

Half of an answer: On Agreement with fraction partitives

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¹This work concerns FRACTION PARTITIVES (FPs), such as the following:

- (1) a. a third of the apple
- b. half of the students
- c. three-fifths of Germany

In many dialects of English, if an FP is in a position of agreement, the verb will agree with *of*'s complement (N2) instead of the fraction.

- (2) a. Two-thirds of a pizza {is/*are} in the fridge.
- b. One-third of the students {*is/are} unsatisfied with the dining choices on campus.

This is surprising when we consider DPs like the subjects of (3-a)-(3-b), which are superficially similar yet exhibit the opposite agreement facts,

- (3) a. The box of chocolates {is/*are} in my office.
- b. The pictures of the cat {*was/were} taken by Mary.

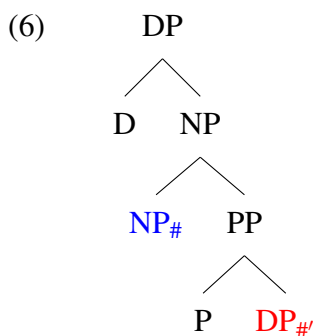
Furthermore, this is clearly not a case of closest-conjunct agreement...

- (4) There is two-thirds of a pizza in the fridge.

...nor is it a case of so-called semantic agreement. Even in a context where there are only five students and one of them is American, it seems wrong to have singular Agreement over plural for (5).

- (5) A fifth of the students {*is/are} American.

The Puzzle: In Minimalism, goal competition is resolved by HEADEDNESS and LOCALITY. Given a structure for partitives like (6) (a plausible way of analyzing (3-a)-(3-b)), how can N2 be the target of agreement in FPs?



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Here's the plan for today:

1. Draft an “anatomy” for FPs by identifying the individual pieces involved in their construction
2. Consider some possible explanations which seem promising but ultimately fall short
3. Propose an analysis where N2 moves to the top of the FP to become a target of agreement
4. Consider cross-linguistic and semantic evidence to further motivate this approach

Anatomy of an FP

The fraction itself is (most prototypically) composed of a *numerator* and a *denominator*. In [Anicotte \(2022\)](#)'s typology of fractions in natural language, English is *bidimensional* (i.e., explicit reference to both the numerator and the denominator is usually required).

- (7) **one** **third** of the students
 numerator denominator

Denominators ≥ 3 are formed by a regular morphological process, making them exactly homophonous with ordinals. There are also nonderived denominators *half* and *quarter*, which for our purposes we can assume behave the same as the derived ones.

Fractions seem nominal-ish. They take what seems to be the productive plural suffix *-s* for numerators ≥ 2 , and they can be modified by adjectives.

- (8) The remaining two thirds of The Nature of Computation consists of seven long chapters. [([Davies, 2010](#))]

There is also the fact that fractions can take a definite determiner, and this can feed the dropping of the numerator if it is understood to be *one*.

- (9) The two-thirds of the students at the local community college live in the county. [[brainly.com](#)]
(10) We could also consider expanding the interventions to try to reach the third of the students who were not responsive to the current set of interventions. [[JoSoTL](#)]

All of this in turn suggests that the FPs as a whole are DPs (an argument further bolstered by facts we already know, such as they can receive θ -roles, be agreed with, etc.)

Definite and bare plurals, definite and indefinite singulars, and bare mass nouns can occupy this position. Crucially, though, a bare count noun cannot be taken by an FP.

- (11) One-fifth of $\left\{ \begin{array}{l} (the) \text{ cats} \\ a/the \text{ pizza} \\ \text{rice} \\ *book \end{array} \right\} \begin{array}{l} \text{definite/bare plural} \\ (in)\text{definite singular} \\ \text{singular mass} \\ \text{singular count} \end{array}$

Proper nouns and pronouns are also fine as N2. Thus, N2 is a DP.

- (12) Over a quarter of Germany runs on wind power. [[WWNO](#)]
(13) Jinfa, upo[n] receiving his paycheck, spent two-thirds of it on car repairs[.] [[Brainly.com](#)]

Some possible approaches which I won't advocate for

While the Agreement pattern I explore here is (as far as I know) an unexplored corner of English syntax, there are existing accounts of similar phenomena which can inform our understanding of FPs. I will

consider two such approaches in this section, but I will argue that they do not provide a convincing account of FP behavior.

Approach 1: the denominator lacks a genuine number feature

Perhaps we could say that the suffixes we observe on denominators aren't actually an instantiation of grammatical number. Perhaps they are only homophonous with the morphemes for SG and PL. If so, there would be nothing intervening between a probe and the number feature on N2. This is the approach of [Klockmann \(2018\)](#) for her analysis of Q-noun partitives like those in (14).

(14) {A lot/lots} of chickens are running through the office.

Two problems: one is that *-s* does not appear arbitrarily on the denominator² (**one-fifths*, **two-third*). The second is that fractions can stand on their own and control agreement.

(15) Two-thirds belong to Mary, one-third belongs to John.

Potential counterpoint: astute observers may contest the existence of “free-standing” fractions in argument positions; Maybe the fractions in (15) have ellided N2s which are being agreed with. It's true that N2 can be ellided and continue to control agreement (for FPs and beyond).

(16) Geographically, the southern third of the peninsula belongs to Germany, [...] and the northern two-thirds belongs to Denmark. [[source](#)]

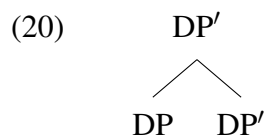
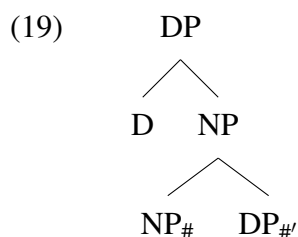
(17) a. Most {of the linguists/ Δ } like John.
b. Lots {of wine/ Δ } was consumed by the partygoers.

If this is true, though, how do we explain (18)?

(18) One-third of students are on free or reduced lunch, and one-third belongs to a minority group. [[source](#)]

Approach 2: *of* does not project

Another plausibility is that *of* is not actually heading any structure.³ For example, perhaps we can treat *of* not as a preposition, but as some kind of clitic or case-marker assigned to N2. This would leave us with a structure like (19) or perhaps (20), crucially reducing the distance between a probe and N2. [Pesetsky \(2013\)](#) pursues a similar idea for Russian numerals.



This won't work for FPs, though. N2 can be wh-extracted, and when it is, *of* remains in-situ. If it were really a clitic or case-marker, wouldn't we expect *of* to be dragged along with the wh-item?

²As far as I know, denominators are the only mathematical object that behave this way in English (cf. *two hundred*, *two thousand*, *two dozen*, *four score*). Many languages (e.g., Slavic langs.) have number morphology in complex cardinals ([Ionin and Matushansky, 2006](#)).

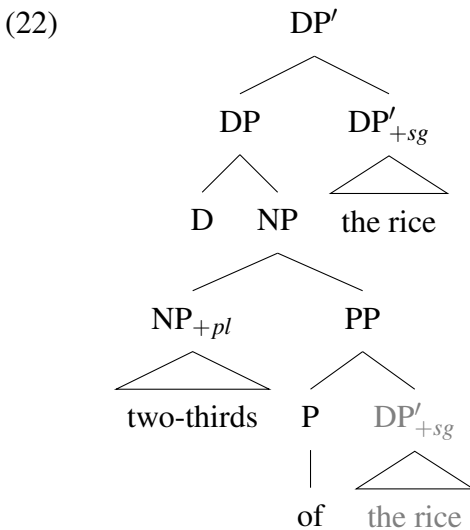
³It's worth noting here that *of* can sometimes be dropped if the fraction is *half*. At first, I thought this might have been a haplological effect, but *of* cannot drop if the N2 is a proper noun or pronoun (**half Germany*, **half it*).

(21) What did John eat three-fifths of?

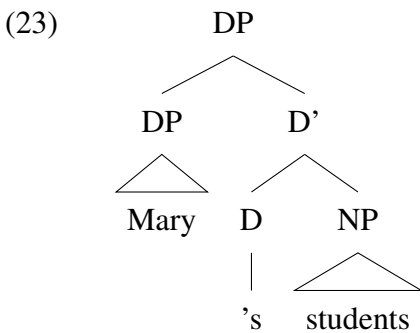
The interim conclusion is to say that the preposition is structurally contentful.

Proposal: N2-raising

Given all of the facts above, I propose a structure like (22)⁴ where N2 moves to the top of the FP and projects its features. This movement can be overt if we allow for rightward movement (so that the linearization matches the surface form), but frameworks which allow agreement with covertly-moved things (e.g., Grishin (2023)) could assume that this movement is covert. This would make N2 the highest nominal element—meaning it should be agreed with—without conceding any independent facts of English.



This movement is **not** a case of N2 moving to a higher [Spec,DP] position. Moving to this position would make N2 invisible to Agree (cf. English possessive constructions).



The proposed movement is nonstandard, yet it is not without precedent. Matushansky and Zwartz (2016) propose a similar idea for English measure partitives, which despite not being directly discussed in the paper, exhibit agreement patterns analogous to fraction partitives.

(24) People may not realize that there's two miles of ice in Antarctica. [(Davies, 2010)]

⁴This structure assumes that *two* forms a constituent with *thirds*, but not *of the rice*; Ionin and Matushansky (2006) assume that it would. As far as I am aware, both constituency structures are compatible with my proposal.

Cross-linguistic data and quantifier scope

FPs in other Indo-European languages exhibit quite different Agreement patterns. Both French and Greek, for example, allow agreement with either the fraction or N2.

- (25) Un tiers des déperditions de chaleur se **fait** par le toit
 one third of loss.PL of heat REFL make.3SG through the roof
 ‘One third of heat loss happens through the roof’ (Agree with fraction)
- (26) Un tiers des adultes **ont** une rhinite allergique en France
 One third of adult.PL have.3PL a allergic rhinitus in France
 ‘One third of adults in France have allergic rhinitus’ (Agree with N2)
- (27) deux tiers de la surface **sont** aménagés dans un esprit lounge
 two third.PL of the surface be.3PL fitted.out in a style lounge
 ‘Two thirds of the surface is outfitted in a lounge style’ (Agree with fraction)
- (28) Deux tiers de la biodiversité mondiale **vit** dans le sol
 two third.PL of the biodiversity on.earth live.3SG in the soil
 ‘Two thirds of Earth’s biodiversity lives in the soil’ (Agree with N2)
- (29) ena trit-o ton maθit-on ine
 one third-NEUT.SG DET.GEN.PL student-GEN.PL COP.3
 eksipn-**{o/i}**
 smart-**{NOM.NEUT.SG/NOM.MASC.PL}**
 ‘One third of the students are smart’ (Agree with N2 or fraction)
- (30) dio trit-a tu mil-u ine kokin-**{o/a}**
 two third-NEUT.PL DET.GEN.SG apple-GEN.SG COP.3 red-**{NOM.NEUT.SG/NOM.NEUT.PL}**
 ‘Two thirds of the apple is red’ (Agree with N2 or fraction)

An interesting side effect of this optionality is that changes in agreement change scope possibilities. Consider the following examples with the quantifier *all* (French *tout* and Greek *ol-*):

- **Scenario A:** There are 6 pies. 2 of them were eaten in their entirety.
- **Scenario B:** There are 6 pies. For each pie, a third of it was eaten.

- (31) a. Un tiers de toutes les tartes **a** été **mangé**
 One third of all the cakes have.PRES.3SG PRF eat.MASC.SG
 ‘One-third of the cakes were eaten’ ✓ A, ✓ B (agree with fraction)
- b. ena trit-o ol-on ton pit-on fagoθik-e
 one third-NEUT.SG all-GEN.PL DET.GEN.PL pie-GEN.PL eat.PASS.PRF.PST-3SG.PST
 ‘One-third of all the pies were eaten’ ✓ A, ✓ B (agree with fraction)

If Agreement is with the fraction, both readings are available. But the situation changes if Agreement selects N2...

- (32) a. Un tiers de toutes les tartes **ont** été **mangées**
 One third of all the pies have.PRES.3PL PRF eat.FEM.PL
 ‘One third of all the cakes were eaten’ ✓ A, × B (agree with N2)
- b. ena trit-o ol-on ton pit-on fagoθik-**an**
 one third-NEUT.SG all-GEN.PL DET.GEN.PL pie-GEN.PL eat.PASS.PRF.PST-3PL.PST
 ‘One third of all the pies were eaten’ ✓ A, × B (agree with N2)

In English, where Agreement in FPs is only possible with N2, only the “non-distributive” reading is available (i.e., it is only compatible with Scenario B).

(33) A third of all the pies were eaten. ✓ A, × B

If we assume that N2 raising is optional in languages like Greek and French, we can say that abstaining from raising allows *all* to be interpreted in the scope of the fraction (Scenario B). It can also undergo quantifier raising to outside the scope of the fraction (Scenario A). If N2 raising does occur, perhaps this bleeds the ability to be interpreted within the scope of the fraction, mandating only the non-distributive reading. Since this movement is mandatory in English, only the wide-scope reading is available.

Conclusion

To sum things up, I believe N2 Agreement in FPs is most straightforwardly-explainable with DP-internal movement of the N2. This movement limits scope readings with certain quantifiers, further lending support to this hypothesis.

Here's what I have lined up for the future:

- How do these facts compare in other Indo-European languages?
- Outside of verb agreement, do pronouns co-indexed with an FP always agree with ϕ -features on N2?
- What's happening with first and second person singular pronouns in English? (**two thirds of me am...*, **two thirds of you are...*)
- What else can we use to diagnose the position of N2? Principle C effects?

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