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Introduction

1 Spoken discourse, especially in dialogue, is dynamic by nature. Speakers construct it rapidly over time building a complex network of forward and backward relations between successive discourse parts and referring expressions. As an illustration, consider the excerpt of this conversation between the two main characters in the first act (first scene) of Oscar Wilde's play "The importance of being Earnest" (Wilde, 1895/1997, underscoring by SF):
(1a) Jack. […] I simply want my cigarette case back.
(1b) Algernon. Yes; but this isn't your cigarette case. This cigarette case is a present from some one of the name of Cecily, and you said you didn't know any one of that name.
(1c) Jack. Well, if you want to know, Cecily happens to be my aunt. [...]
(1d) Algernon. Yes. But why does your aunt call you her uncle? 'From little Cecily, with her fondest love to her dear Uncle Jack.' There is no objection, I admit, to an aunt being a small aunt, but why an aunt, no matter what her size may be, should call her own nephew her uncle, I can't quite make out.

2 In this scene, the speakers mutually have to track down the parts of discourse that are most relevant to their own and their interlocutor's communicative aims, that is, to either keep or disclose a secret surrounding a person called Cecily. They have to quickly track the relations the other speaker is referring to in previous discourse (i.e., anaphoric relations) and guess where the interlocutor is going next (i.e., cataphoric relations) in order to plan their own turn in light of these facts. For instance, a backward relation is found in (1b) where *that name* at the end of the utterance has to be related to the previously mentioned *Cecily.* A more complex backward operation is needed in (1d), so that the *small aunt* is linked with *little Cecily,* although it is not highly likely that the adjective *little* refers to the size of the person. On the other hand, Jack in (1a) and (1c) always sets up themes to be discussed in the upcoming discourse (*my cigarette case*, *my aunt*), but his interlocutor does not continue these themes in the projected way. He shifts to discuss the ownership (*my* (1a) – *not yours* (1b)) and the parental relations (*my aunt* (1c) – *you (as) her uncle* (1d)).

3 What helps speakers / listeners to cope with this relational process of discourse structure building? In the literature on discourse analysis and pragmatics, the notion of salience has become a key term in the debate (Chiarcos et al., 2011). As shown in the sections below, discourse salience means that some parts of discourse are more activated or accessible in memory than others and thereby determine what is conceived and perceived as being relevant in the course of discourse planning and processing. However, the notion of salience and the processes related to it are not very clearly defined. Another concept widely used or sometimes confounded with salience is the notion of prominence. This term is much more used in phonetics and phonology, especially in prosody research to indicate a contextual relation between the prominent unit and its context. In this contribution, I want to clarify which aspects of prosody and syntax contribute to salience in spoken discourse and discuss proposals and experimental results on the role of prominence in shaping backward and forward relations in discourse processing.

1. What is salience?

4 When interlocutors are in conversation, they represent the ongoing discourse by building a mental representation of what is said (van Dijk & Kintsch, 1983; Gernsbacher, 1990; Johnson-Laird, 1980). In example (1), the mental representation would certainly comprise and be

constantly updated on mental representations of the cigarette case, the owner of the cigarette case, the mysterious donor Cecily, the dedication engraved in the cigarette case and the speculations about the relation between owner and donor of the case. The idea that there is a discourse-mediated mental representation of what is experienced in the world is widely agreed amongst discourse researchers. The mental model is called a situation model, a discourse model or an event model (see McNamara & Mogliano, 2009, for a review). The mental model can be seen as a representation in episodic memory which is dynamically modified and updated during discourse processing. In this process, some parts of the representation are likely to be more active in memory than others. This activated information has been termed as being "salient" to the listener / speaker (Chafe, 1994; Lambrecht, 1994). In this view, salience is a cognitive, mnemonic attribute (rather than a linguistic one) of a structure or parts of the mental discourse model. Still, discourse salience is difficult to define (Chiarcos, 2009; Masharov, 2009). This has led to diverse uses of the term. Some of the ideas associated with discourse salience will be reviewed in the next section.

1.1 Backward- and forward-looking salience

5 One basic claim about salience is that it codes a privileged unit with regard to mental operations of the speaker/listener during discourse processing. One of these operations is memory retrieval. Research associated with this notion of salience focuses on backward anaphoric relationships in discourse (henceforth, referred to as "backward-looking salience"). One representative approach is Ariel's (1990, 2001, 2013) accessibility hierarchy (for another prominent proposal, see Gundel et al., 1993, 2012). It was mainly designed to explain the choice of the form of referring expressions such as personal pronouns, proper names or noun phrases with varying determiners. The choice would be made on the basis of a hierarchical ranking of possible discourse antecedents. The more salient the antecedent the more accessible (i.e., easier to retrieve from memory and to establish the backward relation) it should be for the listener[1]. A speaker would account for this fact by choosing a referring expression that encodes the corresponding accessibility status and thereby aids the listener in his search for a possible antecedent.

(2) Adele went to the university library.

(2a) She urgently needed a book for her exams.

(2b) This institution was one of the oldest in the country.

6 In (2a) Adele is re-mentioned with a pronoun which is classified in Ariel's (1990) theory as marking the status of high accessibility. As Adele is the only female human being in the previous sentence, the co-reference relation is easy to establish. In (2b), a pronoun could have been referring unambiguously to the university library as well. However, the presumed activation status of the *library* is lower than that of the human and animated subject *Adele* in the previous sentence which favors the use of a lower accessibility marker (i.e., demonstrative + NP).

7 In theories like Ariel's (1990, 2001), accessibility and salience are also driven by the information status of discourse referents. A discourse unit is "given" when it has already been encountered in previous discourse or can be easily inferred on the grounds of shared knowledge of the speaker and the listener. A discourse unit is "new", if it has not been mentioned or alluded to in previous discourse. Two further distinctions pertain to the description of information status. First, "topic" is the information that is talked about and elaborated on in a sentence or discourse part. Second, "focus" is the information in a sentence or discourse part that is specifically foregrounded in order to mark information that is particularly important, that introduces contrastive or alternative information in relation to previous discourse (see e.g., Chafe, 1994; Halliday, 1994; Lambrecht, 1994; Schwarzschild, 1999; Selkirk, 1995 for elaborate discussions of these terms).

8 A second process that has been associated with salience is the allocation of attention (e.g., Grosz, Joshi & Weinstein, 1995; Grosz & Sidner, 1986). In this view, salience is viewed as a means of "attentional control" (Chiarcos, 2009), of activation status in "consciousness" (Chafe, 1994). Thereby, the attention of the listener is guided through salience

in order to establish a profile of fore- and backgrounded information in his discourse model. One typically cited example is the "Moses-illusion". When people are asked if it is true or false that Moses took two animals of each species to the Ark, they mostly do not realize that it was not Moses but Noah who was the protagonist of the story. When Moses is put under focus (e.g., via clefting: *it was Moses who took two animals*...), the error is detected more often (Bredart & Modolo, 1988). This finding is attributed to the foregrounding of the subject referent under focus which allows to pay more attention and process the structure more readily.

9 In his mental salience framework, Chiarcos (2009) suggests that foregrounding serves to indicate the salience of discourse parts in relation to upcoming discourse. More specifically, he calls this "forward-looking salience" of parts of the mental model. By means of forward-looking salience, speakers convey the importance of an entity in the mental model to the listener relative to the following discourse.

10 The notions of backward- and forward-looking salience seem to be rather divergent. However, in this paper, I follow a unified account inspired by Givòn (1983, 2001)[2]. In his approach, backward-looking relations refer to the continuity of referents throughout discourse. Backward-looking salience therefore enhances the *predictability that a referent was continued from previous discourse* (Givòn, 1983, 2001). Thereby it makes the referent recoverable from previous mention and predictions derived from previous discourse. Forward-looking salience has the opposite direction: the more discontinuous and "surprising" (Givòn, 1983) a discourse entity is, the more it signals referential importance. In other words, a referent becomes more *expected to play a role in the following discourse*, and this despite the fact that it is not recoverable or predicted from previous discourse. In fact, I argue that the key characteristic of salience is its function to encode predictability or likelihood of continuous or discontinuous (previous / next) mention of a discourse part in the mental model throughout time. From this definition, salience can be seen as a cognitive and, in particular, dynamic function of discourse processing.

1.2 Open questions on salience in research on spoken discourse and conversation

11 *The domain of salience: single referents, propositions, scenes or events?*

12 Many theories of referring expressions define salience as a local phenomenon, concerning a single unit or referent in its local context (e.g., Ariel, 1990; Chiarcos, 2009; Grosz et al., 1995). In his discussion of the notion of focus, Schwarzschild (1999) already remarked that it is not sufficient to attribute informational values such as givenness or focus to single referents only, but that at least propositions should be considered for information status. Recent approaches to discourse comprehension argue that mental models are structured in events or scenes (Zwaan et al., 1995, Zwaan & Radvansky, 1998). Possibly, different situational dimensions of the scene (such as temporal, spatial situation) undergo constant tracking and updating processes (Kurby & Zacks, 2012). Therefore, it has been argued that salience of the whole scene or / and its dimensions should be taken into account on a global level of discourse processing (Espino, 2012).

13 *Salience as a graded or an absolute property?*

14 A second question is if salience is an absolute or a relative property. In many of the above-mentioned approaches, the idea is supported that salience is encoded gradually in the mental model (e.g., Ariel, 1990; Chiarcos, 2009; Givòn, 1983). This means that parts of the mental model are ranked according to their salience status and that there is no single entity as a "winner that takes it all". Several referents can be salient but with varying degrees of activation or attention allocation. In centering theory, a distinction between backward- and forward-looking salience is made (Grosz et al., 1995). Every utterance can have several elements (i.e., centers) that convey graded forward-looking salience, but only one center is unambiguously salient in relation to previous information (backward-looking salience). In order to decide if backward-looking salience can always be unequivocally established (as proposed by Grosz et al., 1995), we need to understand the dynamics of the discourse model during ongoing discourse processing. As will be seen later (section 3), discourse processing evolves in time

frames, and temporal dynamics are of great importance in providing a model of discourse structure building.

15 *Linguistic vs. non-linguistic salience?*

16 In particular in conversation, the situational context can also play a role in determining the interpretation of discourse. However, research is not conclusive about how the actual, physical context influences the mental discourse model. Some researchers postulate that there should be an additional situation model representing these aspects ("a context model", van Dijk, 1997). Furthermore, mechanisms should be defined that account for how discourse-mediated, "linguistic salience" interacts with situation-mediated salience or "perceptual salience" (Kecskes, 2013). Others, however, suggest that the influence of situation-mediated salience is marginal and inferior to discourse salience (Ariel, 2001). Note that most models and theories of discourse salience are built on data of written discourse. Thereby, it is not unlikely that dynamic aspects of interaction and conversation are overlooked or underestimated.

17 *Hearer- or speaker-salience?*

18 Another problem concerns the role of salience for the speaker and the hearer during interaction. In models of language processing (e.g., Levelt, 1989), the distinction between production (i.e., speaker-centered) and perception (i.e., hearer-centered) is a very prominent one. Chiarcos (2009) proposes that backward-looking salience is common to the speaker's and the hearer's discourse model whereas forward-looking salience is exclusive to the speaker's model of discourse, as he is the only one to know what he is going to mention next. However, in dynamic interaction as we find it in conversation (see example (1), speaker and hearer constantly change roles by taking turns. Thereby, there is no guarantee that a speaker can plan his discourse model in advance and make his interlocutor continue on a topic that he had provided (especially if the communicative goals differ, as in example (1).

2. What makes a discourse unit salient?

19 In (psycho)acoustic research, salience is often used synonymous to prominence in order to identify an event or element that stands out from the context (Ellis & Jones, 2009; Kohler, 2008). In this paper, however, both terms will be used for separate phenomena. As described above, salience represents a cognitive time-dynamic evaluation of discourse-relevant information. Prominence, in contrast, is a perceptual correlate of structural properties of the linguistic signal. It is linked to the perception or production of a relation between a foregrounded outstanding event and its context, i.e., events differing from their context by means of structural, language-dependent properties. Overall, prominence is neutral as to whether its function is related to discourse processing, syntax, prosody, the lexicon or else. A third notion refers to the physical and structural properties themselves (henceforth, "prominence cues") such as higher pitch, longer duration, syntactic constructions (e.g., clefting) or particles that constitute the observable basis of prominence relations, by making an event differ from its default interpretation and its surrounding context. However, the triad "prominence cues – prominence perception and marking – salience in the discourse model" is far from being well understood.

20 However, in this triad, only prominence cues and the reactions to them (e.g., looking times, comprehension times, neural responses, etc.) are directly observable. Therefore, one key issue is to sort out how to interpret prominence cues in relation to salience. To what extent do prominence cues influence verbal production and perception processes, or purely syntactic or lexical processing rather than discourse modeling itself? In the following, I review results on prominence perception and production from recent studies and link them to backward- and forward-looking salience. Only prominence in the acoustic and the syntactic domains will be discussed.

2.1 Syntactic prominence

21 A special prominence status has been ascribed to first elements in sentences and discourse episodes because of their eminent role in laying a foundation for new structures in the mental model (Gernsbacher, 1990, 1997). Thereby, first-mentioned elements are good candidates for being salient by creating expectations about their re-mention in the following discourse. In

reading and recall experiments, longer reading times and naming times were found for initial sentences and words in narratives and sentences (e.g., Gernsbacher & Hargreaves, 1988).

22 In the syntactic domain, first positions serve as a cue to prominence in many languages. In Thai, for instance, the first preverbal position of an utterance is especially marked for continuity of discourse information (Payawang, 2014). Topics are strictly placed in these positions and then referred to with zero-anaphors in the following discourse.

(3a)

Phanráya:	*tɔ̂ŋ*	*chûəw*	*thɔ:d*	*rɔ:ŋthá:w*
Wife	have to	help	remove	shoes

“[My] wife had to help [me] remove [my] shoes”

(3b)

lɛ́:w	*nam*	*ya:nuəkhla:yklâ:mmaǎ:*	*nûəd*	*khă:*	*háy*
then	brings	ointment for muscles	come	massage	legs	[PREPOSITION]

“Then she brought an ointment for muscles [and] massaged [my] legs”

23 In these example taken from Payawang (2014: 97/98), the wife of the narrator (phanráya:) is the topic of the whole discourse segment. This fact is marked by its mention in the first position at the beginning of the paragraph (3a). Hence, all subsequent actions refer to her and explicit coding is not necessary (i.e., co-reference is established by zero-anaphors, (3b)).

24 In a typological perspective, first positions in sentences have been associated with information flow (e.g., Firbas, 1971). Corpus research has shown a frequent “given-before-new” ordering (Gundel, 1988). Predictable information from previous discourse is often placed in first positions of an utterance or sentence, thereby guaranteeing high accessibility for speaker and listener to previous discourse elements. Less accessible information, in contrast, is found more towards the end of the sentence and is supported by other structural cues such as nuclear accents, additional morphosyntactic marking, etc. (Gundel, 1988). However, in many languages, counter-acting the aforementioned ordering, a “first-things-first” ordering can also be found (Gundel, 1988). That is, discontinuous information such as new topics, focalized or important information for upcoming discourse are placed or moved into first positions (see e.g., Kügler & Genzler, 2011).

25 The aforementioned functional load of first positions in sentences can be demonstrated with German. German has several word order options, and its topology is very sensitive to information structure (e.g., Abraham, 2003, 2005). Main declarative clauses such as *Leo kauft einen Staubsauger* 'Leo buys a vacuum cleaner' display the finite verb (underscored) in the second position. The term 'second position' refers to the fact that there is exactly one syntactic position to be filled before the finite verb (Altmann & Hofmann, 2008). The position can be filled with various kinds of clausal elements, but very frequently, as in our example, it is filled by the subject or by an adverbial. However, when putting e.g., the object in the first position (i.e., topicalization), the structure becomes highly marked: *Einen Staubsauger kauft Leo* 'It is a vacuum cleaner that Leo buys [not a washing machine]'. In this case, the ordering implies that the first position codes contrasted or alternative (i.e., focused, Rooth, 1992) information and it is very likely that the following discourse will refer to this contrast again.

26 In addition to prominence structure provided by word order, languages have several morphosyntactic means to make a discourse part stand out from its context. In many Asian languages, particles mark focused or topical elements (e.g., in Mandarin Chinese, Chen, Li & Yang, 2012). Focus particles are also found in languages such as English and German (*Only the good die young*, e.g., Höhle et al., 2009; König, 1991). Specific syntactic constructions single out and foreground one specific referent, and attract the listener's or reader's attention (such as clefting in French and English, Birch & Rayner, 1997; Halliday, 2004; Rivelin-Constantin, 1992; Sanford et al., 2009). Noun phrases containing attributes are perceived as more prominent than noun phrases without attributes (Klin et al., 2004) as well as syntactic heads compared to non-heads (e.g., Birch & Rayner, 2010; McKoon et al., 1993).

27 Particular attention has been attributed to syntactic role and its effects on discourse processing. Subjects[3] have been proposed as coding preferred referents for what the discourse is or is going to be about (Chafe, 1994; Lambrecht, 1994). Therefore, they are more likely to be continued throughout discourse segments (e.g., by high accessibility markers such as pronouns) and are more predictable (Arnold, 1998; Givòn, 1983; Grosz et al., 1995). Thereby, they are possibly more accessible and more prominent than other syntactic roles (Büring, 2009). Listeners show a bias to prefer subjects as antecedents of pronouns (e.g., Gordon et al., 1993).

(4a) Finally, Ted gave Mike the parcel.

(4b) He looked out of the window for a moment, then turned, and went to the elevator.

28 According to the findings of Gordon et al. (1993), listeners would be more inclined to consider the subject noun phrase *Ted* as being the agent of the actions in (4b). Still, at least from a speaker's perspective, this bias can be attenuated by thematic role and verb-induced argument structure (Arnold, 1998, 2001). In a production experiment and corpus study, Arnold (2001) found that the referent being the goal of an action was more likely to be continued in subsequent discourse independently of syntactic role. From these findings, (4b) could have been equally well been produced as a continuation on *Mike*.

29 In sum, the above discussion shows that salience through syntactic prominence cannot be established in a simple way. Prominence cues, such as syntactic role and position, noun phrase form and definiteness, syntactic constructions and morphosyntactic marking all contribute to the perception and production of salient discourse units. Moreover, semantic factors (e.g., thematic role and argument structure) can interact with syntactic cues in shaping the preference for establishing backward- and forward-looking discourse relations.

2.2 Acoustic prominence

30 In oral communication, prominence is extensively conveyed by acoustic cues such as increased fundamental frequency, intensity, duration or hyperarticulation in comparison to the context (Fry, 1958; Ladd, 1996). In general terms, events in speech that are outstanding[4] by acoustical means have been described as “accents” (e.g., Kohler, 2008). At the same time, accents are not distributed randomly, but are linked to hierarchically defined positions in words (i.e., “stress”), phrases, or utterances (e.g., Gordon, 2014). They can be realized or not in actual discourse. Therefore, they are described on a concrete acoustic as well as on a more abstract phonological level.

31 Different languages provide different acoustic cues to accentuation. In French, the main cues are f0 and duration, whereas in German, intensity, f0 and duration combine (e.g., Lacheret-Dujour & Beaugendre, 1999; Koreman et al., 2008). Furthermore, accent types and their functions are distinguished by different prominence cues. In French, for instance, phrase-final primary accents are conveyed by longer duration of the rhyme portion of the syllable than preceding material, but this is not the case for initial (i.e., secondary) accents that may have a longer syllabic onset (e.g, Astésano, 2001; Welby, 2006). Some cues can also be substituted by others and reach a similar perceptual effect. In English, for instance, higher f0-excursions can signal emphasis. However, a change in alignment of the pitch peak with respect to the vowel, resulting in longer rise duration, can produce the same perceptual effect (Gussenhoven, 2004). On the other hand, timing of pitch rises, peaks and falls is decisive cross-linguistically for which syllable will be perceived as carrying an accent (Hasegawa & Hata, 1992; Hermes, 1997). Moreover, rising and high pitch contours have often been found to be more prominent for the listener than low and falling pitch contours (Pierrehumbert & Hirschberg, 1990).

32 Prominence cues have to be interpreted in relation to the context (Pierrehumbert, 1980). As pitch register naturally lowers in utterances due to aerodynamics (i.e., declination), pitch accents in later parts of an utterance have lower pitch and often smaller excursions than earlier accents (t'Hart & Cohen, 1973). However, listeners perceptually compensate for this phenomenon: Lower pitch in syllables towards the end of an utterance is perceived with equal prominence as in previous material (e.g., Terken 1991, 1994). Furthermore, conflicting cues in the context can result in accent perception despite the lack of a primary prominence cue. Heldner (2001) showed for Swedish that the powerful f0 cue was neither necessary nor

sufficient to explain prominence perception in contexts with conflicting cues, Instead, the combination of acoustic cues was decisive for perceptual processes.

33 In sum, similar to syntactic prominence cues, the relation of acoustic prominence cues and prominence perception and production is far from being simple. Prominence cues and their perception vary with respect to prosodic domains and positions, accentual functions, context, and are language-specific.

2.2.1 Accents and discourse structure

34 A large body of research has shown that the presence and absence of accents can shape the interpretation of discourse-level information in a major way (Wagner & Watson, 2010, for a review). At least in intonation languages like English, German or Swedish, phrase- or utterance level accents, marked by changes in fundamental frequency (i.e., "pitch-accents", e.g., Beckman & Pierrehumbert, 1986; Bolinger, 1958; Pierrehumbert & Hirschberg, 1990), play an important role. In many theories of prosodic phonology, pitch-accents are seen as being markers of "focal"[5], i.e., new or newsworthy (from a speaker's perspective) information (e.g., Pierrehumbert & Hirschberg, 1990). In English or German, each regular prosodic phrase is supposed to have at least one such informationally central accent (i.e., a nuclear accent), occurring towards the end of a phrase and determined on syntactic grounds (Gussenhoven, 1992). However, these accents do not only highlight information provided by the accented word alone, but they function as prosodic heads that "project" to larger units, sometimes to the whole verbal phrase (Birch & Clifton, 1995; Selkirk, 1995). This characteristic is most visible in "broad focus"[6] contexts (Ladd, 1980, 1996), such as in (5a) (the word carrying the nuclear accent is written in capitals).

(5a) What happened? - The driver stopped the car at the STATION.

(5b) Where did the driver stop the car? - The driver stopped the car at the STATION.

35 In (5a), the whole verbal phrase can be considered as being important as an answer to the question. That is, neither the noun itself nor the phrasal structuring of (*at(the(station*)) stands out in this context. Accents also serve to highlight specific parts of discourse. In contrast to (5a), (5b) is an example of "narrow focus", that is, one specific piece of information is highlighted (Ladd, 1996). In this example, only the information about the place of the action is new to the hearer, as requested in the question, and therefore receives an accent. The intonational contour and the accent on *station* in (5b) are likely to be pronounced differently from (5a). In addition to nuclear accents, prenuclear accents may occur throughout utterances or phrases, but they are often perceived as being less prominent (e.g., Welby, 2003). In (5a), these prenuclear accents would be localized on *driver* and *car* (and possibly *stopped*). In (5b), prenuclear accents would disappear, and register and pitch contour would be low and flat until the accented syllable is uttered. Moreover, in natural conversation, the responding person in (5b) would often simply drop the first part of the answer and just give the requested information in form of the noun phrase (i.e., *at the station*).

36 Narrow focus expressing alternative or contrastive information also receives special accent-marking in languages like German, French and English. One well-known phenomenon is contrastive focus (Rooth, 1992).

(6) So, you took the cheese out of the box. - I took the CANDY out of the box.

37 In the English example (6), the first syllable of *candy* is pronounced with a steeply rising (and a higher-than-usual peaking) pitch accent, while all other syllables before and afterwards drop to a lower pitch register (i.e., they become "deaccented"). Depending on the language, contrastive focus can be marked with higher syllabic duration and / or higher intensity and / or hyperarticulation (e.g., larger vowel space; e.g., Hay et al., 2006). In some intonation languages, it has been found that accents can show gradual increase in the strength of prominence cues from non-contrastive to contrastive meanings (e.g., in German, see Féry & Kügler, 2008). One particular kind of contrastive accent is the topical or thematic accent. These accents occur very early in the sentence. In a discourse account, they modify expectations as to what the upcoming utterance will be about with respect to alternative information (e.g., Büring, 1997). In a production and perception study, Braun (2006) showed that contrastive sentence-initial thematic accents in German are reliably produced with higher and later peaks as well

as longer f0 rise than in non-contrastive contexts. However, the differences in contrastiveness expressed by these cues were hardly noticed by untrained listeners. Hence, prosodically marked contrastive information seems to be less prominent when localized in sentence-initial positions or when associated with thematic information, or both. Further studies should disentangle both aspects (i.e., position vs. thematic information).

38 Still, the literature robustly shows that accentuation attracts and guides the attention of listeners with regard to new, non-mentioned referents. For instance, in a much-cited study using the visual world paradigm (Dahan et al., 2002), participants were instructed to manipulate the location of objects displayed on a screen (e.g., *candy* and *candle*). The instruction indicated that they should either displace the same object twice or manipulate two different objects. If one object was referred to twice, but was accented the second time (e.g., *CANdy*), participants were initially looking more often at the unmentioned competitor (*candle*). Thus, by hearing an accent, participants were more inclined to look at the new, unmentioned object. However, in a second experiment, Dahan et al. (2002) found that completely new referents are not always preferred when hearing an accent. Instead, if available, participants looked first at an already mentioned, but non-thematic discourse referent when hearing an accented noun phrase. This result supports the idea that listeners first try to establish backward relations, if ever possible, before attending to and integrating a new referent.

39 Contrastive meaning induced by accentual marking has also been investigated. For instance, in an eye-tracking study, contrastive accents on German adjectives were found to induce an attentional bias (Weber, Braun & Crocker, 2006). Seeing two pairs of scissors on a screen which only differed in color (i.e., red and purple), participants had to click on the pair mentioned in the instruction. When adjectives in the instruction had a contrastive accent (e.g., *click on the RED scissors*), listeners anticipated the contrasted referent earlier (i.e., they looked earlier at the picture of red scissors on the screen) than when the adjective was unaccented.

40 In sum, accents marked by f0 prominence cues have robustly been shown to help guiding attention, and generating predictions about following referents. They are therefore likely to impact on forward-looking salience in the discourse model, but also help establishing backward relations.

2.2.2 Deaccentuation and discourse structure

41 Lack of prominence cues or prominence cues that are weaker than expected are also highly informative for listeners on a discourse level. Concerning backward relations, deaccentuation has been shown to be a powerful cue in discourse interpretation (Cruttenden, 2006). Actually, deaccentuation implies that prominence cues are attenuated or missing on discourse units that have the potential to carry an accent. This is often the case for information that was previously mentioned or can easily be inferred and is not contrastive to present information (e.g. for German, Baumann & Grice, 2006; Féry & Kügler, 2008; Grice et al, 2008). Listeners also expect that these "low-prominence" cues refer to something that is already known to them. Wennerstrom (2010: 347) illustrated how this is exploited to create humorous effects:

(7a) - I heard you had to call a plumber over to your house this morning!

(7b) - Yeah, he's still here and I'm ready to MURDER the $_{\text{ORANGUTAN}}$!

42 In (7b), *orangutan* would normally receive the nuclear accent of the utterance. However, an accented version of the word is likely to be perceived as new information (see above) which would not fit coherently into the dialogue. The deaccentuation of *orangutan* (indicated by subscript letters) leads the listener to the conclusion that the information is already in the discourse model. By deaccenting *orangutan,* a co-referential relation between the plumber in the utterance (7a) and the animal becomes highly likely, which creates a humorous impression. Further perception experiments confirmed that deaccented discourse parts are interpreted as information that co-refers to previous discourse (e.g., Baumann & Grice, 2006; Dahan et al., 2002). Conversely, it was found that accenting a co-referring discourse unit caused longer reaction times and was often judged as being inappropriate when the unit had been explicitly asked for in a preceding question. For example, when listening to the question *What did Anna do with her dog? - She BRUSHED her DOG* would be perceived as more inappropriate than the answer *She BRUSHED her dog* (e.g., Birch & Clifton, 1995).

2.3 Prominence cues and forward- and backward-looking salience

43 The research results presented so far suggest that prominence cues can influence forward- and backward-looking salience. As discussed in section 1, the form of referring expressions plays a major role, in particular for backward-looking salience. For instance, as markers of continuity, pronouns and noun phrase determiners help to establish co-referential relations. Non-prominence (e.g., deaccentuation) in expected positions is also a strong indicator of backward-looking salience. Referents that are continued from previous discourse and are highly predictable often show weaker acoustic prominence cues or are referred to with short pronouns or even zero-anaphors. With respect to forward-looking salience, first elements in discourse segments have a high prominence status and are likely to be retained in the discourse model as they encode information that is important for upcoming discourse. In the syntactic domain, first positions prove to be prominent anchors for backward- as well as forward relations depending on expectations triggered by e.g., grammatical role. Accentuation also marks complex forward and backward relations. Accents have been shown to be interpreted as marking new, discontinuous information that is relevant for further discourse and forward-looking salience. However, they are also a powerful incentive for revising the actual discourse model (i.e., by expressing contrastive meaning), thereby playing on backward- and forward-looking salience at the same time. Syntactic cues may also serve the interpretation of contrastive meaning (e.g., via clefting or discourse particles) or at least, they help foregrounding referents and can therefore play a role in a revised or upcoming discourse model.

3. Interaction of prominence cues: towards a model of oral discourse processing

44 In the final section, I address some open questions, namely the interaction of multiple prominence cues and the functions of prominence to ease processing effort and to enhance discourse processes.

3.1 Multiple cues to salience

45 There is a long-lasting debate as to how syntax and prosody interact in auditory comprehension, and which of the two is primary (e.g., Friederici, 2002; Shattuck-Hufnagel & Turk, 1996; Steinhauer & Drury, 2012). More and more studies therefore investigate how syntax, discourse structure and prosodic structure jointly influence discourse processing. At the same time, models are needed that integrate multiple dimensions of discourse structure. In their model, Féry & Ishihara (2009) identify some aspects of prosodic structure that are intertwined with syntax and others that are linked to information structure. Based on observations in German and Japanese, they argue that syntactic phrasing maps on prosodic phrasing, while information structure (i.e., new and given information) is in particular realized by prosodic prominence relations expressed through f0-scaling in these languages.

46 Baumann & Grice (2006) actually propose that morphosyntactic and prosodic prominences achieve different effects on backward-looking salience. From a listener-based perspective, they suggest that morphosyntactic marking (e.g., definiteness) helps identifying and accessing shared knowledge, more specifically, representations and concepts on the basis of lexical form. Prosody, on the other hand, would mark the presumed activation status of discourse units in memory. However, major morphosyntactic proposals such as the accessibility hierarchy (Ariel, 1990, 2001) or the givenness hierarchy (Gundel et al., 1993) claim that both functions for backward-looking salience can be fulfilled by morphosyntactic means as well.

47 Altogether, there is a need of theoretical models of discourse structure processing that integrate several cues to explain prominence effects. Models that are predominantly based on written language often disregard prosody. For instance, in his hierarchy of structural strength, Büring (2009) argues that the prominence potential of a constituent is jointly built on its information-structural status, its syntactic status as argument, predicate, or modifier, and its word class. The salience model of Chiarcos (2009) relates syntactic function (e.g., subjects are more salient

than objects), with nominal status (pronoun vs. noun) and with word order effects. It would be very valuable to integrate prosodic prominence as an additional factor in such models.

48 In experimental research, there are efforts to combine syntax, prosody and also information structure to explain processing and comprehension of sentences or discourse segments.[7] For instance, as early as in the 80ies, Bock & Mazzella (1983) examined auditory comprehension of sentences by considering a combination of pitch accents with active or passive voice and the positions of objects and subjects in English sentences. In their study, they did not find an effect of voice in the experiments. Therefore, they suggested that intonational prominence may play a predominant role in auditory comprehension of English sentences, but that syntactic prominence marking is more powerful in the comprehension of written language. More recent studies again underlined the dominant role of prosodic prominence cues in oral language processing (Keller & Alexopoulou, 2001; Schumacher & Baumann, 2012). However, written language comprehension also activates prosodic processing (e.g., Bader, 1998). Therefore, future research should compare both written and oral discourse comprehension, and further clarify the role of prosodic and syntactic prominence markers in both modalities.

3.2 Prominence and salience: Processing effort and discourse structure building

49 Givòn (2001: 250) remarks that prominence cues should generate processing advantages, at least in perception: “More prominent and more distinct coding attracts more attention. Information that attracts more attention is memorized, stored and retrieved more efficiently.” In this sense, “efficient processing” in discourse structure building can be interpreted as an optimized resource management between actual attention allocation, memory processes and the effort to construct a discourse model. However, experimental research often produced conflicting results as to processing effort in prominence perception and production in discourse. In some studies prominence cues lead to quicker processing and integration (indicated by e.g., shorter reading, naming or reaction times), in others, processing and integration were rather slowed down (see reviews in Bernata & Clifton, 2014; Birch & Rayner, 2010). Therefore, the next paragraph addresses in more detail the sources for these inconsistent results, notably, processing costs due to early production and perception mechanisms and higher-order discourse processing.

50 First, we consider processing costs associated with discourse processing. In the literature on discourse salience, it has been suggested that high backward-looking salience should be associated with low processing costs and coding explicitness, but high forward-looking salience should generate higher processing costs and lead to more explicit coding (Almor, 1999, Ariel, 1990). Results from a recent reading time study indicate that high backward-looking salience of discourse referents indeed yields lower processing effort (i.e., shorter reading times) than forward-looking salience (Benatar & Clifton, 2014). Increases in reading times were observed for discontinuous information, that is, discourse-new and contrastive referents, implying a revision or major update of the discourse model. A processing account on these grounds could also explain why participants first try to establish backward-relations, before updating or reorganizing the discourse model with new forward predictions. Findings on production also fit into this picture as speakers show disfluencies, indicating higher processing effort, more often before they utter new discourse referents than when they utter already mentioned referents (Arnold & Tanenhaus, 2011).

51 However, brain research suggests that establishing discourse backward and forward relations both yield processing costs, but that they take place in different time windows (see Baumann & Schumacher, 2012, for an overview). An earlier process concerns the semantic and informational integration of information with previous discourse (i.e., reflected by the N400). At a later time point, updating the discourse model with new information is reflected by a late positivity. Moreover, prosody (adequate / inadequate (de)accentuation) and discourse status (given or new information in the discourse model) were found to be processed in different regions of the brain (Baumann & Schumacher, 2012). Overall, brain research underscores the need for describing the dynamics of discourse processing and its cost in time. Moreover,

neurolinguistic studies have the potential to determine the combined and separate effects of prominence cues.

52 When discussing processing effort, the influence of lexical aspects should be taken into account in addition to syntactic and acoustic prominence. A lexical processing bias can be induced by conceptual aspects (concreteness and imageability) or by experience and exposure (frequency, prototypicality, familiarity, age of acquisition) to words or constructions. Typically, more frequent or familiar words are processed quicker resulting in shorter naming or reaction times. In her graded salience hypothesis, Giora (1997, 2003, 2012) argues that the aforementioned factors lead to graded lexical salience which contributes to discourse processing in parallel to contextual aspects. Experimental research has shown that lexical coding matters in particular in the early stages of discourse processing. Raczaszek-Leonardi et al. (2008) demonstrated the dynamic nature of discourse processing when hearing more or less typical representations of a category that had to be related to a preceding context. In early stages of processing, only lexical processing and no contextual influence were observed, but this changed dramatically at a later time point of discourse processing. Nevertheless, it is still a matter of debate how the processing effort due to lexical inhibition or facilitation affects the general comprehension or planning of a discourse segment.

53 Finally, some accounts concentrate on perception and production constraints as the basis of processing effort. In a speech recognition framework, Aylett and Turk (2004, 2006) argue that acoustic prominence cues guarantee the recognition and processing of words and syllables that are not predictable by other linguistic means (e.g., syntactic or lexical). By marking parts of the utterance through acoustic prominence cues, speakers facilitate the identification and processing of infrequent or unfamiliar information for the listener. Therefore, acoustic prominence cues can compensate for processing effort of the listener that is induced by other structural levels. In line with this approach, another view holds that speakers also benefit from acoustic prominence as it facilitates lexical retrieval and parts of the production process in order to maintain verbal fluency (Bell et al., 2009).

54 Recent studies (Lam & Watson, 2010, 2014; Watson, 2010) aimed at teasing apart the role of prominence cues associated with production processes compared to discourse processes. For English, Lam and Watson (2010) found intensity increases as markers of discourse relations (i.e., unexpected mentions of referents had higher intensity), while word duration was more dependent on production constraints (i.e., repeated occurrences of referring expressions were shorter, see also, Bard et al., 2000; Lam & Watson, 2014). Durations of verbally repeated occurrences of given referents were shorter in contrast to productions repeating a referent that was displayed visually previously (Kahn & Arnold, 2012). This result points to a role of articulation constraints in reduced prominence marking. In sum, recent research indicates that the strength of prominence cues is linked to diverse functions such as the need for salience and the reduction of processing effort. Future language-specific research should parcel out the effect of production and perception constraints and discourse structure building on the quantity and quality of prominence cues.

4. Conclusion and outlook: making predictions in discourse processing

55 The previous sections have revealed a dynamic and complex system of prominence cues in speech and language(s) allowing to build and to track complex discourse relations. In a psycholinguistic perspective, memory and attention are limited resources during discourse processing. The salience of discourse referents can be defined as a function of the discourse model resulting from effective management of these resources during processing. It was shown that salience is related to prominence perception and production on different structural levels (syntax, prosody, semantics) and that concrete prominence cues contribute and interplay with respect to discourse structure building. At the same time, it has become evident that models of oral discourse processing are needed that integrate several aspects of linguistic structure, in particular prosody, which has been shown to be a powerful cue for the communication of discourse relations. Much of the research on prosody in discourse has concentrated on

pitch characteristics and its role as a primary cue for the interpretation of discourse relations. However, temporal and intensity cues may also contribute, but probably in a less obvious way (e.g., Heldner, 2001, see also section 3.2). Future experimental and theoretic research should investigate the combined effect of acoustic cues on prominence perception and production and the structure of discourse relations. Furthermore, a thorough examination of the temporal dynamics in production and perception processes should be part of the model and future experimental research.

56 In this contribution, two levels of salience were distinguished (i.e., backward- and forward looking salience). This proved very useful for examining and classifying the potential of prominence cues in discourse processing. However, the distinction leads back to a core question: What is the role of predictions and expectancies during discourse processing? On the one hand, (reduced) prominence cues (such as the use of pronouns or deaccentuation) are helpful to confirm predictions on the continuation of a discourse part made available from previous discourse. It was also shown that backward relations are easier to process provided that they are conform to the predictions made in previous discourse. On the other hand, predictions about discontinuity and the role of discourse referents in future discourse are also generated by prominence cues. They mark new and important referents or help revise prior predictions by signaling alternative or contrasted information. So far, semantic-pragmatic accounts of discourse processing mainly examined the predictability of discourse units from previous mention. However, recently, there is an increased interest in the question of the predictability of next mention (see Kehler & Rohde, 2013, and further contributions in the same issue of *Theoretical Linguistics*).

57 In order to devise a model of predictions for upcoming discourse, semantic processes and their interplay with syntax and prosody need to be considered. Some of the studies cited above underlined the role of semantic expectancies – a topic that is still a focus of current research (e.g., Roland et al., 2012). Thematic roles, such as goals in sentences expressing a transfer action, were preferred by listeners and speakers in establishing relations through syntactic and prosodic prominence (see Arnold, 1998; Dahan et al., 2002). This indicates that scene salience and expectancies induced by event representations are essential parts of future salience models. In addition, it has been recently shown that expectancies and predictions on a syntactic and semantic level are also likely to be influenced by prosodic and phonetic structure (e.g., Brunellière & Soto-Faraco, 2014; Dilley & McAuley, 2008; Kentner, 2012). It remains to be established by future research to what extent these predictions influence discourse processing and how they could be integrated in a comprehensive model of salience.

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Notes

1 However, in Ariel's (1990, 2001) theory, other factors besides salience play a role in the accessibility of an antecedent: she mentions the distance between anaphor and antecedent, the number of competitors, and the unity of perspective on the antecedent or anaphor in discourse, respectively.

2 Givòn used the term “topicality” instead of salience.

3 Note that not all languages possess syntactic subjects, but large Indo-European language families as the Romanic and Germanic families clearly do.

4 Tone is not discussed in this section, although it is well-documented that tone is as much a marker of prominence at the word level as word stress.

5 Note that some of the semantic-pragmatic accounts mentioned in section 1.1 and phonological accounts differ in their use of the term focus.

6 Therefore, it is questionable if the term “focus” is adequate, as it can include almost the whole information provided in an utterance.

7 Because of the large and fast-growing numbers of these studies, I cannot give an extended overview in this article.

Pour citer cet article

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Droits d’auteur

Résumés

Understanding spoken discourse is a complex task that implies monitoring and memorizing relations between important discourse units. Discourse comprehension has therefore been described as a process entailing a continuous competition between attention and memory resources for the sake of discourse structure building. The notion of salience has become a key issue in this debate. Salience refers to the fact that some parts of the discourse are more activated or accessible in memory than others. This is particularly relevant to set up an adequate mental representation of the ongoing discourse. In this contribution, I outline the challenges of defining salience and related processes in spoken discourse. By considering theoretical and experimental results, salience is related to prominence perception and production, and the

interpretation of syntactic and prosodic prominence cues. As a result, the role of predictions in discourse processing is identified as one of the major issues to be addressed in future research.

La notion de “saillance” dans le langage parlé – comment les structures proéminentes façonnent la compréhension du discours

La compréhension d'un discours est une tâche complexe. Entre autre, on observe une compétition continuelle entre les ressources attentionnelles et mnésiques pour bien cerner et mémoriser les relations entre les unités du discours. Dans la recherche actuelle, la notion de saillance a gagné de l'importance dans le débat. Les unités saillantes dans le discours sont celles qui sont plus activées ou accessibles en mémoire que d'autres unités. Ainsi, la saillance aide à construire une représentation mentale du discours avec plus d'efficacité. Dans la présente contribution, je précise les défis en jeu pour définir la saillance dans le discours parlé. En révisant la littérature théorique et expérimentale, je relie la saillance aux processus de la perception et de la production des proéminences, en particulier sur les plans syntaxique et prosodique. Au final, le rôle des prédictions par rapport aux structures du discours est identifié comme étant une des avenues principales pour la recherche future.

Entrées d’index

Mots-clés : saillance, traitement du discours, proéminence prosodique, proéminence syntaxique, prédictions
Keywords : salience, discourse processing, prosodic prominence, syntactic prominence, predictions