

Article

Aspectual Restriction on Sorting in Czech and Slovak

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Abstract: This article is about the cross-linguistic universality of the so-called Universal Sorter, where a noun N means ‘kind of N’. We discuss two restrictions in two Slavic languages which are absent from English, pertaining to perfective verbs and numerically modified count nouns. We establish, first with introspective judgments (for Czech) and then experimentally (for Slovak), that both restrictions are present in a way which supports our analysis of the first restriction as stemming from Slavic, unlike English, having perfective verbs which force a completive reading of an incremental theme.

Keywords: reference to kinds; reference to subkinds; universal sorter; aspect; perfectivity; incremental themes; Slavic

1. Introduction

This article is about the cross-linguistic universality of the so-called Universal Sorter, where a noun N means ‘kind of N’ (Bunt, 1985). We focus on a restriction in Slavic which is absent from English, discovered by Grimm and Dočekal (2021), where *two oils* can mean ‘two kinds of oil’ in (1-a), but the Czech *dva oleje*, ‘two oils’, cannot mean that in (1-b).¹

- (1) a. I used two oils in this salad. (Grimm & Dočekal, 2021)
b. #V salátu jsem použil dva oleje.
to salad AUX.1SG use.PFV-SUFF-MASC.SG.PTCP two oils
Intended: ‘I used two oils (kinds of oil) in this salad.’²

Grimm and Dočekal (2021) identify the restriction in (1-b) as stemming from mass nouns like *olej* ‘oil’ lacking access to the ‘kind of’ reading in episodic contexts.³ This raises the question of why mass nouns in English, like *oil* in (1-a), lack the same restriction.

We circumvent this question by identifying the restriction in (1-b) as aspectual, stemming from incompatibility between (i) the completive reading of the direct object forced by the perfectivity of *použil*, ‘use.PFV’, and (ii) using kinds of oil in a salad. This implies that sorting is felicitous in (1-a) because the English *use* is not perfective in the same way as the Czech *použil*, ‘use.PFV’. Section 2 presents this aspectual analysis, Section 3 experimentally establishes that the aspectual restriction is present in Slovak, and Section 4 is the discussion and the conclusion.

2. Aspectual Restriction on Sorting in Czech

When Jespersen (1914) introduced the distinction between count and mass nouns in English, he noted that certain mass nouns can be modified by count elements under the



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reading ‘kind of’, e.g., *teas*, ‘kinds of tea’. Following the terminology of Bunt (1985), *tea* can undergo the Universal Sorter. This reading is prominently discussed in relation to mass nouns, but it is also available to count nouns, e.g., *this whale* can mean ‘this kind of whale’ (Carlson, 1980; Krifka et al., 1995).

Despite *Universal* being part of the term, Bunt (1985) leaves open the possibility that the Universal Sorter is not applicable to all nouns: “almost any [emphasis added] ‘mass noun’ can be used as a count noun with the reading ‘kind of ...’” (p. 10). Candidates for unsortable nouns in English include *equipment* and *furniture*, which are uncountable altogether (Allan, 1980; Bale & Barner, 2009), including under the sorted reading (Cowper & Hall, 2012; De Belder, 2013; Erbach & Schoenfeld, 2022; Grimm & Levin, 2017; Rothstein, 2017; Sutton & Filip, 2018).

This article contributes to growing research about the cross-linguistic universality of the Universal Sorter. We specifically contribute to the observation that the Sorter is more restricted in Slavic compared to in English (Borik & Espinal, 2020; Despić, 2019; Grimm & Dočekal, 2021; Schoenfeld, 2024). We focus on the pattern discovered by Grimm and Dočekal (2021), exemplified in (2): *two oils* can mean ‘two kinds of oil’ in both English glosses, but the Czech *dva oleje*, ‘two oils’, can only mean that in (2-a). In the analysis of (Grimm and Dočekal, 2021), a mass noun like *olej*, ‘oil’, requires an appropriate context to shift to count via the Sorter, which is provided by the non-episodic (2-a), but not by the episodic (2-b) (the episodic and non-episodic interpretations correspond with an aspectual difference between an imperfective and perfective verb, respectively). In short, mass nouns cannot shift to count nouns via the Sorter in episodic contexts.

- (2) a. Tahle restaurace použ-í-vá v tomhle salátu dva oleje už celé roky.
 this restaurant use-SUFF-IPFV in this salad two oils already whole years
 ‘This restaurant used two oils (kinds of oil) in this salad for years.’
- b. #V tomhle salátu jsi včera použ-i-l dva oleje.
 in this salad AUX.2SG yesterday use.PFV-SUFF-PTCP two oils
 ‘In this salad, you used two oils (kinds of oil) yesterday.’

Sorting being more restricted in Czech (2-b) compared to in English does not mean that the Universal Sorter has different semantics in each language. Instead, the contrast could stem from how a uniform Sorter interacts differently with a typological difference.⁴ For example, Despić (2019) observes that sorting is more restricted in languages without definite articles, in that covert definites cannot refer anaphorically to subkinds to the same extent as overt definites. This is analyzed by Schoenfeld (2024) as the Sorter being uniform in both sorts of languages, while interacting differently with the absence vs. the presence of a definite article.

The account of (2) by Grimm and Dočekal (2021) allows one to maintain that the Sorter is uniform between Czech and English, but it comes at the cost of an ad hoc difference between mass nouns, where *olej*, ‘oil’, is more restricted in shifting to being countable than *oil*. The first goal of this article is to maintain a uniform Sorter in a less costly manner. To that end, Section 2.1 gives an improved account of the cross-linguistic contrast, which appeals to the perfectivity of the Czech *použil*, ‘use.PFV’, forcing a completive reading of its incremental theme, in a way which does not apply to the English *use*. We thus identify the restriction as aspectual. Section 2.2 gives an alternative account to that of Grimm and Dočekal (2021) of the restriction being limited to covert sorting, and Sections 2.3 and 2.4 detail correct predictions of our analysis over that of Grimm and Dočekal (2021), respectively, from sorted mass and count nouns.

2.1. Contrast Between Czech and English

To improve upon the ad hoc appeal of Grimm and Dočekal (2021) to a difference between mass nouns in Czech vs. English, we appeal to a major difference between Slavic and Germanic more broadly, where the former but not the latter has aspectual pairs of verbs. We specifically posit that the restriction in (2-b) stems from the Czech *použil*, ‘use.PFV’, being perfective in a way which does not apply to the English *use*.⁵ An initial indication that this is on the right track is that both languages are aligned in (2-a), where Czech has the imperfective *používá*, ‘use.IPFV’. In the terms of Slavic aspectology, the contrast in (2) corresponds with the aspectual pair of *používá*, ‘use.IPFV’, and *použil*, ‘use.PFV’, which are morphologically linked via the imperfectivizing suffix *-vá*.

As for why perfectivity restricts sorting in (2-b), we build on the observation that perfectivity restricts the interpretation of direct objects which are incrementally affected by the action, known as incremental themes (Dowty, 1991). Consider *dvě cibule*, ‘two onions’, in (3): (3-a) with *používá*, ‘use.IPFV’, is compatible with two onions not being fully used (e.g., half a red onion and half a white onion), whereas (3-b) with *použil*, ‘use.PFV’, entails that two onions were fully used (cf. Filip, 2005, ex.3).

- (3) a. V tom guláši jsem použ-í-val dvě cibule.
in the goulash AUX.I use-SUFF-IPFV.PTCP two onions
‘I {used, was using} two onions in the goulash.’
- b. V tom guláši jsem použ-i-l dvě cibule.
in the goulash AUX.I use.PFV-SUFF-PTCP two onions
‘I used (up) two (whole) onions in the goulash.’⁶

Following how a completive reading of the direct object is forced in (3-b), we posit that the restricted sorting in (2-b) stems from incompatibility between completion and using kinds of oil in a salad. Specifically, it is impossible to completely use up a kind of oil by using oil in a salad. Even in the unlikely scenario of using up the entire global amount of a kind of oil, the kind continues to exist in the sense that more of it can be produced later. Or, if the kind becomes extinct, it continues to exist in the collective memory of humanity. Indeed, (2-b) is not improved in these unlikely scenarios. They also do not improve *complete* in *I used two (#complete) oils in the salad* (cf. De Belder, 2011), which in our analysis is infelicitous for the same reason as in Czech (2-b).

By appealing specifically to the completive reading of the incremental theme, we correctly predict Czech and English to be aligned with non-incremental themes, even when the Czech verb is perfective. For example, *prostudoval*, ‘study.PFV’, does not force a completive reading of the instance-level non-incremental theme in (4-a) (an ore sample is not incrementally affected by being studied). This correctly predicts the sorted direct object in (4-b) to be felicitous.

- (4) a. Prostudova-l jsem dva vzorky rudy, ale ne-prostudova-l jsem
study.PFV-PTCP AUX.I two samples ore but NEG-STUDY.PFV-PTCP AUX.I
je {zcela , úplně }.
them {thoroughly , wholly }
‘I studied two ore samples, but I didn’t study them {thoroughly, wholly}.’
- b. Prostudova-l jsem dvě rudy, ale ne-prostudova-l jsem je
study.PFV-PTCP AUX.I two ores but NEG-STUDY.PFV-PTCP AUX.I them
{zcela , úplně }.
{thoroughly , wholly }
‘I studied two ores (kinds of ore), but I didn’t study them {thoroughly, wholly}.’

We next explain why we identify the restriction in Czech as stemming from perfectivity rather than eventuality type, which is a possibility raised by a reviewer. Given that we want to derive the contrast between Czech and English, the question is as follows: between perfectivity and eventuality type, what is responsible for the Czech *použil*, ‘use.PFV’, unlike the English *use*, forcing a completive reading of its incremental theme? The eventuality type is questionable, because both verbs are alike in being compatible with states (*I used to use a wheelchair*), activities (*I used the computer*), and accomplishments (*I used all of the battery in two hours*). This leaves perfectivity as the culprit, by process of elimination. This is in line with the formalization of Filip (2005), where the completive reading of an incremental theme comes from the contribution of perfectivity.

In sum, the interaction between perfectivity, the eventuality type and sorting is as follows. First, perfectivity forces a completive reading of an incremental theme. Consequently, the eventuality type is an accomplishment, and sorting will be restricted in cases where well-established kinds are incompatible with completion. See Section 2.2 for why we specify *well-established*, and Section 4 for a case where well-established kinds are compatible with the completion forced by a perfective verb.⁷

In conclusion, our appeal to perfectivity maintains a uniform Sorter between Czech and English in a less costly manner than in Grimm and Dočekal (2021). Instead of appealing to an ad hoc difference between mass nouns, we appeal to a well-established difference between Slavic and Germanic more broadly. The next subsection refines our analysis by extending the coverage to overt sorting.⁸

2.2. Overt Sorting

The previous subsection accounted for the restricted sorting in (2-b) by positing that completion is incompatible with using kinds of oil in a salad. If our analysis ended here, then we would predict that the direct object of *použil*, ‘use.PFV’, can never denote kinds of oil. This, however, is incorrect, because the intended reading of (2-b) is expressible by two means in Czech, either with the so-called taxonomic numeral *dvoji*, ‘two kinds’, in (5-a) (Grimm & Dočekal, 2021), or with *druhy*, ‘kinds’, in (5-b). Thus, it is specifically the covert Sorter which exhibits the restriction in (2-b).

- (5) V tomhle salátu jsi včera použil
 in this salad AUX.2SG yesterday use.PFV-SUFF-PTCP
 ‘In this salad, you used yesterday...’
- a. dv-ojí oleje.
 two-OJI oils
 ... two kinds of oil.’
 - b. dva druhy olej.
 two kinds oil
 ... two kinds of oil.’

Grimm and Dočekal (2021) suggest a straightforward account of the felicity of (5): the mass noun *olej*, ‘oil’, does not shift to being countable on its own; instead, the shift is carried out by *dvoji*, ‘two kinds’, (5-a) or *druhy*, ‘kinds’ (5-b). This explanation, however, is not available to our analysis, which denies the relevance of mass nouns shifting to count nouns.

Fortunately, there is an independent difference between overt and covert sorting which accounts for the felicity of (5). Specifically, the output of the covert Sorter is restricted to well-established kinds, defined by Krifka (1987) as kinds which are well established in the shared knowledge of the interlocutors (Krifka et al., 1995).⁹ This is exemplified in (6) with the sorted *wine*, which can describe the well-established kind denoted by *Claret*, but not the ad hoc kind denoted by *cheap wine*.

- (6) {Claret, #Cheap wine} is a common wine. (Pelletier & Schubert, 2003)

Crucially, the restriction on covert sorting in (6) is lifted with the overt *kind* in (7) (cf., Carlson, 1980, §6.2), which can describe both well-established and ad hoc kinds.

- (7) {Claret, Cheap wine} is a common kind of wine.

The preceding contrast between overt and covert sorting replicates in Czech. First, the covert sorting in (2-a), repeated below as (8), can describe well-established kinds of oil, but not ad hoc ones.

- (8) Tahle restaurace použ-í-vá v tomhle salátu dva oleje už celé roky:
this restaurant use-SUFF-IPFV in this salad two oils already whole years:
{olivový a slunečnicový, #levný a drahý }.
{olive and sunflower, cheap and expensive }.
'This restaurant has been using two oils (kinds of oil) in this salad for years: {olive and sunflower, #cheap and expensive}.'

As in English, the restriction on covert sorting in (8) is lifted with the overt *dvoji* and *dva druhy*, 'two kinds', in (9), which can describe both well-established and ad hoc kinds.

- (9) Tahle restaurace použ-í-vá v tomhle salátu {dv-ojí, dva druhy } oleje
this restaurant use-SUFF-IPFV in this salad {two-OJI, two kinds } oils
už celé roky: {olivový a slunečnicový, levný a drahý }.
already whole years: {olive and sunflower, cheap and expensive }.
'This restaurant has been using two oils (kinds of oil) in this salad for years: {olive and sunflower, cheap and expensive}.'

Following how *dvoji* and *dva druhy*, 'two kinds', in (9) can describe ad hoc kinds, we posit that the restriction on sorting is lifted in (5) because the direct objects denote ad hoc kinds, which can be completely used up by using oil in a salad. Specifically, these are kinds which are only instantiated by the amounts of oil used in the salad, so the kinds are indeed used up by their instantiations being used up. By contrast, (2-b) is infelicitous because *dva oleje*, 'two oils', can only denote well-established kinds, which are not used up by their instantiations being used up. In general, only well-established kinds are potentially incompatible with completion. (See Section 4 for the indication that they are sometimes compatible with completion.)

The rest of this section returns to covert sorting by detailing correct predictions of our analysis over that of Grimm and Dočekal (2021), beginning with sorted mass nouns.

2.3. Sorted Mass Nouns

This subsection compares the prediction of Grimm and Dočekal (2021) in (10-a) with our prediction in (10-b). We begin with a case where the predictions are aligned, followed by a divergence in our favor.

- (10) *Dva oleje* 'two oils' should be felicitous as a sorted direct object of *použil* 'use.PFV', if:
a. The proposition is non-episodic. (Grimm & Dočekal, 2021)
b. The direct object lacks a completive reading. (Section 2.1)

First, the two predictions in (10) are aligned in sorting being felicitous in (11), with the modal verb 'can'.

- (11) V tomhle salátu **můžeš** použ-í-t dva oleje.
 in this salad can.2SG use.SUFF-INF.PFV two oils
 ‘In this salad, you **can** use two oils (kinds of oil).’

Prediction (10-a) is borne out by (11) being non-episodic. Likewise, (10-b) is borne out by ‘can’ canceling the completive reading. This reading is entailed on its own, as shown by (12-a) being contradictory, but (12-b) shows that the entailment is canceled by ‘can’. To our knowledge, this is the first observation of a linguistic manipulation which cancels the completive reading of an incremental theme of a perfective verb in Slavic.

- (12) a. #V tom guláši jsem použ-i-l dvě cibule, ale
 in the goulash AUX.I use.PFV-SUFF-PTCP two onions but
 ne-použ-i-l jsem je celé.
 NEG-USE.PFV-SUFF-PTCP AUX.I them whole
 ‘I used two onions in the goulash, but I didn’t use them whole.’ *contradictory*
- b. V guláši **můžeš** použ-í-t dvě cibule, ale ne-můžeš je
 in goulash can.you use.PFV-SUFF-INF two onions but NEG-CAN them
 použ-í-t celé, protože by ta chuť byla pak moc cibulovitá.
 use.PFV-SUFF-INF whole because would the taste be then too oniony
 ‘You **can** use two onions in a stew, but you can’t use them whole because the
 taste would then be too oniony.’ *non-contradictory*

Unlike the two predictions being aligned in (12), they diverge in episodic propositions without a completive reading of the direct object. We next argue that the version of (13) with *zatím*, ‘so far’, expresses such a proposition.

- (13) Ten kuchař #(zatím) použ-i-l v tom salátu dva oleje: tři lžíce
 that cook so.far use.PFV-SUFF-PTCP in that salad two oils: three spoons
 olivového a čtyři lžíce slunečnicového.
 olive and 4 spoons sunflower
 ‘So far, that chef has used two oils in that salad: three tablespoons of olive and four
 tablespoons of sunflower.’

Both versions of (13) (with and without *zatím*, ‘so far’) are episodic, so (10-a) incorrectly predicts both to be infelicitous. By contrast, (10-b) correctly predicts *zatím*, ‘so far’, to license sorting, combined with (14) showing that *zatím*, ‘so far’, cancels the completive reading. This joins (12-b) in being another novel observation of the completive reading being canceled by a linguistic manipulation.

- (14) V tom guláši jsem **zatím** použ-i-l dvě cibule, ale
 in the goulash AUX.I so.far use.PFV-SUFF-PTCP two onions but
 ne-použ-i-l jsem je celé.
 NEG-USE.PFV-SUFF-PTCP AUX.I them whole
 ‘I used two onions in the goulash **so far**, but I didn’t use them whole.’ *non-contradictory*

In conclusion, (13) derives our second criticism of Grimm and Dočekal (2021). First, they imply an ad hoc difference between mass nouns in Czech vs. English (Section 2.1). Second, they do not predict *zatím*, ‘so far’, to license sorting in (13). The next subsection presents a third criticism, of sorted count nouns.

2.4. Sorted Count Nouns

As mentioned at the beginning of this section, the Universal Sorter is applicable not only to mass nouns in English, but also to count nouns. English and Czech are at least partially aligned in this regard, e.g., the Czech *dva medvědi*, ‘two bears’, can mean ‘two kinds of bears’ in (15), and so can *two bears* in the English gloss. See the upcoming (19) for why we write *at least partially*.

- (15) V naší Zoo chováme [pandy a lední medvědy]_i. Naše Zoo zkoumá [oba
In our Zoo keep.IPFV pandas and polar bears. Our Zoo studies.IPFV both
dva medvědy]_i rozšířené po celém světě.
two bears spread over all world.
‘We keep [pandas and polar bears]_i in our Zoo. Our Zoo studies [both two bears]_i
which are distributed worldwide.’

With (15) establishing that count nouns in Czech are, in principle, sortable, note a prediction derived from Grimm and Dočekal (2021): if the only restriction on sorting in (2-b), repeated below as (16), is that the mass noun *olej*, ‘oil’, cannot shift to being countable, then the restriction should be lifted from sorted count nouns, which are already countable to start with. For example, *tři šroubováky*, ‘three screwdrivers’, in (17) should be able to mean ‘three kinds of screwdrivers.’ Our introspective judgment, however, is to the contrary.

- (16) #V tomhle salátu jsi včera použ-i-l dva oleje.
in this salad AUX.2SG yesterday use.PFV-SUFF-PTCP two oils
‘In this salad, you used two oils (kinds of oil) yesterday.’
- (17) #Náš obchod včera vyprod-a-l tři šroubováky.
our shop yesterday sell.out.PFV-SUFF-PTCP three screwdrivers
‘Yesterday our shop sold out three screwdrivers (kinds of screwdrivers).’

As an aside, (16) and (17) have different verbs, *použil*, ‘used’, and *vyprodala*, ‘sold out’, respectively, in order to (unsuccessfully) facilitate the sorted reading in (17). The most prominent reading of *tři šroubováky*, ‘three screwdrivers’, is instance-level, so the kind-level *vyprodala*, ‘sold out’, gives a better chance for the sorted reading, albeit unsuccessfully here. This facilitation is also unsuccessful with *dva oleje*, ‘two oils’, in (18).¹⁰

- (18) #Naše benzinka včera vyprod-a-la dva oleje.
our gas.station yesterday sell.out.PFV-SUFF-PTCP two oils
‘Yesterday our gas station sold out two oils (kinds of oil).’

We next discuss two (compatible) reasons for sorting being restricted in (17). First, the aspectual restriction is at play, i.e., there is incompatibility between (i) the completion forced by the perfectivity of *vyprodala*, ‘sell out.PFV’, and (ii) selling out kinds of screwdrivers. Specifically, a (well-established) kind of screwdriver is typically not sold out globally by being sold out in a given shop. A parallel explanation holds for (18).

Another option is that (17) exhibits a non-aspectual restriction, related to *šroubovák*, ‘screwdriver’, being a count noun. There is reason to suspect that Czech has such a restriction. For example, (19) and (20) indicate that numerically-modified count nouns in Czech are more restricted in sorting than mass nouns, in a way which seems independent of the aspectual restriction, as there are no perfective verbs here.

- (19) #Dvě velryby jsou na pokraji vyhynutí.
two whales.NOM are at verge extinction
‘Two whales (kinds of whales) are on the verge of extinction.’
- (20) Dvě vína jsou téměř vyprodaná.
two wines are nearly sold.out

‘Two wines (kinds of wine) are almost sold out.’

As Borik and Espinal (2020) note for Russian data parallel to (19), English is less restricted in that *two whales* is sortable in the translation. This misalignment raises the question from the beginning of this section: does the Universal Sorter have different semantics across languages? This article maintains a negative answer in light of the aspectual restriction, and we leave the countability restriction to future research.

In the present article, the countability restriction suggests an opposite description to that of Grimm and Dočekal (2021): it is not mass nouns that are restricted in shifting to count via the Sorter, but count nouns. This further challenges the appeal of Grimm and Dočekal (2021) to mass nouns shifting to count nouns.

In conclusion, our introspective judgments, building on those of Borik and Espinal (2020) and Grimm and Dočekal (2021), suggest two restrictions on sorting in Czech which are absent from English: a restriction which we identify as aspectual, contrary to Grimm and Dočekal (2021) identifying it as countability-related, and a countability restriction which is the opposite of what Grimm and Dočekal (2021) describe. The rest of this article serves the dual purpose of (i) experimentally establishing the restrictions, and (ii) arguing in favor of our identification of the first restriction. We carry this out by advancing the research questions in (21) via the experiment presented in the next section.

- (21) a. Is there an aspectual restriction on sorting in Slavic?
- b. Is there a countability restriction on sorting in Slavic?

3. Experiment in Slovak

We conducted an acceptability judgment task experiment carried out in Slovak. Slovak is among the Slavic languages most closely related to Czech, and the languages share a high degree of mutual intelligibility. This is also true for their aspectual system and countability patterns, particularly in the domain of sorting. The judgments reported above for Czech replicate in Slovak (see footnote 1). The results of the Slovak experiment, reported below, correspond to the intuitions of Mojmír Dočekal, a native speaker of Czech. We thus believe that the results of the experiment with native Czech speakers would yield similar results to those reported below. Nevertheless, we plan to replicate the experiment with native Czech speakers in the future.

3.1. Methods

3.1.1. Participants

Participants were recruited both in-person and online. A total of 239 native Slovak speakers participated in the experiment. The experiment was run online using the *L-Rex* platform (Starschenko & Wierzba, 2024). In all, 211 participants passed the fillers of the experiment and were included in the analysis. The participants were not compensated for their participation. The design of the experiment was 3x2 factorial, composed of 18 items in six conditions.

3.1.2. Materials and Procedure

We showed the participants sentences preceded by a context like (22).

- (22) René pripravuje pre mestské noviny článok o lokálnych obchodoch. V
 René prepares for city newspaper article about local stores. In
 článku stojí:
 article stands:
 ‘René is preparing an article about local stores for the city newspaper. In the article
 it says:’ (context)

Following a context like (22), participants saw sentences of the forms in (23-a) and (23-b), which, respectively, are the forms of the PERFECTIVE and IMPERFECTIVE conditions. ENUMERATION stands for a list of three subkinds. We exemplify all of the conditions in an actual item in (24) below.

- (23) a. STORE včera vypred-a-l tri NOUN: ENUMERATION.
STORE yesterday sell.out.PFV-SUFF-PTCP three NOUN.PL: ENUMERATION
'The store sold out three NOUNS yesterday: ENUMERATION.'
- b. STORE už roky pred-á-va tri NOUN: ENUMERATION.
STORE already years sell-SUFF-IPFV three NOUN.PL: ENUMERATION
'The store has been selling three NOUNS for years: ENUMERATION.'

NOUN in (23) stands for a plural count, mass, or object mass noun (conditions COUNT, MASS, OMN: nouns like *skrútkovače*, 'screwdrivers'; *bavlny*, 'cottons'; and *hydiny*, 'poultry', respectively). Examples (24-a) and (24-b), respectively exemplify a COUNT and MASS item in the PERFECTIVE and IMPERFECTIVE conditions.

- (24) Vinotéka {včera vypred-a-la , už roky pred-á-va}
Wine.shop {yesterday sell.out.PFV-SUFF-PTCP , already years sell-SUFF-IPFV}
tri
three
'The wine shop {yesterday sold out, has been selling for years} three'
- a. vývrtky: elektrické, krídelkové a vreckové.
corkscrews: electric.PL, winged.PL and pocket.PL
'corkscrews: electric, winged and pocket.' COUNT
- b. vína: Pálavy, Veltlíny a Merloty.
wines: Pálava.PL, Veltlín.PL, and Merlot.PL
'wines: Pálavas, Veltlíns, and Merlots.' MASS

Note that the enumerations in all of the experimental items consisted of plural nouns, as in (24). For the COUNT condition, e.g., (24-a), this is meant to disambiguate in favor of the sorted reading. An enumeration consisting of singular nouns would have a non-sorted reading, e.g., the wine shop sold out the last three instance-level corkscrews.

Combining the preceding two factors, the experiment had a 3×2 factorial design with the factors of noun type (COUNT, MASS, OMN) and verb type (PERFECTIVE, IMPERFECTIVE). The experimental items appeared in all 6 conditions.¹¹

We asked the participants to rate the sentences on a scale from 1 to 5, with 1 being the lowest and 5 being the highest. We tested 18 experimental items and 18 filler items. Nine filler items were constructed to be rated as acceptable (upper part of the Likert scale), and nine as unacceptable (lower part of the Likert scale). Each participant saw all 18 items and 18 fillers, such that the experiment consisted of 36 items. The order of items was randomized for each participant.

The participants were asked to consent to the terms of the experiment and were informed that the results would be used for scientific purposes only. Before the main part of the questionnaire, participants filled out the practice part with three practice items. After passing the practice portion, the experimental part began.

3.1.3. Predictions

Recall from Section 2.4 the prediction derived from Grimm and Dočekal (2021): if the only restriction on sorting is that a mass noun cannot be sorted in an episodic sentence (here the PERFECTIVE condition), then the restriction should be lifted from count nouns, which are already countable to begin with. This predicts that the mean rating of PERFECTIVE will be lower than that of IMPERFECTIVE only in the MASS condition, as in Table 1.

Table 1. Prediction derived from Grimm and Dočekal (2021).

	MASS	COUNT
PERFECTIVE	–	+
IMPERFECTIVE	+	+

Unlike Table 1, we derive a different prediction from our introspective judgments regarding Czech (17) and (18), repeated below as (25) and (26), where a numerically modified count and mass noun are both infelicitious as direct objects of *vyprodala*, ‘sell out.PFV’. Following our hypothesis that the degradation stems from perfectivity, we predict that the mean ratings of the PERFECTIVE conditions will be lower than those of the IMPERFECTIVE conditions in both the COUNT and MASS conditions.

- (25) #Náš obchod včera vyprodal tři šroubováky.
 our shop yesterday sell.out.PFV-PTCP three screwdrivers
 ‘Yesterday our shop sold out three screwdrivers (kinds of screwdrivers).’
- (26) #Naše benzinka včera vyprodala dva oleje.
 our gas.station yesterday sell.out.PFV-PTCP two oils
 ‘Yesterday our gas station sold out two oils (kinds of oil).’

Furthermore, following our introspective judgments regarding Czech (19) and (20), repeated below as (27) and (28), we suspect that numerically modified count nouns have a non-aspectual restriction on sorting which is absent from mass nouns. We therefore predict that the mean ratings for the COUNT conditions will be lower than those of the mass conditions in both PERFECTIVE and IMPERFECTIVE conditions.

- (27) #Dvě velryby jsou na pokraji vyhynutí.
 two whales.NOM are at verge extinction
 ‘Two whales (kinds of whales) are on the verge of extinction.’
- (28) Dvě vína jsou téměř vyprodaná.
 two wines are nearly sold.out
 ‘Two wines (kinds of wine) are almost sold out.’

In conclusion, our combined predictions are in Table 2, which differs from Table 1 in the COUNT column: Grimm and Dočekal (2021) predict the restriction on sorting to be lifted with COUNT nouns, whereas we predict it to be present, especially in the PERFECTIVE condition, hence – – in the top right corner.

Table 2. Our predictions.

	MASS	COUNT
PERFECTIVE	–	– –
IMPERFECTIVE	+	–

3.2. Results

3.2.1. Descriptive Statistics

The results of the descriptive statistics are summarized in Tables 3 and 4 below. Table 3 reports the mean, median, and standard deviation for each condition. Table 4 shows the same, but the z-score was transformed to eliminate scale bias. For the reasons explained in footnote 11, we focus on the 2 × 2 conditions (COUNT, MASS, PERFECTIVE, IMPERFECTIVE) in the rest of the article.

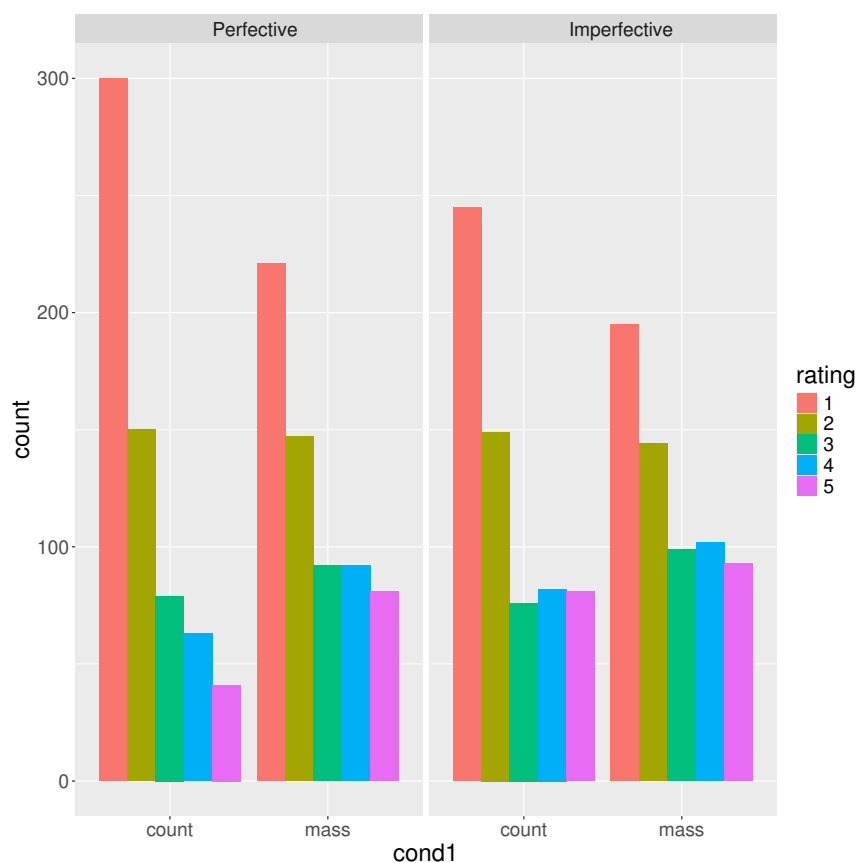
Table 3. Descriptive raw statistics.

Condition	Raw Mean	Raw Median	Raw SD
COUNT, PERFECTIVE	2.04	2	1.26
COUNT, IMPERFECTIVE	2.38	2	1.43
MASS, PERFECTIVE	2.47	2	1.42
MASS, IMPERFECTIVE	2.61	2	1.44

Figures 1 and 2 below visualize the results. Figure 1 shows the counts of each rating per condition. As can be seen, there is no bimodality in the distribution of ratings. Figure 2 shows the mean ratings per condition and standard errors of the mean.

Table 4. Descriptive z-score statistics.

Condition	Z-Score Mean	Z-Score Median	Z-Score SD
COUNT, PERFECTIVE	−0.23	−0.26	0.9
COUNT, IMPERFECTIVE	0.01	−0.26	1.02
MASS, PERFECTIVE	0.08	−0.26	1.01
MASS, IMPERFECTIVE	0.18	−0.26	1.02

**Figure 1.** Counts of each rating per condition.

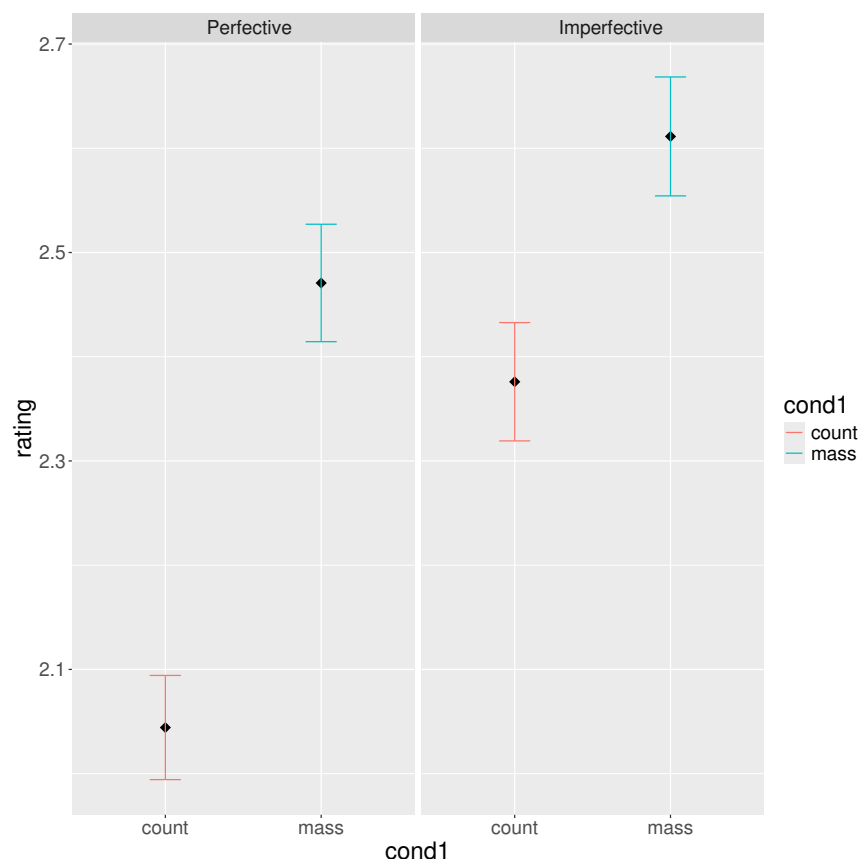


Figure 2. Mean ratings per condition and standard errors of the mean.

3.2.2. Inferential Statistics

The data were analyzed using a Bayesian mixed-effects regression model, using the *rstanarm* (Goodrich et al., 2024) and *bayestestR* (Makowski et al., 2019) packages in R (version 4.4.2) (R Core Team, 2024). The dependent variable was the rating of the sentence on a scale from 1 to 5. The fixed effects were two factors: noun type (the noun was count or mass—conditions COUNT, MASS), and verb type (the verb was PERFECTIVE or IMPERFECTIVE, along with adverbs supporting each interpretation). The model used the default R dummy-coding of fixed effects with interaction terms. The random effects structure included by-participant and by-item random intercepts and slopes (full random effects model). The model used RSTANARM default priors and was run in four chains with 2000 warm-up iterations and 2000 sampling iterations.

The results of the data analysis are visualized in Figure 3. In the model, the reference level of the noun type and the verb type were COUNT and PERFECTIVE, respectively. The reference level was accepted as less than the other conditions: the intercept (mean) of the model $\hat{\mu}$ is 2.05, with a 95% Credibility Interval (CrI) [1.87, 2.24]. The posterior for the model supports the main effect of noun type: MASS was accepted much better than the reference condition ($\hat{\beta} = 0.41$, CrI = [0.21, 0.62]). The Bayes factor for the MASS effect is 10.46, which means strong evidence for the effect.

Next, note that, generally, both IMPERFECTIVE conditions were accepted more than the PERFECTIVE conditions. The main effect of the verb type was $\hat{\beta} = 0.31$, CrI = [0.14, 0.49], with a Bayes factor of 3.66, indicating moderate evidence for the effect's existence. The interaction effects between MASS and IMPERFECTIVE were negative, ($\hat{\beta} = -0.14$, CrI = [-0.35, 0.06]), with a Bayes factor of 0.03. The interaction effects is, according to its Bayes factors, void of evidence for existence.

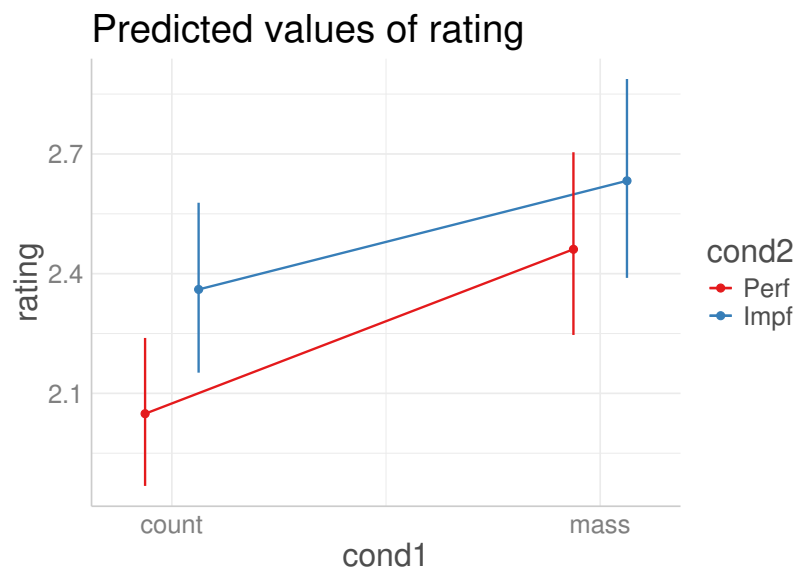


Figure 3. Posterior distributions of the main and interaction effects.

3.2.3. Discussion

We begin this subsection with speculation regarding why the mean ratings of the MASS conditions were not in the upper part of the Likert scale (2.61 for IMPERFECTIVE and 2.47 for PERFECTIVE). We speculate that this is because the enumerations of kinds consisted of plural mass nouns, as in (24-b), repeated below as (29).

- (29) Vinotéka {včera vypred-a-la , už roky pred-á-va }
 Wine.shop {yesterday sell.out.PFV-SUFF-PTCP , already years sell-SUFF-IPFV }
 tri vína: Pálavy, Veltlíny a Merloty.
 three wines: Pálava.PL, Veltlín.PL, and Merlot.PL
 ‘The wine shop {yesterday sold out, has been selling for years} three wines: Pálavas,
 Veltlíns, and Merlots.’

As background to why we think enumerations as in (29) degraded the MASS conditions, we appeal to (30), a general restriction on count properties.

- (30) If a count property is not naturally atomic, then it is contextually atomic.
 (Rothstein, 2010)

A naturally atomic property is one with a uniform way of determining its atoms across all contexts. For example, there is only one way to determine what counts as an atomic cat, as opposed to a plurality of cats. By contrast, a contextually atomic property has multiple legitimate ways of viewing its atoms. For example, fencing forming a square can be viewed as one square fence, or as consisting of four fences, each forming one side of the square. Under (30), the count noun *fence* is restricted to contextually atomic fences, which can be viewed as non-atomic in other contexts (Rothstein, 2010).

Although (30) has only been discussed in relation to instance-level nouns like *fence*, it seems like it should be relevant to sorted nouns. This is because kinds are not naturally atomic: just like every square fence can be viewed as consisting of four fences, every kind can be viewed as a superordinate to multiple subkinds. Consequently, every kind has contexts where it is atomic (where the subkinds are ignored), plus other contexts where it is non-atomic (where the subkinds are highlighted). Applied to the sorted *víno*, ‘wine’, (30) states that it is restricted to contextually atomic kinds of wine, which can be viewed as non-atomic in other contexts.¹²

Crucially, enumerating kinds with plural mass nouns as in (29) goes against the contextual atomicity restriction. A better way to contextualize the three subkinds as atomic would be to name them with singular nouns. By contrast, plural nouns present the subkinds as superordinate non-atoms, each consisting of multiple kinds of wine.

Recall from Section 3.1.2 that enumerations consisting of plural nouns were crucial for the COUNT conditions, to cancel an otherwise-available instance-level reading. We chose to use such enumerations for the MASS conditions for uniformity, but it may have come at the cost of these conditions being degraded due to violating (30), which is independent of the aspectual restriction.

Continuing to inferential statistics, the results of the analysis (visualized in Figure 3) can be interpreted as follows: count nouns as objects of perfective verbs are the least sortable, and imperfective verbs make them more sortable. These verbs also make mass nouns more sortable, but for this type of noun, the distinction between perfective and imperfective verbs is not as clear as for count nouns. Nevertheless, the interaction effect was negligible; therefore, we can conclude that imperfectivity makes sorting more acceptable in general (this can be also inspected with the naked eye in Figure 3—there is a tendency for interaction, but as the Bayes factor confirms, it is not credible).

This confirms our predictions from Section 3.1.3.¹³ The aspectual restriction on sorting is present in Slovak: both count and mass nouns are less sortable with perfective verbs. The countability restriction is also present: count nouns are less sortable than mass nouns. The theoretical implications of these results are discussed in the next section.

4. General Discussion and Conclusions

The results of our experiment can be summarized via the answers to the research questions in (21), repeated below as (31).

- (31) a. Is there an aspectual restriction on sorting in Slavic?
b. Is there a countability restriction on sorting in Slavic?

First, we observed that imperfective verbs are more favorable for sorting than perfective verbs (condition IMPERFECTIVE was more acceptable than PERFECTIVE). This is in line with there being an aspectual restriction on sorting in Czech and Slovak, thus indicating a positive answer to (31-a).

The aspectual restriction in Czech and Slovak is as follows: the perfective verbs *použil*, ‘use.PFV’, (Czech) and *vypredala*, ‘sold out.PFV’, (Slovak) force their direct object (an incremental theme) to have a completive reading, which is incompatible with well-established kinds denoted by sorted nouns. The question arises of whether this incompatibility is general, or specific to the preceding verbs. In terms of the types of verbs which take incremental themes, the preceding verbs most closely resemble so-called verbs of consumption (Jackendoff, 1996), whose leading example is *eat*. We next indicate that the preceding incompatibility does not extend to another type of verb which takes an incremental theme: verbs of creation, here *vyrobil*, ‘produce.PFV’ (Czech). As background, the contradiction in (32) shows that the non-sorted direct object has a completive reading, as is expected from an incremental theme of a perfective verb.

- (32) Petr vyrob-i-l dva stoly ale ne-dokonč-i-l je.
Peter produce.PFV-SUFF-PTCP two tables but NEG-finish-SUFF-PTCP them.
‘Peter produced two tables, but he didn’t finish them.’ contradiction

If a sorted direct object of *vyrobil*, ‘produce.PFV’, also has a completive reading, and if well-established kinds are always incompatible with completion, then a sorted direct object of *vyrobil*, ‘produce.PFV’, should be infelicitous. However, (33) is felicitous.

- (33) Řeční zemědělci vyrobi-li letos dva nové oleje.
 Greek farmers produce.PFV-PTCP this.year two new oils
 ‘Greek farmers have produced two new oils this year.’

Following (33), well-established kinds are not always incompatible with completion. They are incompatible with the verbs of consumption *použil*, ‘use.PFV’, (Czech) and *vypredala*, ‘sold out.PFV’, (Slovak), but compatible with the verb of creation *vyrobil*, ‘produce.PFV’ (Czech). We posit that this follows from an asymmetry between creating and consuming kinds, where the former action is much easier. To create a kind, it suffices to create some of its instances. By contrast, consuming all instances of a kind does not consume the kind itself. Perhaps the only way to consume a kind is to erase it from the collective memory of humanity. Thus, completion is incompatible specifically with consuming well-established kinds.

In conclusion, following the preceding expanded discussion of perfectivity and sorted direct objects, the infelicity of (1-b), repeated below as (34), stems from incompatibility between (i) consuming well-established kinds, and (ii) the completive reading of the direct object, forced by the perfectivity of the verb of consumption *použil*, ‘use.PFV’.

- (34) #V salátu jsem použ-il dva oleje.
 to salad AUX.1SG use.PFV-PTCP two oils
 Intended: ‘I used two oils (kinds of oil) in this salad.’ (Grimm & Dočekal, 2021)

Finishing with the research question on countability, we observed that count nouns are less sortable than mass nouns (condition COUNT was less accepted than MASS), which indicates a positive answer to (31-b), along with the Czech and Russian patterns discussed in Section 2.4. Grimm and Dočekal (2021) also suggest a positive answer to (31-b), but in the opposite orientation: they imply that the restriction on sorting is limited to mass nouns, whereas we show that sorting is restricted for count nouns even more than for mass nouns.

At present, it is unclear whether the countability restriction on sorting in Czech, Slovak, and Russian implies that the Universal Sorter has different semantics in these languages compared to English. We leave this to future research.

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Notes

¹ Czech examples in this article are either from the literature or constructed by Mojmir Dočekal, a native speaker of Czech. Their translation into Slovak was performed by Michaela Hulmanová, a native speaker of Slovak (and corroborated by four other native speakers of Slovak). The acceptability of the Slovak examples replicates the Czech examples, but we do not repeat the Czech examples in the Slovak translation for brevity. The Slovak examples are available upon request.

² The glosses use the usual abbreviations for grammatical categories, e.g., AUX for auxiliary, PTCP for participle, PFV for perfective, IPFV for imperfective, MASC for masculine, SG for singular, SUFF for suffix, and 1SG for first person singular.

- We use the terms *episodic* and *non-episodic* like [Grimm and Dočekal \(2021\)](#), for sentences describing single events vs. generalizations over multiple events.
- [Cheng et al. \(2008\)](#) and [Rothstein \(2017\)](#) argue that the Universal Grinder ([Pelletier, 1975](#)), the namesake of the Universal Sorter ([Bunt, 1985](#)), behaves differently in Mandarin vs. English due to a typological difference where bare nouns can have count readings in the former but not the latter. The Universal Grinder is responsible for a typically count noun N being used as a mass noun to mean ‘stuff made of N’, as with *book* and *shelf* below.
- (i) Johnny the termite will eat **book**, but he won’t touch **shelf**. ([Gleason, 1965](#))
- In the formalization of [Filip and Rothstein \(2006\)](#), *použil*, ‘use.PFV’, is atomic, and *use* is non-atomic. This interacts with another aspect of their formalization, where the event maximalization operator applies to verb phrases in Germanic, and to verbs in Slavic. Consequently, *použil*, ‘use.PFV’, is more restricted than *use*. The relevant restriction here, introduced shortly, is that ‘use.PFV’ forces a completive reading of its incremental theme, unlike *use* (and like *use up*).
- The change from imperfective *používal* in (3-a) to perfective *použil* in (3-b) is also a change in eventuality type, from atelic activity to telic accomplishment.
- We thank the anonymous reviewer for pointing out the important issue of interaction with eventuality type. We are aware that the completive reading with Slavic perfective verbs is a complex issue that deserves further investigation. We hope to address this in future work, and we believe that our analysis is in line with the current understanding of the issue ([Filip, 2005, 2008](#))—even if we have to gloss over some complexities (like the distinction between simple and morphologically complex perfective verbs a.o.).
- We maintain a uniform Sorter by attributing the difference in the availability of sorting to a contrast between the aspectual systems of Czech and English. This opens up the possibility of seeking other contexts where sorting would be restricted by the aspectual (or temporal) properties of these languages. For all we know, tense-aspect does not force a completive reading of incremental themes in English, so we do not expect it to restrict sorting in the same way as in Czech.
- The restriction to well-established kinds is best known as a restriction of singular kind terms which is absent from their plural counterparts:
- (i) a. {Coke, Green} bottles have narrow necks. {well-established, ad-hoc}
b. The {Coke, ^{??generic} green} bottle has a narrow neck. {well-established, #ad-hoc}
- Example (18) has a felicitous reading where the gas station sold the last two canisters of oil. The canisters, however, can consist of the same kind of oil, so this is not the sorted reading, which requires two different kinds.
- The design of the experiment was 3×2 , but we focus on its 2×2 subset, for the following reasons. First, the condition of object mass nouns (OMNs) was exploratory, and it meant to engage with the claim that these nouns are uncountable under the sorted reading in English (references in the beginning of Section 2). Second, our results do not distinguish between COUNT and OMN, both in descriptive and inferential statistics. The raw mean, median, and SD for OMN and PERFECTIVE were 2.25, 2, and 1.38, and for OMN and IMPERFECTIVE they were 2.42, 2, and 1.43. The z-transformed values for mean, median, and SD in both conditions were -0.08 , -0.26 , and 0.99 , and 0.04 , -0.26 , and 1.02 . As an avid reader can observe when comparing these values with Tables 3 and 4, the values are very close to those of COUNT. This was confirmed by a Bayesian model similar to the model discussed in Section 3.2, but fit to the 3×2 design. In such a model, where COUNT, PERFECTIVE is the baseline, the effect of OMN was 0.18, with a Credibility Interval of $[-0.06, 0.42]$ and a Bayes factor of 0.05. Both the magnitude of the effect, but more importantly the Bayes factor (and the Credibility Interval), show that the COUNT and OMN are indistinguishable (non-credibly different) in the design of our experiment. For this reason, we do not further report the descriptive and inferential statistics for OMN.
- It might be possible to subsume the restriction to well-established kinds under the restriction to contextual atoms. This would mean that the restriction in (6), repeated below, stems from it being difficult to contextualize cheap wine as a single kind of wine (cf. [Prasada et al., 2012](#))
- (i) {Claret, #Cheap wine} is a common wine. ([Pelletier & Schubert, 2003](#))
- It is not totally straightforward to translate theoretical predictions into the inferential statistic results. However, our expectation was that the factors COUNT and PERFECTIVE would have a cumulative prohibiting effect. In other words, we expected that the interaction between these two factors would be negative. This is partially confirmed by the graph in Figure 3, which shows some tendency for interaction. However, the interaction is not credible according to our model. This could be due to the fact that there are not enough data to detect the interaction. In future research, it would be interesting to collect more data to test this hypothesis.

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