. Therefore, we would like to stress the importance of using several methods for investigating the subjectivity profiles of causal connectives comprehensively, especially when these have been understudied in a language.

5.2. Correction for the imbalance between relation types

An important issue that is relevant to the discussion of methodological differences is the issue of imbalance between subjective and objective relation types across discourse types. In the corpus study (Study 1), there were more subjective than objective relations among the corpus examples in general, and this prevalence of subjective relations was relatively larger in the spoken than in the newspaper discourse. A similar overall relative prevalence of subjective over objective relations was observed in previous corpus research on Spanish (Santana et al., 2018). In the sentence continuation task of the present paper, more subjective than objective relations were inserted in the spoken stories, but more objective than subjective relations were inserted in the newspaper extracts. In other words, when the number of relation types is not controlled for, as in the corpus analysis or in the sentence continuation experiment, there may be an imbalance between the different types of causal relations, which can be caused by specific properties of the example selection, by discourse type or by other possible factors. This imbalance would lead to an overestimation of the bias for the connective specializing in the overrepresented relation, and an underestimation of the bias for the connective specializing in the underrepresented relation. For example, in a corpus where subjective casual relations happen to be encountered more often than objective relations, the specialization of a subjective connective on subjective causal relations would be overestimated due to the prevalence of subjective causal relations in the corpus in general. On the other hand, the specialization of an objective connective on objective causal relations in such a corpus would be underestimated due to the smaller proportion of objective relations in general. In an attempt to estimate how exactly the relation type imbalance influences the subjectivity profiles of our causal connectives in the corpus and the sentence continuation task, we corrected the absolute frequencies in the following way. The absolute frequencies of occurrence of each connective expressing a specific relation type in a given discourse type were divided by the number of occurrences of this relation type in this type of discourse. Fig. 5 presents the outcome of the two methods if such correction is applied.

The comparison between Figs. 4 and 5 reveals an interesting pattern: corrected figures are somewhat closer to the clearest specialization pattern observed in the connective insertion task. This is not surprising, since the correction eliminates the influence of the relation type bias across discourse types. More specifically, correction for the relative prevalence of subjective relations, which is the case in both spoken and newspaper corpora as well as in spoken stories in the sentence continuation task, results in a more specialized picture for *poetomu* and a less specialized picture for *tak chto*. In fact, the specialization of both connectives becomes comparable: for instance, in the corrected spoken corpus results (Fig. 5), the preference of *poetomu* for expressing objective relations is 63% and the preference of *tak chto* for subjective relations is 65%, while in the spoken corpus without correction the figures are 53% and 74%, respectively (Fig. 4). Indeed, if more subjective relations are expected and produced in spoken discourse, the fact that *poetomu* still prefers to be used in a considerable number of objective cases renders this connective intuitively more specialized, while for *tak*

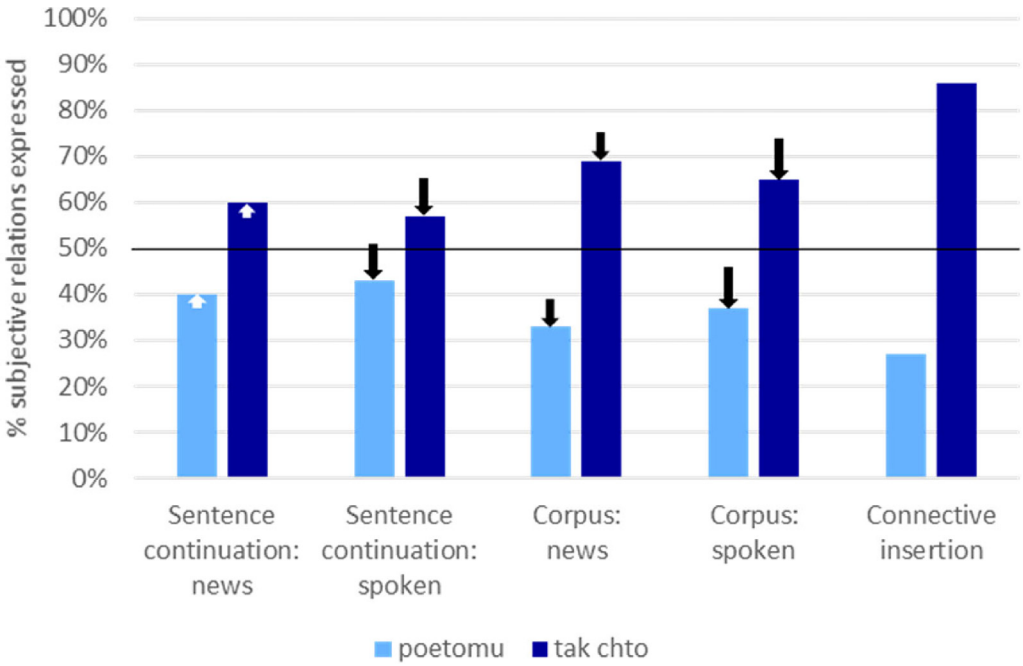

Fig. 5. Specialization of Russian connectives based on frequencies corrected for the number of subjective/objective relations per discourse type. *Note.* The arrows indicate the change with respect to the absolute figures (see Fig. 4).

chto (which already prefers the dominant type of relation), the logic is reversed. In contrast, when objective relations are more common, like in the newspaper stories in the sentence continuation task, the informativeness of *tak chto* as a connective signaling subjectivity is enhanced, whereas the effectiveness of *poetomu* should be decreased, since it triggers expectations about an already preferred relation type. To sum up, although absolute frequencies shed light on the natural usage profiles of causal connectives, the specialization in subjectivity as such is better reflected when the relation type bias is controlled for.

5.3. Subjectivity in Russian causal connectives

The findings of the present study demonstrate that the Russian causality lexicon includes at least two connectives, *poetomu* and *tak chto*, that are specialized in terms of subjectivity. The specialization is also reflected in processing expectations, as Study 3 suggests. At the same time, Study 3′s results indicate that people's expectations for the subjectivity of causal relations are also influenced by discourse type: more subjective relations are expected in spoken conversations, while more objective relations are expected in newspaper discourse. This affects the subjectivity profiles of the connectives in such a way that *tak chto* becomes a less efficient cue for subjectivity in newspaper discourse (57% of subjective continuations), and *poetomu* turns out to be non-specialized and thus not a good cue for objectivity in spoken discourse (49% of objective continuations).

The findings of the sentence continuation task performed in Study 3 deserve special attention. As discussed above, they showed the least specialized picture for both Russian connectives in comparison to the corpus analysis and the connective insertion task. One possible reason for such an outcome is connected to the phenomenon of subjective construal (Verhagen, 2007): one and the same relation can be categorized as subjective or objective by different speakers based on their particular interpretation of the situation or their communicative purposes. The possibility of subjective construal leads to an abundance of relations that are not prototypical and not easy to categorize among the responses of participants of the sentence continuation task, which inevitably affects the results. A closer look at the participants' responses corroborates this reasoning. For instance, there was a considerable number of responses with *nuzhno* 'need', which is a modal predicate roughly meaning one of the two things: 1) either 'have to', indicating external pressure of the circumstances, and as such, conveying more objective meaning, 2) or 'should', expressing the speaker's subjective point of view or advice. An example of a story with a continuation using *nuzhno* is presented in (5).

(5) *Poslushaj, ne bespokojsya, ya mogu tebe pomoch' ustroit'sya k nam. YA obyazatel'no pogovoryu s nashim menedzherom naschet tebya, kak tol'ko poyavitsya vozmozhnost'. Sejchas takoj vozmozhnosti net,* ***poetomu tebe nuzhno nemnogo podozhdat'.***

'Listen, don't worry, I can help you to get into our company. I will definitely talk to our manager about you as soon as there is a possibility. Now this is not possible, **poetomu you need to wait.**'

The continuation in (6) can either be interpreted as "you have to wait", which leads to objective relation, or as "you should wait/I advise you to wait", which leads to subjective relation. It is unclear which of the relations the respondent intended to produce and therefore, categorization of this relation into one or another type by the annotator may not coincide with the respondent's interpretation. The problem of ambiguity between different causal relation types in sentence continuations was also reported by Andersson and Spenader (2014) in their sentence continuation experiment.

The participants of the sentence continuation task could also use various compensation strategies to compromise between the given connective on the one hand, and the type of relation they would like to construe based on the story on the other hand. For instance, in example (6), the respondent could have intentionally used an explicit speech act (*I am asking you to care*) instead of an implicit speech act (*please, care*) in order to adjust to the objectivity of *poetomu* but at the same time preserve the subjective relation that he or she wanted to insert. Examples like (6) are in line with the theory of prototypical structure of causal relations (Stukker and Sanders, 2012), according to which causal relations expressed by incongruent connectives in terms of subjectivity are non-prototypical instantiations of their relation type. In (6), the explicit speech act is a non-prototypical example of speech act relations and subjective relations in general, and therefore its co-occurrence with *poetomu* is not surprising.

(6) *Privet! YA zvonyu, chtoby poprosit' tebya pomoch' s nashimi cvetami, kak v proshlyj raz. My v sredu uezzhaem v otpusk na more na dve nedeli, a za cvetami pouhazhivat' nekomu. Im nuzhno postoyannoe vnimanie,* ***poetomu proshu tebya uhazhivat' za cvetami poka my budem v ot"ezde.***

'Hi! I'm calling to ask you to help us with our flowers like last time. We are leaving on Wednesday for vacation at the seaside for two weeks, and there is no one to look after the flowers. They need constant attention, **poetomu I am asking you to care for them while we are away.**'

Another important remark about the subjectivity of the Russian causal connectives is that the results of all three methods used in the present study reflect only the significance of the difference between the two connectives, which is preserved across methods and discourse types. However, if we consider specialization of each connective separately, without reference to the other connective, a different analysis should be performed. Namely, it needs to be tested whether the distribution of subjective and objective relations expressed by each connective is significantly different from chance distribution ($p = 0.5$). In order to test this, four binomial tests were conducted per connective per discourse type. The corpus data was used to perform these tests, since only these data satisfy the requirement for independent observations. According to the binomial tests, *tak chto* expressed significantly more subjective than objective relations in both spoken (74%, $p < 0.001$) and newspaper (75%, $p < 0.001$) discourse, and can therefore be considered clearly specialized on subjective relations. *Poetomu*, in its turn, was clearly specialized in expressing objectivity only in the newspaper corpus (61%, $p = 0.04$), whereas in the spoken corpus, the distribution between objective and subjective relations expressed by *poetomu* was not significantly different from chance (53%, $p = 0.62$).

Thus, the situation with *poetomu* and *tak chto* in Russian rather resembles the general pattern observed by Stukker and Sanders (2012) for languages like Dutch, French and German: while subjective connectives seem to have a robust preference for expressing subjective relations across discourse types, objective connectives show less consistent profiles that vary across discourse types and studies (Degand and Pander Maat, 2003; Pit, 2003; Stukker and Sanders, 2012; Zufferey, 2012). Russian connective *poetomu* fits in this pattern: the corpus analysis and the sentence continuation task show that in spoken discourse, this connective does not have a strong preference for expressing objective relations as compared to newspaper discourse. In general, diachronic studies suggest that causal connectives are prone to subjectification (Traugott, 1995), which means that the tendency of objective connectives to become more subjective, especially in inherently subjective discourse types such as spontaneous spoken conversations, is in line with the common language development pattern.

As for processing, although the results of the present study cannot be compared directly to the eye-tracking studies conducted for other languages in the previous literature, they do indicate that *poetomu* and *tak chto* provide different processing instructions with respect to subjectivity. This can be considered in line with the processing research on Dutch

and Mandarin that shows how the difference in processing instructions of the specialized connectives is reflected in online reading times and in looks at the Subject of Consciousness (Canestrelli et al., 2013; Li et al., 2017; Wei et al., 2019, 2021).

To conclude, the results for Russian obtained in the present study contribute to the body of literature corroborating the importance of cognitive categorization into subjective and objective relations in the domain of causality. It should be noted that categorization into subjective and objective relations, just like any other cognitive categorization, is not a black-and-white distinction, but rather a matter of degree. Both subjective and objective categories have prototype structure (Rosch, 1973), which means that specialized subjective and objective connectives can sometimes mark relations of another category (Stukker and Sanders, 2012). As explained in Stukker and Sanders (2012), these non-prototypical uses are often ambiguous for the type of relation and can be interpreted as "fuzzy edges" of the same category. The prototype structure of causal categories and the existence of "fuzzy edges" can be considered one of the reasons why the subjectivity profiles of Russian connectives in our study slightly differ across methods, and why subjectivity profiles of connectives in other languages, e.g., Dutch, differ across studies using the same corpus method (Sanders and Spooren, 2015; Degand and Pander Maat, 2003). Moreover, future research into connective usage patterns can inform us whether other, not subjectivity-related, categorizations in the domain of causality coexist with the distinction between subjective and objective causal relations.

6. CONCLUSION

The present study looked at the subjectivity profiles of Russian forward causal connectives across discourse types and methods. More specifically, this study aimed to investigate whether different methods provide converging evidence on the subjectivity profiles of causal connectives in a language. To address this issue, a multi-method approach combining the traditional corpus analysis, the connective insertion task and the sentence continuation task has been applied to identify the subjectivity profiles of two Russian forward causal connectives across discourse types. The results of the three methods provided converging evidence suggesting that the Russian lexicon of causal coherence markers contains connectives systematically varying in the degree of subjectivity. Further research is needed to give a broader overview of subjectivity-related distinctions in the Russian causality lexicon, both in terms of usage preferences and in terms of processing instructions. The evidence from Russian provided by the present study contributes to the field of cross-linguistic research on subjectivity in causality. More importantly, the discussion of the differences between the results obtained with different methods can serve as guidance for future research in the field. The results highlight the importance of using various methods to research the phenomenon of subjectivity reflected in discourse coherence markers.

Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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