

# No ABA patterns with Fractionals\*

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*My dad gave me one dollar bill  
'Cause I'm his smartest son,  
And I swapped it for two shiny  
quarters  
'Cause two is more than one!*

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Smart, by Shel Silverstein

## 1 Background: \*ABA patterns in morphology

Previous work (Bobaljik 2012, Caha 2017, Middleton 2021, among others) has found that across a variety of morphological domains (e.g., adjective-comparative-superlative triplets, case paradigms, pronominals), a certain pattern of syncretism called \*ABA is systematically missing. This lack of \*ABA has been taken to indicate a particular morphosyntactic relation behind the phenomenon.

Concerning the paradigmatic example of comparatives and superlatives (Bobaljik 2012), the comparative form of an adjective can either be morphologically transparent, as in *smart-smarter*, or involve a suppletive stem, as in *good-better*. Similarly, the superlative form can be transparent, as in *smart-smartest* or suppletive, as in *good-best*. With data from numerous languages, Bobaljik (2012) observes the absence of an ABA pattern among adjective-comparative-superlative triplets. That is, there is no adjective (A) that has the suppletive comparative form (B) like *good-better*, but then a transparent superlative form (A) like the hypothetical *\*good-goodest*. Such a pattern would have the label ABA, because *\*good-better-goodest* involves two distinct roots, with the comparative form (in the middle) being the odd one out. On the other hand, patterns such as AAA

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(e.g. *smart-smarter-smartest*), ABB (e.g. *bad-worse-worst*), and ABC (e.g. *bonus-melior-optimus* in Latin) are attested.

The lack of ABA in the comparative-superlative paradigm, furthermore, is taken to indicate a particular structural relation among the three categories, which can be schematically depicted as in (1).



According to this structure, the superlative is necessarily formed from the comparative, and thus if the comparative is suppletive, the superlative has to involve either the same suppletion, which will result in a ABB pattern, or a new suppletive root, which will result in a ABC pattern.

In this short squib, we propose that a similar generalization obtains in the domain of numerals with the triplet being the cardinal, the ordinal and the fractional, and hypothesize that these categories stand in a morphosyntactic containment relation similar to (1), namely:<sup>1</sup>



## 2 The Generalization

Cardinals are words denoting numerals for counting and/or nominal modification, such as *one, two, three, four, etc.*

Ordinals are words denoting order, such as *first, second, third, fourth, etc.* Here, we can already see that the first three examples involve suppletion.

Fractionals are words denoting fractions such as *half, third, and quarter*. English has other ways of expressing fractions such as *two over three* and *two out of three*. It is interesting to note that expressions like *two thirds* involve ordinals, and this strategy is highly productive in English. Many European languages also employ this productive method of forming fractionals using ordinals.

One important caveat here is that we will focus on word formation in this squib, so we will exclude cases of phrasal fractionals like *two over two* and *two*

<sup>1</sup>We thereby disagree with the statement in [Ionin & Matushansky \(2018: p. 328\)](#) and [Tatsumi \(2021: p. 170\)](#), where it is suggested that there is no grammatical basis for the fact that ordinals and fractionals are morphologically related across languages.

*out of three* from the analysis.<sup>2</sup> This is because such phrasal cases seem to involve a number of morphosyntactically different strategies, both within and across languages, and more importantly for our purposes here, they are often not related to ordinals. For instance, the expression *two over three* in English involves no ordinals superficially, and most likely originates from the graphical representation ‘ $\frac{2}{3}$ ’. Similarly, the following Japanese example, which expresses the same fraction  $\frac{2}{3}$ , is arguably phrasal, given that the denominator bears a genitive suffix (see [Tatsumi 2021](#): Ch. 5 for an analysis of this construction). At least superficially, (3) also does not recruit any ordinals.

- (3) san-bun-no ni  
 3-part-GEN 2  
 ‘ $\frac{2}{3}$ ’

On the other hand, *thirds* in *two thirds* is a case of zero derivation in relation to an ordinal, so it is included in our analysis below. Note that *thirds* in this expression is treated as a noun, as the plural morphology indicates, and its singular form *third* denotes the fraction  $\frac{1}{3}$ . In English, cardinals, ordinals, and fractionals can all be used both as nouns or adjectives, but as we will remark towards the end of the squib, in some languages, e.g. Russian, ordinals are exclusively adjectival. This aspect of crosslinguistic variation warrants its own analysis, and will not be examined in the current paper.

In English, the only cases involving suppletion in the fractional are *half* and *quarter*, with all other cases being identical to the ordinal. Furthermore, the only suppletive ordinals in English are *first*, *second*, *third* and *fifth*. This means that for number 2, there is an ABC pattern (i.e., *two*, *second*, *half*), for 3, an ABB pattern (i.e., *three*, *third*, *third*), for 4, an AAB pattern (i.e., *four*, *fourth*, *quarter*), but for all the other cases, there are simply AAA patterns.<sup>3</sup> The situation is similar in other European languages, although some European languages have a suppletive fractional for  $\frac{1}{3}$  (e.g., *trois*, *troisième*, *tier* in French, which is an example of an AAB pattern).

Across languages, suppletive fractionals tend to denote  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$ . Similarly, suppletive ordinals generally tend to occur for 5 or below. As a consequence of the relative dearth of suppletion in both ordinals and fractionals, most cases of cardinal-ordinal-fractional are AAA or ABB patterns. Here are some concrete

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<sup>2</sup>We will put aside complications regarding what counts as phrasal, while acknowledging the fact that in some languages, e.g. Mandarin Chinese, it might not be straightforward to diagnose if a given expression is phrasal, rather than a single word formed via compounding. In the following data set, we discuss more or less clear cases of word-level morphology.

<sup>3</sup>Note that the case of *five*, *fifth*, *fifth* might be ABB or AAA, depending on how one analyzes the root *fif-*. As Daniel Harbour (pers.comm.) pointed out to us, *fif-* might be an allomorphic variant of *five*, as it appears in forms like *fifteen* and *fifty* as well, and as [Bobaljik \(2012: p. 141\)](#) argues systematic allomorphic variants should not count as separate stems. We will return to this point later, when we discuss potential counterexamples to our generalization.

examples.<sup>4</sup>

(4) AAA

- a. English
  - 6: *six, sixth, sixth*
  - 7: *seven, seventh, seventh*
  - 100: *hundred, hundredth, hundreth*  
and many others
- b. French
  - 5: *cinque, cinquième, cinquième*
  - 6: *six, sixième, sixième*  
and many others

(5) ABB

- a. English
  - 3: *three, third, third*
- b. Italian
  - 3: *tre, terzo, terzo*
  - 4: *quattro, quarto, quarto*
  - 5: *cinque, quinto, quinto*
- c. Breton
  - 3: *tri, trede, trederenn*
- d. Hebrew
  - 3: *shlosha, shlishi, shlish*
  - 4: *arba, r'viyiy, reva*

AAB and ABC patterns are comparatively rare, but are attested, as shown below.

(6) AAB

- a. English
  - 4: *four, fourth, quarter*
- b. German
  - 2: *zwei, zweite, halb*
- c. French
  - 3: *trois, troisième, tier*
- d. Korean
  - 2: *i, ceyi, ban*
- e. Japanese

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<sup>4</sup>Note that all the examples of fractionals we see below denote *unit fractions*, i.e. fractions of the form  $\frac{1}{n}$ . It is quite rare to find words for non-unit fractions, though they are attested, e.g. *poltora* in Russian, which denotes  $\frac{3}{2}$ . This word is historically derived from the word for *half* and the word for *second*, literally meaning something along the lines of 'half the second', but it is synchronically not entirely transparent. Such cases do not seem to form a tripartite paradigm involving a cardinal and an ordinal, and so are excluded from the analysis here.

- 2: *ni, dai-ni, han(-bun)*
  - f. Basque
    - 2: *bi, bigarren, erdi*
  - g. Indonesian
    - 2: *dua, kedua, setengah*
  - h. Kazakh
    - 2: *eki, ekinsi, jarym'ga*
  - i. Somali
    - 2: *l'aba, labaad, bad-ki*
  - j. Tagalog
    - 2: *dalawa, ikalawa, kalahati*
  - k. Turkish
    - 2: *iki, ikinci, yarım*
- (7) ABC
- a. English
    - 2: *two, second, half*
  - b. Breton
    - 2: *daou, eil, hanter*
  - c. Italian
    - 2: *due, secondo, metà*
  - d. Russian
    - 2: *dva, vtoroj, polovina*
  - e. Bulgarian
    - 2: *dva, vtori, polovina*
  - f. Czech
    - 2: *dva, druhý, polovina*
  - g. Javanese
    - 2: *loro, kapindho, setengah*
  - h. Konso
    - 2: *lakki, lammatta, paka*
  - i. Nepali
    - 2: *dui, dosro, ādhā*
  - j. Norwegian
    - 2: *to, annen, halv*
  - k. Welsh
    - 2: *dau, ail, hanner*

As pointed out by Daniel Harbour (pers.comm.), some of these examples involve borrowed words. For example, the fractional *quarter* in English, (6-a), is of Anglo-Norman origin, and the fractionals meaning ‘half’ in Korean, (6-d), and Japanese, (6-e), arguably have a common Chinese ancestor. Similarly, the ordinal *second* in English, (7-a), is a Latinate loanword. If such borrowing occurs in

an AAA or AAB pattern, replacing one of the native members, the result will be an AAB or ABC pattern. Borrowing is presumably a common source of suppletion in this paradigm (and elsewhere), but not all of the examples above involve borrowing, e.g., (6-b), (6-c), (7-c), (7-d), (7-e), (7-f).

We have so far surveyed the cardinal, ordinal and fractional expressions for 1 through 5 in 38 languages from 17 language families.<sup>5</sup>

- Austronesian: Hawaiian, Indonesian, Javanese (Ngoko), Maori, Tagalog
- Celtic: Irish, Welsh
- Chadic: Hausa
- Cushitic: Somali
- Germanic: Afrikaans, Dutch, English, German, Norwegian
- Hellenic: Greek
- Indo-Aryan: Hindi, Nepali, Urdu
- Japonic: Japanese
- Kra-Dai: Thai
- Mongolic: Halh Mongolian
- Romance: French, Italian, Portuguese, Spanish
- Semitic: Gulf Arabic, Hebrew, Maltese
- Sinitic: Mandarin Chinese
- Slavic: Bulgarian, Czech, Russian
- Turkic: Kazakh, Turkish, Uzbek
- Finno-Ugric: Finnish, Hungarian
- Language Isolate: Basque

Based on this data, we submit the following generalization as a conjecture.

- (8) There is no ABA pattern in the cardinal-ordinal-fractional paradigm across languages.

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<sup>5</sup>We thank Sara Hockett for her help in compiling the data set, part of which is taken from the online database created by [Bylinina & Barbiers \(2019\)](#).

A hypothetical example of an ABA pattern would look like *\*two-second-twoth*. In our data, there are two potential counter-examples to our generalization, namely the triplets for 2 in Hungarian and 5 in Czech.

- 2 in Hungarian: The cardinal 2 in Hungarian is *kettő* with an alternative form *két* used adnominally and when counting. The ordinal form is *második*, which is formed from *más* meaning ‘other’ or ‘different’ and the ordinal-forming suffix, *-odik* (where the first vowel *O* undergoes vowel harmony). The fractional has two forms, *fél* and *ketted*. While *kettő-második-fél* is ABC and thus is unproblematic for our generalization, the other fractional form creates an ABA pattern, *kettő-második-ketted*. However, the problematic fractional *ketted* is only used in mathematical contexts, e.g., when reading the expression  $\frac{3}{2} \times \frac{5}{7}$ , rather than expressing the equivalent of ‘half the cake’. We therefore consider the scope of our generalization to be the latter contexts (and not those in which one reads aloud specifically mathematical expressions written with numerators and denominators, for which one would pronounce  $\frac{5}{4}$  in English as ‘five fourths’ and not as ‘five quarters’).
- 5 in Czech: The pattern for 5 in Czech is *pět-pátý-pětina*, and shows an ABA pattern. More problematic examples are found in this language, e.g., 10 (*deset-desátý-destina*), 20 (*dvacet-dvacátý-dvacetina*), 30 (*třicet-třicátý-třicetina*), etc. Note that there are transparent AAA cases involving the same suffixes, e.g., 7 (*sedm-sedmý-sedmina*), as well as ABB patterns with the same suffixes, e.g., 3 (*tři-třetí-třetina*), 4 (*čtyři-čtvrtý-čtvrtina*).

While we recognize the above Czech examples as potential counterexamples, it should be emphasized that ABA patterns are still extremely rare crosslinguistically, crucially in comparison to the less frequent AAB and ABC patterns, let alone AAA and ABB patterns. We therefore think it is reasonable to seek for a way to explain these exceptional Czech examples, acknowledging that more research is necessary. Here, we would like to simply outline some analytical possibilities.

- Allomorphy vs Suppletion: As Jonathan Bobaljik (pers.comm.) reminds us, systematic allomorphic variants should not be analyzed as separate stems. Indeed, if *pát* is simply an allomorphic variant of *pět*, then 5 in Czech will just be an AAA pattern, as will be the other counterexamples. While this is certainly a possibility, the synchronic grammar of Czech does not seem to have a productive morphophonological rule that turns /ě/ and /e/ to /á/.
- A direct derivation for some fractionals: The fractionals in Czech all involve a suffix *-ina*, which is quite productive in this language. It forms a feminine noun out of an adjectival stem (e.g., *zmrzl*- ‘frozen’ → *zmrzlina* ‘ice cream’),

a nominal stem (e.g., *list* ‘leaf, sheet of paper’ → *listina* ‘document, register’) or a verbal stem (e.g., *živ-* ‘to feed’ → *živitina* ‘nutrient’). Note that the resulting meaning is often unpredictable. If the same suffix is involved in the fractionals (yielding something like the equivalent to English *-age* in a putative form like *a fiveage*), then these particular (all multiples of five) fractionals might involve a different derivational property than fractionals in other languages, and are created directly from the cardinal stem by suffixing this productive noun-forming suffix.

- Pseudo-ABA: A third possibility is that these problematic cases are *pseudo-ABA patterns* in the sense of [Middleton \(2021\)](#).<sup>6</sup> [Middleton \(2021\)](#) argues that a seemingly ABA pattern may arise if what is called a ‘spanned exponent’ is involved in the more complex forms (see also [Blix 2021](#): §5, for a related account in the framework of Nanosyntax).

### 3 Towards Understanding \*ABA in Fractionals

Supposing that our generalization is on the right track, we take it to indicate that the morphology is organized in the way schematically depicted in (9) in natural language.



The lower part of the structure, illustrating the relation between the ordinal and the cardinal, is not surprising or contentious. Many languages have a productive way of forming ordinals out of cardinals, e.g. the suffix *-th* in English, and previous work on ordinals hypothesize that this suffix takes a cardinal and turns it into an ordinal both morphologically and semantically ([Bylinina et al. 2015](#), [Ionin & Matushansky 2018](#)).

The morphosyntax and semantics of fractionals are comparatively less studied in the theoretical literature (see, e.g., [Ionin & Matushansky 2018](#), [Tatsumi 2021](#)), and to the best of our knowledge, no previous theoretical work has attempted to explain the systematic morphological relation between ordinals and fractionals. In particular, according to our hypothesis in (9), the fractionals are formed from the ordinals, but why this is so requires a deeper explanation.<sup>7</sup> Languages like English have phrasal fractional expressions that refer to order, such

<sup>6</sup>We thank Pavel Caha (pers.comm.) for directing our attention to this idea.

<sup>7</sup>It should be noted that not all ordinals can be used to derive fractionals. Most notably, 1 in many languages lacks a fractional. In English, for example, it has a suppletive ordinal *first*, but it simply cannot be used as a fractional as in *\*two firsts*, and *\*two oneths* is likewise unacceptable.



as *third part*, and *cuts of the second order*, but as already mentioned, phrasal expressions for fractions can be found that do not seem to refer to order, including *two over three* in English and *èr-fēnzhī-yī* (lit. ‘two-divide-one’), suggesting that the concept of fraction itself can be expressed without referring to order. This observation makes our hypothesis that word-level formation of fractionals involves ordinals all the more surprising, as it suggests that natural language has a constraint on how fractions can be expressed at the word level.

It might be tempting to look for a historical connection between ordinals and fractionals. When it comes to number, European culture has retained influence from Egyptian and Babylonian cultures, which are known for their extensive use of fractions, especially unit fractions. However, it appears that our generalization in (8) holds in languages that are culturally and historically remote from Mediterranean civilizations. It will be sensible, therefore, to conclude that the morphological connection between ordinals and fractionals should not be understood as a historical coincidence, but rather in terms of Universal Grammar.

## 4 Outlook

Future work should examine the set of numerals 2–10, across a range of typologically diverse language families, in order to see if other examples of seemingly ABA patterns like 5 in Czech are attested. Should you, reader, know of relevant examples or counterexamples that should advance this study, we would be grateful if you could document them.

Another dimension that we have not treated here, but which is perhaps relevant to the overall puzzle, is the syntactic category of the elements involved – ordinals tend to be adjectival, while cardinals do not. Fractionals do not seem to be adjectival, and from this perspective, their derivation from adjectival ordinals

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One might be tempted to attribute the lack of a fractional for 1 to its semantic vacuity, but a phrasal expression denoting such a vacuous fraction is acceptable. For instance, the phrasal fractional denoting  $\frac{3}{1}$  in Japanese is perfectly acceptable, at least in mathematical contexts.

- (i)    ichi-bun-no    san  
        one-part-GEN 3  
        ‘ $\frac{3}{1}$ ’

This suggests that the semantics itself might not be enough to explain the lack of a word-level fractional for 1 across languages.

Furthermore, quite interestingly, *umpteen* in English has an ordinal *umpteenth* but not a fractional. For example, *two umpteenths* is utterly unacceptable. This should be compared to other non-precise numerals like *zillion*, which does have a fractional, e.g., *a few zillionths of a second*, as well as an ordinal *zillionth*. There might be something about the semantics of *umpteen* that explains the lack of a fractional, e.g., the inference it carries that precise counting is impossible, but we need to leave this issue open at present. We thank Jonathan Bobaljik (pers.comm.) for pointing out this observation, which also holds for German *zigste* ‘umpteen’.

may be surprising, depending on finer details of the syntax.

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