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# Metaphor forces argument overtness

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**Abstract:** This paper uncovers how metaphor forces argument overtness – across languages and parts of speech. It addresses the relationship between semantically unsaturated terms, functors, and the argument terms that complete them. When the component terms' default senses clash semantically, a metaphor arises. In such cases, the argument must be overt, in contrast to literal uses. It is possible to say *Everyone was waiting at the hotel. Finally, Kim arrived*. By contrast, people do not use *arrived* metaphorically without a goal argument: *Everything had been pointing to that conclusion all along. *Finally, Kim arrived.* What they say is *Finally, Kim arrived at it*. We illustrate the phenomenon with powerful and diverse evidence: three corpus studies (Indo-Aryan languages, British English, Vera'a) and a sentence-completion experiment with around 250 native speakers of English. Both the corpus studies and the experiment show no or almost no exceptions to metaphor-driven argument overtness. The strength of the effect contrasts with a complete lack of speaker awareness. We propose that metaphor-driven argument overtness – as well as the lack of speaker consciousness – is a universal phenomenon that can be accounted for in terms of human language processing.

**Keywords:** forward modeling; linguistic universal; production experiment; semantic arguments; zero anaphor

## 1 Introduction

This paper is the first study of how metaphorical language requires argument overtness. It addresses the relationship between semantically unsaturated terms, *functors*, and the *arguments* that complete them, e.g., between relational nouns and their possessors, or between verbs and their arguments. When the component terms'

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default senses clash semantically, a metaphor arises. In such cases, the argument must be overt, unlike literal uses. For instance, it is possible to say *Everyone was waiting at the hotel. Finally, Kim arrived.* By contrast, speakers do not use *arrived* metaphorically without a goal argument: *Everything had been pointing to that conclusion all along. *Finally, Kim arrived.* Instead, they say *Finally, Kim arrived **at it***. Because the metaphorical interpretation only becomes available when the clashing argument (such as the *conclusion*) is expressed overtly, we will call this argument the *metaphor driver*.

This phenomenon – that a metaphor-driving argument must be expressed lexically or pronominally – is found as a hard constraint across the construction types and languages we have examined. We propose that it is a universal of human speech, arising from processing pressures and the needs of communication. When a functor's meaning lexicalizes as a dead metaphor, this generalization is no longer applicable. While plausibly universal, metaphor-driven argument overtness wholly escapes speaker awareness and has until now escaped the notice of linguists, as far as we know. An exception is Reinöhl (2016: 147–158), who gives it a role in the emergence of Indo-Aryan postpositions.[1]

In our corpus and experimental studies, the evidence is both robust and diverse that the overtness of metaphor-driving arguments is obligatory. Corpus evidence from Indo-Aryan, English and Vera'a shows no exceptions. This holds true whether we look at arguments to verbs, nouns or adverbs. In a sentence-completion experiment, 250 native English speakers realized metaphor-driving arguments with an overt form more than 99 % of the time.

Argument overtness is normally accounted for by information-structural features such as topicality or givenness, and semantic features such as animacy. However, these play no role in the phenomenon we describe. Even if the metaphor driver was mentioned as the last word in the preceding clause, and is highly animate, it will still be resumed overtly. The absence of any topicality, givenness or animacy effects is striking.

The remainder of the paper is structured as follows. Sections 2 and 3 present the phenomenon, while Sections 4 and 5 outline the corpus and experimental evidence for it. Section 6 grounds metaphor-driven argument overtness in other argument-overtness constraints, explores a potentially related phenomenon, touches on its role in language change, and considers implications for language processing.

**1** Restrictions on passivization as described in Quirk et al. (1985: 163) possibly relate to the same or a similar underlying cause, but do not involve questions of argument overtness or covertness.

## 2 Meaning-invariant argument optionality

Metaphor-driven obligatoriness of arguments can only be seen in situations where we otherwise find optionality. Before we come to the effects of metaphor in Section 3, we first take a closer look at argument optionality.

Many constructions allow semantic arguments to remain unexpressed if they are made available in the context, without the omission changing the meaning of the utterance. We call this "meaning-invariant argument optionality". If provided by previous discourse, we are dealing with zero anaphora.[2] Compare the following two examples:

(1) English
  a. overt
     *There is a piano in the middle of their large living room.*
  b. covert
     *They have a large living room. There is a piano in the middle.*

In Examples (1a) and (1b), the noun *middle* takes the semantic argument *their large living room*. When it is available from the context, this argument does not need to be overtly encoded, even with a pronoun, as in (1b). In the tradition of Keenan (1974), Zwicky (1985, 1993), and others, we use the term "functor" for unsaturated elements, i.e., ones like *middle* which have a semantic slot for an argument.[3]

The existence of such optionality is neither language-specific nor word class-specific. In many languages, spatial nouns are functors that take arguments in the form of optional possessors. In parallel to (1), the following examples with words meaning 'middle' come from phylogenetically unrelated or distant languages.

(2) Kera'a (Tibeto-Burman)
  a. overt
     … *ae* ***alochi*** ***kolombo*** ***ma***
     … well path middle LOC
     'In the middle of the path (where the pear tree is)'
     (keraa-20160226-UR-01-T-pear_story, field recordings UR)

**2** We use "zero anaphora", also known as "null anaphora", as it is wide-spread in typology and information structure (e.g., Du Bois 1987; Haig and Schnell 2016; Huang 2000). Other terms include "definite NP deletion" (Mittwoch 1971), "latent object" (Matthews 1981), "contextual deletion", "contextual suppression" (Allerton 1982), or "definite null complement" (Fillmore 1986).

**3** Semantic slots may be sensitive to contextual priming. On the label "functor", note that it only partially overlaps with the otherwise more wide-spread term "head". The latter is more strongly tied to syntactic assumptions and frameworks, and does not always cover semantically unsaturated terms.

b. covert
kolombo ***ma*** *thru* *cho-ro-ga* …
middle LOC run come-wait-PL
'**in the middle** (of the path) (they) meet'
(keraa-20160226-UR-01-T-pear_story, field recordings UR)

(3) Sanskrit
a. overt
*ekaviṃśam* *etad* *ahar* *upayanti*
ekaviṃśa.ACC.SG.N DEM.ACC.SG.N day.ACC.SG.N perform.3PL
*visuvantam* ***madhye*** ***saṃvatsarasya***
equinox.ACC.SG middle.LOC.SG.N year.GEN.SG.M
'They perform the Ekaviṃśa day, the equinox, **in the middle of the year**.'
(AiB 4.1.8.1, Reinöhl 2016: 149)
b. covert
atha ***madhya*** *āghārayati*
now middle pour.3SG
'Now, (he) pours (ghee) **onto the middle** (of the altar, i.e., as opposed to its corners).'
(ŚaB 3.5.2.13, Reinöhl 2016: 153)

(4) German
a. overt
***In*** ***der*** ***Mitte*** ***des*** ***Fußballfelds*** *steht* *der*
in ART middle of soccer_ground.GEN.SG.N stand.PRS.3SG ART
*Schiedsrichter.*
referee
'I**n the middle of the soccer ground**, the referee is standing'
b. covert
*Sie* *spielen* *auf* *dem* ***Fußballfeld***.
3PL play.PRS.3PL on ART soccer_ground
***In*** ***der*** ***Mitte*** *steht* *der* *Schiedsrichter.*
in ART middle stand.PRS.3SG ART referee
'They play on the soccer ground. The referee is standing **in the middle**.'
(Reinöhl 2016: 152)

Crosslinguistically, argument optionality is found in many kinds of constructions. For example, it occurs in verb-argument combinations with zero anaphora as permitted in Vera'a (Austronesian) and Jiwarli (Pama-Nyungan). Consider the following 'minimal pairs':

(5) Vera'a (Austronesian)

a. overt
*nik* *wo=m* ***big*** ***diē***
2SG if=TAM1 eat(protein) 3SG
'If you **eat it** (, it can be poisonous).'
(Fish15_AS.004, Stefan Schnell, p.c.)

b. covert
*gidē* *me* ***big***
1PL.INCL FUT eat(protein)
'(Here near Vera'a) we **eat** (it), (but some do get poisoned).'
(Fish_AS.008, Stefan Schnell, p.c.)

(6) Jiwarli (Pama-Nyungan)

a. overt
***yawarnu*** ***wantha-rrartu*** *ngatha*
*windbreak*.ACC put-USIT 1SG.ERG
'I used **to put (down) a windbreak**'
(T61s40, Austin 2001: 311, translation adapted)

b. covert
*yalha-ngka* ***wantha-rrka*** *nganthurra-lu* *marrungku-lu*
*ground*-LOC put-FUT we.PL-ERG for.ever-ERG
'We will **put** (them) in the ground for ever.'
(T44s21, Austin 2001: 312)

Adverbs (or "prepositions") that take optional noun phrase arguments offer further examples in Ancient Greek and English (see Reinöhl and Casaretto 2018).

(7) Ancient Greek

a. overt
*Argeîoi* *d'* ***en*** ***nēusì*** *phílēn* *es* *patríd'*
*Argives* PTC in ship:DAT.PL.F dear:ACC.F to homeland:ACC.F
*ébēsan*
go:AOR.3PL
'The Argives had gone back **in their ships** to their native land'
(Il. 12.16, Luraghi 2003: 83)

b. covert
*(ópseai …)* *nêas* *emás,* ***en*** *d'* *ándras*
see.FUT.2SG ship.ACC.PL.F POSS inside PART man.ACC.PL.M
*eressémenai* *memaôtas*
row.INF think.PTCP.ACC.PL.M
'(you shall see) my ships, and **inside**, men eager to row'
(Il. 9.361, Bortone 2010: 134)

(8) English

a. overt
*(The unemployment club is) above, **above the shop**, just above, up the stairs.*
(BNC, H4B)

b. covert
*(The unemployment club is) **above**, above the shop, just **above**, up the stairs.*
(BNC, H4B)

The phenomenon of meaning-invariant optionality extends to cases that are not universally regarded as involving functor-argument relations.[4] The following English examples illustrate this point. Verbs of motion are traditionally regarded as having a single argument, with goals, locations and sources expressed as adjuncts. The meaning, however, is just as invariant in (9) as in Examples (1–8) (for a parallel extension see Fillmore 1986: 103–104).

(9) English

a. overt
*Finally he **arrived at the hotel**.*

b. covert
*(Everyone was waiting at the hotel.) Finally, he **arrived**.*

Languages, of course, differ in their syntactic limits on meaning-invariant optionality. English famously requires overt subjects and objects in many cases, notwithstanding genre-specific effects such as the "diary drop" of 1st person subjects (e.g., Haegeman and Ihsane 2001; Nanyan 2013). Similarly, body parts in English typically come with their possessor expressed, regardless of whether the possessor is given or not (e.g., *I have to stay at home. **My back** hurts*). The optionality we discuss above is rarely available in such construction types. In the same vein, meaning-invariant optionality also plays no role in cases of obligatory expression through bound head-marking as with, e.g., obligatorily possessed body parts in the Papuan language Yali (see Riesberg 2017: 19).

Also note that some types of so-called optional arguments do not in fact uphold meaning-invariance when absent, and therefore are not relevant here. For example,

**4** A broad understanding of functor-argument combinations is found e.g., in Categorial Grammar and some versions of type-theoretic semantics: "With function application as the main rule for combining linguistic expressions, compositionality requires that complex expressions be interpreted in terms of function argument structure" (de Swart 2011: 575). See also Fillmore's (1986) use of "complement".

in English, verbs like *to eat* can be used intransitively or transitively. The question in (10) targets whether someone has eaten (and is full), and is not interested in what was eaten. The intransitive form lacks an anaphoric unexpressed argument.[5] Thus, this phenomenon does not fall within the scope of the current investigation.

(10) (Arriving at a friend's house, the friend asks): *Have you eaten?*

Till now, the distribution of overt and covert arguments has normally been explained in terms of information structure, specifically as an aspect of reference tracking (e.g., Du Bois 1987; Givón 1983). Factors implicated in the choice of referring expression – among them, the zero anaphora – include topicality and animacy. In this paper, we argue that such factors account for a smaller part of the distribution than hitherto assumed. A prior determining factor in argument encoding has been overlooked. This governing principle is semantic rather than information-structural.

# 3 Metaphors require argument overtness

The following subsections lay out how metaphor precludes optionality of the type we have seen in Section 2. We first show that metaphor-driving arguments need to be overt (Subsection 3.1), then give a semantic account of metaphor (Subsection 3.2) and contrast it with alternative approaches (Subsection 3.3). Subsection 3.4 highlights the role of discourse in sense selection. We show that obligatory argument overtness applies unless the metaphorical interpretation of the clause is already established through a prior metaphor-driving argument (Subsection 3.5). Finally, we bolster our claim that information-structural factors have no impact on whether metaphor-driving arguments are overt (Subsection 3.6).

## 3.1 Metaphor and overtness

Our central claim is that metaphors require overt expression of the metaphor-driving argument, covering Rai and Chakraverty's (2020) "Type II" metaphors of

**5** In some traditions, the intransitive version is interpreted as involving an implicit indefinite argument, in an effort to avoid the duplication of lexical entries (see e.g., Dowty 1981; Fodor and Fodor 1980; Gillon 2012; see also Landau 2010 on English implicit arguments). However, some of these approaches conflate cases where the referent is unknown with cases where it is indifferent or in fact missing in the discourse universe (see also Fillmore 1986: 96), or where the emphasis is on the event, as when a common routine is expressed (e.g., Glass 2020). Accounts of which verbs allow for omission revolve around how much the verb semantically constrains possible arguments (e.g., Groefsema 1995 or Resnik 1993).

verb-argument combinations, but going beyond these in covering any functor-argument combination irrespective of word class. Optionality of arguments is only found with literal uses.

Let's look again at *middle*. Literal middles exist in spatially or temporally convex[6] objects, e.g., rooms, tables, days or years, as seen in Examples (1)–(4).[7] Now consider metaphorical uses:

(11) English
*If there is **trouble** it seems Jones is inevitably **in the middle of it**.*
(BNC, CEP)

(12) Apabhramsha (Indo-Aryan)

| | | | |
|---|---|---|---|
| *dharivi* | *ihu* | ***majjhi*** | ***hiyayaha*** |
| carry.CONV | DEM.ACC.SG | middle.LOC.SG.N | heart.GEN.SG |

'he carried this [i.e., a thought] **in the middle of his heart**: ('I will …')'
(SA 707.4, Reinöhl 2016: 151)

*Trouble* in (11) and *hiyaya* 'heart' in (12) are not convex objects but respectively encode a state and the seat of thoughts and emotions, and so lack literal middles. This incompatibility of terms forces a metaphorical interpretation. In all such cases, we find the metaphor-driving argument expressed overtly.

What we never see in our data are sentences like *If there is trouble it seems Jones is inevitably in the middle*, where the covert argument of *middle* resumes *trouble*. We have illustrated metaphor-driven argument overtness here with nouns, but it occurs also in combinations of other parts of speech that force a metaphorical interpretation. Here (13) and (14) are examples from English involving *above* and *arrive*, contrasting with the optionality seen in the literal Examples (8), (9).

(13) English
*What makes a car a classic? Must it follow **fashion** or be **above it**?*
(BNC, CFT)

(14) English
*You are usually given problems in advance, and will be asked to give your **solutions** and how you **arrived at them**.*
(BNC, EX5)

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**6** By convex we mean convex-ish – shaped in such a way that a periphery can be distinguished from a center. Convex containers also include 1-dimensional sequences: *Mary is in the middle of the row*.
**7** Temporal objects are sometimes considered as being metaphorical by definition. However, it has been shown that the literal/metaphorical divide does not align with spatial/non-spatial. We take this point up again in Section 3.3.

The hypothetical case where a metaphorical sense occurs without the corresponding metaphor-driving argument – e.g., *arrive* occurring without the overt expression of what is metaphorically arrived at – does not occur.

As far as we know, the only previous account of the phenomenon is given by Reinöhl (2016: 147–158) who describes the distribution of overt and covert arguments combined with relational nouns and adverbs in Indo-Aryan. While some existing work on zero arguments contains relevant contrast pairs, e.g., *return (to the camp)* versus *return *(to the task)* (Fillmore 1986: 102), the phenomenon of obligatory metaphor-driven argument overtness has passed unnoticed. One reason for this oversight seems to be that most studies (e.g., many of those quoted in Fn. 2) focus on the question of which functors (specifically, verbs) allow for zero arguments. In contrast, we ask the question: if a functor in principle allows an anaphoric zero argument, when must that argument be overt?

The literature on lexical semantics recognizes that more context is usually needed – and quite unsurprisingly so – to evoke less common interpretations of terms (e.g., Cruse 1986: 72–73; Löbner 2012: 74–77). For instance, Löbner (2012) briefly discusses the need for more context to facilitate shifts to figurative interpretations resulting from metaphor or metonymy. The phenomenon, however, is definable much more precisely and with a much wider scope than has been noted before. There is absolute or near-absolute resistance of metaphor drivers to being covert – across parts of speech and languages – no matter how activated.

## 3.2 A closer look at the literal and the metaphorical

At the heart of every metaphor is a conflict in literal senses. Terms have literal, "citation" senses, those that come to mind when asked about the word in isolation, and these are the ones that typically end up as the primary definition in dictionaries (the "established" senses in Cruse 2000: 108; see 'minimalist' approaches in Recanati 2003).[8] One testable characteristic of literal senses is that they survive in emphatic reduplication, as in *There was a mouse – a MOUSE mouse – sitting next to my laptop*! (i.e., as opposed to a pointing device).[9] Often, the literal senses are semantically richer than metaphorical ones (e.g., *to arrive* generally signifies that a particular

**8** In some cases, compatible literal senses can also be combined for metaphorical effect (see the examples of "My cat is a tiger!" in Neuman et al. 2013), which we do not focus on in this paper.

**9** In fact, most kinds of applied prominence, including additional word stress, seem to select the literal sense. For example, *There was a MOUSE next to my computer*, suggests a flesh-and-blood mouse.

endpoint is reached, but only the literal use involves the added component of spatial movement).[10]

When two terms with conflicting literal senses come together in a functor-argument relationship – e.g., when the semantic type of the argument violates selectional restrictions imposed by the functor – this conflict can be resolved through metaphorical interpretation (Asher 2011). Language users resolve such conflicts by reanalyzing the terms to build a coherent interpretation. Combined with *trouble, middle* loses its reference to an actual spatial or temporal center. At the same time, a schema of convex containerhood is imputed to *trouble* (e.g., Boroditsky 2000; Lakoff and Johnson 1980). We refer to the argument in conflict with selectional restrictions and therefore coercing reinterpretation as the *metaphor-driving argument* (see Rai and Chakraverty 2020: 5–6 for references on selectional preference resolution accounts of metaphor).[11]

Close examination of corpus data reveals that there are transparently literal and transparently metaphorical expressions, but also unclear ones, where one could argue for either classification. Importantly, however, argument optionality seems to be found only with transparently literal cases. Potentially ambiguous cases such as the natural spoken-language example in (15) are generally found in our corpus with overt lexical or pronominal arguments. While a restaurant can be conceptualized as a convex space, the point here does not seem to be that *he* is literally in the restaurant's center, but in a situation where *he* can't speak at ease; thus, *in the middle* here conveys immersion rather than reference to a specific center.

(15) *But he was i**n the middle of a restaurant** he said and I can't,* [sic!] *think he felt a bit awkward speaking* (BNC, KE2)

Metaphors are widespread, some more conventionalized and others more ad-hoc. As Lakoff and Johnson (1980) have famously emphasized, metaphorical language is not restricted to poetical or flowery ways of speaking, but pervades ordinary language use (see also e.g., Steen et al. 2010). In some cases, metaphorical constructions have a

**10** Whenever we could not contact native speakers to test for context-free literal meanings for our data analysis, we rely on alternative strategies such as comparing (non-contextualized) word glosses with free translations (see Section 4.3 on Vera'a).

**11** The linguistic process we represent here assumes – in accordance with standard approaches in lexical semantics (e.g., in Cruse 1986 or Löbner 2012) – that not all possible senses of a term in all contexts are necessarily contained in its lexical meaning. We regard metaphorical interpretations as arising (sometimes, spontaneously) from the non-monotonic combination of semantic components. Non-monotonic combination means that the semantics of the whole is not accessible within the default semantics of all (or potentially any) of the parts, e.g., *to arrive at a conclusion* is not an instance of literal 'arriving'. This approach provides a principled distinction between literal and metaphorical uses, which is not possible if all interpretations of a term are potentially available in all contexts. For a formal account of this process see Ellison and Reinöhl (in prep.).

special pragmatic force; compare, for example, *in the middle of trouble* with *in trouble*. In many other cases, however, the metaphorical construction adds no special force, as in *to arrive at a conclusion, to take control, the head of the company*, *warm light,* etc. The ordinariness of these conventionalized metaphors is highlighted by Lakoff and Johnson (1980) to the point that they call them "literal" (e.g., 1980: 53, and elsewhere). While we take their point, we do not adopt their usage, but retain the traditional language sense of "literal" as contrasting with "metaphorical".

It might be tempting to equate "literal" with "most frequent" (e.g., Levshina 2018). There are, however, many examples where non-literal uses compete in frequency with literal ones (see Cruse 2000: 199). Consider for example English nouns such as *obstacle*, *goal*, *target*, or *foundation.* The one respect in which frequency may play an important role is when the metaphorical sense of a lexeme over time becomes a literal one because the original literal sense has been lost or almost lost. An example of this might be the English noun *set-up*, which originally had a literal use meaning 'An object set up or upright, an upright. Also spec. a stand or display at a carnival, etc.' (OED)[12] besides its metaphorical use 'The way in which something is organized, arranged, or constituted' (OED). In contemporary English, only the originally metaphorical meaning remains in productive use and may hence now be characterized as the new literal use. In such cases, we would predict that metaphor-driven argument overtness may not hold (anymore). We would further predict that it may already break down as the literal use declines.[13] In other words, obligatory argument overtness affects cases where there is a productive relation between a literal and a metaphorical interpretation.

Before we move on, it is worth noting some phenomena that do not fall within the scope of the present study. Firstly, cases where a construction as a whole functions as an idiom are not relevant when they do not involve a semantic conflict between the literal senses of functor and argument. Thus, *kick* and *bucket* are semantically fully compatible under their literal senses in modern English, even if only folk-etymologically, and it is only the construction *to kick the bucket* as a whole that has a figurative sense.

We also do not address metonymy. Cases of metonymy do not force argument overtness in the way metaphors do. For instance, it is widely believed that modal verbs grammaticalize by way of metonymical, not metaphorical processes (e.g.,

**12** Current online version of the Oxford English Dictionary (last accessed 11/02/2020). https://www.oed.com/view/Entry/176880?rskey=6zLQPu&result=3&isAdvanced=false#eid.

**13** Related cases involve lexemes with literal and metaphorical uses which are borrowed into another language only with the metaphorical sense. In the borrowing language, the latter would be considered literal. We suspect that e.g., numerous borrowings from Latin or Norman French into English may belong here.

Bybee et al. 1994). Modals can elliptically take up an already-mentioned argument – *Will you help me? Yes, **I will***. – which contrasts with the obligatory expression of metaphor-driving arguments.

## 3.3 Alternative accounts of metaphor

The distinction between literal and metaphorical is often paraphrased as the distinction between spatial or "concrete" and abstract, but this characterization is misleading. Even though metaphors from the spatial domain to an abstract one seem common, there are many cases where we see a different, even reverse mapping (see Kövecses 2017: 16). For instance, in *Currently the world is limited to existing on a completely flat, homogeneous surface that extends forever in all directions* (Belote 2008: 30), spatial size is conceptualized in terms of temporal duration. Metaphors building on non-spatial concepts are common also in the realm of cross-modal metaphors. The temperature terms *warm* and *cold* can indicate voice qualities (among other things). In other cases, metaphors remain in the same general domain, e.g., from sound to sound in the example *awakened by the thunderclap of a large branch falling on the roof*.[14] In our data collection, both from corpora and in the experiment we conducted, we made sure to not only include the better established metaphors from space to non-spatial domains, but also others.

A mapping from space to time – as a sub-type of mappings from space to non-spatial domains – is particularly often invoked. For example, take a verb like *to come* whose literal sense involves a reference to space ("to move to or towards a person or place", OELD).[15] Because of this, *your day will come* is a metaphor (see Boroditsky 2000 on the metaphoricity of temporal *come*-constructions). Some concepts, however, are equally literal across multiple domains, some across both space and time. One such example is *middle*, whose primary sense is defined in the Oxford English Learner's Dictionary as "the part of something that is at an equal distance from all its edges or sides",[16] illustrated both by spatial and temporal examples (e.g., *in the middle of the road*, *in the middle of the night* etc.) (see also Reinöhl 2016: 148–149). In fact, literal uses of *middle* extend to other abstract entities that have inherent quantifiable scales, e.g., temperature or income.

As laid out above, we operationalize the concept of functor-argument metaphors more generally in terms of a clash in selectional restrictions, rather than in terms of traditional comparison-based or substitution-based approaches to

**14** https://www.merriam-webster.com/dictionary/thunderclap (10/MAR/2020).

**15** https://www.oxfordlearnersdictionaries.com/definition/english/come_1?q=come (25/MAR/2020).

**16** https://www.oxfordlearnersdictionaries.com/definition/english/come_1?q=come (26/JAN/2020).

metaphor (see Rai and Chakraverty 2020 for an overview). In terms of the actual interpretation of a functor-argument metaphor in communication, we furthermore subscribe to an interaction-based view that takes into account context, world knowledge and discourse participants' perspectives and attitudes that are updated in real time, and we thus reject the possibility of a monolithic semantic interpretation. Our focus in this paper is not, however, on such interactional aspects, but on the structural consequences of the clashes in underlying selectional restrictions. While recent years have seen a rise in computational approaches to metaphor-detection, we here rely on manual annotation given that there is so far no proposed method that approaches 100 % of what coders intuitively regard as metaphorical (see Rai and Chakraverty 2020 for a detailed overview). Several computational approaches moreover involve a step of human coding, ultimately falling back on intuition, as is the case with the Metaphor Identification Procedure that is intended as an objective and reliable method (see Pragglejaz Group 2007). Since our interest here is in capturing all metaphorical cases in our datasets in order to test whether metaphor-driven argument overtness really does hold as robustly as we claim, we therefore rely on our operationalization as outlined above, where senses found in isolation, viewed as prototypical by native speakers, are the reference points for what is and is not metaphorical (see further detail in Sections 4 and 5).

## 3.4 Lexical semantics and discourse context

Many of the metaphor drivers we have encountered have inherently abstract meanings, e.g., *trouble*. However, there are terms which can represent either a concrete or an abstract sense. One example is *hiyaya* 'heart' in ex. (12), repeated as (16). In principle, 'heart' could designate either the physical organ or the seat of emotions and cognition. Context makes it clear that the term here refers to the heart as an abstract entity.[17] Thus, whether a term drives a metaphor depends not solely on its lexical semantics, but on the use to which it is put in context.

**17** One reviewer raises the possibility that body part references in expressions of emotion may not be metaphorical. Evidence from Old (and Middle) Indo-Aryan suggests that *in the middle of GEN* is a pragmatically charged competitor of the morphological locative in expressions of this type (see Reinöhl 2010 (ms), 2016: 165–167). The pragmatic force arises from the semantic clash between the constituent lexemes. This metaphoricity is the key to *in the middle of GEN* becoming available as an emphatic alternative to the morphological locative. Even if one wished to argue against this evidence of metaphoricity, however, we point out that this would not offer negative evidence contradicting our argument for obligatoriness, but would only exclude this specific semantic domain of evidence.

(16) Apabhramsha (Indo-Aryan)

| | | | |
|---|---|---|---|
| *dharivi* | *ihu* | ***majjhi*** | ***hiyayaha*** |
| carry.CONV | DEM.ACC.SG | middle.LOC.SG.N | heart.GEN.SG |

'he carried this [i.e., a thought] **in the middle of his heart**: ('I will …')'
(SA 707.4, Reinöhl 2016: 151)

Another important domain of such conceptual duality arises with humans, who can be talked about as bodies or as abstract entities (e.g., social agents). Since humans spend a good deal of time talking about themselves and others of their kind, references to people constitute particularly common cases of concrete-abstract ambiguity (see also Reinöhl 2016: 158–160).

The importance of discourse context naturally extends to pronominals. In (17), we have an anaphoric reference to *contradictions* which clashes with the literal meaning of *middle,* and so the pronoun drives a metaphorical rather than a literal interpretation.

(17) English
*Having ridden **the contradictions**, the paper suddenly found itself in the middle of **them**.*
(BNC, HA1)

Whether or not an argument drives a metaphor thus depends on its interpretation in context. The crucial role of context in triggering overtness underscores that metaphor-driven argument overtness is a phenomenon of communication. It arises out of the effort that speakers make to model listeners' minds, an insight informing our psycholinguistic model in Section 6.4.

## 3.5 When we already speak in metaphorical terms

If a functor takes two (or more) arguments, either one could drive a metaphor, i.e., be the first argument in the clause to establish the metaphorical interpretation. If the first argument in the clause does (e.g., the subject), then subsequent arguments are not needed overtly, since we have already been pushed into the metaphorical realm.[18] Consider the following example:

(18) ***The truth** lies in the middle.*

**18** In other cases, the metaphor-driving term may follow, e.g., *The target is 500 schemes by 1993, with a switch of emphasis towards small- and medium-sized companies* (BNC, A94). Here, the metaphorical interpretation of *target* is triggered by the second argument *500 schemes*.

*Truth,* as an abstract entity, cannot in fact literally, spatially lie anywhere. Since it pushes *lie in the middle* into metaphor, there is then no need to supply an additional metaphor-driving argument to *middle*. In more formal terms, since the first argument clashes with the selectional restrictions of the functor's literal sense, the latter is reinterpreted with adjusted selectional restrictions in accordance with the semantics of the first argument. Since the second argument does not clash with these modified restrictions, it can remain covert (see Ellison and Reinöhl in prep., for a detailed formal account employing graphical semantic representations). We refer to such cases for short as the "metaphor-post-driving" or just "post-driving" condition (see Section 5.2), where argument optionality (instead of obligatoriness) is expected.

Given Example (18), one might think that the non-obligatoriness of the second argument is restricted to frequent collocations. However, the same phenomenon is found in Example (19) which does not involve a frequent collocation. The metaphor-driving constituent *diseases of joints, muscles and gut* is overt, while the container of *middle* remains covert.

(19) … *in very general terms in the physical sphere a skin rash or a cold is of minor significance whereas a heart, lung or brain disease is much more serious.* ***Diseases of joints, muscles and gut lie somewhere in the middle.*** (BNC, B1R)

One special case occurs with imperatives. They have an in-built argument concerning (usually) 2nd person speech-act participants. This paradigmatic zero remains even when these act as metaphor drivers, e.g., *Drop it!* or *Leave it!*. Given the metaphor-driving zero, the second argument can also remain covert in some languages where the syntax allows it, e.g., Tamil *Viḍu!*.[19]

We return to the interaction between multiple arguments to one functor in the context of our corpus studies and of our sentence-completion experiment.

## 3.6 Outside information structure

Whether we express a referent covertly or overtly with a full noun phrase or pronoun traditionally lies within the purview of information structure. Indeed, this choice is often determined by factors such as how activated or topical a given referent is. However, information-structural constraints on overt or covert

**19** Thanks to Siva Kalyan for pointing out the Tamil example and for making us think about imperatives.

expression are restricted to the arena of literal language. In the realm of metaphor, there is no optionality.[20]

We suspect that scrutiny of the literature on reference tracking will reveal cases where overt expression has been attributed to causes such as low topicality, while it was in fact forced by metaphor. We are aware of at least one such study (David 2016: 83–84) which explicitly attributes the necessary overtness of *at the conclusion* in *We arrived at the conclusion* to the argument's insufficient topicality, rather than to the inherent semantic clash between functor and argument.

Arguments can only drive metaphors within their own simple clause (For spoken language, further research will likely revise this generalization to the intonation unit). A metaphor-driving element cannot combine with a functor in a different clause, even if immediately adjacent. We have already seen this phenomenon above (e.g., (11), (13), (14)) and it is also illustrated by the next two Examples (20) and (21). The referents in question are pronominally resumed in the immediately following clauses (for an example of resumption by means of a synonym, see (25)). Both examples illustrate that the domain of obligatory argument overtness is not the sentence (or the complex clause), but the simple clause.

(20) *Actually, I agree with you: there 's* ***something awry here*** *and I seem to be caught* ***in the middle of it****.*
(BNC, CA3)

(21) *…* ***she*** *has been a good and loyal friend to me and I will* ***stand by her****.*
(BNC, G39)

While information-structural factors are irrelevant for the overtness of metaphor-driving arguments, highly activated referents best exemplify the contrast between literal and metaphorical language. It is precisely with given referents that zero expression may become possible in literal language, while there is no such effect in the case of metaphor. Throughout the paper, we therefore primarily choose examples for illustration which involve a highly activated referent, which is pronominally resumed. This example type also forms the basis for our sentence-completion experiment discussed in Section 5.

**20** Metaphor-driven argument overtness might be recast within information structure. For example, accessibility (e.g., Lambrecht 1994: 165) perhaps falls below a necessary threshold in metaphorical uses, forcing a referent to be resumed obligatorily. The fit is imperfect however, as information structure deals with coherence across larger domains, minimally inter-sentential. Metaphor-driven argument overtness, in contrast, holds at the clausal level, which is why we do not adopt this approach. Of course, while information-structural factors have no influence on the overtness of metaphor-driving arguments, they retain their role in determining the form of the metaphor-driver, e.g., lexical or pronominal.

# 4 Corpus evidence

In this section, we show metaphor-driven argument overtness in three corpus studies. We examine several different construction types in both spoken and written data. The phenomenon was first noticed for spatial terms and their possessors in Indo-Aryan (Section 4.1). To probe its crosslinguistic robustness we turn to English and the British National Corpus (Section 4.2), testing several different construction types. We conclude with a study of verb-argument combinations in Vera'a, an Austronesian language of Vanuatu (Section 4.3).

## 4.1 Indo-Aryan: spatial nouns and their possessors

Reinöhl (2016) studies the emergence of postpositions and postpositional phrases across the three millennia of attested Indo-Aryan history. She observes that spatial nouns over time occur more and more frequently with overt possessors and in metaphorical contexts, suggesting a connection between the two phenomena. On the topic of Sanskrit *madhye* 'in the middle' developing into Hindi *mẽ* 'in', she observes that metaphorical uses (subsumed within "non-basic grounds") require overt possessors:

> [A]ny usage of MADHYE relating to a non-basic ground, that is to a ground which lacks an intrinsic centre, requires its overt expression. Only MADHYE expressing IN MIDDLE in relation to a spatial or temporal ground with an intrinsic centre may be used without an overt possessor. (Reinöhl 2016: 152)

She goes on to list two types of evidence for this claim:

> First, instances of MADHYE in isolation tell us about the possibilities when covert reference is possible. Second, instances where MADHYE takes a pronominal possessor give clues about where a ground which is inferable from context is nevertheless expressed overtly, even though covert reference is a syntactic possibility. (2016: 152)

Her results show that argument overtness depends on the literal-metaphorical distinction. Literal arguments allow for covert expression, while metaphor drivers require overt forms. This leads to the phenomenon of pronominals being overt even where referents are highly activated.

The study is based on a corpus consisting of the bulk of Vedic Sanskrit texts and a substantial number of texts in different varieties of Middle and Early New Indo-Aryan. All 104 cases of *madhye* occurring without an overt possessor refer to a physical or temporal container as illustrated in (22) and (23) (see also Example (3b)).

(22) Vedic Sanskrit
*atha* *madhye* *'ṅgúlyākāśáṃ* *karoti*
now middle.LOC.SG.M finger_hole.ACC.SG.M do.3SG
'he then makes a finger-hole **in the middle** (of the knot)'
(ŚaB 3.3.2.20)

(23) Vedic Sanskrit
*tasya* *ardhāḥ* *śastvā* *ardhāḥ* *pariśiṣya*
DEM.GEN.SG.M half.ACC.PL.F recite.CONV half.ACC.PL.F leave_over.CONV
***madhye*** *nividaṃ* *dadhāti*
middle.LOC.SG.N invocation.ACC.SG.F put.3SG
'having recited half its (verses), leaving half over, he places an invocation **in the middle** (of the recitation)'
(AiB 3.19)

In metaphorical constructions, possessor arguments are overt, even when given, such as the 1st person speech act participant cast as a social entity in (24):

(24) Vedic Sanskrit
*dāsyāḥ* *putraḥ* *kitavo* *'brāhmaṇaḥ*
slave.GEN.SG.F son.NOM.SG.M cheat.NOM.SG.M non_Brahmin.NOM.SG.M
*kathaṃ* ***no*** ***madhye*** *adīkṣiṣṭa* *iti*
how GEN.1PL middle.LOC.SG.N consecrate.AOR.MID.3SG QUOT
'The child of a slave woman, a cheat, no Brahman; how has he been consecrated in **our middle**?'
(AiB, Reinöhl 2016: 154)

The Indo-Aryan evidence unequivocally supports obligatory metaphor-driven argument overtness. While the corpus is larger than many historical corpora of other languages or language families, it is small in comparison to the corpora of some modern world languages. Thus, we now turn to English.

## 4.2 English

We explore the obligatoriness of metaphor-driving arguments in English across several construction types. These include relational nouns taking possessors (Section 4.2.1), adverbs selecting spatial arguments (Section 4.2.2), and verbs of motion and posture having goals or locations (Section 4.2.3). The data is taken from the British

National Corpus (BNC),[21] which contains about one hundred million words. It covers modern British English in a broad variety of genres, spoken and written, and was compiled between 1991 and 1994.

The full BNC is available for download free of charge. We incorporated it into a MySQL relational database and developed SQL and PYTHON scripts to search for target words in tailored contexts defined by part-of-speech and punctuation. For each target word and context, we made a random selection of 100 examples for the study. All examples are provided in the supplementary materials.

Examples were classified into "literal" or "metaphorical" (in the first step, without taking into account which argument is the metaphor driver) by three research assistants and the authors based on our understanding of this difference outlined in Section 3.2, which builds on our operationalization of literal as the primary definition sense given for a word in isolation. If there was disagreement between raters, we coded examples as "metaphorical", in order not to overlook potential counterexamples for our hypothesis (see also fn. 23). A residue of cases was marked as "unclear" where the context did not disambiguate literal from metaphorical (potentially including, but not limited to, twice-true metaphors, see Cohen 1976) or where it was hard to pin down the exact meaning. For example, in (25), *arrive* can be taken spatially or non-spatially and both interpretations are felicitous. The *talks* can be understood either as an abstract entity or literally as standing for the location where they take place (by metonymy).

(25) *[During **negotiations** between Syria and Israel …] At the end of the first week Allaf was particularly critical of the Israeli delegation's tactics, saying that the Israeli delegation had **arrived at the talks** with a "premeditated determination not to allow any progress".*
(BNC, HLG)

A fourth category "other" was used for the few cases where automatic filtering failed to select only cases of relevance to the study, as in the following example with *arrive at* not before punctuation:

(26) *So one is forced to conclude that the reason hundreds of dismayed tourists and walkers are stranded on stations up and down the length of the West Highland line at the height of the season, unable to squeeze into an already packed 'Sprinter ', if it **arrives at** all, …*
(BNC, AS3)

**21** The British National Corpus, version 3 (BNC XML Edition). 2007. Distributed by Bodleian Libraries, University of Oxford, on behalf of the BNC Consortium. URL: http://www.natcorp.ox.ac.uk/.

In very few cases in data from spoken conversations, instances are classified as "other" because the construction type cannot be determined with certainty, for example, when parts of the utterance are inaudible.

To assign an instance to one of the four categories, we worked with the immediate context of 128 words and with punctuation symbols after the target word. When more information was needed, we made use of the larger context accessible in the online version. Appendix A explicates the decisions for each target word individually, with several examples for illustration (As for slight differences in presentation between the downloaded and the online version of the BNC, please see details in Appendix A). Figure 1 gives an overview of the results which we discuss in detail in the next Sections; the exact queries can be found in Appendix A.

For each target functor, we contrasted occurrences before nominal expressions ("with", i.e., before nouns, adjectives, articles, or pronouns) with occurrences before punctuation ("without"). The former indicates the presence of an overt argument, while the latter its absence. Note that *all* cases of covert arguments rated metaphorical occur in sentences with a preceding, overt metaphor-driving argument in the same sentence, i.e., our "metaphor-post-driving" condition. We discuss these results in more detail below.

For all part-of-speech combinations, we trialed several more items than the ones seen in Figure 1 and selected only ones productively occurring in both literal and

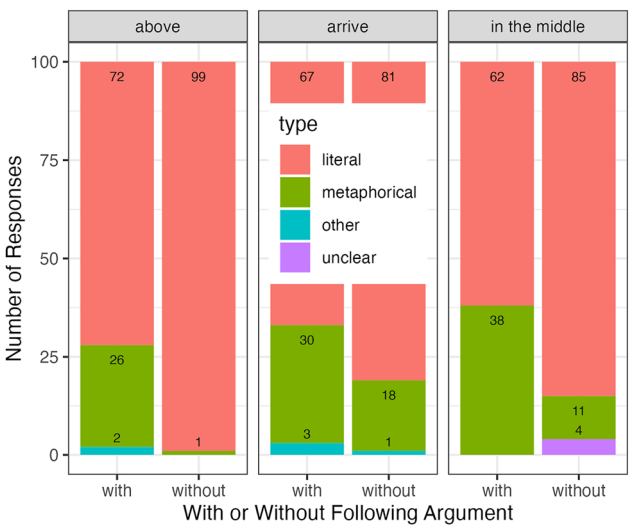


**Figure 1:** BNC queries and distribution of results across the four classifications: "metaphorical", "literal", "other" and "unclear".

metaphorical uses. For some of the trialed target words, we found no optionality under a literal interpretation, and thus there is no contrast with obligatoriness forced by metaphor. For example, while *fall from* occurs literally and metaphorically (e.g., *fall from a tree* vs. *fall from grace*), it requires an argument in any case (*John was climbing a tree. Suddenly, he fell *from*). The bare verb likewise does not create meaning-invariant optionality, because it does not necessarily have a semantic argument slot for a source. Thus, *John was climbing a tree. Suddenly, he fell.* can mean that John fell or slipped on a branch, rather than that he fell from the tree.

### 4.2.1 Relational nouns and their possessors

We looked at a number of relational nouns including spatial ones such as *edge* (e.g., *on the edge of a cliff* vs. *on the edge of bankruptcy*) or *top* (e.g., *on the top of the mountain* vs. *on the top of my mind*) and ones marking social relations such as *mother* (e.g., *the mother of the vice chancellor* vs. *the mother of all talk shows*). We decided to focus on *middle* for a detailed BNC analysis to draw a direct parallel with the Indo-Aryan data. As shown in table (30) we extracted two data sets, one targeting *in the middle of* before nouns, adjectives, pronouns, and articles, and the other targeting *in the middle* before punctuation. We excluded combinations with possessive pronouns, e.g., *in its middle*, as the possessive in this case does not participate in meaning-invariant optionality; in other words, it cannot be dropped, only replaced (*in middle). For *in the middle of* before a nominal expression, we find 62 literal cases and 38 metaphorical ones. *In the middle* before punctuation occurs with literal meaning in 85 cases, with metaphorical meaning in 11, and there are 4 unclear examples. Importantly, all the 11 metaphorical cases of *in the middle* before punctuation involve another preceding argument that acts as a metaphor driver (i.e., the "metaphor-post-driving" condition), explaining the covertness (see Section 3.5).

Examples (27) and (28) illustrate literal cases with and without overt arguments respectively.

(27) *The moonlight glimmered on **the great sweep of lawn** and on a curious bird standing **in the middle of it**.*
(BNC, AEB)

(28) *Be careful with **soilless composts** they have a nasty tendency to become bone-dry **in the middle**, while the surface remains moist and apparently well watered.*
(BNC, FEB)

In none of the randomly selected 100 uses of *in the middle* before punctuation does the covert argument function as a metaphor driver. This result fits with a prior pilot

study, where we looked at 455 cases of *in the middle* without an argument (cases not followed by possessor phrases), with the same result. Metaphorical uses are only ever found with overt possessors, as in Example (29), unless there is another argument driver (30).[22]

(29) *There was **a pool of isolation** and she was **in the middle of it.***
(BNC, CDY)

(30) *Reality is a dichotomy of two opposites and **the best** lies **in the middle**.*[23]

In sum, the metaphor-driving argument to *middle* is always overt.

### 4.2.2 Adverbs and locative arguments

We also examined combinations of adverbs with locative arguments. Not all adverbs appear in literal and metaphorical combinations, but *above* is one that does. For *above* before a nominal expression we find 72 literal cases, 26 metaphorical ones, and 2 qualifying as "other". *Above* before punctuation occurs in 99 literal cases and in one metaphorical one which has another metaphor-driving argument.

We saw literal uses both with and without overt arguments in Example (8), repeated here:

(31) *(The unemployment club is) **above**, **above the shop**, just **above**, up the stairs.*
(BNC, H4B)

Uses with argument also occur with metaphorical readings:

(32) *What makes a car a classic? Must it follow **fashion** or be **above it**?*
(BNC, CFT)

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**22** All cases involving another argument-driver as in Example (30) involve reference to a middle *between* abstract entities (e.g., someone being "stuck" or "caught" between others' views, opinions, etc.). We do not, however, find examples expressing immersion, as we do with the uses of *in the middle of* followed by an argument. Since cases such as Example (30) refer to a middle – even if an imagined one – while the immersion cases are non-referential, we feel that the former are closer to the literal uses and may even be categorized as such. Any initially divergent coding choices between raters were related to these and similar cases. In our consensus coding, we chose to code any borderline cases conservatively as "metaphorical" to retain potential counter-examples to our theory. The important point is that we find no case of a missing metaphor driver, even when we classify examples as "metaphorical" very liberally.

**23** Comment on https://www.returnofkings.com/119468/bizarre-science-fiction-novel-sheds-light-on-what-the-technological-singularity-will-be-like (last accessed 25/09/2020).

Among the cases without a locative argument, we find none showing a metaphorical interpretation without another metaphor driver present. The single case of *above* before punctuation, with another preceding metaphor driver, is the following:

(33) *As in many similar Romantic writings on the left of the political spectrum,* ***the working class*** *is considered authentic by virtue of precisely those attributes which have been forced upon it by oppression from* ***above****.*
(BNC, FAK)

In sum, obligatory metaphor-driven argument overtness holds strictly for combinations of adverbs and locative arguments. Optionality is found with literal uses only. Whichever argument drives a metaphor must be expressed.

### 4.2.3 Verbs and spatial arguments

Syntactic optionality is not normally available for verb-argument relations in English. However, some syntactically intransitive verbs optionally take a second argument, e.g., *arrive* taking a goal argument, as shown in Example (9). For *arrive at* before a nominal expression we find 67 literal cases, 30 metaphorical ones, and 3 classified as "other". The cases before punctuation encompass 81 literal cases, 18 metaphorical ones, and one categorized as "other". All cases before punctuation displaying a metaphorical reading include a preceding metaphor driver in the same clause.

Optionality under literal interpretation was illustrated in Examples (9a) and (9b). An example with a metaphor-driving argument involving *arrive* was shown in (14) and another is shown below in (34).

(34) *Of course, Freud, to whom we owe this* ***discovery****, did not* ***arrive at it*** *by way of evolutionary theory; on the contrary, he reached his conclusions by direct observation of adults and children*
(BNC, HTP)

Cases before punctuation showing metaphorical readings involve other preceding metaphor-driving arguments in the same clause, as in Example (35).

(35) *The reply of Jesus makes it clear that* ***the time for fasting*** *had* ***not yet arrived****.*
(BNC, CEJ)

## 4.3 Vera'a: verbs and their arguments

Research on verbal arguments in particular has traditionally focused on the impact of information-structural factors on their overt or covert realization (e.g., Huang 2000; Matić et al. 2014; van Craenenbroeck and Temmerman 2018). However, the following study of the Austronesian language Vera'a, described in Schnell (2011), shows that verbal arguments, like those of English verbs of movement discussed above, are also subject to metaphorically conditioned obligatoriness.

Vera'a lends itself to this study because substantial amounts of the spoken language corpus have been annotated for zero arguments (Schnell 2015).[24] We investigated all annotated missing arguments in the text *as1*, regardless of semantic role or syntactic function; these came to 94 zero arguments from a total of 589 arguments, occurring in 213 clause units. While adding important, non-Indo-European evidence, this corpus study is explorative and awaits future validation based on a larger corpus sample. It here serves to demonstrate the methodology of how metaphor-driven obligatoriness can be tested in lesser-studied languages.

The zero arguments combine with verbs across a range of semantic fields, in particular verbs of movement, handling, speaking, and possessing, as illustrated in the examples below.

(36) Vera'a
**ZERO** ***van*** *rōw* *ma* *anē* **ZERO** ***'ēn*** *ēn* *wōvēre* *mi'ig*
ZERO go down hither DEM1.A ZERO see ART fibres coconut
'**(They) came** down here and **(they) saw** coconut fibres.'
(veraa_as1_047)

(37) Vera'a
*duru=m* *wōl* *ēn* *raw* *anē* *den*
3DL=TAM1 buy ART hermaphrodite.pig DEM1.A ABL
*di* *va'anē* **ZERO** ***le*** ***sur*** **ZERO** *mē* *diē*
3SG TEMP.DEM1 ZERO transfer down ZERO DAT 3SG
'So the two had bought the intersex pig from him now, **gave (it)** to him.'
(veraa_as1_016)

None of the zero arguments seem to occur with metaphorical meaning. We certainly do not claim a general ability to decide between literal and metaphorical senses in a language for which we lack native intuitions, even while metaphor has been shown, e.g., by grammaticalization studies (e.g., Sweetser 1990), to serve as a strategy across

**24** The data are accessible at https://multicast.aspra.uni-bamberg.de//#veraa. Missing arguments are annotated as "ZERO" in the eaf files. Person and animacy values are given in the GRAID annotation tier, which we do not include here for ease of presentation. Clause boundaries are marked by #.

languages. However, all the examples with zero arguments in the Vera'a corpus involve basic actions such as 'to take', 'to go', or 'to say', so it seems safe to attest a literal sense in these cases. A literal interpretation is corroborated by a comparison of the glossed senses on the word level with the free translations of the whole utterances. Moreover, context showed literal interpretations to be coherent in each case. Stefan Schnell (p.c.) agrees with our assessment of these uses as literal.

In contrast to the optionality observed in examples such as (36) and (37), there is evidence that the argument is generally overt in cases that are good candidates for metaphor such as (38) and (39), an assessment shared by Schnell (p.c. and see Schnell 2011: 36 on the example quoted in (38)). Across all Vera'a texts, there are no comparable metaphorical uses of these verbs where the metaphor-driving argument remains unexpressed.

(38) Vera'a
*'a=n* *kele-gi* *di* *me* ***le=n*** ***ka-kaka*** *mē* *nikē*
LOC=ART after-3SG 3SG TAM give=ART RED-talk DAT 2SG
'Afterwards he will **give a talk** to you.'
(JJK 0.32; adapted from Schnell 2011: 35)

(39) Vera'a
*So,* *'a* *'enei* *gidē=m* ***mom*** ***ēn*** ***so*** *kaonsol*
CONJ LOC now 1PL.INCL=TAM put ART name council
*mu-de*
POSS.CLF-1PL.INCL
'So, now we **gave our council the name** …'
(GMV.096, adapted from Schnell 2011: 37)

The same verbs *le* and *mom* found in (38) and (39) can occur without overt second argument if the latter is activated and when the meaning involves a literal action of transfer, as illustrated in the two following Examples (40) and (41).

(40) Vera'a
*ē* *di* *ne* ***le*** **ZERO**
DEM3 3SG TAM2:3SG transfer ZERO
'And then he **took (it)** [and started to yarn these coconut fibers…].'
(veraa_as1_0048)

(41) Vera'a
*duru=m* *le* *ma=n* *vusu-ruō #*
DL=TAM1 transfer hither=ART bow-3DL #
ZERO *mom* *lēn* ***mom*** **ZERO** *rōvrōv'e* *duruō*
ZERO put LOC=ART put ZERO close.to 3DL
'The two took their bow and arrows, **put (them)** close to them (DL).'
(veraa_hhak_0176)

In summary, then, this section has shown that evidence from corpora of Indo-Aryan, English and Vera'a show absolute support for metaphor-driven argument obligatoriness across a range of part-of-speech combinations.

# 5 Experimental evidence

There is strong corpus evidence for metaphor-driven argument obligatoriness, equally for spontaneous speech and written texts. Across all genres, we find no exceptions. We now move on to examining the robustness of the metaphoricity effect in a sentence-completion experiment. This experiment serves as a stress test for the effect since the lack of natural context could conceivably weaken it.

In talks that we have given on metaphor-driven argument overtness, most English native speakers in the audience concur that a statement like *there is a lake with islets in the middle* acceptably expresses the same meaning as *there is a lake with islets in the middle* ***of it***, but ×*if there is trouble, then Jones is in the middle* does not acceptably convey the same meaning as *if there is trouble, then Jones is in the middle of it* (× here indicates a grammatical construction that does not seem to occur with the targeted meaning). Some, however, claim they might accept, or even produce, a sentence like ×*if there is trouble, then Jones is in the middle* with the metaphorical reading. However, the corpus results seen above in Section 4 are unequivocal: metaphor drivers must be overtly expressed. It appears that conscious reflection does not reliably access the cognitive forces underpinning metaphor-driven argument overtness (on which more in Section 6).

The lack of reliable intuition could impact results in situations where a conscious choice between alternatives is forced, an effect that may explain some of our audience members' assertions that metaphor-driven argument obligatoriness does not apply to their speech. To test this, we designed an experiment in which participants consciously choose between overt and covert realizations of arguments. With both the lack of reliable conscious intuitions and the less-than-natural experimental context, we expected mixed results. This is not what we find. Our experimental results are robust to the same degree as the natural corpus data, with conformity to metaphor-driven obligatoriness approaching 100 %.

## 5.1 Design

We conducted an online sentence-completion experiment in which English native speakers chose whether or not to provide functor nouns with overt arguments. The experiment explored how arguments were provided for 13 target functors. Framing

each functor once as literal in a suitable context, and once as metaphorical using a different context, we constructed 26 distinct questionnaire items. Each item consisted of an initial context sentence which primes the argument, typically in sentence-final position. This is followed by a sentence containing the target functor. Potential arguments to the functor were provided in a drop-down menu, allowing the choice between a covert or an overt, i.e., pro-form, argument. For some target words, more than one type of pro-form is available in natural language; for this reason, some questions offer a total of two, and others three completion options.

An example of a target word in a literal context is shown in (42) with three options for completion, and the corresponding metaphorical case is shown in (43). The order of completion options was randomized for each participant.[25]

(42) *Here is a box of sweets. You will find some chocolates at*
*1. the bottom.*
*2. the bottom of it.*
*3. its bottom.*

(43) *Something weird is going on there. I just can't get to*
*1. the bottom.*
*2. the bottom of it.*
*3. its bottom.*

The 13 metaphorical framings were split into two groups. In six sentences, the targeted argument is the driver of the metaphor. In this condition, an example for which is (43), we expect consistent argument overtness. In the remaining seven, a prior argument in the clause – the subject – acts as a metaphor driver, so that the targeted argument becomes what we call a post-driving argument. In these cases, we would predict covert arguments to occur as discussed in Section 3.5. In the following example, *His relationships* drives the metaphor, so our prediction is that *fodder* does not have to be provided with an overt argument:

(44) *Tom became the focus of the neighborhood gossip network. His relationships often provided*
*1. fodder.*
*2. fodder for it.*
*3. its fodder.*

Participants were randomly assigned different versions of the questionnaire. Each target functor occurs only once in each version – in a literal or a metaphorical frame.

25 Originally, we considered having people complete the items themselves and ran a trial experiment. It turned out that, even when given detailed instructions, the answers varied, sometimes whimsically, beyond the targeted options.

**Table 1:** Sentence-completion questionnaire conditions.

| | | |
|---|---|---|
| Condition 1 | Blocked: | All functors in literal frames only |
| Condition 2 | Blocked: | All functors in metaphorical frames only |
| Condition 3 | Mixed: | Version 3a: 6 functors in literal/7 in metaphorical frames |
| | | Version 3b: 7 functors in literal/6 in metaphorical frames |

The different questionnaire versions correspond to three experimental conditions. The first two conditions are blocked in the sense that they contain either only literal frames (Condition 1) or only metaphorical ones (Condition 2). Condition 3 is mixed, containing similar numbers of both literal and metaphorical items. To rule out target word-specific effects, we created two versions for Condition 3, resulting in four questionnaire instances in all. The two questionnaires for Condition 3 were counterbalanced: a target functor framed metaphorically in the first was framed literally in the second, and vice-versa. For each participant, the 13 items of their questionnaire version were presented in a randomized order. The breakdown of the conditions is shown in Table 1.

The combination of mixed and blocked conditions allows us to check for inter-question structural priming. If structural priming was a problem, we would expect differences in the distribution of responses for the same question posed in a blocked versus mixed condition.

We collected metadata from the participants about their native variety of English, in case this might be a factor influencing the results. We also asked for their competence in other languages. Participants were given the option of supplying their gender and age. After the experiment, participants could comment on their experience, and we discuss some of their remarks below. The experiment was disseminated via institutional and private social media accounts.

## 5.2 Results

Our questionnaire was completed by 259 people. Of these, 9 were excluded as the participants indicated in the metadata that they either had been, or may have been, at a talk by the authors on the topic being investigated. The remaining participants came from a range of English dialects: 99 were native speakers of Australian English, 63 of a North American dialect, 60 of a dialect from the UK or Ireland, 18 of South African English, and 7 of New Zealand English, with other dialects of English sharing the remaining 3. The majority of participants (185; 74 %) identified as not speaking another language natively or native-like. Female-identifying participants made up

65 %, male-identifying as 33 %, with 1 participant each identifying as trans, non-binary, and as agender; 3 participants did not volunteer a gender. The mean age of the 227 participants who volunteered their year-of-birth was 42 (standard deviation 14.3).

Because participants were randomly assigned a questionnaire, we were not guaranteed identical numbers in each. Thus there were 67, 53, 70 and 60 respondents across the four conditions respectively. A basic statistical analysis of the blocked and mixed conditions showed no significant difference in the covert/overt responses overall, although it is near significant ($\chi^2 = 3.3856$, $df = 1$, $p = 0.06577$). Breaking these results down by conditions shows larger $\chi^2$ for metaphor-post-driving ($\chi^2 = 2.3366$, $df = 1$, $p = 0.1264$) and literal ($\chi^2 = 2.4226$, $df = 1$, $p = 0.1196$) than metaphor-driving conditions ($\chi^2 = 0.92369$, $df = 1$, $p = 0.3365$), suggesting that these are more responsive to priming conditions.

The primary descriptive results appear in Figure 2 (see Appendix B2 for all results). The rows correspond to the three conditions: the top is the metaphorical condition where the targeted argument is the metaphor driver, the second where an earlier argument (the subject) acts as metaphor driver, so that the questioned argument is a (metaphorical) post-driving argument. The third row corresponds to the literal condition. The columns correspond to the two types of sentence completion: one with an *overt* or one with a *covert* argument. The crucial number of metaphorical uses without an overt argument – which our theory would predict to be zero – are shown in the top left corner.

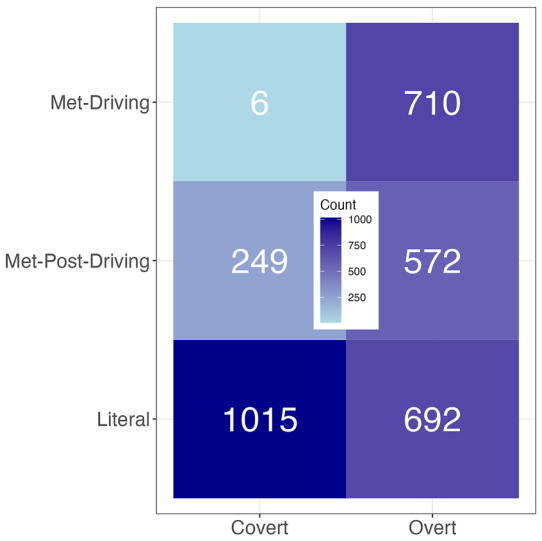


**Figure 2:** Descriptive results of sentence-completion study.

The results in Figure 2 show strong support for overtness. For literals – whether in a mixed or blocked condition – more than half of the responses drop the argument. By contrast, when the argument acts as metaphor driver, the overt choice is almost exceptionless. When another argument drives the metaphor, we find an intermediate level of argument overtness, consistent with our expectations for post-driving arguments.

Since there are no relevant differences between the blocked and mixed conditions, we aggregate the results from these conditions in what follows. Figure 3 contrasts the proportion of overt arguments we found in literal constructions compared to those where they act as metaphor drivers. The contrast is striking: only 41 % overt arguments in the literal cases, and over 99 % in the metaphor-driving cases.

Figure 4 adds the post-driving argument condition, in which participants preferred overt arguments 70 % of the time.

These results support the claim that metaphorical constructions *require*, rather than just *prefer*, overt drivers. Only when a preceding argument acts as driver – e.g., when the subject has already pushed us into the metaphorical realm – can the targeted argument be omitted.

While the results shown in the bar graphs are clear, we also evaluate them statistically. The question we wish to answer is whether the same process could have given rise to the overtness frequencies for all three categories: literal, post-driving

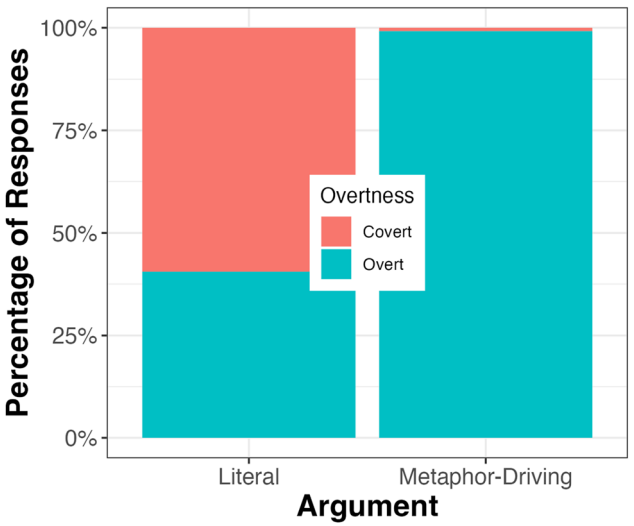


**Figure 3:** Literal and metaphor-driving arguments (in percentage).

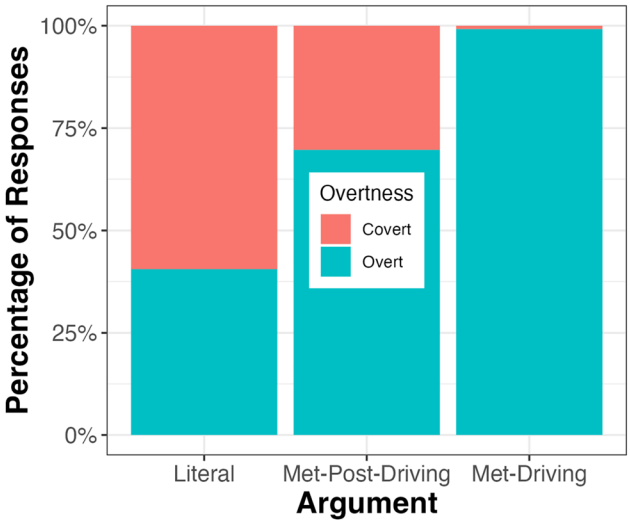


**Figure 4:** Literal, metaphor-post-driving and metaphor-driving arguments (in percentage).

and metaphor-driving, or whether the near-absolute overtness of metaphor-driving arguments reflects an entirely different process. In other words, the question is how strongly does our experimental evidence support metaphor-driven argument overtness.

We evaluate the strength of evidence using a simple model in which each category has its own value for the likelihood of responding with an overt argument. For a literal target, the likelihood of using an overt argument is $l$, for a post-driver target the likelihood is $p$, and for a metaphor-driving target the likelihood is $m$. We assume that the prior distributions – that is the probability associated with different values before considering any data – are flat for $l$, $m$ and $p$. We then evaluate how strongly our evidence supports one hypothesis over the other. We first compare the values of primary interest, i.e., the literal category $l$ and the metaphor-driving one $m$. We explore the strength of evidence that they differ by more than our criterion for 'sameness' – being within 0.05 (5 %) of each other.

| | |
|---|---|
| Hypothesis LM-Different: | The underlying difference $\|m\text{-}l\|$ in the likelihood of using an overt argument for a literal target and for a metaphor-driving target is greater than or equal to 0.05. |
| Hypothesis LM-Same: | The underlying difference $\|m\text{-}l\|$ in the likelihood of using an overt argument for a literal target and for a metaphor-driving target is less than 0.05. |

The $\log_2$ Bayes Factor favors LM-Different over LM-Same with a strength of 662.7. Kass and Raftery (1995) define $\log_2$ Bayes Factors above 7.2 as indicating *very strong*

*evidence* for one hypothesis over the other. Given the logarithmic scale, 662.7 – corresponding to an odds ratio of $3.19 \times 10^{199}$ – indicates extreme certainty that Hypothesis LM-Different is correct, i.e., that metaphor is a distinct and powerful factor forcing argument expression.

These results confirm that we have *very strong evidence* that the distribution of arguments in the literal and metaphorical cases reflect substantially different distributions, and hence are the result of different underlying processes.

Parametric chi-square statistics offer us similar conclusions. Pairwise comparison of the overtness/covertness distributions give us likelihoods of the data for metaphor-driving and literal having been generated by the same distribution as very low ($\chi^2 = 708.59$, $df = 1$, $p \simeq 0$).[26]

Just as LM-Different and LM-Same were two hypotheses about the proximity of the likelihoods of overtness in literal and metaphor-driving arguments in the experiment, we can define hypotheses LP-Different and LP-Same about the difference between the overtness likelihoods of literal and post-driver arguments, and similarly PM-Different and PM-Same for the difference in overtness likelihoods between post-driver and metaphor-driving arguments in the experiment. The $\log_2$ Bayes Factor in favor of LP-Different over LP-Same and PM-Different over PM-Same are 121.2 and 197.9 respectively. The corresponding odds ratios are $3.0 \times 10^{36}$ and $3.8 \times 10^{59}$ respectively. The data provide very strong evidence (in the Kass and Raftery [1995] sense) that the effect strength – the difference between overtness likelihoods – is substantial. The chi-square comparisons of these conditions are also overwhelmingly significant ($\chi^2 = 187.0$, $df = 1$, $p \simeq 0$ and $\chi^2 = 238.4$, $df = 1$, $p \simeq 0$). The base R distributional functions for the chi-square distribution were unable to distinguish $p$ from 0, in all comparisons between conditions.

The above evidence has shown that there is very strong evidence for a difference between the distribution of arguments found in literal and metaphorical constructions where the argument is a metaphor driver. Furthermore, the effect size is very large.

## 5.3 Discussion

Our hypothesis that metaphor-driving arguments are overt is borne out by the results of the experiment. The metaphor driver is expressed in more than 99 % of the cases, even though the referent was always strongly primed. The few aberrant cases, 6 out of 716, are spread across stimulus items (1× *bottom*, 3× *middle*, 1× *warmth*, 1×

**26** Where the probability is smaller than can be reliably computed with the packages we use, we report this as a probability that is approximately zero.

*view*), participants, varieties of English, and both blocked and mixed conditions, with no evidence for any specific determining factor.

Given the unnaturalness of this type of experiment, these results by far surpass our expectations. In view of the near-absolute robustness of the effect seen here, paired with the absolute robustness across the corpus studies, the few "aberrant" cases might not indicate that the phenomenon is not categorical, but rather that something else is going on. Perhaps the most straightforward explanation is performance error: one can easily imagine clicking on an unintended sentence completion in the drop-down menu. However, at least two other explanations are possible. There is the artificiality of asking someone to complete a sentence that someone else started. When a speaker expresses a message of their own, semantic coherence is more likely to be sustained. In experimental set-ups of this kind, participants may not always fully process the priming material before selecting a completion. This may especially be the case here because the context provided is minimal.

Another possible explanation can be found in the fact that, in four of the six cases, a literal interpretation is marginally accessible if additional context is imagined, which could account for the argument covertness. Thus, for the target words *bottom* and *middle*, literal interpretations are imaginable despite the intended metaphorical framing. For instance, providing the pronominal argument supports the metaphorical reading in *Something weird is going on there. I just can't get to the bottom of it.* However, the argument-less version *Something weird is going on there. I just can't get to the bottom.* forces a literal reading, where e.g., someone is trying to reach the bottom of some sort of a container, or a swimming pool that is unexpectedly deep. Such literal interpretations are not available for the other two target words *warmth* and *view* for which the two remaining instances of aberrant cases are found.

Given these potential confounding factors, it is surprising that the number of aberrant answers is so vanishingly small. Thus, we conclude that the near-uniformity of the overall results reflect the profound robustness of metaphor-driven obligatoriness.

The astute reader might wonder if a preference account could explain our experimental results. Under this account, there is not a hard requirement for the metaphor-driving argument to be overt – this option is just preferred. However, two kinds of evidence speak against this explanation. In the first case, our experimental results are exceptionally close to categorical, meaning that the preference is very strong. The second kind of evidence is what we saw in the corpus results. In spontaneous productions found in the BNC, we found no clear cases of covert metaphor-driving arguments. So, if the overtness of metaphor-driving arguments is a preference, it is a preference that enjoys very strict application in language production.

When a preference is universally applied, how can we distinguish it from a hard rule? However, see our previous discussion of potential grey areas due to, e.g., lexicalization.

In the cases of literal use, we find a rate of 41 % overt arguments; a mix of covert and overt arguments conforms to the expectations outlined in Section 2. Differences of overt expression between target items (see Appendix B2 for details) may reflect factors from realms such as activation or animacy, to the extent that the small contexts given in the experiment provide such information. For instance, the number of overt argument encodings is relatively high with the functor *edge*. A possible explanation is that the referent to be resumed (*crevass*) is slightly further away, coming a little earlier in the context sentence in comparison to other stimulus items (see Appendix B1 for the full set of stimuli).

Post-driving arguments also can be covert or overt – which matches our prediction (see Section 3.5 above). The higher overtness rates in comparison to literal uses may reflect a dependency of post-driver argument overtness on the type of the metaphor driver. Thus, inherently abstract entities, such as *truth*, may better facilitate the covertness of a post-driver argument than inherently ambiguous terms, such as body parts or humans (see Section 3.4). If the driver is lexically ambiguous, the speaker may help the listener reach a metaphorical interpretation by overtly resuming a post-driver argument, since argument covertness is normally linked to literal use. Besides questions of lexical ambiguity, it is also conceivable that the difference between pronominal and a lexical encoding of the metaphor-driving argument may influence subsequent argument overtness.

The experimental results fully corroborate the results from the corpus analyses. It is noteworthy that these results match those of the natural language of the corpora despite being produced in less-than-natural conditions.

The results are particularly noteworthy in light of the inability of speakers to introspect and identify the impact of metaphorical language on what must be expressed. None of the comments submitted with the questionnaire indicated any understanding of the pattern. On the contrary, several participants highlighted their puzzlement over why they sometimes felt like supplying, and sometimes did not feel like supplying the argument in question. It is fascinating to see how the effect, being so robust, utterly escapes speaker consciousness. Here are some of the comments:

(45) *"For many questions two answers seemed equally appropriate, so many of my choices felt pretty arbitrary."*
*"Really difficult to pick."*
*"Unsure why I use the forms I do!"*

Other speakers mention intuitions without any insight into where these come from.

(46) *"I became aware of a lack of consistency in my answers, so I was totally reliant on what sounded correct."*
*"Most answers came quite naturally."*

In conclusion, our language production experiment with English native speakers yields remarkable support for our claim that metaphor drivers must be overt. Strikingly, the effect raised no conscious awareness whatsoever on the side of the speakers. This explains why some members of our audiences at conference presentations claim that they might accept covert metaphor drivers, or even use them. Since they struggle to accurately access the factors determining their choice in natural production settings, their ability to acccurately predict what they might do is poor.

# 6 Discussion

This section discusses and contextualizes our findings. We begin by connecting metaphor-driven argument overtness with other argument overtness constraints (Section 6.1) and then we connect it to a related phenomenon involving verbal complement overtness (Section 6.2). We subsequently indicate its role not only in synchrony but also in diachrony, bringing about syntactic obligatoriness (Section 6.3). Finally, we explore metaphor-driven argument overtness within the forward-modeling account of language production and comprehension (Section 6.4).

## 6.1 Other triggers of argument overtness

Metaphor is not the only trigger for frequent or obligatory argument overtness. We discussed syntactic constraints in Section 2, such as those on core verbal arguments in English. We have also mentioned information structure-related biases, where e.g., the lack of activation of a referent, or the need for a contrastive focus, promote overt expression, even if zero anaphora is a syntactic option. There are two ways of thinking about how the different constraints – syntactic, semantic, and information-structural – interact. Either we describe their interaction about an individual instance of a construction use or we focus in general on what determines argument overtness for a particular construction type in a language.

In the first scenario, at least one of the three sources of overtness tends to apply for the argument to be realized in that way. For instance, the English subject must normally – for syntactic reasons – be overt even when the construction is literal and even when the referent is highly activated. It does not affect the outcome if more than

one condition applies, e.g., when the English subject is also a metaphor driver. The same applies to metaphoricity and information-structural biases as determining factors. Any one of them, or multiple ones in concert, may trigger argument overtness.

When generalizing over a construction type in a given language, a nested picture emerges. Thus, information-structural biases are only testable factors for argument overtness in the absence of a metaphorical or syntactic constraint. Metaphoricity, in turn, is only a testable conditioning factor in the absence of a syntactic constraint.

## 6.2 Argument overtness and verbal-complement overtness

While we are not aware of any study on metaphor-driven obligatoriness apart from the remarks in Reinöhl (2016) and subsequent work in Ellison and Reinöhl (2022), a related phenomenon has been brought to light by Rosemeyer and Grossman (2017). Investigating the grammaticalization of a Spanish auxiliary construction expressing anteriority, the authors note that *acabar* 'to finish' was in Old Spanish at first only accompanied by verbal complements expressing unexpected or "informative" events. They illustrate this phenomenon with the following English example: *Eating* is often unexpressed in a context such as *John finished the pasta*, as it is the event associated by default with *pasta*. In contrast, *instagramming* would be more likely to be expressed overtly, given that it is not the default action associated with food. Through "overtification" accompanying a process of grammaticalization, uninformative events also come to be more frequently expressed.

Rosemeyer and Grossman (2017) thus uncover the influence of "informativity" or "unexpectedness" on whether or not the verbal complement to *acabar* 'finish' is expressed. As with our selectional-restrictions approach, the "default" semantics (Rosemeyer and Grossman 2017: 525, drawing on Pustejovsky 1991, 1995) determine what is and what is not a natural match. The naturalness of the match in turn governs argument expression.[27]

At this point it is unclear whether informativity-driven overtness – if we may call it that – applies as an absolute rule or whether it is sensitive to activation. Rosemeyer and Grossman (p.c.) checked 50 instances of transitive *acabar* without an overt verbal complement, none of which involved an informative event. However, it seems imaginable that Speaker B's response in Example (54) would occur in a situation where the interlocutors are engaged in instagramming food, and Malte Rosemeyer agrees (p.c.). In other words, informativity-driven overtness may be sensitive to activation in contrast to metaphor-driven overtness.

27 See also Goldberg and Ackerman (2001) on "pragmatically obligatory adjuncts".

(47) Speaker A: *Have you finished instagramming the desert yet?*
Speaker B: *No, I only just finished the pasta.*

Certainly, we may be misjudging the naturalness of (47), just as some of our audience misjudged the possibility of dropping metaphor drivers. If our intuition is correct, there is an important difference between the two phenomena. When comparing Speaker B's response in (47) with the second sentence in Example (48), we believe that the former shows meaning invariance, i.e., it paraphrases *No, I only just finished instagramming the pasta*. By contrast, the sentence *Finally, he arrived.* in (48) does not show meaning invariance. Without an argument, the sentence is interpreted (possibly with a processing delay, see below) as the subject referent arriving at a contextually retrievable physical location; the metaphorical interpretation is not selected.

(48) *Everything has been pointing towards this conclusion. Finally, he arrived.*

In summary, metaphor-driven and informativity-driven overtness appear to be closely related phenomena. Clarifying how the two relate to each other is an exciting direction for future research. Our findings lead us to believe that sensitivity to activation is plausible with informativity-driven overtness, but not with metaphor-driven overtness. This would suggest different underlying psycholinguistic mechanisms. For example, metaphor-driven overtness may be triggered in concert with lexical retrieval, as soon as a clash in default interpretations is identified. Informativity-driven overtness, on the other hand, might arise in the combination of lexical structures with contextual information. Finally, it also remains to be seen how the verbal complements discussed by Rosemeyer and Grossman (2017) relate to the argument types discussed in this paper given their differences in semantic and syntactic characteristics. An obvious difference is that the verbal complements' nominal arguments serve to buttress conceptual structure; no parallel support structures exist for the arguments discussed in this paper.

## 6.3 From metaphor-driven overtness to syntactic obligatoriness

Metaphor-driven overtness can develop over time into a syntactic constraint: one that applies to all cases including literal ones. Reinöhl (2016) shows for Indo-Aryan that the crucial semantic shift which marks the transition of relational nouns and adverbs into postpositions begins with metaphorical uses. We briefly illustrate this with the development of Sanskrit *madhye* 'in the middle', via Middle Indo-Aryan *majjhe/-i*, into the Hindi postposition *mẽ* 'in'. The mismatch between the literal sense

in Example (49), 'in the middle of his heart', and the intended sense, an emphatic expression of containment (here: in the seat of emotion) without reference to an actual spatial center, leads over time to the loss of the semantic component 'center' in all contexts. In its new meaning 'in', the functor requires an overt dependent in all cases; thus, it has become a postposition.

(49) Apabhramsha (repeated from 12)

| *dharivi* | *ihu* | ***majjhi*** | ***hiyayaha*** |
|---|---|---|---|
| carry.CONV | DEM.ACC.SG | middle.LOC.SG.N | heart.GEN.SG |

'he carried this [i.e., a thought] **in the middle of his heart**: ('I will …')' (SA 707.4, Reinöhl 2016: 151)

It has long been recognized that metaphor plays an important role in grammaticalization processes (e.g., Bybee et al. 1994; Sweetser 1990). However, the impact of metaphoricity on argument overtness has until now only been described in Reinöhl (2016) to our knowledge. Non-metaphorical sources of syntactic obligatoriness include the process of "overtification" discussed in the previous section, where arguments are at first overtly expressed because of their informativity, but later as a general syntactic rule.[28]

## 6.4 The psycholinguistics of metaphor-driven argument overtness

While there is a considerable amount of research into the psycholinguistics of metaphor (e.g., Boroditsky 2000, 2018; Gibbs 2008; Gibbs and Matlock 2008; Glucksberg 2003; Katz 2017), we are not aware of any study focusing on metaphor-driven argument overtness. Yet the consistency of the effect suggests that its roots lie in human language processing, rather than being language-specific. We here suggest possible production- and comprehension-related effects as a focus for future psycholinguistic research.

For language production, we need to account for why speakers infallibly provide an overt argument even if the corresponding referent is highly activated. Two scenarios can be envisioned. In scenario A, the bare functor goes into production first, keeping online processing costs low. Observing signs of incomprehension, the speaker quickly repairs the sentence by providing the argument. In scenario B, there is no repair post-production, but an overt argument is incorporated in sentence planning before the functor is articulated, such as suggested in forward modeling

**28** A further source of syntactic obligatoriness is rebracketing (see Harris and Campbell 1995: 61–93 for details).

accounts of language production (see Pickering and Garrod 2013). There is evidence suggesting that this second scenario is the correct one.

Firstly, we would expect consistent evidence for a pause if we were dealing with a repair mechanism as in scenario A. However, we have not seen any evidence pointing to such an effect. In the corpus data, we find no evidence for pauses after the functor is articulated – if these had been present, they would have been indicated by commas or pause annotations. Secondly, if scenario A were correct, with speakers repairing post-production, we would not expect argument overtness to be total. Not all speakers pay continuous close attention to their hearers, and so may not pick up on signs of incomprehension. Furthermore, in monologues and in written language, there is no such feedback loop in most cases (with the exception of quoted direct speech). Thirdly, post-production repair seems likely to imply a certain level of speaker consciousness, i.e., at least some speakers would plausibly be able to analyze what they are doing and why without having the phenomenon explained to them. This is not what we find.

All evidence points to scenario B, the formation of the complete construction before articulation. Possibly, a paradigmatic choice is available when the construction is planned. Crucially, we believe that – even though we are dealing with syntactically compositional constructions consisting of, e.g., nominal heads and their possessors or verbs and their arguments – the units in question are larger, indivisible semantic wholes. Functor and argument, by the very nature of their relationship, have an intimate semantic connection. The terms are even more closely bound in metaphorical uses as their meanings co-adapt. In the example *in the middle of trouble*, *middle* does not refer to an actual center, and *trouble* is portrayed as if it had one. We propose that metaphorical constructions as gestalts are indivisible for the purposes of production, as their semantic structures are not achievable through an incremental, monotonic process of cumulative restriction.

We make the following predictions about comprehension-related effects. We pointed out in Section 6.2 that, if the argument is not provided, a literal interpretation is forced (see Example (57), repeated from (55)). The listener will prefer any interpretation rather than considering the sentence ill-formed. Research exploring the boundaries of "grammaticality" is therefore not relevant to identifying the causes and limits of metaphor-driven argument obligatoriness. Instead, studies of referent recovery costs, which tie the referent closely to expectation-in-context, yield relevant predictions. In examples such as Example (50), the listener will consider the second sentence well-formed, but they have to "search around" for a possible referent matching a literal interpretation. In these cases, therefore, we predict an N400 effect, as the referent is hard to identify (e.g., Frenzel et al. 2011; Kaan 2007) or hard to "retrieve" (Brouwer et al. 2017).

(50) *Everything has been pointing towards this conclusion. Finally he arrived.*

# 7 Conclusions

This paper demonstrates that metaphor-driving arguments must be overtly expressed – across languages and across parts of speech. Metaphor-driven argument overtness pervades ordinary language as does metaphor. We could only *arrive at this conclusion* by referring to *this conclusion* explicitly. Lexical or pronominal argument overtness is forced in all functor-argument combinations where a semantic conflict between default senses yields a metaphorical interpretation.

We are not aware of any prior investigation of metaphor-driven argument overtness other than observations in Reinöhl (2016). Even though pervasive, the phenomenon seems to have fallen between the cracks of linguistic sub-disciplines. In particular, argument optionality has so far primarily been studied under the purview of information structure. It turns out, however, that the obligatory overtness of metaphor-driving arguments is insensitive to information-structural effects such as activation. Even when highly activated, a metaphor-driving argument must be overtly expressed. Metaphor-driven argument overtness may also not have drawn attention because of the focus on meaning rather than form in the literature on metaphor – whether linguistic or psycholinguistic. And finally, there appears to be a tendency in syntax, including historical syntax, to analyze fully present constructions, rather than asking under what conditions the building blocks of the constructions in question co-occur.

We substantiate our claim of metaphor-driven argument overtness with powerful and diverse evidence. We report on three corpus studies (the first from the literature and the other two carried out for this paper): one of a historical corpus of Indo-Aryan languages, another of modern British English, and a third of fieldwork data from Vera'a. We also conducted a sentence-completion experiment with about 250 native speakers of English. Both the corpus studies and the experiment show no or almost no exceptions to metaphor-driven argument overtness. The strength of the effect contrasts with a complete lack of speaker awareness – even when speakers are asked to actively choose whether to resume an argument overtly or covertly. We propose that metaphor-driven argument overtness – as well as the lack of speaker consciousness – can be given a general account in terms of human language processing and hence is plausibly universal.

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**Data availability:** The data underlying this article are available in the Zenodo repository: https://doi.org/10.5281/zenodo.10393132.

## Abbreviations

Glossing abbreviations used in this paper:

| | |
|---|---|
| ABL | ablative |
| ACC | accusative |
| AOR | aorist |
| ART | article |
| CLF | classifier |
| CONJ | conjunction |
| CONV | converb |
| DAT | dative case |
| DEM | demonstrative |
| DEM1.A | prefixed basic demonstrative 1 (for Vera'a) |
| DEM.3 | basic demonstrative 3 (for Vera'a) |
| DET | determiner |
| DL | dual |
| ERG | ergative case |
| F | feminine |

| | |
|---|---|
| FUT | future tense |
| GEN | genitive case |
| IN | inclusive |
| INCL | inclusive |
| INF | infinitive |
| LOC | locative case |
| M | masculine |
| N | neuter |
| PL | plural |
| PRS | present |
| PTC | particle |
| PTCP | participle |
| POSS | possessive marker |
| RED | reduplication |
| QUOT | quotative particle |
| SG | singular |
| TAM1 | tense aspect mood marker 1 (for Vera'a) |
| TAM2 | tense aspect mood marker 2 (for Vera'a) |
| TEMP | temporal adverb |
| USIT | usitative |

# Appendix A: BNC

## Searches

A query language for BNC searches was developed which identifies sequences of word specifications (separated by spaces). The components of the word specifications are separated by semicolons and take the form [<FIELD> "="] <VALUE> for exact matches and <FIELD> "~" PATTERN for regular-expression matches, where <FIELD> is one of the BNC field names. If no field is given, then the *headword* field **Hw** is assumed:

**Table 2:** BNC queries.

| Target | Before nominal expression | Query | Limit |
|---|---|---|---|
| *in the middle* | YES | POS=PREP;in POS=DET;the POS=NOUN;middle POS=PREP;of POS~^(SUBST\|ADJ\|ART\|PRON)$ | 100 |
| *in the middle* | NO | POS=PREP;in POS=DET;the POS=NOUN;middle C5=PUN | 100 |
| *above* | YES | above;POS~^(PREP\|ADV)$ POS~^(SUBST\|ADJ\|ART\|PRON)$ | 100 |
| *above* | NO | above;POS~^(PREP\|ADV)$ C5=PUN | 100 |
| *arrive* | YES | POS=VERB;arrive Hw~^(there\|at)$ POS~^(SUBST\|ADJ\|ART\|PRON)$ | 100 |
| *arrive* | NO | arrive;POS=VERB C5=PUN | 100 |

For example, to find instances of *arrive* with its optional prepositional phrase headed by *at*, the following pattern was used: "POS=VERB;arrive POS=PREP;at". In contrast, to find the same verb but without the adjunct, we used the search term "POS=VERB;arrive C5=PUN" to find the same headword but followed immediately by punctuation.

Note that the results of these queries differ from the original BNC formulation in spacing (i.e., space is frequently doubled in our database version). More importantly, the markup for turn-taking is also not included in that version. While turn-taking markup is of minor importance in written genres, it can substantially affect the interpretability of data from spoken conversations. We thus advise the reader to cross-check examples provided in the supplementary materials with how they are presented in the online version (https://www.english-corpora.org/bnc/), if a classification (into "literal", "metaphorical", etc.) is not immediately transparent.

## Classification

"literal" when the literal citation meanings of functor and argument do not clash

"metaphorical" when the literal citation meanings of functor and argument clash

"unclear" when meaning cannot be determined precisely (often in spoken language transcripts) or when literal and metaphorical interpretations are equally felicitous

"other" irrelevant construction type, e.g., the example "if it arrives at all" (BNC, AS3) picked up by the argumented version of *arrive*, even though *at all* is not a goal argument, but an adverb

## Demarcation of "literal" from "metaphorical"

We here illustrate the difference between literal and metaphorical uses for each target functor. Since argument-less versions often show no or few metaphorical uses, we here choose examples with overt arguments for illustration.

***in the middle***

Any references to middles of entities which have a natural center – e.g., spatial or temporal containers, but also entities of finite one-dimension extents, whether spatial, temporal or on spectra such as of temperature or of income – are classified as "literal". Any other cases are classified as "metaphorical". The latter includes cases where the sense expressed is one of immersion rather than reference to a center,

i.e., where *middle* is not referential (see also ex. 15; see also fn. 23 on further distinctions).
Examples:

(51) literal
*On the floor, set i**n the middle of the elaborate mosaic** that appeared to be the building's sole concession to prettification but was in fact the evidence of its true purpose, were the bundles of artifacts Godolphin brought back from his travels, neatly tied up by Hoi-Polloi Nuits-St-Georges, the knots encrusted with scarlet sealing wax.* (BNC, CRE)

(52) literal
*Mothers who had left jobs **in the middle of the socio-economic spectrum** were most exposed to the risk of falling back on the ladder, particularly if they left a long gap in their employment record.* (BNC, FP4)

(53) metaphorical
*Binks had given the robot the somewhat unglamorous name RAMP, standing for Random Access Multi Program. Unhappily, in 1974, Pye's top management began to query the project. Some of the directors became adamant that there was no future in robots. **In the middle of these difficulties** I was invited to visit the Chicago headquarters of Binks Manufacturing (Binks Bullows's parent company) to negotiate selling the machine to the US.* (BNC, B78)

(54) metaphorical
*When at last she made her way downstairs towards the terrace, she could hear their voices speaking in English. Slowing down, she listened in case they were **in the middle of a talk** too personal to be interrupted …* (BNC, FSC)

***above***

Uses of *above* which refer to a dimension of either verticality or magnitude are treated as "literal". Other uses are categorized as "metaphorical".

(55) literal
*Below was a massive fireplace in a medieval pattern. In front of it was an enormous oak table surrounded by high-backed chairs. Battle standards hung **above the fireplace**.* (BNC, HTW)

(56) literal
*The main allegations centre on contracts worth between £100,000 and £4 million awarded by ministries and Downing Street. They are all **above the £92,500 ceiling** which requires that they be advertised throughout the European Community.* (BNC, A8X)

(57) metaphorical
*Such arguments will have no pretensions, by definition, to knowledge-claims that affect to rise **above the historical conditions** in which they are made.* (BNC, CTY)

(58) metaphorical
*Those who know, think it a matter without interest, so that again and again in my enquiries, when some touch of colour has been given illuminating the ways of life among the people who are **above the need for help**.* (BNC, CMF)

***arrive at***

Any example involving *arrive* in a spatial sense is classified as "literal". Any other use is classified as "metaphorical".

Examples:

(59) literal
*We stayed for three days, and then we took the night boat to Belgium, and **arrived at a tall, fine school building in the centre of Brussels**.* (BNC, FNY)

(60) literal
*The two of them **arrived at the broken gate of a house** even more rackety than its peeling neighbours.* (BNC, ADA)

(61) metaphorical
*Reading is a way of **arriving at ideas by looking at print**.* (BNC, BML)

(62) metaphorical
*If you really want to understand what anthropologists do you will have to do it yourself. The next best thing is to read, with real care and attention, detailed accounts of modern fieldwork such as are provided by the two Hugh-Jones volumes. Concentrate on the details of a single system; do not expect to **arrive at generalizations** by picking up ethnographic snippets from here, there and everywhere.* (BNC, H10)

# Appendix B1: Stimuli

After collecting some meta-data, subjects were given the following instructions:

*Instructions.*
*We're going to ask you to complete a series of sentences. We want you to complete each one by selecting an entry from the menu provided.*
*For example, you might see:*

> *They have a large living room. There is a piano in …*

*The menu will provide options like:*

> *… the centre.*
> *… the centre of it.*
> *… its centre.*

*Please read the text carefully, consider all the options, and then pick the one that sounds best and/or makes the most sense to you.*

*Remember: there are no right answers, we just want to know what phrasing works best for you.*

The subjects were then provided with a subset of the following sentence completion tasks (see Section 5 for detail). The answering options were arbitrarily ordered. Of those examples involving metaphorical language, the ones with the target words *fodder, edge, front, pillar, pile, key, way* contain additional metaphor drivers (typically, the subject). Note that there is some variation with regard to the number and kind of possible completion options which include a pronoun, possessive, or demonstrative due to lexical restrictions and also to ensure naturalness (e.g., *my view* was included besides *this view* as a highly frequent collocation).

*One of Germany's most famous cities is Cologne. It has a well-known cathedral in*
1. *the middle.*
2. *the middle of it.*
3. *its middle.*

*There's always trouble here. Johnny is usually in*
1. *the middle.*
2. *the middle of it.*
3. *its middle.*

*Here is a box of sweets. You will find some chocolates at*
1. *the bottom.*
2. *its bottom.*
3. *the bottom of it.*

*Something weird is going on there. I just can't get to*
1. *the bottom.*
2. *the bottom of it.*
3. *its bottom.*

*They live in a picturesque hills residence. It has a manicured lawn at*
1. *the front.*
2. *its front.*
3. *the front of it.*

*This century is seeing a health tech revolution. Sweden is at*
1. *the front.*
2. *its front.*
3. *the front of it.*

*There was a famous crevass near the hut. Anna terrified her friends by standing at*
1. *the edge.*
2. *the edge of it.*
3. *its edge.*

*Semantech's shareholders had long feared insolvency. That day, the company was at*
1. *the edge.*
2. *the edge of it.*
3. *its edge.*

*Freddie went looking for bricks. Behind the shed he saw*
1. *a pile.*
2. *a pile of them.*

*Clients constantly call me with complaints. Every day I get*
1. *a pile.*
2. *a pile of them.*

*The woman accused her colleague of stealing a heater from her office. After all, he had*
1. *the key.*
2. *the key to it.*
3. *its key.*

*For many years, Ian tried to win her heart. He eventually found*
1. *the key.*
2. *the key to it.*
3. *its key.*

*After the earthquake, safety concerns closed the cathedral chapel. There was cracking in*
1. *the pillars.*
2. *in its pillars.*
3. *in the pillars of it.*

*Ahmed taught his students about Greek philosophy. He said that inquiry and reason were*
1. *the pillars.*
2. *its pillars.*
3. *the pillars of it.*

*I like summer nights. I really enjoy*
1. *the warmth.*
2. *the warmth of them.*
3. *their warmth.*

*These are such friendly people. I love*
1. *the warmth.*
2. *their warmth.*
3. *the warmth of them.*

*We keep sheep. They eat a lot, so we always have a shed full of*
1. *fodder.*
2. *their fodder.*
3. *fodder for them.*

*Tom became the focus of the neighbourhood gossip network. His relationships often provided*
1. *fodder.*
2. *fodder for it.*
3. *its fodder.*

*There are strict rules at this hospital. Smoking is not allowed anywhere on*
1. *the grounds.*
2. *the grounds of it.*
3. *its grounds.*

*He did have a tendency to make private phone calls while teaching. Unimpressed, the headmaster fired him on*
1. *the grounds.*
2. *those grounds.*
3. *the grounds of it.*

*Lakes on Venus are made of lava. The atmosphere is dense enough, that the wind can whip up*
1. *waves.*
2. *waves of it.*

*In cars, Julia was prone to nausea. On that trip through the Alps, she had to endure*
1. *waves.*
2. *waves of it.*

*From Sydney city centre, you will catch a ferry to the zoo. You will go past the Opera House on*
1. *the way.*
2. *the way to it.*

*Lots of people want immortality. But so far, noone has found*
1. *a way.*
2. *a way to it.*

*The flat looked across to the city skyline. Only a crane interrupted*
1. *the view.*
2. *the view of it.*
3. *its view.*

*I reckon that humans use too much plastic. Lots of people share*
1. *the view.*
2. *this view.*
3. *my view.*

## Appendix B2: Results

The numbers in the “Lit”eral and “Met”aphorical columns are the counts of answers of the question with the corresponding colour. Argument completion is marked as

being either “Cov”ert or “Ov”ert. Where a functor is marked with an asterisk, it indicates that the stimulus contains a metaphor driver other than the target argument.

**Table 3:** Descriptive results.

| | | OptionsMark | | | Lit | | Met | |
|---|---|---|---|---|---|---|---|---|
| Functor | Lit/Met | 1 | 2 | 3 | Cov | Ov | Cov | Ov |
| **middle** | Lit | the middle. | the middle of it. | its middle. | 53 | 74 | | |
| | Met | the middle. | the middle of it. | its middle. | | | 3 | 120 |
| **bottom** | Lit | the bottom. | the bottom of it. | its bottom. | 109 | 28 | | |
| | Met | the bottom. | the bottom of it. | its bottom. | | | 1 | 112 |
| ***front** | Lit | the front. | the front of it. | its front. | 98 | 39 | | |
| | Met | the front. | the front of it. | its front. | | | 20 | 93 |
| ***edge** | Lit | the edge. | the edge of it. | its edge. | 39 | 88 | | |
| | Met | the edge. | the edge of it. | its edge. | | | 41 | 82 |
| ***pile** | Lit | a pile. | a pile of them. | | 13 | 114 | | |
| | Met | a pile. | a pile of them. | | | | 10 | 113 |
| ***key** | Lit | the key. | the key to it. | its key. | 76 | 61 | | |
| | Met | the key. | the key to it. | its key. | | | 56 | 57 |
| ***pillars** | Lit | the pillars. | the pillars of it. | its pillars. | 62 | 75 | | |
| | Met | the pillars. | the pillars of it. | its pillars. | | | 9 | 104 |
| **warmth** | Lit | the warmth. | the warmth of them. | their warmth. | 74 | 63 | | |
| | Met | the warmth. | the warmth of them. | their warmth. | | | 1 | 112 |
| ***fodder** | Lit | fodder. | fodder for them. | their fodder. | 72 | 55 | | |
| | Met | fodder. | fodder for it. | its fodder. | | | 47 | 76 |
| **grounds** | Lit | the grounds. | the grounds of it. | its grounds. | 99 | 27 | | |
| | Met | the grounds. | the grounds of it. | those grounds. | | | 0 | 123 |
| **waves** | Lit | waves. | waves of it. | | 81 | 46 | | |
| | Met | waves. | waves of it. | | | | 0 | 123 |
| ***way** | Lit | the way. | the way to it. | | 129 | 7 | | |
| | Met | a way. | a way to it. | | | | 66 | 47 |
| **view** | Lit | the view. | the view of it. | its view. | 110 | 15 | | |
| | Met | the view. | my view. | this view. | | | 1 | 120 |

# References


Allerton, David John. 1982. *Valency and the English verb*. New York: Academic Press.

Asher, Nicholas. 2011. *Lexical meaning in context: A web of words*. Cambridge: Cambridge University Press.

Austin, Peter. 2001. Word order in a free word order language: The case of Jiwarli. In Jane Simpson, David Nash, Mary Laughren, Peter Austin & Barry Alpher (eds.), *Forty years on: Ken Hale and Australian languages*, 305–323. Canberra: Pacific Linguistics.

Belote, Greg. 2008. *Multivehicle simulation system*. Cambridge, MA: Massachusetts Institute of Technology dissertation.

Boroditsky, Lera. 2000. Metaphoric structuring: Understanding time through spatial metaphors. *Cognition* 75. 1–28.

Boroditsky, Lera. 2018. Language and the construction of time through space. *Trends in Neurosciences* 41(10). 651–653.

Bortone, Pietro. 2010. *Greek prepositions from antiquity to the present*. Oxford: Oxford University Press.

Brouwer, Harm, Matthew Crocker, Noortje Venhuizen & John Hoeks. 2017. A neurocomputational model of the N400 and the P600 in language processing. *Cognitive Science* 41. 1318–1352.

Bybee, Joan, Revere Perkins & William Pagliuca. 1994. *The evolution of grammar: Tense, aspect, and modality in the languages of the world*. Chicago & London: University of Chicago Press.

Cohen, Ted. 1976. Notes on metaphor. *The Journal of Aesthetics and Art Criticism* 34(3). 249–259.

Craenenbroeck, Jeroen van & Tanja Temmerman (eds.). 2018. *The Oxford handbook of ellipsis*. Oxford: Oxford University Press.

Cruse, Alan. 1986. *Lexical semantics*. Cambridge: Cambridge University Press.

Cruse, Alan. 2000. *Meaning in language: An introduction to semantics and pragmatics*. Oxford: Oxford University Press.

David, Oana. 2016. *Metaphor in the grammar of argument realization*. Berkeley, CA: U of California Berkeley dissertation. https://escholarship.org/content/qt07j56079/qt07j56079.pdf (accessed 04 December 2023).

De Swart, Henriëtte. 2011. Mismatches and coercion. In Claudia Maienborn, Klaus von Heusinger & Paul Portner (eds.), *Semantics: An international handbook of natural language meaning*, 574–597. Berlin & Boston: De Gruyter Mouton.

Dowty, David. 1981. Quantification and the lexicon: A reply to Fodor and Fodor. In Michael Moortgat, Harry van der Huelst & Teun Hoekstra (eds.), *The scope of lexical rules*, 79–106. Dordrecht: Foris.

Du Bois, John W. 1987. The discourse basis of ergativity. *Language* 64. 805–855.

Ellison, Timothy Mark & Uta Reinöhl. 2022. Compositionality, metaphor, and the evolution of language. *International Journal of Primatology*. https://doi.org/10.1007/s10764-022-00315-w.

Ellison, Timothy Mark & Uta Reinöhl. In prep. A model of metaphor-driving arguments: How they work and why you need to express them.

Fillmore, Charles. 1986. Pragmatically controlled zero anaphora. *BLS* 12. 95–107.

Fodor, Jerry & Janet Dean Fodor. 1980. Functional structure, quantifiers and meaning postulates. *Linguistic Inquiry* 11. 759–769.

Frenzel, Sabine, Matthias Schlesewsky & Ina Bornkessel-Schlesewsky. 2011. Conflicts in language processing: A new perspective on the N400–P600 distinction. *Neuropsychologia* 49(3). 574–579.

Gibbs, Raymond Jr. 2008. *The Cambridge handbook of metaphor and thought*. Cambridge: Cambridge University Press.

Gibbs, Raymond Jr. & Teenie Matlock. 2008. Metaphor, imagination and simulation: Psycholinguistic evidence. In Raymond Gibbs Jr. (ed.), *The Cambridge handbook of metaphor and thought*, 161–176. Cambridge: Cambridge University Press.

Gillon, Brendan. 2012. Implicit complements: A dilemma for model theoretic semantics. *Linguist and Philosophy* 35. 313–359.

Givón, Talmy (ed.). 1983. *Topic continuity in discourse: A quantitative cross-language study*. Amsterdam & Philadelphia: John Benjamins.

Glass, Leila. 2020. Verbs describing routines facilitate object omission in English. *Proceedings of the LSA* 5(1). 44–58.

Glucksberg, Sam. 2003. The psycholinguistics of metaphor. *Trends in Cognitive Sciences* 7(2). 92–96.

Goldberg, Adele & Farrell Ackerman. 2001. The pragmatics of obligatory adjuncts. *Language* 77(4). 798–814.

Groefsema, Marjolein. 1995. Understood arguments: A semantic/pragmatic approach. *Lingua* 96. 139–161.

Haegeman, Liliane & Tabea Ihsane. 2001. Adult null subjects in the non-pro-drop languages: Two diary dialects. *Language Acquisition* 9(4). 329–346.

Haig, Geoffrey & Stefan Schnell. 2016. The discourse basis of ergativity revisited. *Language* 92(3). 591–618.

Harris, Alice C. & Lyle Campbell. 1995. *Historical syntax in cross-linguistic perspective*. Cambridge: Cambridge University Press.

Huang, Yan. 2000. *Anaphora. A crosslinguistic study*. Oxford: Oxford University Press.

Kaan, Edith. 2007. Event-related potentials and language processing: A brief overview. *Language and Linguistics Compass* 1(6). 571–591.

Kass, Robert & Adrian Raftery. 1995. Bayes factors. *Journal of the American Statistical Association* 90(430). 773–795.

Katz, Albert N. 2017. Metaphor acquisition and use. In Elena Semino & Zsófia Demjén (eds.), *The Routledge handbook of metaphor and language*, 472–485. New York: Routledge.

Keenan, Edward L. 1974. The functional principle: Generalizing the notion of 'subject of'. *Chicago Linguistic Society* 10. 298–309.

Kövecses, Zoltán. 2017. Conceptual metaphor theory. In Elena Semino & Zsófia Demjén (eds.), *The Routledge handbook of metaphor and language*, 13–27. New York: Routledge.

Lakoff, George & Mark Johnson. 1980. *Metaphors we live by*. Chicago: University of Chicago Press.

Lambrecht, Knud. 1994. *Information structure and sentence form: Topic focus and the mental representation of discourse referents*. Cambridge: Cambridge University Press.

Landau, Idan. 2010. The explicit syntax of implicit arguments. *Linguistic Inquiry* 41. 357–388.

Levshina, Natalia. 2018. *Towards a theory of communicative efficiency in human languages*. Leipzig: University of Leipzig Habilitation thesis.

Löbner, Sebastian. 2012 [2003]. *Semantik*. Berlin & Boston: De Gruyter.

Luraghi, Silvia. 2003. *On the meaning of prepositions and cases: The expression of semantic roles in Ancient Greek*. Amsterdam & Philadelphia: John Benjamins.

Matić, Dejan, Eric van Gijn & Robert Van Valin Jr. (eds.). 2014. *Information structure and reference tracking in complex sentences*. Amsterdam & Philadelphia: John Benjamins.

Matthews, Peter. 1981. *Syntax*. Cambridge: Cambridge University Press.

Mittwoch, Anna. 1971. Idioms and unspecified NP deletion. *Linguistic Inquiry* 2. 255–259.

Nanyan, Varduhi. 2013. *Subject omission in English diaries*. Ghent: University of Ghent dissertation. https://lib.ugent.be/fulltxt/RUG01/002/060/282/RUG01-002060282_2013_0001_AC.pdf (accessed 26 January 2020).

Neuman, Yair, Dan Assaf, Yohai Cohen, Mark Last, Shlomo Argamon, Newton Howard & Ophir Frieder. 2013. Metaphor identification in large texts corpora. *PLoS One* 8(4). e62343.

Pickering, Martin J. & Simon Garrod. 2013. An integrated theory of language production and comprehension. *Behavioral & Brain Sciences* 36. 329–392.
Pragglejaz Group. 2007. MIP: A method for identifying metaphorically used words in discourse. *Metaphor and Symbol* 22(1). 1–39.
Pustejovsky, James. 1991. The generative lexicon. *Computational Linguistics* 17. 409–441.
Pustejovsky, James. 1995. *The generative lexicon*. Cambridge, MA: MIT Press.
Quirk, Randolph, Sidney Greenbaum, Geoffrey Leech & Jan Svartvik. 1985. *A comprehensive grammar of the English language*. London: Longman.
Rai, Sunny & Shampa Chakraverty. 2020. A survey on computational metaphor processing. *ACM Computing Surveys* 53(2; 24). 1–37.
Recanati, François. 2003. *Literal meaning*. Cambridge: Cambridge University Press.
Reinöhl, Uta. 2010. *Zum Begriff der Renovation im Rahmen der Grammatikalisierungstheorie*. Münster: University of Münster M.A. thesis.
Reinöhl, Uta. 2016. *Grammaticalization and the rise of configurationality in Indo-Aryan*. Oxford: Oxford University Press.
Reinöhl, Uta & Antje Casaretto. 2018. When grammaticalization does NOT occur. Prosody-syntax mismatches in Indo-Aryan. *Diachronica* 35(2). 238–276.
Resnik, Philip. 1993. *Selection and information: A class-based approach to lexical relationships*. Philadelphia: University of Pennsylvania dissertation.
Riesberg, Sonja (ed.) [in collaboration with Carmen Dawuda, Lucas Haiduck, Nikolaus Himmelmann & Kurt Malcher]. 2017. *A Yali (Angguruk)-German dictionary: Wörterbuch Yali (Angguruk)-Deutsch*. Canberra: Asia-Pacific Linguistics.
Rosemeyer, Malte & Eitan Grossman. 2017. The road to auxiliariness revisited. The grammaticalization of FINISH anteriors in Spanish. *Diachronica* 34(4). 516–558.
Schnell, Stefan. 2011. *A grammar of Vera'a, an Oceanic language of North Vanuatu*. Kiel: Kiel University dissertation.
Schnell, Stefan. 2015. Multi-CAST Vera'a. Multi-CAST: Multilingual corpus of annotated spoken texts. In Geoffrey Haig & Stefan Schnell (eds.), *Multi-CAST*. multicast.aspra.uni-bamberg.de/#veraa (accessed 2 December 2019).
Steen, Gerard, Aletta Dorst, Berenike Herrmann, Anna Kaal, Tina Krennmayr & Trijntje Pasma. 2010. *A method for linguistic metaphor identification: From MIP to MIPVU*. Amsterdam & Philadelphia: John Benjamins.
Sweetser, Eve. 1990. *From etymology to pragmatics: Metaphorical and cultural aspects of semantic structure*. Cambridge: Cambridge University Press.
Zwicky, Arnold. 1985. Heads. *Journal of Linguistics* 21. 1–29.
Zwicky, Arnold. 1993. Heads, bases and functors. In Greville Corbett, Norman Fraser & Scott McGlashan (eds.), *Heads in grammatical theory*, 292–315. Cambridge: Cambridge University Press.