

Formalizing spatial-causal polysemy of Agent prepositions*

Camil Staps
Leiden University
Radboud University Nijmegen

Johan Rooryck
cOAlition S
Leiden University

Abstract Current formal approaches to *by*-phrases in passives analyze the Agent preposition *by* as semantically vacuous: *by* merely rearranges the arguments so that the argument of *by* fulfills the same function as the external argument in the corresponding active sentence. This leads to a view of agentive *by* as essentially homonymous with spatial and temporal *by*. We argue, on the basis of work in the cognitive linguistic tradition and a new analysis of the French Agent prepositions *par* and *de*, that Agent markers do have non-trivial semantic content, and are polysemous rather than homonymous with their spatial counterparts. To formalize this we propose to model these prepositions with general denotations of a polymorphic type $\langle \eta, \langle \theta, t \rangle \rangle$, which can be instantiated with a concrete type in a specific syntactic and semantic context, such as $\langle e, \langle e, t \rangle \rangle$ for the spatial meaning of *by*. The use as an Agent preposition is simply one of these instantiations, with type $\langle e, \langle s, t \rangle \rangle$ (where *s* stands for events). The concrete meaning in context depends on both the general, polymorphically typed denotation and the specific type in the given context. In this way our proposal integrates a useful insight of cognitive linguistics in a semantic formalization of the passive, and opens up possibilities for similar accounts of other highly grammaticalized prepositions.

Keywords: *by*-phrases, passive, prepositions, polysemy, causation, proto-agentivity

1 Introduction

Formal analyses of *by*-phrases in passives tend to treat the Agent preposition *by* as a purely functional element, for example akin to a case marker (Collins 2018; cf. also Bruening 2013). In all accounts known to us, the denotation of *by* is merely what is needed to ensure that its argument plays the same role as the external argument in the corresponding active sentence; *by* does not project any additional meaning.

* This article is currently under revision for *Semantics & Pragmatics*. We thank our informants for verifying our judgments of the French examples in this article. This article has benefited tremendously from insightful comments of Bridget Copley, Louise McNally, Joost Zwarts, the audiences of *Agency and Intentions in Language 2* and the COCOA seminar, and three anonymous reviewers of *Semantics & Pragmatics*; we extend our gratitude to them as well. Any mistakes are ours alone.

We see three problems with these approaches. First of all, they effectively take the Agent preposition *by* as accidentally homonymous with other uses of *by* (e.g., spatial *by the house*; temporal *by five o'clock*). They do not clarify the relation between these other uses of *by* and its use as an Agent preposition. This is problematic because the syncretism is not, in fact, accidental; Croft (2012: 222–226) has shown that Agent markers cross-linguistically tend to derive from prepositions with an ablative ('from') or perlocative ('through') meaning.¹ The underlying reason for this would be that causation is cognitively represented as a chain, with causes preceding effects and thus being marked as something 'through' or 'from' which an effect arises. However, if Agent prepositions are purely functional elements, there is a priori no reason why other prepositions, such as *to* or *for*, could not become Agent markers as well. Ideally, the formal analysis would predict that such developments occur only very rarely.

A second argument against these approaches comes from languages that have multiple Agent prepositions, like French. In French passives, the Agent can be introduced by both *par* 'through, by' (1a) and *de* 'from, of, by' (1b):²

- (1) a. *Le chien est lavé*^{1.00} *par*^{-0.96} *de Marie*.³ (Straub 1974: 584)
 'The dog was washed by Mary.'
- b. *Le mois de février est précédé du?par le mois de janvier.*
 (Straub 1974: 591⁴)
 'February is preceded by January.'

1 This is also the case for English *by*. Before obtaining a proximative sense, *by* had a perlocative meaning, which survives in expressions like *I went by that road* (Palancar 2002: 184).

2 Note that *de le* shortens to *du*, *de les* shortens to *des*, and *de* reduces to *d'* before vowels. We are only interested in *de* followed by proper DPs here; for the use of *de* followed by a bare NP see Martin (2005). French *de* and *par* have cognates in at least Spanish (Suñer 1981) and Portuguese (Moody 1972: 64–66), with very similar behavior. Our analysis readily translates to these languages, but we focus here on French, as the behavior of the two prepositions seems to have been discussed in most detail for this language.

3 Because the difference in acceptability between *de* and *par* can be subtle in many of the examples discussed here, we use superscript numbers to indicate acceptability. These numbers are averaged Likert scores from an informal survey and range from –1 (not acceptable) to 1 (acceptable). They are only meant to give a quick impression of the general tendency of the survey responses; for full details about the distribution of the responses, as well as more information about the survey, see appendix A. Standard judgment marks are used for sentences that we did not test in our survey.

4 *Par* is ungrammatical in this example according to Straub (1974), but for speakers we consulted it was acceptable to varying extents in a similar context (see [25a] below). Over the years, *par* has become more and more the default preposition. In our tests, speakers only strongly rejected *par* with positional verbs like *précéder* 'precede' and *suivre* 'follow', and then only when the context is clearly stative (cf. [1b]). When we critique earlier work, it should be kept in mind that previous analyses may have been correct for older stages of the language, even when they do not apply any more.

<i>par</i>	<i>briser</i> ‘break’; <i>construire</i> ‘build’; <i>écrire</i> ‘write’; <i>laver</i> ‘wash’; <i>tuer</i> ‘kill’
<i>par/de</i>	<i>aimer</i> ‘love’; <i>respecter</i> ‘respect’; <i>abandonner</i> ‘abandon’; <i>délaisser</i> ‘abandon’; <i>accompagner</i> ‘accompany’; <i>précéder</i> ‘precede’ (dynamic); <i>suivre</i> ‘follow’ (dynamic); <i>surplomber</i> ‘overlook’ ⁶
<i>de</i>	<i>précéder</i> ‘precede’ (stative); <i>suivre</i> ‘follow’ (stative)

Table 1 Example verbs grouped by Agent preposition.

In some sentences, both prepositions are felicitous, but in different contexts (table 1 gives an impression of the kind of verbs the French Agent prepositions *de* and *par* are typically used with).

- (2) *Les enfants vont jouer au foot accompagnés*^{0.87} *de*^{0.94} *par* *leurs parents*.
 ‘The children are going to play soccer accompanied by their parents.’
de ⇒ the parents are only watching;
par ⇒ the parents may be playing with the children.

The choice between *par* and *de* depends on the relation of the Agent to the event. In (2), the presence of the parents has little effect when *de* is used, as they are simply observing from off the field. By contrast, when *par* is used, their presence changes the interpretation of the event, as they are now actively participating in the match. We will argue that *de* marks arguments that are less proto-agentive in the event, while *par* marks arguments that are more proto-agentive (in the sense of Dowty 1991 and the scalar notion of transitivity of Hopper & Thompson 1980).⁵ This also explains the distribution in (1). However, it is difficult to incorporate such information transparently in analyses that treat *by* as a case marker and use the identity function $\lambda x_e.x$ as its denotation (e.g., Collins 2018), as the event is then not available as an argument of the denotation of the Agent preposition.

A third issue is that current approaches to *by*-phrases are tailor-made for passive sentences (Bruening 2013, Collins 2018, Angelopoulos et al. 2020). However, Agent prepositions are often part of a more general causative pattern of use. For example, *by* can also be used to mark means (*by bus*, *by force*), and French *de* and

⁵ Since these implications survive negation, we assume that this aspect of their meaning is presuppositional. For example, the following is only felicitous if *de* is stressed and used meta-linguistically: *Les enfants ne vont jouer au foot accompagnés de leurs parents; leurs parents participeront aussi* ‘The children are not going to play soccer accompanied by their parents; their parents will also participate’.

⁶ Gaatone (1998: 203) and Spang-Hanssen (1963: 74–76) list many verbs similar to *surplomber* ‘overlook’: *cerner* ‘surround’, *encadrer* ‘frame’, *encercler* ‘encircle’, *enclorre* ‘enclose’, *entourer* ‘surround’, *envelopper* ‘wrap’, *environner* ‘surround’; *auréoler* ‘halo’, *couronner* ‘crown’; *border* ‘border’, *couper* ‘cut’, *(re)couvrir* ‘cover’, *flanquer* ‘flank’, *jalonner* ‘stake out’.

par also have related causal meanings. As we will see below, the denotations proposed for the Agent preposition in accounts of the passive cannot be used in such contexts, because these contexts lack the specific syntactic environment of the passive for which they were developed. The agentive and other causal uses of these prepositions are effectively taken to be accidentally homonymous. However, the semantic contribution of the preposition in these contexts is roughly the same: as we will show below, *de* is associated with stativity in this environment, whereas *par* is associated with dynamicity, a distinction related to proto-agentivity. This suggests that we should be aiming at a more general semantics for these prepositions, independent of the syntactic structure of the passive. Such an analysis is expected based on Croft (2012), discussed above, since the notion of a causal chain is not limited to passives but generalizes to other causal contexts.

In sum, we seek an account of *by*-phrases with the following properties:

- (3) a. The analysis should predict that Agent prepositions only develop from prepositions with specific spatial meanings.
- b. The analysis should allow Agent prepositions to express properties of the Agent in relation to the event.
- c. The analysis should be general enough to apply to causal uses of Agent prepositions outside passives as well.

We will propose an analysis that satisfies these criteria. Since the prepositions *de* and *par* motivate the need for all three criteria, we specifically focus on French in this article. Section 2 provides cognitive linguistic background and presents the proposal. Section 3 works out the case of the French Agent prepositions *de* and *par* in detail, building on earlier descriptive work as well as many more subtle examples presented here for the first time. Section 4 discusses related work; descriptive work on French *de* and *par* as well as formal analyses of *by*-phrases and prepositional polysemy. Section 5 summarizes and concludes. Appendix A describes an informal survey which we used to confirm our judgments for our examples from French.

2 Integrating cognitive linguistic insights: the proposal

As already mentioned in the introduction and discussed in more detail in section 4.2, formal accounts of *by*-phrases have tended to effectively take the Agent preposition use of *by* as homonymous with the spatial and temporal uses of this preposition. This is in contrast to much work in the cognitive linguistic tradition, which holds that different uses of prepositions are related in a principled way (e.g., Tyler & Evans 2003, Croft 2012):

[Principled polysemy] holds that a particular form [...] is conventionally associated with a number of distinct but related meanings. [...] In essence [...] our proposal is that (the vast majority of) distinct meaning components associated with a lexical item [...] are related to each other in a systematic and motivated way.

(Tyler & Evans 2003: 37–38)

2.1 Incorporating principled polysemy

To incorporate this idea, we propose that these prepositions receive a single denotation, which is general enough to derive, given contextual clues, the different specific meanings of the preposition. Typically, the general meaning has to do with space, since many words can be shown to have developed non-spatial meanings from a spatial origin. In the case of English *by* (e.g. *the house by the lake*), the general meaning would involve *close proximity* of the Figure (*the house*) to the Ground (*the lake*). However, this close proximity is to be understood in an abstract, not necessarily physical way. Thus, for example, moments in time can also be seen as in close proximity to each other.

Our approach makes use of polymorphic types as described by Morrill (1994: 162) (the notion of polymorphic types in Asher 2011: 219–236 is unrelated). The general denotation of the preposition has a polymorphic type $\langle \eta, \langle \theta, t \rangle \rangle$, in which the type variables η and θ can be instantiated with concrete types depending on the syntactic context. In the general denotation in (4) we use f and g for Figure and Ground, respectively. The exact formalization of “ f is in close proximity to g ” depends on assumptions about the cognitive representation of abstract space. For example, Bierwisch (1999: 44) assumes that spatial representation is based on locations in a three-dimensional space, and Zwarts & Winter (2000) develop a more general model based on n -dimensional vectors. In such models, close proximity could be defined in terms of Euclidean distance.

$$(4) \quad \llbracket \text{by} \rrbracket_{\langle \eta, \langle \theta, t \rangle \rangle} = \lambda g_{\eta} \lambda f_{\theta} . f \text{ is in close proximity to } g$$

To see how instantiation of a polymorphic type works, consider the physical spatial meaning in *the house by the lake*. For this sentence, the type would be instantiated with $\eta = e$, $\theta = e$, which triggers the specific meaning: applying the abstract notion of close proximity to a context with two entities of type $\langle e \rangle$ gives rise to the specifically physical interpretation of nearness (5a). In the case of the causal meaning (*written by Mary*), the preposition describes the relation between an entity and an event, and must therefore be instantiated with $\eta = e$, $\theta = s$ (5b).⁷

⁷ This is similar to the “dual analysis” based on reanalysis put forward by Dowty (2003). Formalizing the temporal meaning could be done in a richer type system with separate types for time expressions.

We will not go into detail what $\text{Initiator}(x, e)$ entails exactly. For our purposes this category can be quite broad; for example, $\text{Initiator}(x, e)$ could be taken to mean that x is highest on Fillmore’s (1968) subject selection scale in e .

- (5) a. $\llbracket \text{by}_{\text{spatial}} \rrbracket_{\langle e, \langle e, t \rangle \rangle} = \lambda x_e \lambda y_e. y$ is in close proximity to x
 interpretation: y is physically near x
- b. $\llbracket \text{by}_{\text{causal}} \rrbracket_{\langle e, \langle s, t \rangle \rangle} = \lambda x_e \lambda e_s. e$ is in close proximity to x
 interpretation: $\text{Initiator}(x, e)$

This approach leads to a clear division of labor between cognitive linguistics and formal semantics. The formal syntactic and semantic context, by using certain types, enforces the required type of the specific instantiation of the polymorphic denotation. This ensures, for example, that we do not interpret *by* spatially in Agent phrases in passives: the context requires an instantiation of type $\langle e, \langle s, t \rangle \rangle$, not $\langle e, \langle e, t \rangle \rangle$. In this way, the formal theory predicts which interpretation a highly polysemous preposition receives.

Without a story how the different senses of a preposition are related, this formal machinery is still not much more than a way to describe massive homonymy. It is a task of cognitive linguistics, then, to explain how the meaning of the concrete instantiations in (5) can be derived from the general denotation in (4) and the type provided by the formal context. For the spatial meaning, the explanation will usually be quite simple, since the general denotation is described in abstract spatial terms like “close proximity” in (4). For other domains, one needs to consider how that domain is mapped onto the spatial domain or, alternatively, how the spatial representation module is recycled to represent that domain.⁸

There is a long history of research into the spatial representation of causation.⁹ Causation is usually considered to build on the spatial notions of Source and Goal, possibly through an intermediary temporal representation and the common *post hoc ergo propter hoc* fallacy (Radden 1985: 186–194):

This meaning would then express that an event is “in close proximity” to a moment, that is, happens shortly before or after that moment. We focus on causal meanings here.

⁸ For mapping one domain onto another, see Lakoff & Johnson (1980) and subsequent work. For the spatial representation module, see Bierwisch (1999), and for the notion of recycling, see Rooryck (2019) building on Biberauer (2017).

⁹ The below follows Radden (1985), but similar ideas appear in Dirven (1995) and other sources. Talmy (1988) develops the framework of force dynamics which represents causes as vectorial forces, a theory which we will use in section 2.3.

- (6) a. Source, Start, Cause: *from Paris, from 8:30, die from hunger*
b. Goal, Endpoint, Purpose: *to Dijon, Monday to Friday, dress to impress*

Causation can also build on the notion of Path, in which case multiple interpretations are possible (Radden 1985: 198–200):

- (7) a. Spatial Path: *pass by a newsstand*
b. Means: *work by candlelight*
c. Permissive Cause: *printed by permission*
d. Agentive Cause: *bitten by a dog*

Croft (2012: 222–226) develops the notion of a causal chain, which contains the different entities that influence each other in an event. A causal chain encompasses the causal Sources, Goals, and Paths. For example, the causal chain for (8a) is given in (8b):

- (8) a. *The coconut was broken for John by Sue with a hammer.*
b. Sue → hammer → coconut → John (cf. Croft 2012: 222)

Based on the mapping of the causal domain onto the spatial domain proposed by Radden (1985), we expect that Source prepositions mark Causes at the origin of the causal chain (e.g., Agents but not Instruments) and that Goal prepositions mark Beneficiaries. Path prepositions may be used to mark Means or Instruments, which are between the origin of the causal chain and the Patient. Due to language change, these categories may shift somewhat, so that Path prepositions like *by* commonly mark Agents that appear to be at the origin of the causal chain as well. However, these changes are very limited; for example, we do not expect Path prepositions to mark Beneficiaries. These predictions regarding the causal meaning of spatial prepositions have been confirmed in typological studies (Croft 2012: 225 and references therein). The fact that unrelated languages display the same mappings between spatial and causal concepts suggests a cognitive reality. This forms the basis for a cognitive linguistic argument explaining the relation between an abstract spatial denotation (4) and its causal instantiation (5b) (and thereby also the relation with the physical spatial instantiation [5a]). We develop this argument further for French in section 3.5.

In the following subsections we describe how the proposal in (4) can be made to work in passives (section 2.2) and illustrate its generality by applying it to prepositions in causal adjuncts (section 2.3).

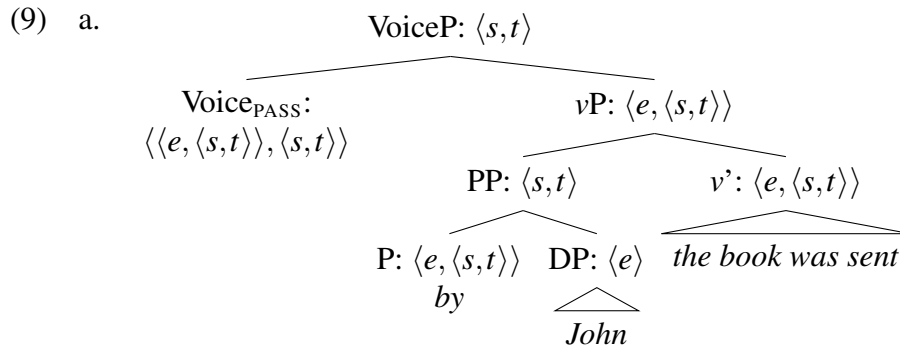
2.2 By-phrases in passives

To apply the denotation in (5b) to passive sentences, we largely adopt the approach to *by*-phrases of Angelopoulos et al. (2020) (see section 4.2 for a discussion of the differences, as well as a comparison with other strategies). In this approach, the *by*-phrase takes the same place as the external argument in an active sentence. Given that a *by*-phrase expresses a relation between an Agent and an event, we argue that the denotation of *by* must be of type $\langle e, \langle s, t \rangle \rangle$, as in (5b):

$$(5b) \quad \llbracket \text{by}_{\text{causal}} \rrbracket_{\langle e, \langle s, t \rangle \rangle} = \lambda x_e \lambda e_s. e \text{ is in close proximity to } x$$

interpretation: Initiator(x, e)

As a result, the *by*-phrase is of type $\langle s, t \rangle$. In the compositional analysis in (9), we assume a vP projection selected by an active or passive Voice head (an assumption made to simplify our comparison with other accounts in section 4.2). The *by*-phrase combines with the v' projection using Event Identification (Kratzer 1996: 122). It effectively fills the syntactic argument position without saturating the semantic argument.



$$b. \quad \llbracket \text{Voice}_{\text{PASS}} \rrbracket = \lambda p_{\langle e, \langle s, t \rangle \rangle} \lambda e_s. \exists x_e : p(x)(e)$$

Example (10) provides an example of the derivation of a passive with a *by*-phrase (bold letters stand for the constants ‘send’, ‘book’, and ‘John’). We gloss over the derivation of the v' projection here. The existential closure introduced by $\text{Voice}_{\text{PASS}}$ is needed in passives without *by*-phrases, but becomes redundant in this derivation when the variable it introduces is identified with the argument of *by*. This can be ensured via the theta criterion: an event can only have one Initiator (Landman 2000: 68; Williams 2015: 287; cf. Dowty 1989: 85, 99–103).

- (10) a. $\llbracket \textit{the book was sent} \rrbracket = \lambda x_e \lambda e_s. \mathbf{s}(e) \ \& \ \text{Initiator}(x, e) \ \& \ \text{Patient}(\mathbf{b}, e)$
 b. $\llbracket \textit{by John} \rrbracket = \lambda e_s. \text{Initiator}(\mathbf{j}, e)$
 c. $\llbracket vP \rrbracket = \lambda x_e \lambda e_s. \mathbf{s}(e) \ \& \ \text{Initiator}(x, e) \ \& \ \text{Patient}(\mathbf{b}, e) \ \& \ \text{Initiator}(\mathbf{j}, e)$
 d. $\llbracket \text{VoiceP} \rrbracket$

$$\begin{aligned}
 &= \lambda e_s. \exists x_e : \mathbf{s}(e) \ \& \ \text{Initiator}(x, e) \ \& \ \text{Patient}(\mathbf{b}, e) \ \& \ \text{Initiator}(\mathbf{j}, e) \\
 &= \lambda e_s. \mathbf{s}(e) \ \& \ \text{Patient}(\mathbf{b}, e) \ \& \ \text{Initiator}(\mathbf{j}, e) \quad (\text{theta criterion})
 \end{aligned}$$

The analysis in (9) places *by* somewhat on the border between a purely lexical and a purely functional preposition. On the one hand, its type is regular and it carries semantic content related to the general meaning in (4); on the other hand, the *by*-phrase appears in the same place as the external argument in active sentences. This intermediate status is in line with the fact that *by* has both lexical (e.g., spatial) and functional (e.g., agentive) uses.

2.3 Prepositions in causal adjuncts

Before turning to the interpretation of French *de* and *par* in passives in section 3, we want to illustrate the generality of our proposal by showing how it can be used to capture distributional facts about prepositions in causal adjuncts. The example we work out here is the observation by Copley & Harley (2015) that English *from* marks causes that are forces, rather than causes that are situations:

- (11) a. *The floor broke **from** the *(weight of the) elephant.*
(Copley & Harley 2015: 141)
- b. *The window broke **from** John*(’s hitting it).*
(Copley & Harley 2015: 141)

Based on this and many other facts, Copley & Harley (2015, 2022) develop a semantic framework in which an event is either a situation (type $\langle s \rangle$) or a force (type $\langle f \rangle$) (in this subsection we thus use $\langle s \rangle$ for situations and not for events in general). Conceptually, a situation “includes individuals and their property attributions” (Copley & Harley 2022: 12; cf. Barwise & Perry 1983), and a force is an input of energy that arises from a situation. Formally, a force is a function that maps situations to situations: $f(s_0) = s_1$. In this framework, a causal event is not a composite of a cause and a result, but a force that, as a function, maps one situation to another (12). The distribution of *from* can now be captured in terms of a type constraint: *from* in causal adjuncts has type $\langle f, \langle s, t \rangle \rangle$ but not $\langle e, \langle s, t \rangle \rangle$ or $\langle s, \langle s, t \rangle \rangle$.



French *de* and *par* are sensitive to the same distinction between situations and forces. The examples in (13) show that *de* can be used to name causes that are situations (e.g., *faim* ‘hunger’), while it cannot be used to name causes that are forces (e.g., *un tremblement de terre* ‘an earthquake’). Instead, a majority of speakers use *par* for this purpose:

- (13) a. *Jean est mort* ^{1.00}*de*/^{-0.87}*par* {*faim / vieillesse / la maladie de Parkinson*}.
 ‘Jean died of/from hunger/old age/Parkinson’s disease.’
 b. *La fenêtre s’est cassée* ^{-0.90}*de*/^{0.37}*par* {*un tremblement de terre / l’impact du ballon*}.
 ‘The window broke due to an earthquake/the impact of the ball.’

We therefore propose that *de* is instantiated with type $\langle s, \langle s, t \rangle \rangle$, but *par*, for most speakers, with type $\langle f, \langle s, t \rangle \rangle$.¹⁰ This can be formalized with the concrete denotations in (14b) and (15b), based on the general, polymorphic denotations in the (a) examples (cf. [4–5]). In these denotations, $\text{net}(s)$ is the net force generated in situation s (Copley & Harley 2022: 14).

- (14) a. $\llbracket \text{par} \rrbracket_{\langle \eta, \langle \theta, t \rangle \rangle} = \lambda g_{\eta} \lambda f_{\theta}$.figure f is through/via ground g
 b. $\llbracket \text{par}_{\text{causal}} \rrbracket_{\langle f, \langle s, t \rangle \rangle} = \lambda f_f \lambda s_s$.situation s is through/via force f
 interpretation: s comes about through f
 formally: $\exists s_0 : \text{net}(s_0) = f \ \& \ f(s_0) = s$ ¹¹
- (15) a. $\llbracket \text{de} \rrbracket_{\langle \eta, \langle \theta, t \rangle \rangle} = \lambda g_{\eta} \lambda f_{\theta}$.figure f is from/of ground g
 b. $\llbracket \text{de}_{\text{causal}} \rrbracket_{\langle s, \langle s, t \rangle \rangle} = \lambda s_s \lambda s'_s$.situation s' is from/of situation s
 interpretation: s' arises from s
 formally: $(\text{net}(s))(s) = s'$

In words, *par f* expresses that f is the net force of a situation s_0 , and that f maps s_0 to the situation s described in the clause. Thus, in (13b), the earthquake (or the impact of the ball) is the net force f of a situation s_0 , so that $f(s_0) = s$ is a situation in which the window is broken. By contrast, *de s* expresses that the net force of s maps s to the situation s' described in the clause. In (13a), s contains Jean,

¹⁰ Thus the type of English *from* matches that of *par*, and not that of *de*, as we might expect based on spatial meaning. This is probably because English contrasts *from* with *of*. Radden (1985: 188–192) argues that *from* expresses an origin and therefore carries the notion of distance, whereas *of* expresses a smaller distance (e.g., a boat anchored *off* the coast is still close to the coast). From this he derives the fact that *of* marks immediate causes (*die of lung cancer*) whereas *from* can describe indirect causal relations (*die from smoking*). French uses prepositions with different spatial meanings, and therefore ends up partitioning the causation space in (12) differently. As a result, a preposition with a different spatial meaning (*par* ‘through’) has the same distribution in causal adjuncts as English *from* (marking forces).

¹¹ Copley & Harley (2015: 142) give *from* the denotation $\lambda f \lambda s. \text{net}(\text{pred}(s)) = f$, with $\text{pred}(s)$ defined as the predecessor situation of s . This denotation is roughly the same as the one in (14b), but we do not assume that a situation’s predecessor is identifiable.

The factors we found to be relevant for the choice between *de* and *par* are a combination of proto-Agent properties (Dowty 1991: 572) and proto-transitivity properties (Hopper & Thompson 1980).¹³ All relevant factors are relational properties in the sense of Næss (2007: 30–32); they concern the relation of the Agent to the event. They are the stative/dynamic contrast (“kinesis”), telicity (“punctuality”), volitionality, and bringing about a change (“agency”, “potency”).¹⁴ Of these, the property of bringing about a change is primary, in the sense that if a verb can imply a change, the use of *par* will force it to do so.

We will not address the question where the threshold of “high” and “low” proto-agentivity lies, exactly. In intermediate cases, where the Agent has some but not all properties of proto-Agents, it is to be expected that speakers show quite some variation as to their preference for one preposition or the other, and factors like style and register may also come into play. This should be the topic of a more descriptively oriented study. Among our survey participants (appendix A) we could not clearly distinguish clusters of speakers with similar preferences. Here we are therefore only concerned with establishing the fact that there is a proto-agentivity threshold that determines the choice between the two prepositions, and proposing a theory to account for it.

3.1 Change: prototypically transitive verbs

Prototypically transitive verbs by definition take an Agent that is high in proto-agentivity. In this subsection we treat verbs that imply at least that the Agent brings about a change (whether physical or not). We use Beavers’s (2011) conception of *affectedness* to define change. For Beavers, affectedness involves (a) a Theme participant undergoing a change and (b) a scale participant measuring the change.¹⁵

In prototypically transitive events, the Agent volitionally and telically causes a physical change in a Patient, as in (1a). In this example the Theme is the dog and the scale is being-washed or cleanliness. It is clear that (35) correctly predicts that only *par* is felicitous here:

13 There are correlations with proto-Patient properties and affectedness (Beavers 2011), but these are indirect. For example, *par* will be used more with highly affected Patients, but this is because *par* is used to mark Agents that bring about a change and these Agents go together with highly affected Patients. To see that *par* does not directly express affectedness of the Patient, consider that there are many verbs which take *par* while their Patient is the least affected in the hierarchy of Beavers (2011: 358), such as *voir* ‘see’, *considérer* ‘consider’, and *lorgner* ‘ogle’.

14 As an anonymous reviewer points out, based on these properties we may expect the degree of transitivity to depend on aspect. As a result, some of the judgments we give in this article may be different if the aspect of the sentence is changed.

15 However, we cannot depend on Beavers (2011) too directly, as he explicitly limits himself to dynamic predicates, while many of our examples involve stative predicates.

- (1a) *Le chien est lavé* ^{1.00}*par*/^{-0.96}*de Marie*. (Straub 1974: 584)
'The dog was washed by Mary.'

Table 1 above gives more examples of highly transitive verbs which only take *par*. We also consider verbs of maintaining to belong to this group:

- (17) *Le bord supérieur du filet est maintenu* {^{1.00}*par des*/^{-0.81}*des*} *flotteurs et demeure à la surface*.¹⁶
'The upper edge of the net is buoyed (maintained) with floats and remains on the surface.'

This is a case of entrainment causation (cf. Michotte 1946 in citation by Copley & Harley 2022: 4–5; see also the discussion of “maintenance” by Neeleman & van de Koot 2012: 38–43 and “stative causers” by Kratzer 2000 and Pylkkänen 1999). In entrainment causation, the effect occurs during the cause rather than after the cause (which is *launching causation*). For example, in *push the cup to the edge of the table*, the cup is at the edge *after* the pushing (launching causation), but in *push the cup along the edge of the table*, the cup is along the edge *during* the pushing (entrainment causation). In the latter case, there is no change in the along-the-edgesness of the cup, which is nevertheless brought about by the pushing. Entrainment causation thus provides a middle ground between a lack of causation (in which no participant is causally affected) and launching causation (in which a change in the described state can be observed). Similarly, in (17) there is no physical change, but there is physical causation. The scale measures whether the net is on the surface (or, alternatively, the depth of the net), and the Agent is needed to keep the Theme at the same position on that scale. There is also volitionality, since the floats are placed purposefully. These features entail relatively high proto-agentivity, which explains the preference for *par*.

Verbs with Incremental and Holistic Themes (Dowty 1991: 567–571) also belong to this group. With an Incremental Theme, the scale to measure change is directly derived from the extent of the Theme (18). Clearly, the Agent is highly proto-agentive due to the clear change it brings about in the Patient.

¹⁶ <http://tsb.gc.ca/fra/rapports-reports/marine/2004/m04w0225/m04w0225.html>, retrieved January 30, 2023.

- (18) *Le gâteau a été mangé/cuit par/*de Jean.*¹⁷
 ‘The cake was eaten/baked by Jean.’

With a Holistic Theme, the Theme is conceived of as a path that can map onto a scale on which change can be measured. Thus, in (19a), the degree to which the route has been followed is measured by the point on the route, and similarly for (19b).

- (19) a. *Voici la route suivie {^{1.00}par les/^{-0.45}des} premiers explorateurs qui sont arrivés en Amérique.* (based on Gaatone 1998: 203)
 ‘This is the route followed by the first explorers who arrived in America.’
 b. *Le désert était traversé ^{0.96}par/^{-0.77}de la caravane.*¹⁸
 ‘The desert was crossed by the caravan.’

While one could argue that the route in (19a) only comes into existence in the described event, the desert in (19b) cannot be said to be brought about or affected by the caravan. In this case the change is not in the Patient but in the Agent itself. In this sense the Agent is still involved in bringing about a change, namely in its own position (also cf. Dowty’s 1991: 572 proto-Agent property “movement (relative to the position of another participant)”).

In sum, while the exact cut-off point will vary between speakers, it is clear that there is a group of highly transitive verbs that require *par*. This group contains at least telic verbs that entail physical change, verbs of maintaining, and verbs with Incremental/Holistic Themes.

3.2 Change on a contextually inferred scale

With some verbs that do not imply a change in and of themselves, change can be implied by the use of *par* when a scale can be inferred based on the context. We are only aware of examples of stative verbs, so all the examples in this subsection are cases of entrainment causation.

Inferred scales are particularly frequent with emotion verbs. Being stative, emotion verbs have been reported as preferring or requiring *de* (Clédat 1900 and, to a lesser extent, Straub 1974), but we now see that *par* is available with these verbs as well and is taking over as the default. Nevertheless, *de* remains quite acceptable for most speakers. It is now used in particular when the emotion is presented as not having any effect. Thus, in (20a), the love of the grandfather has no effect beyond

¹⁷ This example was not included in our survey, but is uncontroversial.

¹⁸ *Traverser* ‘traverse’ also occurs with *de*, but then selects a bare NP without article: *un espace traversé de/*des tensions politiques* ‘a field riddled with political tensions’. This is a genitive of substance (Martin 2005) and is unrelated.

his own emotional state. By contrast, in (20b), the love of the grandfather is the cause of concrete actions, which affect the Patient:¹⁹

- (20) a. *Elle est adorée*^{0.60} *de*^{0.77} **par** *son grand-père qui devient toujours émotionnel quand il regarde ses photos.*
 ‘She is loved by her grandfather, who always gets emotional when he looks at her photos.’
- b. *Elle est adorée*^{0.50} *de*^{0.92} **par** *son grand-père qui l’emmène toujours manger des glaces et lui offre d’énormes cadeaux pour son anniversaire.*
 ‘She is loved by her grandfather, who always takes her to eat ice cream and gives her huge presents for her birthday.’

The mention of concrete actions on the part of the Agent (Experiencer) in (20b) suggests that the *adorer* event implies a change on a being-spoiled scale. No scale for change can be inferred in (20a). The lower degree of proto-agentivity in (20a) compared to (20b) explains why *de* is more, and *par* less acceptable in (20a) than (20b). When the context is not rich enough, either preposition will be felicitous, but the use of *de* will suggest that the event is relatively inconsequential.²⁰

The judgments for (21–22) are similar, but the difference is not as large. This probably has to do with the more stative aspect of these verbs.

- (21) a. *Le prêtre était très aimé*^{0.92} *de*^{0.70} **par** *ses paroissiens parce qu’il était toujours attentif à leurs besoins.*
 ‘The priest was much loved by his parishioners because he was always attentive to their needs.’
- b. *Le prêtre était très aimé*^{0.83} *de*^{0.77} **par** *ses paroissiens; ils lui donnaient toujours des tartes et des bouteilles de vin.*
 ‘The priest was much loved by his parishioners; they always gave him cakes and bottles of wine.’

19 One may compare *He sneezed the napkin off the table*, where *sneeze* atypically brings about a change on a contextually inferred location scale (Beavers 2011: 360; Boas 2003: 260–277). Bar-Asher Siegal & Boneh (2020: 38–43) also discuss contextually inferred effects.

20 The choice of Agent preposition with emotion verbs has received quite some attention in the literature on Romance languages. Moody (1972: 66) suggests that the loving is Platonic in Portuguese *Nora é amada de todos* ‘Nora is loved by all’, but that with *por* (French *par*) “an entirely different event may be implied”. For Clédât (1900: 222–223), *adoré par* is only felicitous in the sense of ‘worship’ (*Les animaux [sic] sont adorés par certains peuples* ‘Animals are worshiped by certain nations’), which may imply consequences such as offerings or vegetarianism. For Clédât, *de* is required in both contexts in (20). This must reflect an older stage of the language, however, since Straub (1974: 586) already reported that *Le garçon est adoré par le grand-père* ‘The boy is loved by his grand-father’ is felicitous.

- (22) a. *Il était évident qu'il s'agissait d'un roi très respecté* ^{0.77}*de*/^{0.89}*par sa communauté et de/par la société dans son ensemble.*
 'It was clear that this was a king who was much respected by his community and the society as a whole.'
- b. *Le roi était très respecté* ^{0.64}*de*/^{0.81}*par ses sujets qui lui apportaient du tribut chaque année.*
 'The king was much respected by his subjects who brought him tribute every year.'

There are more types of verbs that can imply change on a contextually inferred scale. We already discussed (2) with *accompagner* 'accompany' in the introduction. When the parents are involved in the event, they are marked by *par*; when they are merely watching, *de* is preferred:

- (2) *Les enfants vont jouer au foot accompagnés* ^{0.87}*de*/^{0.94}*par leurs parents.*
 'The children are going to play soccer accompanied by their parents.'
de ⇒ the parents are only watching;
par ⇒ the parents may be playing with the children.

When the parents join in the event with *par*, this does not necessarily imply a change, but it might: the game may get rougher, for example. There is a potential for change, and this is already enough to trigger the use of *par*, since *de* would imply that the accompaniment by the parents has no effect at all.²¹

A minimal pair can be constructed along the lines of (23).²² In (23a), the policeman is guarding the inmate, which is seen as a form of (non-physical) affecting. We can understand this in two ways. Either the policeman psychologically affects the inmate, or there is a potential for change: if the inmate tries to escape, the policeman will try to prevent this. By contrast, (23b) involves a *former* inmate who merely happens to be accompanied by a policeman. Most of our informants found both *de* and *par* acceptable in both sentences, but several commented that *par* foregrounds the aspect of surveillance.²³

21 Rappaport Hovav & Levin (2001: 787–788) and Beavers (2011: 357–365) also discuss potential change. The contexts are slightly different, but nevertheless lend support to the idea that sentences in which there is a potential for change are more transitive than sentences in which there is no such potential.

22 We thank an anonymous reviewer for suggesting this contrast.

23 The difference may be brought out better if the context in (23a) were such that the inmate is more likely to escape (and therefore needs surveillance). For example: *Le détenu se rend aux funérailles de sa mère pendant sa liberté conditionnelle, accompagné par/#d' un policier* 'The prisoner is going to his mother's funeral during his parole, accompanied by a policeman.' A similar contrast is discussed by Moody (1972: 66) for Portuguese: *O presidente fugiu seguido da/pela polícia* 'The president fled followed by the police.' When *da* is used, the police "did not act upon the president" (e.g., after a

- (23) a. *Le détenu se rend au poste médical accompagné^{0.96} par^{0.79} d' un policier.*
 'The prisoner is going to medical accompanied by a policeman.'
- b. *L'ex-détenu est apparu devant le tribunal, accompagné {^{0.89} par le/^{0.79} du} policier qui l'avait arrêté.*
 'The former prisoner appeared in front of the courthouse accompanied by the policeman who had arrested him.'

For some speakers, the possibility of implying a change on a contextually inferred scale is not limited to animate Agents. In (24b), the inanimate mountain chain maintains a value on a scale measuring the speed with which the emergency services arrive. By contrast, there is no such scale in (24a), where any effect of the surrounding mountains is explicitly denied. Thus, (24b) implies a change on a contextually inferred scale (the lateness of the emergency services).

- (24) a. *Le village est entouré^{0.87} d'^{0.73} par une chaîne de montagnes, mais néanmoins bien relié au reste du pays.*
 'The village is surrounded by a mountain chain, but nevertheless well-connected to the rest of the country.'
- b. *Le village est entouré^{0.79} d'^{0.77} par une chaîne de montagnes, à cause de laquelle les services d'urgence arrivent toujours trop tard.*
 'The village is surrounded by a mountain chain, because of which the emergency services always arrive too late.'

Our judgments for this pair were confirmed by only a few survey respondents. This may be because as a non-animate Agent, the mountain chain in (24) does not have volitionality, while differences in volitionality could be a contributing factor to the choice of Agent preposition for the previous examples in this section.

3.3 Volitionality: *suivre* 'follow'

There are also verbs for which the difference in interpretation expressed by *de* and *par* does not involve change but volitionality. This is most clear with verbs like *suivre* 'follow' and *précéder* 'precede', that have both a dynamic and a generic reading.²⁴ The clearest difference exists between a purely locative and a telic, vo-

coup the president is followed by the police forces loyal to him); but with *pela* (French *par*), the police "pursued" the president (e.g., after the president has escaped with the country's treasure).

²⁴ For *suivre* in the meaning of 'follow a path' rather than 'follow something/someone', see (19a) above.

litional interpretation. The use of *par* is not quite acceptable for all speakers in the former case (25a), while it is required for the standard reading of (25b).²⁵

- (25) a. *Lundi est précédé* ^{0.83}*de*/^{0.50}*par* *dimanche et le mois de février est précédé* ^{0.83}*du*/^{0.50}*par* *le mois de janvier.*
 ‘Monday is preceded by Sunday and February is preceded by January.’
- b. *Le criminel est suivi* ^{0.35}*du*/^{0.98}*par* *le détective qui voulait le prendre en flagrant délit.*
 ‘The criminal is followed by the detective who wanted to catch him red-handed.’

Example (25a), together with minimal pairs like (26), suggests that *de* is used more in generic contexts. This is correct, but we believe this to be a side effect of properties of proto-agentivity. Generic statements can be used to mention things that depend on convention (25a,26a), whereas a concrete statement like (26b) more often involves volitionality; in this case the author’s volitional choice to order the chapters in this way.

- (26) a. *Le dernier chapitre est suivi* ^{0.98}*d’*/^{0.31}*par* *une table des matières.*
 ‘The last chapter is followed by a table of contents.’
- b. *Cette introduction est suivie* ^{0.77}*de*/^{0.64}*par* *l’étude de la structure atomique et électronique des atomes.*²⁶
 ‘This introduction is followed by the study of the atomic and electronic structure of atoms.’

To show that the generic flavor of (25a,26a) is only a side effect, consider the pair in (27). These sentences are equally generic, yet *de* is clearly preferred in (27a), while the difference is smaller in (27b).

- (27) a. *Pour mettre en place l’échiquier, on place les pions sur la deuxième rangée, suivis* {^{0.89}*des*/^{0.50}*par* *les*} *autres pièces sur la première rangée.*
 ‘To set up the chess board, we place the pawns on the second rank, followed by the other pieces on the first rank.’
- b. *Dans l’ouverture, nous avançons d’abord quelques pions, suivis* {^{0.77}*des*/^{0.68}*par* *les*} *cavaliers.*

25 The use of *de* suggests a purely spatial relation between the criminal and the detective (thus decreasing the Agent’s proto-agentivity). Such a reading was meant to be excluded by *qui voulait le prendre en flagrant délit* ‘who wanted to catch him red-handed’, but, judging from survey comments, some informants marked *de* as acceptable here because the relation may still be purely spatial, for example if the detective is unknowingly, accidentally following the criminal. Informants also suggested that *de* would be more appropriate in case someone taking a walk is ‘followed by’ a friend or their dog.

26 Based on <https://www.programmes.uliege.be/cocoon/20212022/cours/CHIM9275-1.html>, retrieved December 8, 2021.

‘In the opening game, we first advance some pawns, followed by the knights.’

The difference between these sentences lies in the volitionality of the presupposed chess player. In (27a), there is no strong reason to set up the pawns first. It may be slightly more practical (setting up the other pieces first would require lifting the pawns over the other pieces to place them on the second rank), but nothing would go wrong if one were to set up the pieces in a different order instead, for example from left to right. In (27b) however, the player has good reason to advance the pawns first: they can be used to control the center, while at the same time preparing the queen and bishops for development. There is clear purpose behind the decision to advance the pawns first, even though this purpose (and hence volitionality) is ascribed to the presupposed player rather than the pieces themselves.

The same type of volitionality, and hence proto-agentivity, also explains the preference for *par* in (28b): sending out the infantry before the cavalry is part of a well-thought-out strategy. By contrast, the order in (28a) is determined by protocol, and involves less purpose and volitionality.

- (28) a. *Au défilé militaire du 14 juillet, l’infanterie était suivie* ^{0.71}*par*^{0.81}*de la cavalerie.*
 ‘In the military parade of July 14, the infantry was followed by the cavalry.’
- b. *Napoléon envoya l’infanterie au combat, suivie* ^{0.77}*par*^{0.73}*de la cavalerie.*
 ‘Napoleon sent out the infantry to battle, followed by the cavalry.’

Example (29) presents an interesting case:

- (29) *Ce pianiste est toujours suivi* ^{0.98}*par*^{0.66}*d’**une foule d’admirateurs.*
 (based on Gaatone 1998: 203)

‘This pianist is always followed by a crowd of admirers.’

de ⇒ the admirers are physically behind the pianist;

par ⇒ the admirers could also be following the pianist’s career.

Both *de* and *par* are felicitous here, but *de* suggests a spatial relation, whereas *par* suggests that the admirers are following the pianist’s *career*. There are no obvious differences in the proto-transitive properties of verbal aspect, volitionality, telicity, or bringing about a change. It may be that the difference in interpretation is simply due to the frequent use of *de* with *suivre* in purely locative contexts similar to (25a), but this explanation is ad hoc. It rather seems to us that there is a subtle difference in volitionality. With *de*, it is likely that the crowd does not consist of the same members in each instance of the habitual event: if the pianist is on tour, the

crowd will likely be different in each city. A reading in which the members of the crowd change regularly is much less likely with *par*, it seems to us. Here we understand a dedicated group of admirers that persistently follows the pianist's career. This dedication could be understood as relating to a higher degree of volitionality, and hence proto-agentivity. However, it is clear that more minimal pairs with better contexts would have to be tested to verify this.

3.4 Telicity: *abandonner* 'abandon' and *délaisser* 'leave behind'

Finally, with some verbs, the choice between *de* and *par* tells us something about telicity. It has long been recognized that *de* is not always permitted when a goal PP is added, making the event telic:²⁷

- (30) a. *(un enfant) abandonné de/par ses parents* (Authier-Revuz 1972: 50)
 '(a child) abandoned by its parents'
- b. *(un enfant) abandonné *de/par ses parents sous le porche*
 (Authier-Revuz 1972: 50)
 '(a child) abandoned by its parents under the porch'

In (30b), there has clearly been an event of physically abandoning the child, whereas (30a) could be used for a neglected child (and that is certainly the interpretation triggered by *de*). We attempted to capture this contrast in a minimal pair with a difference between children needing food and accommodation due to their parents' abandonment (telic; [31a]) and children needing help with homework and social problems (atelic; [31b]). Another minimal pair tested a similar opposition with *délaisser* 'abandon, neglect': (32a) is telic; (32b) atelic (*laisser* 'leave' behaves the same).

- (31) a. *Notre organisation soutient les enfants abandonnés* ^{-0.12}*de*^{1.00}*par leurs parents avec un logement et de la nourriture.*
 'Our organization helps children abandoned by their parents with housing and food.'
- b. *Notre organisation vient en aide aux enfants abandonnés* ^{-0.07}*de*^{0.92}*par leurs parents, et les aide à faire leurs devoirs et résoudre leurs problèmes sociaux.*
 'Our organization comes to the aid of children abandoned by their parents and helps them with doing their homework and resolving social problems.'

²⁷ These examples were not included in our survey, but are uncontroversial.

- (32) a. *Quand l'alarme a sonné, Notre Dame a été vite délaissée* {^{0.10}*des*/^{0.83}*par les*} *touristes qui s'y trouvaient.*
 'When the alarm rang, the Notre Dame was quickly abandoned by the tourists who were there.'
- b. *Voici une photo de Notre-Dame délaissé* [sic] ^{0.28}*de*/^{0.85}*par ses touristes en plein confinement pendant COVID.*²⁸
 'This is a photo of the Notre Dame, abandoned of its tourists in full lockdown during COVID.'

Though acceptability scores for *de* varied widely between speakers in our survey, this preposition seems to be slightly worse for most speakers in the (a) examples than in the (b) examples. It may be that better contexts can be constructed to make *de* more acceptable in the atelic (b) sentences. The difference in acceptability for *par* is very small, probably because *par* acts as the default Agent preposition.

3.5 French *de* and *par* in passives: discussion

In the previous subsections we have shown that the choice between *de* and *par* depends on several properties of the relation between the Agent and the event. The most important factors are bringing about a change (sections 3.1 and 3.2), volitionality (section 3.3), telicity (section 3.4), and the stative/dynamic contrast. When both *de* and *par* are possible, we found that the choice is influenced by one or more of the first three of these properties. The stative/dynamic contrast is a property of clauses that plays in the background of many sentences, but we are not aware of any sentences where the choice between *de* and *par* is only or primarily conditioned by this property.

It seems to us that the property of bringing about a change is primary: if a predicate can imply a change, the use of *par* will force it to do so. Thus, if a predicate *can* imply all of change, volitionality, and telicity, the use of *par* will imply change but not necessarily volitionality or telicity. As evidence for this, note that entrainment causation can be seen as change without telicity (Copley & Harley 2022), and that cases of entrainment causation with clear changes require *par* (17). Similarly, non-volitional Agents that bring about a change still require *par* as well:

- (33) *Le chien est lavé par/*de Marie, bien qu'elle n'en avait pas envie.*²⁹
 'The dog was washed by Mary, though she didn't want to (wash it).'

We conclude the following for sentences in which both *de* and *par* are allowed:

²⁸ Based on <https://twitter.com/chouettephoto/status/1344600099113074691>, retrieved March 18, 2022.

²⁹ This example, built on (1a), was not included in our survey, but is uncontroversial.

- (34) a. If change could be implied by the event, *par* will imply change and *de* will imply lack of change. The scale to measure change may be inferred contextually. *Par* does not necessarily imply any other properties of proto-agentivity.
- b. If change is excluded by the event, *par* will imply a higher level of volitionality and/or telicity than *de*.

The differences in proto-agentivity presupposed by *de* and *par* can be expressed very transparently with the approach to *by*-phrases proposed in section 2.2. We argued there that Agent prepositions have denotations of type $\langle e, \langle s, t \rangle \rangle$, and thus naturally lend them to express properties of the relation between the Agent and the event. Assuming the polymorphic denotations of *de* and *par* from (14a) and (15a), the concrete meanings in passives can be given as in (35). As discussed on (5b), we use $\text{Initiator}(x, e)$ quite broadly here; our interest is in the difference in presupposed proto-agentivity.

$$(14a) \quad \llbracket \text{par} \rrbracket_{\langle \eta, \langle \theta, t \rangle \rangle} = \lambda g_{\eta} \lambda f_{\theta} . f \text{ is through/via } g$$

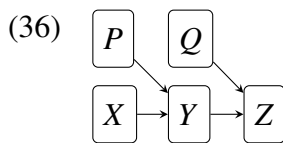
$$(15a) \quad \llbracket \text{de} \rrbracket_{\langle \eta, \langle \theta, t \rangle \rangle} = \lambda g_{\eta} \lambda f_{\theta} . f \text{ is from/of } g$$

- (35) a. $\llbracket \text{par}_{\text{agentive}} \rrbracket_{\langle e, \langle s, t \rangle \rangle}$
 $= \lambda x_e \lambda e_s . e \text{ is through/via } x$
 interpretation: $\text{Initiator}(x, e)$
 presupposed: x has high proto-agentivity in e
- b. $\llbracket \text{de}_{\text{agentive}} \rrbracket_{\langle e, \langle s, t \rangle \rangle}$
 $= \lambda x_e \lambda e_s . e \text{ is from/of } x$
 interpretation: $\text{Initiator}(x, e)$
 presupposed: x has low proto-agentivity in e

Why would *de* ‘from, of’ imply low proto-agentivity and *par* ‘through, via’ high proto-agentivity? Ultimately, the answer depends on how humans conceptualize causation using spatial notions. We can only sketch the outline of a possible answer here. Consider again the notion of the causal chain in which arguments are either antecedent or subsequent to the Patient (section 2.1). Croft (2012: 222–226) showed that arguments antecedent to the Patient (Agent, Instrument, etc.) are typically marked by ablative or perlativ prepositions (‘from’, ‘through’), whereas arguments subsequent to the Patient (Beneficiary, Goal, etc.) are typically marked by allative prepositions (‘to’, ‘for’). We suggest that the causal meaning of a preposition is not only determined by the relative position expressed by its spatial meaning, but also by the *distance* it expresses. In particular, *par* ‘through, via’ places the Fig-

ure at a smaller distance from the Ground than *de* ‘from, of’, and would therefore be used for Agents at a smaller ‘causal distance’ from the Patient. This smaller causal distance would then be interpreted as a greater ability for the Agent to affect the Patient, and hence, as a higher degree of proto-agentivity. This argument based on the causal chain can be extended to other causal prepositions; for instance, *avec* ‘with’ expresses an even smaller distance than *par* and can be used for Instruments, which stand between the Agent and the Patient in the causal chain.

Another way to understand the difference in meaning between *par* and *de* builds on causal models (e.g. Halpern & Pearl 2005). Causal models are directed graphs representing the dependency of variables on each other, as in (36):



In this model, *Z* depends on *X* only through *Y*. It can be proven, but is intuitively clear, that the set of cases (i.e., variable assignments) in which *Z* depends on *X* is a subset of the set of cases in which it depends on *Y*. For example, the formula for *Y* may disregard the value of *X* for certain values of *P*; in this case, *Z* still depends on *Y*, but not on *X*.³⁰ Therefore, a greater distance between two variables in the causal model corresponds to a smaller dependency of the effect on the cause. If *Z* were to represent a scale on which change is measured, and *X* and *Y* represent actions by Agents or other causing arguments, a greater distance therefore corresponds to a smaller degree to which an Agent can affect the Patient. This is another way in which the link between the distance expressed by *de* ‘from, of’ can be related to the implication of low proto-agentivity in its causal uses.

It is important to note that in different languages, prepositions with very similar spatial meanings may have different causal meanings. Staps & Beukenhorst (In preparation) argue that in Biblical Hebrew, the preposition *min* ‘from’ marks Causes that are more “dominant” than those marked by *be* ‘in’. In French, *de* is intuitively less dominant than *par*, even though it has roughly the same spatial meaning as Biblical Hebrew *min*. Thus, it becomes clear that there are different ways to express causal relationships in spatial terms. This is not necessarily a problem. One may compare this situation with the two conceptualizations of time described by Lakoff & Johnson (1980): one in which we are stationary and time moves (*there’s a deadline coming up*), and one in which we move through time (*the weeks behind us*). These two conceptualizations can coexist even within the same language, so there

³⁰ We leave more complex models out of consideration here (e.g., if *Q* were to also depend on *X*, so that *Z* depends on *X* through two paths). It is not clear that natural languages can describe such models without periphrasis.

is no reason why two different spatial conceptualizations of causation could not coexist. For this reason, we also do not feel it necessary to choose between the explanation based on a causal chain and the one based on causal models above. Both are equally possible ways for speakers to spatially represent causal relations, and we have at present no reason to prefer one over the other. What is crucial, however, is that both conceptualizations have a cognitive basis. In that sense, the proposal we put forward here is more constrained than one in which different senses of prepositions receive entirely unrelated semantics.

4 Related work

In this section we discuss related work. Section 4.1 compares our results to previous work on French *de* and *par*, and section 4.2 discusses other formal accounts of *by*-phrases in passives. Finally, in section 4.3 we compare our approach to polysemy in causal prepositions using polymorphic types to an alternative using sum types.

4.1 Related work on French *de* and *par*

The distinction between *de* and *par* has received quite some attention in the literature. An intuitive approach based on the difference between verbal and adjectival passives cannot be used to describe the data.³¹ Instead, the difference is usually framed in terms of Aktionsart, with *de* co-occurring with stative events (Zumthor & von Wartburg 1947: 297). The choice also depends on register (*de* being more formal; Gougenheim 1938: 307; and nowadays felt to be archaic), but our focus is here on semantic distinctions. The most complete descriptive generalization is given by Straub (1974):

- (37) a. The Agent of a verb that denotes a non-state is always marked by *par*.
 b. Verbs denoting states with animate Agents can be marked by both *de* and *par*.
 c. Verbs denoting states with inanimate Agents always take *de*.

In our analysis we used the notion of proto-agentivity, claiming that *de* expresses low proto-agentivity while *par* is used for more prototypical Agents and as a

³¹ Given the preference of *de* for statives, we might expect that adjectival passives take *de*, while verbal passives take *par*. However, some simple tests based on Hallman (2021) show that this idea does not pan out. *De*-passives can be verbal, too (cf. [2]), and combinations with adjectival morphology and coordination with adjectives do not rule out either *par*-phrases or *de*-phrases (*Le garçon est gentil et très adoré par leldu grand-père* ‘The boy is kind and very much loved by the grandfather’), nor do verbs like *sembler* ‘seem’ (*Le garçon semble adoré par leldu grand-père* ‘The boy seems loved by the grandfather’). It is not clear that the verbal-adjectival passive distinction is useful in French.

default. This derives the intuition of (37), if we remember that the stative/dynamic contrast is related to proto-agentivity through transitivity (Hopper & Thompson 1980), and that animacy is related to proto-agentivity through the notions of volitionality and bringing about a change.

However, (37) is not precise enough, since many of the judgments from section 3 are incompatible with it.³² As just one example, (24b) is typically seen as a state and has an inanimate Agent, yet allows *par* (contra [37c]):

(24b) *Le village est entouré*^{0.79} *d'*^{0.77} *par* *une chaîne de montagnes, à cause de laquelle les services d'urgence arrivent toujours trop tard.*

‘The village is surrounded by a mountain chain, because of which the emergency services always arrive too late.’

We explained this by appealing to the notion of entrainment causation (section 3.1) to make a more precise distinction than that between “states” and “non-states”, and by allowing for contextually inferred scales to measure change (section 3.2).

Another problem with (37) is that it does not predict anything regarding the choice between *de* and *par* when both are possible (37b). We resolved this by moving away from a strict rule-based approach (‘if a sentence has these properties, this preposition must be used’) to a more flexible approach based on the *degree* of proto-agentivity. This approach also does more justice to the variation between speakers and to the fact that for many sentences the difference in acceptability between the two prepositions is small.

4.2 Related work on *by*-phrases

There are two mainstream formal semantic accounts of *by*-phrases in passives. The main difference between them is whether the *by*-phrase is an argument or an adjunct.³³ The approach on which we built our own proposal in section 2.2 is that of Angelopoulos et al. (2020), who argue that the *by*-phrase is an argument of *v* (the head of the light verb phrase introducing the Agent). It thus takes the same place as the external argument in an active sentence. Angelopoulos et al. (2020) are not explicit about a formal semantic analysis but base themselves on Collins (2018), who gives the Agent preposition the identity function as its denotation:

32 Many examples are also discussed by Gaatone (1998: 175–210). Our analysis is compatible with his data, but we do not systematically compare our work to his since he does not propose an explanatory theory.

33 See Williams (2015: 281–291). We focus on what he terms “Base Argument Theories”, which assume that “some syntactic part of a short passive clause, and some part of the host in a long passive, has a functional semantic argument in the deep-S role” (Williams 2015: 282). We do not discuss No Base Argument Theories, being unaware of formal semantic analyses in such theories.

$$(38) \quad \llbracket \text{by}_{\text{agentive}} \rrbracket = \lambda x_e . x \quad (\text{Collins 2018: 4})$$

As a result, the denotation of the *by*-phrase is of type $\langle e \rangle$ and can compose by Function Application with the denotation of v' , which has type $\langle e, \langle s, t \rangle \rangle$. By contrast, we argued that the type of *by* must be $\langle e, \langle s, t \rangle \rangle$ (and composes with v' using Event Identification). Section 2.2 presented this mostly as following from our suggestion for the formalization of principled polysemy in section 2.1, but there is an independent reason why we believe (38) is not ideal. With the denotation in (38), *by* is essentially seen as a kind of case marker, needed to mark the argument but semantically vacuous. This may suffice for English *by*, but we have seen in section 3 that French *de* and *par* are *not* semantically vacuous. Instead, they carry a presupposition concerning properties of the Agent's relation to the event.

Since this presupposition does not concern an inherent property of the Agent (e.g., animacy) but a property of the relation of the Agent to the event, we believe the most transparent way to do this is to have the denotation of *by* take the event as an argument. It would be much less transparent to have a presupposition ' x has high proto-agentivity in e ' on a preposition with the meaning in (38), since it would have to be contextually inferred what event e refers to. We find a formalization in which the presupposition only depends on variables provided as arguments to the denotation preferable. Admittedly, this argument does not entirely rule out an analysis along the lines of (38). However, we see no immediate benefit to such an analysis, while we do believe it is worthwhile to make the reference of the presupposition to the event transparent and to systematically derive the meaning of Agent prepositions from a more general, polymorphic meaning of that preposition (as discussed in section 2.1).

Another common approach to *by*-phrases is found in Bruening (2013) (Legate 2014 has a similar proposal). Bruening (2013) assumes a Voice projection of type $\langle e, \langle s, t \rangle \rangle$. In a regular active sentence, the $\langle e \rangle$ argument of this projection is saturated by the external argument (39a), and in a passive without a *by*-phrase, it is saturated by existential closure of an additional Pass projection above Voice (39b). In a passive with a *by*-phrase, the *by*-phrase is an adjunct to Voice. It is seen as a purely functional element of type $\langle e, \langle \langle e, \langle s, t \rangle \rangle, \langle s, t \rangle \rangle \rangle$ (39c), which fills in the argument of Voice (i.e., it performs the same task as the external argument in the active voice); the passive Voice head is semantically vacuous (39d):

- (39) a. $\llbracket \text{Voice} \rrbracket = \lambda p_{\langle s,t \rangle} \lambda x_e \lambda e_s. p(e) \ \& \ \text{Initiator}(e,x)$ (Bruening 2013: 21)
 b. $\llbracket \text{Pass} \rrbracket = \lambda p_{\langle e, \langle s,t \rangle \rangle} \lambda e_s. \exists x_e : p(x,e)$
 (without *by*-phrase; Bruening 2013: 25)
 c. $\llbracket \text{by} \rrbracket = \lambda x_e \lambda p_{\langle e, \langle s,t \rangle \rangle} \lambda e_s. p(x,e)$ (Bruening 2013: 25³⁴)
 d. $\llbracket \text{Pass} \rrbracket = \lambda p_{\langle s,t \rangle} \lambda e_s. p(e)$ (with a *by*-phrase; Bruening 2013: 25)

In this analysis, the denotation of the Agent preposition has access to the event argument, so our critique of Collins (2018) does not apply. However, note that this approach makes several unusual assumptions. For example, the denotation of the *by*-phrase, an adjunct, applies to that of the Voice projection, rather than the other way around. It also fails to account for certain binding facts, as pointed out by Collins (2018) and Angelopoulos et al. (2020): the Agent in a *by*-phrase can bind an anaphor in the VP (40a), which is expected if the *by*-phrase is an argument, as in Angelopoulos et al. (2020) and our modification of it, but unexpected if the *by*-phrase is an adjunct. Both *de* and *par* behave like English *by* with respect to binding (40b), in contrast to other French prepositions (40c):

- (40) a. *The packages were sent **by** the children_i to themselves_i.*
 (Angelopoulos et al. 2020: 11)
 b. *Les enfants vont jouer au foot accompagnés **de/par** leurs parents_i conformément à leur_i propre volonté.*
 ‘The children are going to play soccer accompanied by their parents according to their own wish.’
 c. *Les enfants vont jouer au foot *avec/*sans/*chez/*pour leurs parents_i conformément à leur_i propre volonté.*
 ‘The children are going to play soccer with/without/at/for their parents(’) according to their own wish.’

For this reason, we adopted an account under which the *by*-phrase is an argument in section 2.2.

4.3 Polymorphism compared to sum types

Finally, in this subsection we discuss an alternative approach to polysemy of causal prepositions. Maienborn & Herdtfelder (2017) show that German *von* ‘from, of, by’ can be used for causal adjuncts with both stative and eventive readings, which have different inferential properties. Stative (41a) implies that the hailstones are (i) on

³⁴ Bruening (2013: 25) gives the denotation as $\llbracket \text{by} \rrbracket = \lambda x \lambda p_{est} \lambda e. p(e,x)$, with the arguments to p swapped. We assume this is a mistake given that the denotation of the *by*-phrase has to apply by Function Application to that of the Voice projection.

the square and (ii) white, while eventive (41b) does not imply that the shoes are (i) still on the bench or (ii) dirty.

- (41) a. *Der Platz ist weiß von den Hagelkörnern.*
 ‘The square is white from the hailstones.’
 (Maienborn & Herdtfelder 2017: 285)
- b. *Die Bank ist dreckig von den Schuhen.*
 ‘The bench is dirty from the shoes.’
 (Maienborn & Herdtfelder 2017: 285)

Maienborn & Herdtfelder (2017) give an account in which these inferential properties are derived from a different type. They propose that stative *von* expresses a causal relation between TROPEs (Moltmann 2007), while eventive *von* expresses a relation between EV(ent)s. The argument is of the sum type $EV \sqcup TROPE$: it is either of type EV, or of type TROPE (for simplicity, we abstract away over coercion here). Since the actual type of the argument propagates, inferential differences can be derived from whether the argument is an event or a trope.

This approach is superficially similar to ours with a polymorphic type $\langle \eta, \langle \theta, t \rangle \rangle$ (4): one might say that EV and TROPE are two types with which η and θ can be instantiated. However, we do not think sum types are the right way to think about the polysemy of prepositions. This only works for causal *von* because Maienborn & Herdtfelder restrict themselves to causal adjuncts (2017: 284). The type constraint does not generalize to Agentive *von*, let alone meanings in other domains such as that of space (*von hinten* ‘from behind’) or time (*von morgens* ‘from morning’).

Storing the type information for all these meanings in the same lexical entry would lead to a very complex definition. Furthermore, the denotation would have to be general enough to account for all different uses, and it is not clear that such a denotation can be given. Maienborn & Herdtfelder compare *von* to English *from* (2017: 283) and Russian *ot* ‘from, of’ (2017: 291–293, 313 n. 29), which both behave slightly differently, as does French *de* (section 2.3). At the same time, these prepositions have very similar spatial meanings. This makes it doubtful that general denotations can be developed for each of these prepositions which derive the correct spatial meaning and also explain the differences in causal use (as well as differences in other domains).

The approach developed in (4) seems more promising. As discussed in section 3.5, it allows the same abstract denotation to be interpreted in different ways in different languages, as long as the interpretation does not violate cognitive constraints. Polymorphic typing as proposed here is able to capture the polysemy observed in prepositions, while the requirement of a cognitive linguistic explanation for concrete interpretations constrains the model. This way, a preposition’s inter-

pretation in a non-spatial domain is constrained but not fully predictable, and may therefore vary between languages.

5 Conclusions

Common approaches to *by*-phrases in passives treat the Agent preposition as semantically vacuous: it merely rearranges the arguments so that the argument of *by* fulfills the same role as the external argument in the corresponding active sentence (Bruening 2013, Legate 2014, Collins 2018, Angelopoulos et al. 2020). This paper put forward three arguments against this view.

First, cross-linguistic research shows that Agent prepositions develop from prepositions with specific spatial meanings, and cognitive linguistic arguments can be given to relate these spatial meanings to the function of Agent marking (Croft 2012: 222–226). However, common approaches to *by*-phrases essentially treat agentive *by* as accidentally homonymous with spatial *by*, and therefore cannot explain this cognitively motivated cross-linguistic pattern.

Second, we discussed languages with more than one Agent preposition, where the choice of the Agent preposition is semantically motivated. Building on Straub (1974) and others, we showed that French *de* ‘from, of, by’ is used for Agents with low proto-agentivity, whereas *par* ‘through, by’ is the default Agent preposition and used for Agents with high proto-agentivity. Current approaches to *by*-phrases may be able to express such differences but are, we feel, not the most transparent way to do so.

Third, common approaches to *by*-phrases in passives do not generalize to other syntactic environments in which the same preposition appears with a causal meaning. This is especially problematic in the case of French, where it can be shown that the meanings of *de* and *par* in passives are similar to those in causal adjuncts. In causal adjuncts, *de* is related to stativity (marking causes that are situations), while *par* is related to dynamicity (marking causes that are forces). Stativity and dynamicity are related to low and high proto-agentivity, respectively, which is what *de* and *par* presuppose in passives. This parallel suggests that a formalization must not be limited to the syntactic environment of the passive.

The alternative we present builds on the notion of principled polysemy (Tyler & Evans 2003): the idea that the many different meanings of prepositions are not accidentally homonymous, but are instead related to each other through a shared core. We propose to formalize this using a polymorphically typed general denotation. This general denotation is typically an abstract form of the spatial meaning of the preposition, since spatial meanings tend to be original in processes of semantic extension. It has a polymorphic type: $\langle \eta, \langle \theta, t \rangle \rangle$, in which η and θ still have to be instantiated with concrete types to obtain a concrete interpretation.

In this system, the exact meaning of a preposition in context will depend on three things. First, the syntactic and semantic context forces a certain type on the denotation of the preposition. Second, the interpretation is restricted to a certain domain depending on the type (e.g., the spatial domain for $\langle e, \langle e, t \rangle \rangle$ or the causal domain for $\langle e, \langle s, t \rangle \rangle$). Third, the concrete meaning within that domain depends on the way that domain is spatially conceptualized in the mind. For example, in the case of causation, causes are typically conceived of as antecedent and/or proximate to effects (e.g., [Croft 2012: 222–226](#)), which explains why prepositions like English *by* and French *de* and *par* receive the causal interpretation they do.

This approach can be extended to systems with more types than e , s , and t to derive the meanings of different prepositions in a broader range of contexts. In section 2.3 we showed how this might work, analyzing French *de* and *par* in causal adjuncts in the force-theoretic framework of [Copley & Harley \(2022\)](#). We hope that the approach to the polysemy of prepositions put forward here is useful for other prepositions in other domains as well.

A Survey data

Most of the French example sentences from this article are based on real-world examples on the web or examples from the literature. Examples from the web were found through Google and Linguee and come from sources that we assumed were written by native speakers. We adapted sentences to add context to promote a certain reading and added sentences to create minimal pairs. Examples (2) and (29) were unintentionally ambiguous.

We confirmed our judgments, except for some uncontroversial examples, with a small number of native speakers in an informal survey. We invited informants whom we expected to still be familiar with a more formal or archaic register, based on age, education level, and religious background (as Bible translations tend to use a more conservative register). 21 Informants from France, Belgium, and Switzerland completed the survey, with a mean age of 49 (standard deviation 19); 16 (76%) had at least a Master's degree. Though the sample size is not large enough to expect statistically significant results, the tendencies in the data align with our own judgments. For each sentence there was also space for comments, for example to remark on differences in interpretation when respondents considered both *de* and *par* were acceptable. These comments were all in line with our own intuitions.

Each sentence was presented as-is to the participants without additional context, but with the Agent preposition replaced by a blank (e.g., *Le chien est lavé . . . Marie* for [1a]). Participants were then asked to rate the acceptability of both *de* and *par* on a 6-point Likert scale ranging from *pas du tout acceptable* 'not at all acceptable' to *parfaitement acceptable* 'perfectly acceptable'. They were asked to rate a preposition as acceptable if they were familiar with its use in the given context even if they would not use it themselves.

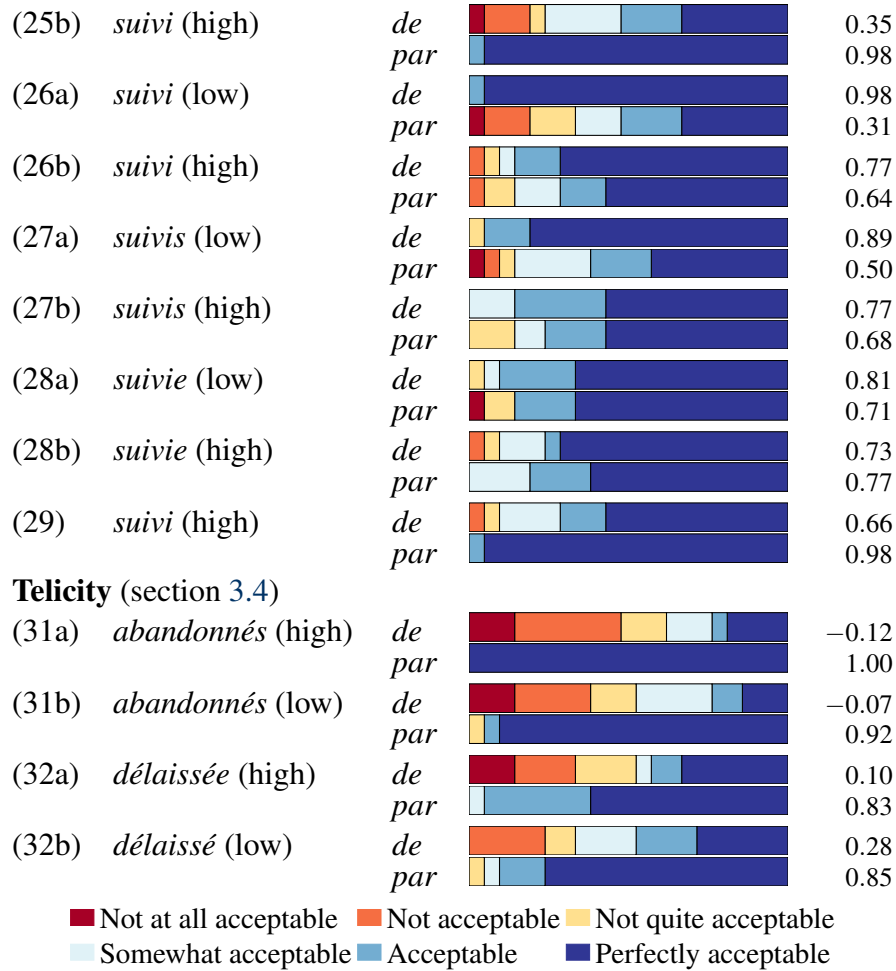
The results are summarized in table 2 below, in the order the sentences are discussed in sections 2 and 3. The table indicates for each sentence whether we expected the sentence to have relatively high or proto-agentivity (and thus, whether we expected *par* or *de*, respectively, to be more acceptable). The scores for each preposition are presented in stacked bar charts. They were also recoded to values from -1 (not at all acceptable) to 1 (perfectly acceptable) to be able to compute the mean, which we only used to give a quick impression of the general tendency in judgment marks throughout this chapter.

Example		Distribution	Mean
Causal adjuncts (section 2.3)			
(13a) <i>mort</i> ¹	<i>de</i>		1.00
	<i>par</i>		-0.87
(13b) <i>cassée</i> ²	<i>de</i>		-0.90
	<i>par</i>		0.37
Change (section 3.1)			
(1a) <i>lavé</i> (high)	<i>de</i>		-0.96
	<i>par</i>		1.00
(17) <i>maintenu</i> (high)	<i>de</i>		-0.81
	<i>par</i>		1.00
(19a) <i>suivie</i> (high)	<i>de</i>		-0.45
	<i>par</i>		1.00
(19b) <i>traversé</i> (high)	<i>de</i>		-0.77
	<i>par</i>		0.96
Contextually implied change (section 3.2)			
(20a) <i>adorée</i> (low)	<i>de</i>		0.60
	<i>par</i>		0.77
(20b) <i>adorée</i> (high)	<i>de</i>		0.50
	<i>par</i>		0.92
(21a) <i>aimé</i> (low)	<i>de</i>		0.92
	<i>par</i>		0.70
(21b) <i>aimé</i> (high)	<i>de</i>		0.83
	<i>par</i>		0.77
(22a) <i>respecté</i> (low)	<i>de</i>		0.77
	<i>par</i>		0.89
(22b) <i>respecté</i> (high)	<i>de</i>		0.64
	<i>par</i>		0.81
(2) <i>accompagnés</i>	<i>de</i>		0.87
	<i>par</i>		0.94
(23a) <i>accompagné</i> (high)	<i>de</i>		0.79
	<i>par</i>		0.96
(23b) <i>accompagné</i> (low)	<i>de</i>		0.79
	<i>par</i>		0.89
(24a) <i>entouré</i> (low)	<i>de</i>		0.87
	<i>par</i>		0.73
(24b) <i>entouré</i> (high)	<i>de</i>		0.79
	<i>par</i>		0.77
Volitionality (section 3.3)			
(25a) <i>précédé</i> (low)	<i>de</i>		0.83
	<i>par</i>		0.50

(continued on the following page)

Formalizing spatial-causal polysemy

(continued from the previous page)



1 Tested with *faim*.

2 Tested with *l'impact du ballon*.

Table 2: Survey data (high = high proto-agentivity; low = low proto-agentivity).

References

- Angelopoulos, Nikos, Chris Collins & Arhonto Terzi. 2020. Greek and English passives, and the role of *by*-phrases. *Glossa: a journal of general linguistics* 5(1). 1–29. <https://doi.org/10.5334/gjgl.1185>.
- Asher, Nicholas. 2011. *Lexical meaning in context: A web of words*. Cambridge: Cambridge University Press.
- Authier-Revuz, Jacqueline. 1972. Etude sur les formes passives du français. *Documentation et recherche en linguistique Allemande contemporain - Vincennes* 1. 1–145. <https://doi.org/10.3406/drlav.1972.878>.
- Bar-Asher Siegal, Elitzur A. & Nora Boneh. 2020. Causation: From metaphysics to semantics and back. In Elitzur A. Bar-Asher Siegal & Nora Boneh (eds.), *Perspectives on causation: Selected papers from the Jerusalem 2017 workshop* Jerusalem Studies in Philosophy and History of Science, 3–52. Cham: Springer. <https://doi.org/10.1007/978-3-030-34308-8>.
- Barwise, Jon & John Perry. 1983. *Situations and attitudes*. Cambridge, Massachusetts: The MIT Press.
- Beavers, John. 2011. On affectedness. *Natural Language & Linguistic Theory* 29(2). 335–370. <https://doi.org/10.1007/s11049-011-9124-6>.
- Biberauer, Theresa. 2017. Factors 2 and 3: A principled approach. *Cambridge Occasional Papers in Linguistics* 10(3). 38–65. <https://doi.org/10.5565/rev/catjl.219>.
- Bierwisch, Manfred. 1999. How much space gets into language? In Paul Bloom, Merrill F. Garrett, Lynn Nadel & Mary A. Peterson (eds.), *Language and space*, 31–76. Cambridge, Massachusetts: The MIT Press.
- Boas, Hans Christian. 2003. *A constructional approach to resultatives* Stanford Monographs in Linguistics. Stanford, CA: CSLI Publications.
- Bruening, Benjamin. 2013. *By* phrases in passives and nominals. *Syntax* 16(1). 1–41. <https://doi.org/10.1111/j.1467-9612.2012.00171.x>.
- Clédat, L. 1900. “de” et “par” après les verbes passifs. *Revue de philologie française et de littérature* 14. 218–233.
- Collins, Chris. 2018. Is the passive *by*-phrase an adjunct? <https://lingbuzz.net/lingbuzz/004032>.
- Copley, Bridget & Heidi Harley. 2015. A force-theoretic framework for event structure. *Linguistics and Philosophy* 38(2). 103–158. <https://doi.org/10.1007/s10988-015-9168-x>.
- Copley, Bridget & Heidi Harley. 2022. What would it take to tame the verbal Hydra? <https://bcopley.com/wp-content/uploads/What-would-it-take-to-tame-the-verbal-Hydra-2022.pdf>.

- Croft, William. 2012. *Verbs: aspect and causal structure*. Oxford & New York, NY: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199248582.001.0001>.
- Dirven, René. 1995. The construal of cause: The case of cause prepositions. In John R. Taylor & Robert E. MacLaury (eds.), *Language and the cognitive construal of the world* (Trends in Linguistics Studies and Monographs 82), 95–118. Berlin and New York: Mouton de Gruyter.
- Dowty, David. 1989. On the semantic content of the notion of ‘thematic role’. In Gennaro Chierchia, Barbara Hall Partee & Raymond Turner (eds.), *Properties, types and meaning*, vol. 2 (Studies in Linguistics and Philosophy 38–39), Dordrecht: Kluwer Academic Publishers.
- Dowty, David. 1991. Thematic proto-roles and argument selection. *Language* 67(3). 547–619. <https://doi.org/10.1353/lan.1991.0021>.
- Dowty, David. 2003. The dual analysis of adjuncts/complements in Categorical Grammar. In Ewald Lang, Claudia Maienborn & Cathrine Fabricius-Hansen (eds.), *Modifying adjuncts*, 33–66. De Gruyter Mouton. <https://doi.org/10.1515/9783110894646.33>.
- Fillmore, Charles. 1968. The case for case. In Emmon Bach & Robert T. Harms (eds.), *Universals in linguistic theory*, 1–90. New York: Holt, Rinehart & Winston.
- Gaetone, David. 1998. *Le passif en français* Champs Linguistiques. Paris: Duculot.
- Gougenheim, Georges. 1938. *Système grammatical de la langue française*. Paris: d’Artrey.
- Hallman, Peter. 2021. On passive and perfect participles. In Kleantes K. Grohmann, Akemi Matsuya & Eva-Maria Remberger (eds.), *Passives cross-linguistically: Theoretical and experimental approaches* (Empirical approaches to linguistic theory 17), 64–97. Leiden: Brill. <https://doi.org/10.1163/9789004433427>.
- Halpern, Joseph Y. & Judea Pearl. 2005. Causes and explanations: A structural-model approach. Part I: Causes. *The British Journal for the Philosophy of Science* 56(4). 843–887. <https://doi.org/10.1093/bjps/axi147>.
- Hopper, Paul J. & Sandra A. Thompson. 1980. Transitivity in grammar and discourse. *Language* 56. 251–299. <https://doi.org/10.2307/413757>.
- Kratzer, Angelika. 1996. Severing the external argument from its verb. In Johan Rooryck & Laurie Zaring (eds.), *Phrase structure and the lexicon* (Studies in Natural Language and Linguistic Theory 33), 109–137. Dordrecht: Springer. https://doi.org/10.1007/978-94-015-8617-7_5.
- Kratzer, Angelika. 2000. Building statives. In Lisa J. Conathan, Jeff Good, Darya Kavitskaya, Alyssa B. Wulf & Alan C. L. Yu (eds.), *Proceedings of the twenty-sixth annual meeting of the Berkeley Linguistics Society*, 385–399. Berkeley,

- CA. <https://doi.org/10.3765/bls.v26i1.1131>.
- Lakoff, George & Mark Johnson. 1980. *Metaphors we live by*. Chicago: University of Chicago Press.
- Landman, Fred. 2000. *Events and plurality* (Studies in Linguistics and Philosophy 76). Dordrecht: Springer. <https://doi.org/10.1007/978-94-011-4359-2>.
- Legate, Julie Anne. 2014. *Voice and v: Lessons from Acehnese* (Linguistic Inquiry Monographs 69). The MIT Press. <https://doi.org/10.7551/mitpress/9780262028141.001.0001>.
- Maienborn, Claudia & Johanna Herdtfelder. 2017. Eventive versus stative causation: The case of German causal *von*-modifiers. *Linguistics and Philosophy* 40(3). 279–320. <https://doi.org/10.1007/s10988-016-9201-8>.
- Martin, Fabienne. 2005. Genitives of substance and locative verbs in French. In Ji-yung Kim, Yury A. Lander & Barbara H. Partee (eds.), *Possessives and beyond: semantics and syntax* (University of Massachusetts Occasional Papers in Linguistics 29), 411–426. Amherst, MA: GLSA Publications.
- Michotte, A. 1946. *La perception de la causalité* (Etudes de Psychologie 6). Louvain: Editions de l'Institut Supérieur de Philosophie.
- Moltmann, Friederike. 2007. Events, tropes, and truthmaking. *Philosophical Studies* 134(3). 363–403. <https://doi.org/10.1007/s11098-005-0898-4>.
- Moody, Raymond. 1972. Portuguese prepositions: some semantic categories. *Luso-Brazilian Review* 9(1). 36–71.
- Morrill, Glyn V. 1994. *Type logical grammar: Categorical logic of signs*. Dordrecht: Springer.
- Næss, Åshild. 2007. *Prototypical transitivity* (Typological Studies in Language 72). Amsterdam: John Benjamins Publishing Company. <https://doi.org/10.1075/tsl.72>.
- Neeleman, Ad & Hans van de Koot. 2012. The linguistic expression of causation. In Martin Everaert, Marijana Marelj & Tal Siloni (eds.), *The Theta system: Argument structure at the interface* Oxford Linguistics, 20–51. Oxford: Oxford University Press.
- Palancar, Enrique L. 2002. *The origin of Agent markers* (Studia Typologica 5). Berlin: Akademie Verlag.
- Partee, Barbara H. 1997. Genitives: A case study. In Johan van Benthem & Alice ter Meulen (eds.), *Handbook of logic & language*, 464–473. Amsterdam: Elsevier.
- Pylkkänen, Mariliina. 1999. On stativity and causation. In Carol L. Tenny & James Pustejovsky (eds.), *Events as grammatical objects: The converging perspectives of lexical semantics and syntax*, 417–445. Stanford, CA: CSLI Publications.
- Radden, Günter. 1985. Spatial metaphors underlying prepositions of causality. In Wolf Paprotté & René Dirven (eds.), *The ubiquity of metaphor: Metaphor in language and thought* (Current Issues in Linguistic Theory 29), 177–207. Am-

- sterdam and Philadelphia: John Benjamins.
- Rappaport Hovav, Malka & Beth Levin. 2001. An event structure account of English resultatives. *Language* 77(4). 766–797. <https://doi.org/10.1353/lan.2001.0221>.
- Rooryck, Johan. 2019. ‘Recycling’ evidentiality: A research program. In Metin Bağrıaçık, Anne Breitbarth & Karen De Clercq (eds.), *Mapping linguistic data. Essays in honour of Liliane Haegeman*, 242–261. Ghent.
- Spang-Hanssen, Ebbe. 1963. *Les prépositions incolores du français moderne*. Copenhagen: University of Copenhagen dissertation.
- Staps, Camil & Martijn Beukenhorst. In preparation. Semantic properties of prepositions: The distinction between causal *min* ‘from’ and *be* ‘in’.
- Straub, Sylvia A. 1974. The passive prepositions *de* and *par*. *The French Review* 47(3). 583–593.
- Suñer, Margarita. 1981. Por vs. de: agential prepositions? *Hispania* 64(2). 278–283.
- Talmy, Leonard. 1988. Force dynamics in language and cognition. *Cognitive Science* 12. 49–100.
- Tyler, Andrea & Vyvyan Evans. 2003. *The semantics of English prepositions: Spatial scenes, embodied meaning and cognition*. Cambridge: Cambridge University Press.
- Williams, Alexander. 2015. *Arguments in syntax and semantics* Key Topics in Syntax. Cambridge: Cambridge University Press.
- Zumthor, Paul & Walther von Wartburg. 1947. *Précis de syntaxe du français contemporain*. Bern: Francke.
- Zwarts, Joost & Yoad Winter. 2000. Vector space semantics: A model-theoretic analysis of locative prepositions. *Journal of Logic, Language and Information* 9(2). 169–211. <https://doi.org/10.1023/A:1008384416604>.