

The sum total of ‘all’

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1 Introduction

Many languages have a word that expresses totality or universality over sums, across (i) sums of atoms, (ii) sums of mass, (iii) atoms reconceptualized as sums. In Icelandic, for example, the stem *all-* combines with definite plural terms, as in (1), definite mass terms, as in (2), or definite singular count terms, as in (3).

- (1) Hvað myndi breytast ef allir jöklarnir á Íslandi hyrfu?¹
what would happen if all glaciers.DEF on Iceland vanished
‘What would happen if all the glaciers on Iceland disappeared?’
- (2) Til að bræða allan ísinn þyrfti að hlýna verulega á jörðinni...²
To to melt all ice.DEF needed to warm significantly on earth.DEF
‘For all the ice to melt, the Earth would have to warm significantly...’
- (3) Þess vegna finnst mér að ganga eigi alla leið og friða allan jökulinn.³
that cause finds me to go not all way and peace all glacier.DEF
‘Therefore we shouldn’t go all the way and protect the whole glacier.’

Other Germanic languages – Dutch, English, MSc... – belong to the apparently relatively few languages that make lexical distinctions among these three cases. In particular, English and MSc draw a line between the second and third case.⁴

¹Source: https://vefir.mms.is/dagsins/loftslagsdagurinn/pdf/loftslagsdagurinn_midjan.pdf

²Source: <https://www.visindavefur.is/svar.php?id=406>

³Source: <https://www.mbl.is/greinasafn/grein/311612/>

⁴In fact, the word *all* is to some extent also used in the third case in English, alongside *whole*:

- (4) If all of the glacier melts away, the moraine will still be there.
(Source: <https://epod.usra.edu/kepow/2013/01/glacier-lesson-5.html>)
- (5) If the whole glacier melts away... there will still be water in the Upper Ganges.
(Source: https://en.wikipedia.org/wiki/Talk%3AGangotri_Glacier)

Although English *whole* as in (5) has been described, by Moltmann (2005, 628), as inducing a distribution “over all the actual parts of an object”, it has also been argued, by Morzycki (2002), to be very different from *all*. Therefore, section 2 is devoted to arguing that it and *all* are, after all, very similar, and that the lexical distinction drawn in English and some other languages is a superficial one.

Then in section 3, existing accounts of the English determiner *all* are reviewed, with difficulties coming to light along the way. In fact, it appears that theorists have been unduly focused on the plural count case, at the cost of the mass case. Even the most recent proposal, by Champollion (2017), faces challenges.

2 Facts about ‘whole’

Below I will try to show that what may in English seem to be one word *whole* is three-way ambiguous, splitting up into three words with different logical types: one intersective adjective, one merely subsective adjective, and one determiner.

The first expresses what has been called the ‘integrity’ reading, the second and the third have been treated as one word expressing one reading, the ‘universal’ (Igel, 2021), ‘distributive’ (Moltmann, 2005), or ‘external’ (Morzycki, 2021) one; I will argue, however, partly from interlingual evidence, that they are distinct, so that we get a trichotomy as depicted in Fig. 1.

	logical type	function	nickname
<i>whole</i> ₁	(<i>et</i>)	predication	integrity
<i>whole</i> ₂	(<i>et</i>)(<i>et</i>)	modification	100 %
<i>whole</i> ₃	<i>e</i> ((<i>et</i>) <i>t</i>)	quantification	universality

Fig. 1: The three words that coincide in English *whole*

2.1. The integrity reading

The word with the integrity reading, *whole*₁, is an intersective adjective, as can be demonstrated with the entailment in (6):

- (6) a. Maria replaces the broken key with a whole key \Rightarrow
 b. Maria replaces the key that is broken with a key that is whole

For something to be whole, in rough paraphrase, all its parts must be together, forming what has been, e.g., by Igel (2021), referred to as an *integrated whole*.

2.2. The 100 % reading

On this reading, *whole* is not intersective: (7-a) fails to entail (7-b), where *whole* is a predicative adjective in a relative clause.

- (7) a. Maria replaces the egg yolk with a whole egg \nRightarrow
 b. Maria replaces the egg yolk with an egg that is whole

To be sure, there is a reading – the integrity reading – on which this entailment is valid, but also one on which it is not, as in a situation where Maria decides to use not just a yolk, as the recipe prescribes, but a white as well. On this reading, *whole egg* does not really mean ‘egg which has all its parts together’ but rather ‘sum of the parts of an egg’ – white plus yolk.

In fact, something can be *a whole P* without being an integrated whole:

- (8) This box contains a whole lamb:
 1 piece of lamb neck – approx 700g
 [...] Minced lamb – approx 1.5 kg
 (Source: <https://bankground.com/products/a-whole-jacob-lamb-meat-box>)

This ‘100%’ reading mostly occurs with an indefinite article or, as in Icelandic or Russian, in an indefinite sense:

- (9) Ef nauðsynlegt er að... friðað heilt vatn eða hluta þess...
 if necessary is to protect whole lake or part its
 ‘If it is necessary to...protect a whole lake or a part of it...’
 (Source: https://www.hafogvatn.is/static/files/2022_2/hv2018-35.pdf)

- (10) Snežnaja lavina pohoronila celuju derevnju, ...
 snowy avalanche buried whole village
 ‘An avalanche has buried a whole village, ...’

(Source: <https://glavred.info/politics/70101-v-afganistane-lavina.html>)

Rather than contrasting with *broken*, 100% *whole* contrasts with *half* and other fraction words, or it contrasts the noun with something smaller or less than it.

In fact, it does not seem to make much, if at all any, at-issue content difference; its sole contribution seems to consist in the contrast with alternatives formed by proper parts or things adding up to less, adding a scalar, often mirative flavor.

Fig. 2 shows the difference between integrity and 100% *whole* in a nutshell.




			
<i>a whole₁ coconut</i>	yes	no	no
<i>a whole₂ coconut</i>	yes	yes	no
<i>a coconut</i>	yes	yes	no

Fig. 2: Scenario where *whole₁ coconut* and (*whole₂*) *coconut* come apart

2.3. The universal reading

Morzycki (2002) treats what I call 100% *whole* and what I call universal *whole* as one item. But I will propose to single out a universal, type $e((et)t)$ determiner.

Important motivation comes from cross-linguistic facts, and additional support comes from facts about relative scope, presented in section 2.4.

2.3.1. Determiner-like behavior in Norwegian

The Norwegian cognate, *heil-*, can precede a definite without being preceded by an article. This correlates with a universal interpretation.

- (11) Jeg fikk hele det knuste vinduet over meg, sier Sandra.
I got whole.WEAK the broken window.DEF over me says Sandra.
‘The whole broken window fell down on me, Sandra says.’
(Source: <https://www.klikk.no/produktjhemmesider/herogna/3159138>)

The reading one normally gets with the preposed definite article is the integrity reading. The 100% reading is possible but requires a prior, indefinite mention.

- (12) Du betaler for vekta av den heile grisen før nedskjæring.
you pay for weight of the whole.WEAK pig.DEF before downcutting.
‘The price is calculated for the whole pig carcass prior to cutting.’
(Source: <https://www.haugengardsmat.no/heile-og-halve-slakt>)

The correlation between the missing ‘adjective’s definite article’ and a universal interpretation suggests that *heil-* is not an adjective in these cases but a word with an argument slot for the type of things definites denote, namely, individuals.

This view is corroborated by the fact that *heile* is able to combine with just any referring expression, not just definites but pronouns and names as well.

- (13) Universitetet har studenter fra hele Afrika, ...
university.DEF has students from whole.WEAK Africa
‘The university has students from all (of) Africa, ...’
(Source: <https://sosiologen.no/student/782-2/>)

2.3.2. *Ganz-* across the board in German

In German, integrity, 100%, and universality ‘whole’ all spell out as *ganz-*, but it does not stop there – *ganz-* is also an exponent of ‘all’ in connection with mass nouns and even, though to a lesser extent, with plural count nouns:

- (14) Das ganze Geld war weg.
the whole money was gone
‘All the money was gone.’ (Source: <https://www.krone.at/2618190>)
- (15) Die ganzen Tassen sind verschwunden.
the whole cups have disappeared
‘All the cups are gone.’ (Cited by Haspelmath 1995, 366)

This already raises doubts about any deep difference between *whole* and *all*.

2.3.3. *It’s all all in many languages*

It is not uncommon that one stem is used indiscriminately to cover universality in regard to parts of the denotations of three kinds of expressions:

1. DEFINITE PLURAL COUNT NOUNS (‘the pearls in the necklace’),
2. DEFINITE MASS NOUNS (‘the silver in the necklace’),
3. DEFINITE SINGULAR COUNT NOUNS (‘the necklace’).

This situation obtains in, among other languages, Hebrew, Icelandic and Russian, as shown in Fig. 3.⁵

	U-count pl	U-mass	U-count sg	100 %	Integrity
German	<i>alle</i>	<i>ganze</i>	<i>ganze</i>	<i>ganze</i>	<i>ganze</i>
Norwegian	<i>alle</i>	<i>all</i>	<i>heile</i>	<i>heil(e)</i>	<i>heil(e)</i>
English	<i>all</i>	<i>all</i>	<i>whole</i>	<i>whole</i>	<i>whole</i>
Icelandic	<i>allar</i>	<i>öll</i>	<i>öll</i>	<i>heil(a)</i>	<i>heil(a)</i>
Russian	<i>vse</i>	<i>vsja</i>	<i>vsja</i>	<i>celaja</i>	<i>celaja</i>
Hebrew	כָּל	כָּל	כָּל	שְׁלֵמָה	שְׁלֵמָה
Catalan	<i>tot(e)s</i>	<i>tota</i>	<i>tota</i>	<i>tota</i>	<i>sencera</i>

Fig. 3: Uses of an ‘all’ word and uses of a ‘whole’ word across seven languages; the framed column represents the ‘universal reading’ with singular count nouns (the listed forms are nominative feminine, plural in leftmost column)

In Catalan and other Western Romance languages, the line is drawn still farther to the right, between the 100% reading and the integrity reading of ‘whole’.

⁵Hebrew is like Arabic: כָּל ~ كَلِّ.

Below are samples of the four lower, lightgray cases in the framed column.

- (16) Þess vegna finnst mér að ganga eigi alla leið og friða allan jökulinn.
that cause finds me to go not all way and peace all glacier.DEF
‘Therefore we shouldn’t go all the way and protect the whole glacier.’
(Source: <https://www.mbl.is/greinasafn/grein/311612/>)
- (17) Otmetim, vojska RF, ..., zaminirovali počti ves’ gorod.
note troops RF mined almost all town
‘Note that the Russian troops, ..., had mined almost the whole town.’
(Source: <https://prm.ua/ru/v-kherson-vernuly-lektro-nerhyiu/>)
- (18) צה"ל הרס את כל הכפר, הוץ מהמסגד.
mosque.DEF apart village.DEF all ACC destroy IDF
‘The IDF destroyed the whole village, except the mosque.’
(Source: <https://www.makorrishon.co.il/nrg/online/54/ART2/068/776.html>)
- (19) ... quan tota la Lluna està coberta per l’ombra de la Terra.
when all the moon is covered by the-shadow of the Earth
‘... when the whole moon is covered by Earth’s shadow.’
(Source: <https://planetariodevitoria.org/ca/espaco/que-tipo-de-eclipse.html>)

Key lesson from this survey: A lexical line is commonly drawn not between the meaning of *all* and the meaning of *whole* but through the meaning of *whole*.

2.4. Scopal interactions

There is an “initially clear intuition”, Morzycki (2002, 184) writes, that *the whole* means ‘all the parts of the’. Indeed, one can observe flexible scope interactions with negation: (20) shows $\forall > \neg$, (21) shows $\neg > \forall$.

- (20) It never occurred to him that if the whole class did not grasp what was taught to them, then it was the teacher who needed to be corrected.
- (21) The whole class did not need the social story reread, but some student groups did.

But as Morzycki (2002, 186f.) observes, *whole* shows an “unwillingness to scope like normal, well-behaved universal quantifiers with respect to existentials”.

There is reason to doubt this, however – in fact, there are two reasons.

2.4.1. *Narrow-scope existentials*

It may be unusual for *the whole* to scope over an existential, but it does happen. (22) mirrors the way *all* evidently scopes over existentials in cases like (23):

- (22) There was an entire wall of screens indicating **the whole building was covered by at least one camera**, and some areas by two or three.
(Source: Julie Rowe, *Hell and Back*)
- (23) This means that while most of the water in your soda has never been in another soda, almost all of it has been drunk by at least one dinosaur.
(Source: <https://what-if.xkcd.com/74/>)

2.4.2. *Narrow-scope disjunctions*

In addition, it is not unusual for *the whole* to evidently scope over a disjunction. (24) shows that *all* can do this, and (25) is a case where *whole* does it, in contrast to (26), where the disjunction has wide scope.

- (24) All the timber was either recycled or derived from renewable sources.
(Source: <https://mini-ielts.com/1228/view-solution/reading/stadium-australia>)
- (25) For one thing, they wanted to redo the paint.
“**The whole house was either brown or gray**,” says Renee.
(Source: <https://www.cvhomemag.com/new-beginnings/>)
- (26) ...: the whole script is either majuscule or minuscule.
(<https://www.lancaster.ac.uk/users/yorkdoom/palweb/week03/palwk3b.htm>)

3 Three theories about *all*

The cumulative evidence suggests that, say, Arabic *كُلٌّ* has a uniform semantics whether its argument is a sum of atoms, a sum of mass, or apparently an object; and that, say, ‘universal’ *whole* essentially shares the meaning of *all*.

But what is the meaning of *all*?

3.1. Universality I: \subseteq

It is often assumed that *all* is a quantificational determiner, and in fact, that it is basically synonymous with *every* as defined by Barwise and Cooper (1981, 169). The definition of *all* given by Westerståhl (1984, 152) is a case in point.⁶

$$(27) \quad \llbracket all \mu \rrbracket = \{X \subseteq E : \llbracket \mu \rrbracket \subseteq X\}$$

More recent work broadly in this spirit includes (Križ, 2015), (Ivlieva, 2020), and (Minor, 2022). While Križ (2015) tacitly assumes that *all* is universal and that it thus removes the so-called ‘homogeneity property’ “as a matter of its semantics”, Ivlieva (2020) and Minor (2022), aiming to account for ‘dependent plurals’, offer analyses of *all* in terms of distribution over atoms.

But *all* differs from *every* in several regards. It can only combine with plural count nouns – not with singular ones. Besides, it can combine with mass nouns. Moreover, it has a strong tendency to combine with definite descriptions, which do not denote sets but individuals, non-atomic ones in plural and mass cases, and which tend to get universal interpretations on their own, through distributivity.

Let us in this light consider:

- (28) With some chains, every second link is welded, usually pressure forged in an induction furnace. Sometimes all the links are done in this way.

It is reasonable to assume that *all* is a functor which takes the definite description *the links* as an argument, be it as its sole argument or as one of two arguments. This description will denote a sum individual, say, the sum over a contextually salient set of links. Universal quantification as one has mostly known it, relating two sets to each other, is not applicable to this case, not directly anyway.

Ivlieva (2020, 442), for one, resolves this conflict by universally quantifying over parts of sum individuals. Let us take a close look at her definition of *all*:⁷

$$(29) \quad \llbracket all \rrbracket = \lambda x \lambda P_{e(vt)} \lambda e P(x)(e) \wedge \forall y (y \leq x \wedge \text{ATOM}(y)) (\exists e' \leq e \wedge P(y)(e'))$$

This may be adequate for the plural count case, but not for the mass case, as in this case, the second conjunct – the ‘distributive part’ according to Ivlieva – will be trivially true because there will not be any atomic parts $y \leq x$.

⁶Indeed, when Gentzen (1935, 178) introduced the symbol \forall , he chose it because A is the first letter of *alle*, the main German word for *all* (“ \forall “für alle” ... als All-Zeichen”).

⁷Actually, Ivlieva does not define *all* in isolation but the DP *all the boys*, but the way she would define *all* can be interpolated from that definition.

To see this clearly, consider (30):

- (30) All the steel is galvanised, which results in excellent rust protection and provides enhanced durability.⁸

Informally, (29) predicts that (30) is true just in case (i) the steel is galvanised and (ii) every atomic part of the steel is galvanised – which can be granted since the steel cannot be assumed to have any atomic parts, only parts that are themselves non-atomic.⁹

This deficiency could be avoided by removing the conjunct $\text{ATOM}(y)$ from the \forall restrictor in the definiens in (29) as far as mass term arguments are concerned. This has been done in (31).

- (31) $\llbracket \text{all} \rrbracket = \lambda x \lambda P_{e(vt)} \lambda e P(x)(e) \wedge \forall y (y \leq x) (\exists e' \leq e \wedge P(y)(e'))$

However, another challenge becomes visible in the light of sentences like (32).¹⁰

- (32) ... all the water either infiltrates into the soil or runs off.¹¹

The problem is that the truth conditions defined in (31), in the ‘cumulative’ first conjunct as well as in the ‘distributive’ second conjunct, are too strong for the intended interpretation of (32), where some of the water infiltrates into the soil and the rest runs off; according to (31), the sentence is false in such a scenario. To clearly see why, note that the set of (non-atomic) things that either infiltrate or run off consists of the things that infiltrate and the things that run off; it is the union of the set of things that infiltrate and the set of things that run off.

According to (31) now, the water and the event under consideration – x and e – must form a member of the set of pairs of objects and events – P – where the event is one of infiltrating or one of running off and the object is in either case its theme, meaning that there must be an event of the water infiltrating *in toto* or one of the water running off *in toto* for the sentence to be true. But in reality, it suffices if there are infiltrating events with parts of the water as their themes and there are running off events with other parts of the water as theirs, as long as these latter themes constitute the residue of the water.

⁸Source: <https://hipages.com.au/connect/leebrofencing>

⁹See the insightful discussion of this point in (Lønning, 1987, 7f.), concluding that mass nouns ought to be treated as having homogeneous – cumulative and distributive – reference.

¹⁰That such cases are potentially problematic was observed by Roeper (1983, 254).

¹¹Source: https://link.springer.com/referenceworkentry/10.1007/1-4020-4497-6_130

The source of this misfit is that the predicate *infiltrate into the soil or run off* is not referentially homogeneous: it may be divisive, but cumulative it is not.

One way to make (31) fit both non-cumulative and cumulative predicates is to not use P as is in the definiens but to substitute for it the set of sums that can be formed from members of it, its algebraic closure $*P$. This results in (33).¹²

$$(33) \quad \llbracket all \rrbracket = \lambda x \lambda P_{e(vt)} \lambda e *P(x)(e) \wedge \forall y (y \leq x) (\exists e' \leq e \wedge *P(y)(e'))$$

This move means that the water and what happens to it no longer need to have the property of infiltrating into the soil or of running off for (32) to be true, it is sufficient if they can be divided into parts which have that property separately.

Another way to derive this interpretation is to regard it as a distinct reading brought on by a silent distributivity operator, say, the algebraic closure operator $*$ (see Champollion 2019, 293), operating on the predicate.

It speaks in favor of this option that such an operator is required in any case when mass or plural definites combine with disjunctive predicates, as noted by de Vries (2017, 180f.) for the plural case. (34) is an instance of the mass case.

$$(34) \quad \text{However, if precipitation occurs over land, } \underline{\text{the water}} \text{ either runs over the surface, or percolates into the ground.}$$

But, generally speaking, if distributivity can be had independently, the question arises what there is left for *all* to do. Indeed, Brisson (1998) and Champollion (2010) have proposed non-quantificational treatments of *all*, to be discussed in section 3.3 and 3.4. First, however, two treatments where *all* is quantificational but where the relevant relation is not set-theoretic inclusion but mereological parthood will be discussed, namely, Lønning (1987) and Korat (2016).

3.2. Universality II: \sqsubseteq

In the framework set up by Lønning (1987), that all the water infiltrates means that the sum object denoted by *the water* is a part of that denoted by *infiltrates*. This line of analysis is broadly adopted by Higginbotham (1994).¹³

$$(35) \quad \llbracket all \mu \rrbracket = \{x \in E : \llbracket \mu \rrbracket \sqsubseteq x\}$$

¹²Note that P is a binary relation, a set of pairs; see Champollion (2010, 15) for a definition of the algebraic closure of a relation in terms of pointwise sum formation.

¹³Lønning actually treats the mass noun as a sum object and the definite article as the identity function; this does not matter in the present connection.

VPs have thus “got denotations different from what is usual” (Lønning, 1987, 27). That they denote sum objects instead of sets makes good sense for mass nouns but not necessarily for count nouns, and Lønning (1987, 26ff.) discusses ways to merge the mass model and the count model into a combined semantic model.

Note that the potential problem posed by cases like (32) does not become an actual problem once VP disjunction gets “the obvious interpretation” as sum:

$$(36) \quad \llbracket \mu \text{ or } \nu \rrbracket = \llbracket \mu \rrbracket \oplus \llbracket \nu \rrbracket$$

Specifically, (32) is predicted to be true just in case

$$(37) \quad \llbracket \text{the water} \rrbracket \sqsubseteq \llbracket \text{infiltrates into the soil} \rrbracket \oplus \llbracket \text{runs off} \rrbracket$$

– which is a reasonable prediction, allowing for some of the water to infiltrate and the rest to run off.

More recently, Korat (2016) has proposed a definition of Hebrew כּוֹל *kol* ‘all’ which renders the right result for disjunctive predicates and which fits all cases, whether it combines with a definite plural term, a definite mass term or a definite singular count term (where *whole* is used in English):¹⁴

$$(38) \quad \llbracket \text{kol} \rrbracket = \lambda x \lambda P_{(et)} \downarrow x \sqsubseteq \bigoplus P$$

This analysis resembles Lønning’s, but VPs have more standard denotations (not sum objects but sets) and the analysis is to account not just for the mass case but also for the plural case and even for the singular count case.

While it works well for disjunctive predicates and for distributive predicates more generally, this analysis runs into problems with collective predicates as in (39) and with collective interpretations of neutral predicates.

$$(39) \quad \text{The way the land lies means all the water gathers and flows down the wall side, eroding ... }^{15}$$

Since if the water is a part of the sum over the things that gather, so is any part of the water, according to (38), (39) entails that any part of the water, however small, gathers, which is at odds with the meaning of *gather*; this predicate may distribute down to some parts but not to arbitrarily many.

¹⁴The ‘downsum’ function \downarrow is adapted from Landman (2011): it maps x to the sum of its parts; if x is non-atomic, it does nothing, if x is atomic (a pure atom or a group, an ‘impure atom’), it is the corresponding mass or plural individual.

¹⁵Source: <https://www.thebusinessdesk.com/yorkshire/news/739631-c>

3.3. Maximality

According to Brisson (1998; 2003), the task of the word *all* is to induce maximal interpretations of definite plural terms. Her point of departure is the observation that on their own, such terms allow non-maximal interpretations, as in (40):¹⁶

- (40) ... , naturally, when class lets out, (#all) the girls are crying.
Not all 12 of them, but a good half.¹⁷

Theoretically, Brisson starts from the notion of covert distribution restricted by a contextual cover, as developed by Schwarzschild (1996). A set C can be called a cover of the domain of discourse D if everything in D is a part of something in C and the sum over C is the same as that over D (see Morzycki 2002, 192), and the distribution operator defined by Schwarzschild can be formulated as in (41) (see Champollion 2016, 13).

- (41) $\llbracket \text{Part}_C \rrbracket = \lambda P \lambda x \forall y [C(y) \wedge y \sqsubseteq x \rightarrow P(y)]$

A definite plural term may now have a non-maximal interpretation because the cover C may fail to contain each and every atomic part of its denotation or even, for each and every atomic part, any nonatomic bigger part. In the example (40), the context might determine a cover such that, say, four of the girls are neither members of it nor parts of parts of the girls that are members of it.

But *all* hinders this from happening by requiring C to be a ‘good fit’ wrt. x . For a set to be a good fit wrt. a sum entity means to, for any part of the entity, either contain it itself or a part of the entity of which it is a part – as defined in (42) (see Morzycki 2002, 193):

- (42) C is a good fit wrt. x iff $\forall y : y \sqsubseteq x \rightarrow \exists z : C(z) \wedge y \sqsubseteq z \wedge z \sqsubseteq x$

The ‘maximising effect’ of *all* noted by, e.g., Dowty (1987) is accounted for if this is a condition built into the meaning of *all*. Brisson does not commit to just how, but notes that the condition “is not a component of truth-conditional meaning, but something more like presupposition” (2003, 142). Be that as it may, note that (i) the theory readily generalises from plural to mass terms, and that (ii) it does not draw a sharp line between distributive and collective readings; the latter will ensue if the cover happens to contain nothing else out of x than x .

¹⁶The attested example is without *all*; with *all*, the discourse becomes contradictory.

¹⁷Source: <https://www.nytimes.com/2002/02/24/magazine/girls-just-want-to-be-mean.html>

3.4. Stratified reference

This last fact sets Brisson’s theory clearly apart from that of Champollion (2017), where the leading idea about *all* is that it is an “almost distributive” determiner, ensuring, through a presupposition, a certain degree of distributivity.

This leading idea is a part of a wider theory where a family of expressions, such as the temporal preposition *for* and the pseudopartitive preposition *of*, are ascribed similar presuppositions, namely, that the predicate under consideration has ‘stratified reference’ (see Champollion 2017, 94). In simplified terms,

- (43) P has stratified reference if and only if any x in P can be divided into small parts that are in P .

The vagueness and relativity of the term “small parts” is intentional, as the size of the parts will depend on a dimension parameter and a granularity parameter, different across sorts, types, and contexts.

Champollion (2017, 250ff.) assumes that *all* imposes stratified reference as a presupposition on the predicate, making sure it distributes down to small sums.

- (44) $\llbracket all \rrbracket = \lambda\theta \lambda x \lambda P \lambda e : SR_{\theta,g}(P) . P(e) \wedge \theta(e) = x$

In this slightly simplified definition, θ is the thematic role in question and what instantiates the dimension parameter and g is the granularity parameter, which instantiates to ‘few’ if x is a plurality and to ‘little’ if x is a mass.

The presupposition $SR_{\theta,g}$ expands to:

- (45) Any e in P is the sum of parts that are in P and whose θ s are small.

The reason Champollion does not require P to be divisible down to atoms in the plural count case, or infinitely in the mass case, is that he does not only want to account for cases like (46) but also for cases like ((39) and) (47).

- (46) ..., naturally, when class lets out, all the girls are crying.
 (47) ...he had once met Jelke in an elevator. “All the women surrounded him, as if he were a cross between St. Francis of Assisi and Truman Capote,”¹⁸

Following work by Kuhn (2020), he distinguishes between predicates that are “a bit distributive”, like *surround him*, and such that are not even a bit distributive, like *be numerous*; these are generally held to be incompatible with *all*.

¹⁸Source: <https://www.nydailynews.com/sex-sinful-girl-article-1.719959>

4 Challenges

All the approaches to ‘all’ face two challenges that have not yet been duly noted, one indirectly, the other directly connected to ‘all’.

4.1. The mass distribution conundrum

Recall that in the theory of Champollion (2017), *all* introduces a presupposition. Let us for simplicity consider the meaning rule in (48):

$$(48) \quad \llbracket all \rrbracket = \lambda x \lambda P : \text{any } x \text{ in } P \text{ is the sum of } g\text{-size parts of } x \text{ in } P. P(x)$$

The free g is the contextually specified granularity parameter.

When that presupposition is not satisfied by an inherently distributive predicate, stratified reference can be provided through a covert operator whose output is true of something iff the input is true of any relevant part of it; in simple form:

$$(49) \quad \llbracket D \rrbracket = \lambda P . * \lambda x P(x) \wedge g\text{-size}(x)$$

When P only makes sense for atoms, or its subject is based on a plural noun or a group noun, g -size is set to **atom**. When its subject is based on a mass noun, however, it must be set to something else, such as infinitesimal, saliently small, or a portion fitting in a contextual cover.

An operator with a high granularity indeed must evidently be freely available to account for the intended interpretation of sentences like (34), (50), (51) or (52):

- (50) Consequently, when the water had evaporated or infiltrated the plain surface, any suspended sediment in the water was deposited there.¹⁹
- (51) The central corridor is enclosed by two lateral marginal zones in which the ice is either stationary or very slow moving.²⁰
- (52) Rivers also flooded local peat and the peat was eroded or covered with fluvial clay.²¹

Truth conditions are too strong unless we distribute down as far as it takes.

See also (53):

¹⁹Source: <https://eprints.soton.ac.uk/466384/1/1126444.pdf>

²⁰Source: <https://onlinelibrary.wiley.com/doi/10.1002/esp.4145>

²¹Source: <http://resolver.tudelft.nl/uuid:869aad72-519c-4a75-8ca6-50a01c0f17a6>

- (53) Those people should remember that all the water on earth has been recycled in one form or another, and that the expensive bottled water they're drinking probably passed through a dinosaur at some point in time.²²

In fact, since according to (49), if g is set to arbitrary, $D(\text{evaporate or percolate})$ admits anything that can be divided into parts that percolate or evaporate, that definition gives truth conditions that are sufficiently weak.

But this distribution-down-to-molecules is evidently highly constrained. Let us distinguish between divisive but not cumulative predicates like *one-colored* and cumulative but not divisive predicates like *many-colored*. Note that in the latter case, distribution to proper parts amounts to strengthening, while in the former, it comes down to weakening. (50)–(53) are all cases of the weakening sort.

Now distribution happens even when it leads to strengthening:

- (54) The yarn has at least 70% mohair content, ...²³

This may be intended to convey that one sub-yarn of the yarn used in the two-colored sweater contains 70% mohair while another contains, say, 80% mohair. The granularity parameter would be set to a cover partitioning the yarn into the sub-yarns. Compare also the portion reading of mass definites like *the beer*.

But distribution readings where the granularity of distributivity is very high are hard to get, even with predicates where distribution would lead to weakening:

- (55) The foliage shows only one color
 (56) ... the lead weighs less than .3 gram.

What exactly enables arbitrary-part distribution is an open question.

4.2. The collective challenge

Closer scrutiny of how *all* is used seems to show that quantized predicates are after all compatible with it, as long as it combines with a definite term.²⁴

Below are two English, two Icelandic and two Russian examples.

²²Source: <https://www.ocregister.com/2007/12/04/a-toast-to-recycled-sewage/>

²³Source: <https://www.etsy.com/listing/1346258559/hand-knitted-mohair-sweater>

²⁴ P is quantized iff whenever P holds of something, it does not hold of any of its proper parts.

- (57) All the wood cost me about 70 bucks plus nails.²⁵
- (58) According to Wegener, all the continents formed a single ... mass.²⁶
- (59) Allar eyjarnar eru um 597 ferkílómetrar að stærð og ...²⁷
all islands.DEF are about 597 squarekilometers to size and
'All the islands are about 597 square kilometers wide.'
- (60) Allt silfrið vegur hátt í 700 gr. og ...²⁸
all silver.DEF weighs high in 700 grams and
'All the silver weighs close to 700 grams, and ...'
- (61) ..., vse regiony rozdeleny na 9 časovyh pojsov: ...²⁹
..., all regions divided to 9 hourly zones
'..., all the regions are divided into 9 time zones: ...'
- (62) Ves' metall vesit 12 tonn.³⁰
all metal weighs 12 tons
'All the metal weighs 12 tons.'

A presupposition of Stratified Reference will not be satisfied in these cases. One way to restore Stratified Reference would be to invoke a distribution operator – but that would move us away from the intended truth conditions.

Champollion (2017, 265f.) is aware that a word like *together* has been noted to make collective and cumulative readings available that would otherwise violate the stratified-reference constraint imposed by *all*, and speculates that a covert version of it may be available. But he also notes that

it is an open question in what ways the interaction of ... *together* with the semantics I have assigned to *all* can be derived from current theories about the meaning of *together*,

citing, i.a., Moltmann (2004).

Another way to meet the challenge could consist in positing 'cardinal' versions of *all* and other 'quotient' words beside the determiners.

²⁵Source: <https://www.truckmountforums.com/threads/bosshoggs-box-truck-setup.40017/>

²⁶Source: <https://prepp.in/news/e-492-ncert-notes-for-upsc-continental-drift-theory>

²⁷Source: <https://timarit.is/page/1226475#page/n6/mode/2up>

²⁸Source: <https://timarit.is/page/2873552#page/n2/mode/2up>

²⁹Source: <https://www.kakprosto.ru/kak-69575-kak-uznat-moskovskoe-vremya>

³⁰Source: <https://forum.dwg.ru/showthread.php?t=94392>

However, the challenge from collective readings has yet another shade to it, especially prominent when *all* DPs are subjects of causative verbs, noted by Glass (2021) to facilitate collectivity. To illustrate:

- (63) Nobody likes all the rules.³¹
 (64) All the snow made it difficult.³²
 (65) Although hidden by all the trees, the Colorado River flows below.³³
 (66) Due to all the fjords, Norway has a coastline stretching over 28 953 km.³⁴

Stratified reference is clearly not given here, and it is not clear where the inference that there are many of them or there was a lot of it comes from.

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³¹Source: <https://www.smithsonianmag.com/travel/the-public-bath-35160656/>

³²Source: <https://www.alltrails.com/trail/us/wyoming/becker-lake?u=m>

³³Source: <http://www.austinexplorer.com/Locations/ShowLocation.aspx?LocationID=1391>

³⁴Source: <https://no.pinterest.com/pin/706854104004695868/>

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