Discourse prominence: Definition and application

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A B S T R A C T

We argue that prominence is a structure-building principle throughout the grammar of languages, and in particular for building discourse representations. We provide an explicit characterization of prominence as a) relational, b) dynamic, and c) as an attractor of operations. This characterization allows us to better account for other key notions of discourse representation and discourse models on prominence, such as referential activation, attention, accessibility, and salience. We show that these notions can either be derived from or are closely related to prominence. Finally, we illustrate the structure-building force of such a clearly defined notion of prominence by two recent studies on referential choice and structural attraction.

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1. Introduction

Text-level prominence is a central notion for the characterization of referential management, temporal relations, coherence relations, and the relations between the content of propositional units. The notion of prominence has been used to account for various phenomena in these areas, such as referential activation (Chafe, 1976; Lambrecht, 1994), attention (Grosz et al., 1995; Grosz and Sidner, 1986), accessibility (Ariel, 1990), givenness (Gundel et al., 1993), or salience (Chiarcos et al., 2011; Falk, 2014). Moreover, an intuitive concept of prominence is often used in close relation to other notions such as familiarity, information status (Prince, 1981a) and topicality (Givón, 1983). However, a precise characterization of prominence is still lacking. We assume with Himmelmann and Primus (2015) that prominence is a structure-building principle in all areas of the grammar of natural languages. Based on their definition of prominence for grammar in general, we propose that prominence in discourse pragmatics is characterized by a) being relational, b) being dynamic and c) attracting linguistic operations. This characterization will lead to a better understanding of the underlying structure of discourse representation and a more transparent account of various discourse phenomena, as illustrated by two recent studies on referential choice and referential management.

In the next section, we introduce the general definition of prominence of Himmelmann and Primus (2015) and show that this definition can be used to account for phenomena on various levels of grammar. In section 3, we present our characterization of prominence in pragmatics and discuss all three main characteristics in detail. Section 4 discusses other central discourse structure notions such as referential activation, attention, accessibility, and salience and argues that they can either be inferred from our notion of prominence or that they are related to prominence in a meaningful way. In the subsequent two sections, we illustrate how prominence is a suitable notion to account for referential management in discourse; to this end,

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we showcase two recent studies on referential choice (section 5.1) and topic-worthiness (section 5.2). In section 6, we relate our concept of pragmatic prominence to language processing in discourse.

2. Prominence in language

In linguistics, the term prominence is often informally used in the sense that a prominent entity "stands out" in a certain context. It is at times used interchangeably with the terms "salience", "accessibility", "attention" and "activation" in the literature on discourse-pragmatics, "highlighting" in phonology, or "the higher rank of an element on a hierarchy of semantic or syntactic entities", such as the referentiality or animacy hierarchy (Aissen, 2003). Its usage is primarily based on intuition and the need to descriptively capture scales and ranked alternatives. We therefore propose the following definitional criteria for a first approximation to characterizing the notion prominence. These definitions have evolved from joint work with our colleagues in Cologne and are based on the initial proposal of Himmelmann and Primus (2015). The definitional criteria go beyond what is traditionally implied by "accessibility" or "highlighting" and try to account for functional and structural aspects of prominent entities.

(1)   Proposed criteria of prominence in grammar (Himmelmann and Primus, 2015)
     (i)   linguistic units of equal rank (e.g. syllables, co-arguments of a predicate) compete for the status of being in the center
     (ii)   their status may shift
     (iii)   prominent units act as structural attractors in their domain

The first criterion of prominence captures the intuitive idea of prominence as relating to a highlighted entity. Himmelmann and Primus (2015) establish a link to the cognitive sciences by referring to the *center of attention* as the unit that receives the most consideration at a given point in time. They also distinguish between the notion of attentional center and its counterpart in grammar (what they refer to as "a-center"). Accordingly, grammar provides intrinsic means of organizing linguistic units that interact with operations of attentional centering. The first criterion further adds to it that a prominence unit can only be prominent with respect to units of equal type. It thus is a strongly relational notion, whereby the status of an entity is assessed relative to members of the same type. This has the following implications. First, the prominence of an entity cannot be determined by itself but only *in relation to other entities*, i.e. prominence is a relational notion. In addition, prominence relies on the assessment of entities of *a particular type*, i.e. the level of linguistic description matters for the computation of the degree of prominence. Relevant types within which entities are compared against each other are, for instance, syllables at the phonological level, arguments at the sentence level, or referents at the discourse level. The most prominent entity is determined on the basis of particular principles governing the relevant level of description, for example the syllable with the strongest accent is singled out from other syllables or the argument that carries most proto-agentive features is singled out from the rest of the arguments in a given clause. In fact, the picture is not that simple. So-called prominence-lending cues interact with each other in the determination of prominence. Take for instance phonological structure, where accentuation contributes to prominence, but also positional information (e.g., edge vs. non-edge placement) or the sentence level, where, in addition to thematic role information (agentivity), grammatical function (e.g., subject vs. object), positional information (first vs. last mentioned) and other cues, may guide prominence computation. The strength of the cues and their interaction may further vary cross-linguistically. Crucially, this criterion narrows down the comparison space for prominence and excludes other relations, like the head-dependent relation, markedness or prototypicality (cf. Himmelmann and Primus, 2015).

The second criterion captures the *dynamicity* of prominence. It points out that the prominence status of an entity changes over time, i.e. a particular unit is not prominent *per se* but may be more or less prominent depending on its context and relation to other entities as the discourse unfolds. Prominence is computed in a moment-by-moment manner and a particular word, argument or discourse referent may be the most prominent unit in utterance *u* but may be replaced by another unit that becomes the most prominent unit in utterance *u+1*. This criterion excludes non-dynamic notions like markedness or frequency.

The third criterion suggests that prominent elements serve important functions during structure building and *attract more structures or operations* than less prominent entities. A prosodic unit with a prominent accent may for instance occur in a prominent prosodic position such as the left or right edge of a linguistic unit. Or a prominent syntactic argument may license passivization or cleft structures, while less prominent arguments do not contribute to the emergence of alternative syntactic constructions. A prominent discourse entity — but not one of its competitors — may also serve as temporal anchor for entire propositions. We think that this third criterion is at the core of the structure-building function of prominence and has not been recognized or described before. The importance of this property will be illustrated in sections 5.1 and 5.2.

In the next section, we will slightly modify these criteria in order to clearly characterize prominence in discourse pragmatics and in its discourse representation.

3. Prominence in discourse pragmatics

Within discourse pragmatics, prominence is an organizational principle that governs individual referents, eventualities, time points as well as propositions and basic discourse segments. Any discourse model or representation must account for the prominence structure defined below in (2). This definition is based on the original definition of Himmelmann and Primus (2015) and its application to pragmatics in Jasinskaja et al. (2015). We think that (2) is the most appropriate characterization of prominence for discourse pragmatics.

(2)   Characterization of prominence for discourse pragmatics and as a structure building principle for discourse representation
        Def.1: Prominence is a relational property that singles out one element from a set of elements of equal type and structure.
        Def.2: Prominence status shifts in time (as discourse unfolds).
        Def.3: Prominent elements are structural attractors, i.e. they serve as anchors for the larger structures they are constituents of, and they
        may license more operations than their competitors.

The most extensively studied phenomenon in this respect is reference to individuals and therefore we illustrate the definitions in this domain. However, the characterization in (2) also holds for the ranking and the accessibility of eventualities and temporal points (Jasinskaja et al., 2015, section 3; Kehler, 2000; Becker and Egetenmeyer, 2018), the relation between coherence relations (Jasinskaja et al., 2015, section 4; Asher and Lascarides, 2003; von Heusinger et al., 2019) and the relation between the content of propositional units or inferences (see Ariel, 2019).

3.1. Singling-out (Definition 1)

Languages make available a large inventory of expressions to refer to entities, and the choice of a particular realization has been linked to the accessibility of the respective entity in discourse (cf. e.g., Ariel, 1990; Gundel et al., 1993; Prince, 1981a). The accessibility of certain discourse referents and their ranking with respect to other referents available in discourse representation (Def.1) has received a lot of attention in research on anaphora. A central diagnostic for determining the factors that contribute to the identification of prominent entities has been pronoun resolution. Unstressed personal pronouns — or zero forms if available in a language — are typically used to refer to the most accessible entity in discourse and a wealth of research has harnessed this observation to assess the influence of particular features associated with the referent (for an overview see, e.g., Arnold, 2010). We refer to such features as "prominence-lending cues", indicating that they boost the prominence value of their respective referent to a certain extent. Among these cues are grammatical function (subject vs. object), topicality (topic vs. non-topic), thematic role (agent vs. patient — in fact, most studies have targeted the contrast goal vs. stimulus using transfer of possession verbs or stimulus vs. experiencer using implicit causality verbs) and givenness (where given vs. new should be considered a gradient notion) (cf. e.g., Almor, 1999; Clark and Sengul, 1979; Gordon et al., 1993; Grosz et al., 1995; Gundel et al., 1993; Kaiser and Trueswell, 2008; Kehler et al., 2008; Schumacher et al., 2017; Stevenson et al., 1994). In addition, coherence relations have been shown to influence pronoun resolution as well as order-of-mention of the referential expressions and parallelism in structural representation between the pronoun and its antecedent (e.g., Clark and Sengul, 1979; Kehler et al., 2008; Streb et al., 1999; Wolf et al., 2004). Research focusing on full noun phrases has investigated information status, definiteness and positional information as prominence cues (Burkhardt, 2006; Schumacher, 2009; Schumacher and Baumann, 2010; Schumacher and Hung, 2012). Individual research has targeted different prominence-lending cues, and a comprehensive understanding of how potential prominence-lending cues interact with each other in a given language has not been reached yet. We would like to emphasize that all this work is based on a relational view of prominence, i.e. the designated referent is prominent with respect to other competing referents. Since this line of research is well established, we now turn to a more detailed reflection of Def.2 and 3 in reference to individuals.

3.2. Dynamicity (Definition 2)

Concerning the second definitional criterion for prominence, we claim that the prominence status of an entity changes over time, i.e. the currently most prominent entity can become less prominent as discourse unfolds and an entity with low prominence can rise to high prominence status. This dynamicity of the prominence status of a discourse referent is generally assumed by dynamic models of discourse (see Kamp, 1981; Lascarides and Asher, 2007, and Dekker, 2011 for an overview). While there is a preference for referential maintenance, the referential chain associated with the most prominent entity can be disconnected. The language system provides numerous means to shift the focus of attention and therefore update prominence structure.

For instance, certain referential expressions can be used to signal a shift in prominence structure, such as demonstrative pronouns. These expressions are claimed to have a forward-looking potential, i.e. they can initiate topic shifts or enhance referential persistence in subsequent discourse (cf. Givón, 1983). Consider the following example from a German text continuation task (Schumacher et al., 2015; Exp.2) that used the demonstrative pronoun *der* (he-DEM) in the second sentence of (3a), which is a potential topic shifter. This attentional shift is reflected by the subsequent use of a subject pronoun to refer

to *the critic* in the third sentence. In contrast, the use of a personal pronoun (*er* in German) in (3b) results in the referential maintenance of the previous center of attention (*the cello player*):

Demonstrative pronouns typically reject the most prominent entity as a potential referent (cf. Comrie, 1997) and, in

(3)   a.   The cello player wants to impress the critic. He-DEM is asleep at the switch. He keeps looking at his cell phone. The cello player had prepared for this performance for weeks and is now disappointed that the critic is absent-minded.
      b.   The cello player wants to impress the critic. He is asleep at the switch. It was obvious how much effort he put into receiving the critic's attention. But in an orchestra with more than 50 members, this was not easy.

addition, they signal a possible disruption of the referential chain and pave the way for an upcoming topic shift in favor of their respective referent (Abraham, 2002). This can be tested experimentally in a text continuation study, in which participants are asked to continue a story with a certain number of sentences and referential expressions are subsequently annotated for their discourse change potential and referential persistence, among others (cf. Gernsbacher and Shroyer, 1989). Schumacher et al. (2015) compared the forward-looking potential of the German personal pronoun *er* with that of the demonstrative pronoun *der* in a text continuation study presenting stimuli consisting of two introductory sentences (see (3) above) and found overall more topic shifts following the demonstrative pronoun.

Likewise, research on the so-called indefinite *this* (Prince, 1981b) showed a higher topic shift potential relative to a regular indefinite expression. Using the same type of text continuation methodology, Deichsel and von Heusinger, 2011 showed for German indefinite *this* a larger amount of topic shifts compared to regular indefinites as well as an overall higher referential persistence (see also Chiriacescu, 2011; Gernsbacher and Shroyer, 1989).

Other means that facilitate the dynamic development of prominence structure are morphological markers like the Japanese topic marker *-wa* or the Romanian differential object marker *pe-* as well as syntactic operations like topicalization or clefting that can elevate an entity to a higher prominence status (Chiriacescu and von Heusinger, 2010; Kuno, 1987; Lambrecht, 1994; Neeleman, 2016).

3.3. Structural attraction (Definition 3)

Regarding structural attraction, prominent discourse referents allow for more variation with respect to the anaphoric expressions that refer to them. Gundel et al. (1993) propose that cognitive states are implicationally related, according to which prominent entities ("in focus" in the givenness hierarchy of Gundel, Hedberg and Zacharski) are ideally referred to by an unstressed personal pronoun or a zero form but can also be picked up by a more marked form like a definite description, since a prominent entity is not only "in focus" but also "activated", "familiar", and so on. This is illustrated by reference to *the swimmer* in (4), where the prominence of *the swimmer* is a function of its introduction by a proper name plus description (4b) and subsequent mention as subject, agent and sentential topic (4c). In (4d), coreference can then be established through various referential forms. In contrast, less prominent entities can only be referred to with a limited inventory of referential forms. For instance, the first-mentioned referent *rower* in (4e) can only be referred to by an indefinite expression.

Moreover, prominent referents, due to being singled out from a set of entities of equal type, are more likely to be

(4)   a.   Many athletes met at the annual award ceremony in Baden–Baden.
      b.   It was the first time for Ron, a member of the swimming team, to attend this get-together.
      c.   At the buffet, the swimmer talked for some time to a cyclist.
      d.   He/This swimmer/The athlete reminisced about the Olympics in Rio de Janeiro.
      e.   Later in the evening, he was introduced to *a rower/*the rower/*him*.

rementioned in subsequent discourse, i.e. they are structural attractors by impacting the progression of the discourse as a whole. Prominent entities thus give rise to referential continuity, reminiscent of Givón's (1983) notion of topic continuity. Accordingly, there is an inverse relation between the degree of prominence of an entity and its referential persistence in subsequent discourse. Prominent entities are expected to recur numerous times throughout the discourse (consider *the swimmer* in (4) above), whereas entities with low prominence (such as the indefinite expression *a cyclist* in (4c)) fall short of being remembered (i.e. are discontinuous in Givón's terms). Based on cross-linguistic investigations, Givón (1983) proposes a set of quantitative measures of referential continuity including referential distance, potential interference, and referential persistence. Referential distance (or "look back") addresses the number of intervening clauses between two coreferential expressions; the smaller the distance between the anaphor and its antecedent, the more prominent the entity. Potential interference (or "ambiguity") takes account of semantic competitors in the immediately preceding discourse; low semantic overlap and low compatibility of the referential competitors with the relevant predicate enhances the prominence status of an entity. Also, referential persistence (or "decay") considers the referent's contribution to subsequent discourse; prominent

entities are expected to have a more long-lasting presence in the upcoming text. In particular, this latter effect on subsequent discourse represents a case of structural attraction because referential prominence impacts the development of upcoming discourse. This discourse-structuring potential — or forward-looking potential — yields referential maintenance for highly prominent entities.

Prominent referents furthermore serve as structural attractors for perspective-dependent operations. Hinterwimmer, 2019 argues with respect to free indirect discourse that only prominent referents — qua topicality and/or sentience — may serve as perspectival anchors. The perspectival center of a discourse is typically the speaker or narrator (i.e. the external source), which, from a text structuring stance, is the most prominent anchor. In free indirect discourse — i.e. when the feelings or thoughts of one of the protagonists are reported (i.e. internal source) — perspective can be shifted from the narrator to a prominent protagonist. Yet not any entity qualifies as anchor for such a shift in perspective. In (5), only Phil serves as a licit perspectival anchor — reflected by the appropriate expression of his inner thoughts in (5f) — but the sailor's feelings cannot be expressed — illustrated by the unavailability of (5e). *Phil* as a referent outranks *the sailor* by virtue of being the discourse topic and the highest thematic argument in (5d).

(5) a. Phil liked to start his busy day in one of the local coffee shops.
  b. He especially liked to sit on the patio of *Clairs*, drink a cappuccino and observe the sailors on the lake.
  c. Today only one sailor was there who practiced some maneuvers.
  d. Phil watched the sailor who was suddenly whacked by the boom.
  e. #Ouch! That hurt!
  f. Poor guy!

3.4. Discourse prominence in a broader perspective

A powerful discourse representation has to model not only referential and topical chains, but also temporal chains, re-lations between eventualities, discourse units and the content of propositional units. We cannot provide examples for all of these structures and show how deeply prominence structures are built into those structures. But we illustrate this by an example that prominent referents serve as temporal anchors. This can, for instance, be expressed by temporal and spatial adverbs linked to the protagonist's reference time (e.g., *now*, *here*). In Romance languages, the imperfect is used to indicate a shift in perspective from the default narrator to a prominent protagonist (Giorgi, 2010). The imperfect tense requires a temporal reference in discourse (i.e. it cannot be uttered out of the blue) and it is the only indicative form acceptable in free indirect discourse as illustrated by the Italian example in (6) (from Giorgi, 2010:200). See also Becker and Donazzan (2017) on perspectival shifts triggered by the temporal adverb "now" in French and Italian.

(6) Era la sua forza [commentava Baudolino a Niceta] e in questo modo lo aveva menato per il naso una prima volta, lo stava menando ora e lo avrebbe menato per alcuni anni ancora (Eco, *Baudolino*, p. 264)
  This was(impf) his strength—Baudolino was commenting to Niceta—and in this way he had(impf) taken him by the nose once, he was(impf) leading him by the nose now, and he would(fut-in-past) take him by the nose for some years still

Concerning temporal ordering, Becker and Egetenmeier (2018) argue that the relative ranking of time points depends on their prominence within a discourse segment. According to their account, potential candidates for prominent time points are the initial time point of a segment and time points flagged by adverbial expressions because they introduce an explicit anchor point and have the potential to start a new discourse segment. They take the following example from Kamp and Rohrer (1983:258) to illustrate this:

(7) a. Le docteur entra chez lui
  b. et vit sa femme debout.
  c. Il lui sourit.
  d. Un moment après elle pleurait.
    a. The doctor got home b. and found his wife awake. c. He smiled at her. d. A moment later, she was crying.

The events in the passage form a narration relation. In the domain of temporal structure, location times of the individual events introduce reference points that serve as anchors for location times of subsequent events. In this example, the reference point of (7a) is prominent because it represents the opening event of the text segment and the reference time in (7d) obtains prominence by the adverbial expression (*un moment après*) that introduces a specific time point and also signals a temporal gap compared to the earlier events.

4. Prominence-based notions of discourse models

Discourse representational models are built on notions that are often based on or explained by an intuitive concept of prominence. In this section, we will sketch a reconstruction of four notions central for discourse structure based on our explicit definition of prominence in the last section. We show that referential activation (Chafe, 1976; Lambrecht, 1994) can be reconstructed by the relational nature of prominence, while attention or centering (Grosz et al., 1995; Grosz and Sidner, 1986) mirror the competitive nature of prominence (see Def.1). Accessibility (Ariel, 1990) and givenness (Gundel et al., 1993) are scalar properties that control the choice of a referential expression. We think that this measure can be modelled by Def.3, i.e. the higher number of operations, here of types of anaphoric expressions. We then also compare the concept of salience (see Chiarcos et al., 2011; Falk, 2014) with our definition of prominence and will show that our three definitions provide a more concrete understanding than the corpus-based notion of salience of Chiarcos et al., 2011 and the cognitive notion of salience of Falk (2014). There are more notions relevant for discourse structure that are related to prominence, such as familiarity and information status (Prince, 1981a), topicality (Givón, 1983), or information structure in general (Krifka, 2007). We cannot provide a comprehensive account of the relation of these notions with prominence here, but compare the overviews in Chiarcos et al., 2011 and Falk (2014).

4.1. Referential activation *(Chafe, 1976; Lambrecht, 1994)*

A referring expression introduces, activates or evokes a mental object (or discourse item). This entity is assigned a certain activation level due to syntactic position, lexical properties of the associated expression and other semantic and pragmatic features. For instance, an entity associated with a subject receives a higher accessibility than one associated with an object. A definite noun phrase (NP) or a proper name activates its associated referent in a different way than an indefinite NP. Sometimes inherent properties of the objects referred to are also included in this activation (see Chafe, 1976; Lambrecht, 1994). In this approach, the introduction of a discourse item into the discourse structure consists of two processes: First, the discourse item gets its representation and, second, the representation is assigned a certain activation status. It is, however, somewhat unclear how to define different activation statuses. If we understand the activation status according to our Def.1 as a relational property of a discourse referent with respect to comparable items, we can provide a more nuanced definition of activation. The activation is the status of being more prominent than some other elements. A less activated item is less prominent than the most prominent item but more prominent than some other item. In this way, we can construct a relational scale of items with different activation levels without assuming that there are predefined static activation levels or statuses. Such a prominence-dependent definition of activation is both relational (Def.1) and dynamic (Def.2) and thus allows us to use it in different contextual settings and depending on different contextual parameters (or "prominence-lending features").

4.2. Attention or centering *(Grosz et al., 1995; Grosz and Sidner, 1986)*

Centering Theory assumes that the referential expressions in a text are represented as a list of ranked discourse items. The ranking is constructed by the different contextual features of the referential expressions that introduce the discourse items. In other words, centering or ranking of the discourse items is the result of the particular features of the discourse items. In the original version of Centering Theory, grammatical function is the crucial feature to determine the ranking of referential expressions (subject > object(s) > other) (Grosz et al., 1995:214); based on cross-linguistic considerations, this ranking has been amended by topicality and empathy among others (Walker et al., 1998). As discussed in the last section, in a static view of activation (or centering) we do get problems with similarly activated or ranked elements. In our relational perspective (Def.1), we always compare elements of a similar type with each other, and only one can be the most prominent etc. In this respect, our Def.1 of prominence constitutes the fundamental assumption of centering. Def.2 describes the dynamic change of the ranked elements that is described in Centering Theory by the re-computation of the established list and by the availability of different transitional states between utterances (continuity, retention, shift). Yet, Centering Theory focuses only on the type of referential expression in the next sentence. We think, however, that the ranking (or prominence statuses) of the discourse items show more structural effects in the discourse structure and are not only local as in Centering Theory, but also show more global impact, i.e. beyond the relation between two utterances (see section 5.1 and 5.2).

4.3. Accessibility *(Ariel, 1990)*, or givenness *(Gundel et al., 1993)*

Ariel (1990) and Gundel et al. (1993) have developed different types of scales that reflect the cognitive status of a particular discourse item and relate them to the type of referential expressions that anaphorically refer to the introduced items. Thus, the scales assign particular referential expressions to pre-defined cognitive statuses or activation levels of the discourse items. A short and not very informative referential expression, such as a pronoun, is assigned to a highly activated status, say, "in focus" or "activated". The speaker uses a particular referential expression based on his or her assumption of the mental representation of that entity in the hearer's mental model. Accordingly, the appropriate use of a referential expression allows the hearer to more easily identify the associated discourse item. The Accessibility Hierarchy of Ariel or the Givenness Hierarchy of Gundel, Hedberg and Zacharski can be understood as a generalization of alignments between lexical form and

cognitive status. These hierarchies differ from our definition of prominence in that they are basically static and non-relational. The relation between lexical item and cognitive status is fixed and does not depend on other lexical items. According to our definition of prominence, discourse operations, such as the preference of a particular referent or the choice of a particular form, fundamentally depend on the potential competitors (Def.1). We have already illustrated above that this process is highly dynamic (Def.2). We further assume that higher ranked discourse items allow for more discourse operations on different levels. They show a higher forward-looking potential in that they are referred to more often and they more frequently constitute the topic of the next utterance. More prominent discourse referents also provide a better accessibility for subsequent anaphoric expressions. Therefore, such discourse referents can be picked up by pronouns or full descriptive terms, while less prominent referents can only be picked up by full descriptive terms. More prominent discourse referents are also much better anchors for perspectival operations than less prominent ones, as discussed above in example (5).

4.4. Salience (Chiarcos, 2011; Falk, 2014)

The notion of salience is used in quite different ways depending on the discipline. In the cognitive sciences, salience describes entity-inherent properties that make those entities more visible or more perceivable than other similar items. In discourse semantics, and also in formal semantics, salience is used in a very similar way to our concept and definition of prominence (see von Heusinger, 1997 for a comprehensive overview). In this section, we present two views of salience in discourse, one based on corpus studies and one based on phonology. Chiarcos in a series of papers (Chiarcos, 2011; Chiarcos et al., 2011) uses "salience metrics to predict contextually adequate realization preferences" (Chiarcos, 2011:32). He calculates salience scores that predict particular realizations of referential expressions. Like Chiarcos, Falk (2014) distinguishes between "backward looking or hearer salience" and "forward looking or speaker salience". This contrast concerns the function of particular anaphorically used referential items to "look backward" towards their antecedents and the function of particular referential items to signal whether or not that referent will be picked up in the upcoming discourse. While both authors ground this distinction in a cognitive model of text representation in a speaker-and-hearer model, we think that these two functions follow easily from our perspective of prominence. The forward function corresponds to the various parameters that "lend prominence" and dynamically update the ranking, while the backward function corresponds to Def.3, which says that prominent units allow for more (structure-inducing) operations.

In this section, we have sketched commonalities and differences between our proposed notion of prominence and various related approaches. Crucially, these approaches touch upon particular aspects of the three definitional criteria but never upon all of them. In contrast, we suggest that all three criteria — singling-out, dynamicity, structural attraction — are essential ingredients of prominence in discourse pragmatics.

5. Two brief case studies

We now turn to two case studies to further illustrate the importance of the three definitional criteria. The first example investigates how the interaction of different parameters can create different prominence levels, with the level of prominence being measured in the choice of reference (Def.1) and the potential to create referential structure (topic shift, referential persistence, cf. Def.2). Since Def.3 — structural attraction — has received only sparse attention in previous research on discourse referents, we discuss topic-worthiness as one operation that targets prominent discourse units in the second example.

5.1. Modelling prominence structure and referential choice

In a series of experiments, Brocher and von Heusinger (Brocher et al., 2016; Brocher and von Heusinger, 2018) developed a model that is able to compute different prominence cues or prominence-lending features to one relational prominence structure, exploring Def.1 from above. In particular, the authors tested the interaction of information status (or familiarity), a noun phrase's definiteness marking, and additional pragmatic inferences with respect to the prominence status of the associated discourse referents. The authors were interested in how a descriptive noun phrase (e.g., *the dirty owner*) introduces a new referent and promotes it to a specific prominence status. In their first experiment, using visual world eye tracking, Brocher and colleagues created stories of three sentences: a context sentence (i), a second sentence introducing two human referents (ii), and a third sentence (iii) including a personal pronoun.

(8)   i   The construction site at the neighbor's was loud and dusty.
        ii   Philip stared at _____
           (a)   the dirty owner.
           (b)   a dirty construction worker.
           (c)   the pedestrian at the fence.
           (d)   a pedestrian at the fence.
        iii   When the dust dispensed, *he* stepped back and rubbed his eyes.

Importantly, in stories like in (8), the subject and direct object compete in being the antecedent of the pronoun in the third sentence. The likelihood of being related to the direct object was then taken as a measure of the prominence status of that referent relative to the subject referent. As crucial manipulation, the authors varied the information status of the critical noun phrase (inferred in (a) and (b) vs. brand-new in (c) and (d)) and definiteness marking (definite in (a) and (c), vs. indefinite in (b) and (d)). All test materials were presented over headphones and, during story presentation, participants looked at a computer screen showing a picture of the referent in subject position, a picture of the referent in object position, and a look-away picture.

Brocher et al. were interested in the prominence of the object referents and, to that end, measured where participants were looking, starting at the pronoun: The more activated or prominent a referent is, the more looks should fall on the picture showing that referent onscreen. The authors found that the picture of the object referent received most looks when the concept of the associated referent (i) could be inferred from preceding context and (ii) was expressed by a definite marked noun phrase (cf. (8iia)). For referents with brand-new concepts, no differences in prominence were found (cf (8iic-d)): definiteness marking did not affect a referent's prominence when the associated noun phrase was brand-new. Finally, and most surprisingly, Brocher et al. found that referents with inferred noun phrases and an indefinite article (cf. 8iib) were least accessible at pronoun encounter (see also Schumacher, 2009 for online effects of information status and definiteness marking at the descriptive noun phrase).

The authors interpreted their results within a Dual-Process Activation Model, which is able to compute different prominence cues, such as information status, definiteness marking and pragmatic inferences into one relational prominence status, elaborating on Def.1. The stark contrast between the prominence status of definite and indefinite inferred noun phrases can be explained along the assumption that definites come with a uniqueness condition (cf. 8iia), while indefinites with a domain restriction (as in 8iib) only express existence. For brand-new noun phrases, a different picture emerges, as indefinites without domain restrictions come with a uniqueness implicature (cf. Heim, 1991), explaining the similarity between brand-new definites and brand-new indefinites in pronoun resolution.

In their second experiment, Brocher et al. (2016) were interested in the structural contribution of prominent discourse referents (Def.3). They tested a referent's topic shift potential and its persistence in a text (see Chiriacescu and von Heusinger, 2010) by using the first two sentences of their materials from Experiment 1 (cf. 8i-ii) and having participants continue these fragments with five additional sentences. The authors found that, already for the first sentence of continuations, participants again mentioned referents of inferred definite noun phrases least often. Also, these referents were least often made topics. Referents of the other three conditions, i.e. inferred indefinites, brand-new indefinites, and brand-new definites, were mentioned again and represented topics roughly equally often.

The two experiments, then, revealed an interaction of different parameters that contribute to the prominence status of competing referents, such as subject vs. object in (8) (Def.1) and the effects of prominence status with respect to creating and continuing referential chains (Def.3). The experiments also showed that inferred definites display a high prominence status with respect to referential choice, i.e. they are used as antecedents more often than other types of noun phrases. At the same time, these expressions show a lower probability of building up referential structure in the subsequent discourse. This part of the results corroborates observations made by Rohde and Kehler (2014, and Kehler and Rohde, 2019) with respect to speaker choice and comprehender choice. But it also raises questions about the different types of prominence in discourse.

5.2. Prominence and structural attraction

Following Def.3, we claim that prominent entities are structural attractors. Here we illustrate that prominent entities represent good candidates for the topic of a particular sentence. In Mandarin Chinese, topics occur in sentence-initial position and are typically restricted to entities that carry prominence-lending features – an ideal topic is given, animate and agentive (cf. Li and Thompson, 1976; Givón, 1979, 1992). Accordingly, a prominent entity is more likely to be the topic of the next sentence than a lower ranked entity.

The impact of a referent's prominence profile on topic processing in Mandarin Chinese was investigated in a series of studies by Hung and Schumacher (2012, 2014). They recorded the electrical brain activity of native speakers of Mandarin while reading question-answer sequences for comprehension. Following a topic question (e.g., "What about Zhangsan?", "What about the cover?"), different types of answers were presented with either an ideal topic with respect to prominence-lending features in initial position (e.g., the proper name in (9a/b) below) or an entity that did not qualify for a highly prominent entity in terms of animacy and agentivity (*the cover* in (9c/d)).

(9)   a.   What about Zhangsan? – Zhangsan soiled the cover.
       b.   What about the cover? – Zhangsan soiled the cover.
       c.   What about Zhangsan? – The cover, Zhangsan soiled (it).
       d.   What about the cover? – The cover, Zhangsan soiled (it).

Hung and Schumacher (2014) reported two separate electrophysiological effects at the sentence-initial expression of the answer – (i) an effect of the likelihood of encountering a particular entity in the given context (reflected in a more

pronounced negativity for less expected entities, an N400) and (ii) an effect associated with topic-worthiness (where good topics carrying prominence-lending features were processed without any effort and suboptimal topics exerted processing costs reflected in a late positive ERP signature). Crucially, the later effect showed that sentence-initial animate, agentive entities – as ideal topics – showed no processing costs (irrespective of the context question, both (9a) and (9b) showed the same signature); in contrast, inanimate entities – being suboptimal topics – engendered a more pronounced positivity when they were not already the topic of the topic question (9c>9d) (cf. Hung and Schumacher, 2014). Note that the relative ease of processing the inanimate expression in (9d) suggests that, although prominent entities are structural attractors for topicality, less prominent entities can still serve as topics under certain circumstances, for example when they are already introduced as topics by the context. Overall, these data indicated that the more prominence-lending features an entity carries, the more topic-worthy it is.

Crucially, referents in sentence-initial position – as the designated position for topics – were processed differently from referents in sentence-medial position, i.e. topicality induced specific constraints, attracting only the most prominent entity (calculated as a combination of givenness and agentivity in the discourses tested for Mandarin Chinese). In contrast, entities in non-topic positions were processed on the basis of givenness and not on the basis of the prominence profile of the respective entity. Thus, prominence is a useful notion to identify entities that qualify as potential topics in Mandarin Chinese.

6. Prominence in discourse representation

In this last section, we want to argue that prominence structure is essentially represented in discourse representation. We assume that prominence is – in addition to linearization and hierarchical structure[1] – a third structure-building principle in grammar. Speakers and hearers constantly engage in the establishment of a mental model and the discourse representation is constructed dynamically as the information unfolds. The functional significance of the discourse representation is twofold. It encodes the current state of the discourse, including potential shifts and updates in the discourse structure and the ranking of entities. At the same time, discourse representation structure is the basis for the generation of predictions for the next discourse units and discourse segments.

Prominence plays an important role in the maintenance and construction of the discourse representation. Essentially, we assume that each discourse representation contains a ranked set of discourse units. This structure must be dynamically updated on the basis of incoming information and it serves as the basis for forward-directed parsing. Prominence thus has reflexes in language processing, as we have already illustrated above. In fact, the relational nature of prominence and its function of singling out an element from among a set of equals (Def.1) can be observed in expectation-based parsing during incremental processing. Expectation-based processing is a fundamental cognitive mechanism, building on the assumption that we rely on an internal state (i.e. mental model) to predict upcoming informational content or sensory input (Friston, 2010; Bornkessel-Schlesewsky and Schumacher, 2016). Prominence-lending features corroborate establishing a ranking of discourse entities and this ranking feeds into expectation-based processing. Accordingly, the parser generates expectations for up-coming entities based on a given prominence ranking, and encountering a less expected entity results in processing costs. This has for instance been shown for the comprehension of givenness, where new discourse referents evoke longer reading times or more pronounced neurophysiological signatures (e.g. Brocher et al., 2016; Burkhardt, 2006; Clark and Haviland, 1977). Enhanced processing demands have also been attested for the comprehension of reference to non-topics over topics (Gordon et al., 1993; Hung and Schumacher, 2012) among many other studies on various prominence-lending cues.

Regarding discourse updating (Def.2), language comprehension studies indicate that changes in discourse representation structure are computationally demanding. Longer reading times have been observed for topic shifts over topic maintenance (Gordon et al., 1993) and topic shifts indicated by morphosyntactic cues have given rise to a particular electrophysiological marker (for evidence from Japanese see e.g., Hirotani and Schumacher, 2011; Wang and Schumacher, 2013 and from demonstrative pronouns in German see e.g., Schumacher et al., 2015).

Finally, structural attraction (Def.3) reflected in the choice of a particular structure is probably most evident in language production and planning. Speakers choose pronouns or zero forms for prominent discourse referents (e.g., Arnold, 1998; Kehler et al., 2008). And marked constructions, such as passives, are produced to promote a particular referent in prominence by aligning it with one or more prominence-lending cues (such as subjecthood). This has for instance been illustrated by Tomlin (1997): in his seminal investigation utilizing the "fish film", native speakers of English were presented with a video clip, in which one fish swallowed another one. A visual cue (an arrow) directed the participants' attention to one of the fish. Afterward participants were asked to describe the scene they had just watched. They were more likely to generate a passive construction when the fish carrying the patient role had been visually cued during the video clip presentation.

These brief observations from language processing indicate that advancements in both the characterization of prominence and the investigation of the underlying processing architecture are beneficial for a better understanding of the notion of prominence.

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[1] By hierarchical structure we refer to branching structures that encode additional information about the relation or precedence of certain units over others, such as c-command or head-dependent relations. Prominence structure in turn represents an ordered set without further structure-internal dependencies.

7. Conclusion

We presented a proposal that views prominence as a general organizing principle of language and demonstrated how this pertains to discourse-pragmatic phenomena and discourse management. We argued that the notion of prominence is not merely confined to singling out an entity from a set but should also be viewed as a dynamic principle shaping discourse. Accordingly, prominent entities are typically not inherently prominent, but their prominence status may shift and vary as a function of context. Furthermore, prominent entities act as anchors for grammatical operations.

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