ВЫБОР ЛИЧНЫХ МЕСТОИМЕНИЙ ТРЕТЬЕГО ЛИЦА В ДИСКУРСЕ
CHOICE OF THIRD-PERSON PRONOUNS IN DISCOURSE[1]

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Выбор референциальных выражений в дискурсе в высокой степени зависим от контекстных характеристик референта. В настоящей работе рассматриваются условия употребления прототипических (например, актантных) и периферийных (например, посессивных) местоимений. Для анализа использовались два немецких корпуса, аннотированных по референции: PCC (Stede 2004) и NEGRA (Skut et al. 1997). Результаты подтверждают гипотезу о том, что различные типы местоимений по-разному чувствительны к параметру расстояния. Также на основании анализа влияния факторов одушевленности, синтаксического параллелизма, дискурсивной выделенности, позиции в предложении и дискурсивной структуры, было обнаружено влияние нескольких компенсирующих механизмов: референциального и риторического расстояния; одушевленности и расстояния; преимущество первого упоминания и позиции в предложении, топикальной устойчивости и расстояния.

1. Introduction

This paper focuses on referential choice, i.e. choice of one referential expression that the speaker makes of a given set of alternatives. This phenomenon is related to a cognitive phenomenon of activating information in a working memory (Chafe 1994, Tomlin and Pu 1991). The basic research questions this study is concerned with are as follows:

1) What are the factors, or indicators for a speaker to determine when a pronoun is used?

2) Are there differences as to different types of personal pronouns or do these make up a homogenous class?

The first question has been a concern of many other researches as well. Here, we deal with some important hypotheses by exposing them to corpus evidence. To reach this goal, as well as to provide answers to the second question, we extracted information in the course of two case studies from two anaphorically annotated corpora: PCC (Stede 2004) and NEGRA (Skut et al. 1997).

The structure of this paper is as follows. In Section 2, we outline cognitive background and the method; in Section 3 we proceed to the first case study, in the fourth Section the second study is presented. Section 5 concludes this paper.

2. Methodology
2.1. Cognitive background

Activation/salience-based theories of anaphora claim that it relies on the cognitive ability to focus and refocus attention on the currently most prominent/relevant entity. Salience rankings are typically based on surface properties of discourse, e.g. grammatical roles, distance, etc.

Centering is an established theory which suggests mappings between certain grammatical structures and the choice of referential expressions (cf. Grosz et al., 1995). Subjects are considered to represent more salient entities and thus to be preferred as candidates for (pronominal) antecedents in a following sentence.

Occasionally, the ultimative explanatory power of salience-based models has been questioned. Recently, Kehler (2002) criticized purely salience-based apporaches, comparing them to those trying to explain anaphora on the basis of semantic or syntactic constraints alone. Assumed indicators of salience do explain certain types of instances and fail by the other. To account for this, preferences of competing indicators of increasing intricacy have been outlined, which turn out to be more complex than human cognitive capacities can ever afford, according to Kehler. As an alternative, he suggests a set of fundamental coherence relations underlying interpretation aspects of most of linguistic procedures, including anaphora.

Our hypothesis both resembles and differs from purely salience-based accounts and Kehler's approach. In our pre-

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vious work, we have encountered failure of single-factor-based accounts in face of corpus data (Chiarcos and Krasavina 2005).

2.2. Recency criterion

Since early discourse-oriented accounts (e.g. Givón, 1983), it has been argued that pronouns refer to referents mentioned in immediately preceding clauses, in contrast to full NPs typically occurring at larger distances to their antecedents. We operate with two notions of distance:

referential distance is a measurement of linear distance corresponding to the number of clauses between anaphor and antecedent, i.e. distance measured in Givón's sense;

rhetorical distance is a measurement of hieararchical distance corresponding to the shortest path on the rhetorical graph between anaphor and antecedent. We adopted the method by Kibrik (2000), see also Kibrik and Krasavina (2005) that counts the number of steps between nodes connected by rhetorical relations. In an empirical investigation outlined in Chiarcos and Krasavina (2005), this method showed slight advantage over alternative heuristics (Cristea et al. 1998; Grosz and Sidner 1986).

Referential distance is a simple and popular method to assess the degree of referential accessibility, whereas rhetorical distance is a more fine-grained, theory-dependent notion. In some cases, both measures deliver similar results. However, referential and rhetorical distances from C to A and B in Figure 1 and Table 1 are different.
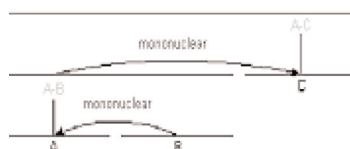

Figure 1. Examples of rhetorical structure

Distance	From C to B	From C to A
referential	1	2
rhetorical	2	1

Table 1. Rhetorical vs. referential distance on Figure 1

Rhetorical distance captures the hierarchical closeness of nodes that are immediately connected in the discourse structure but separated linearly, as C and A in both configurations in Figure 1. It also captures the hierarchical separation of linearly adjacent nodes, such as C and B in Figure 1.

2.3. Annotation scheme

For annotation we used PoCoS coreference scheme presented in detail elsewhere (Chiarcos and Krasavina 2006). Annotation scheme involved 1) discourse entities, or referents – objects existing in the discourse model (but not necesserily in the real world), e.g. individuals, substances, concepts, events, etc.; 2) attributes of these entites; 3) links between these entities. Following expressions were subject to annotation:

defNPs definite NPs
ne   proper names
pds   demonstrative pronouns
pper   pronouns
ppos possessives

Only linearly previous (left-most) antecedents were annotated, so that a referential chain presented one discourse referent. Attributes of primary and secondary markables included both inherent properties of discourse referents (e.g. animacy) as well as textual ones (e.g. grammatical role).

3. Case study 1

The sample involved in this analysis consisted of 134 German newspaper commentaries from the PCC annotated in accordance with the PoCoS annotation scheme/core scheme (Stede 2004). For annotation, the MMAX tool was used[2]. Two linguistics students, native speakers of German carried out the annotation.

Here and below, we will mainly focus on *short* linear distances (of 0 or 1 clauses), providing just summary figures for all long distances, in order to retain the "big" picture. In short distances, referential distance has been shown to be a sufficient measurement, at least for these texts, so we rely on this measurement in this study.

3.1. Referential expressions and rhetorical distance

We found that the most typical referential means at the distance of 0 are pronouns. Beginning with the distance of 1, definite NPs are the most frequent ones. This might be due to their overall high frequency, however. Assuming there is a choice between a pronoun and a definite NP, this data can be helpful in explaining or predicting this choice: the probability of a pronoun to be used in the same sentence is greater than its probability to be used across a sentence boundary, the opposite being true for definite NPs.

The preferences of referential expressions with respect to the distances to antecedents can be arranged into the following scales of prototypicality:

RD=0:   ppos > pper > pds > ne > defNPs
RD=1:   pds > pper > defNPs > ne, ppos
RD=2:   ne > defNPs > pds & pper
RD=3+: ne > defNPs

For comparison we will use Ariel's (1990) observations for English. According to her findings, high accessibility expressions are most popular in short distances, low accessibility expressions are most popular in larger distances. Our results are consistent with that of Ariel. Pronouns and demonstratives "tend to favour the same environment", which is the same sentence, demonstratives being more frequent than pronouns at larger distances.

Further, Ariel found that there is no text position at which demonstratives are more frequent than the other referential forms, due to their low frequency in English, still being intermediate since "the majority of its occurrences fall in the two intermediate distances" (Ariel 1990:19). In our data demonstratives never predominate as well, however, the statement about intermediate distances does not seem to retain: only short and one of the intermediate distances (the shortest one) are covered by demonstratives. Still, they are intermediate in the short-distance domain, in the sense that they

(i)   have an intermediate position on the scale of preferences by the RD=0;
(ii)   dominate at the intermediate distance within the short distances (RD=1).

In other words, one can say that demonstratives are intermediate at short distances.

In the short distances (<3), the following patterns are observed. Most definite NPs occur to at the distance of 1. Proper names show higher preference for the distance of 2. Demonstratives, pronouns and possessives are most frequent at the same sentence with their antecedent. The following distance – expression scale summarizes the observations made so far:

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 Pds
 Pper      >    DefNPs  >    ne
 Ppos           (RD=1)      (RD=2)
(RD=0)
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Note that short distances are generally preferred by all referential expressions. However, whereas the scope of demonstratives, pronouns and possessives is limited to short distances exclusively, definite NPs and proper names can also be used at longer distances to antecedent.

3.2. Impact of other factors

Complexity: The definition of complex NPs that we used by annotation was: "a description consisting of more than one nominal phrases", e.g. *nach dem Fall von Masar-i-Scharif 'after the fall of Masar-i-Scharif'*. 847 out of 1010, that is, more than 80% of complex NPs are discourse-new in our data. Just 252 (25%) of complex NPs are antecedents themselves.

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[2] http://mmax.eml-research.de

Furthermore, we observed a trade-off between distance of antecedent and complexity of noun phrases as predicted by Ariel (2001). The frequency of complex NPs grows as the distance increases, whereas the frequency of non-complex NPs decreases.

Parallelism: The hypothesis of syntactic parallelism (e.g., Stevenson et al., 1995) suggests that syntactic positions of anaphors tend to correspond to that of their antecedents.

In our data, parallelism effects take place in 536 cases (of 3145). Among these, pronouns seem to be most sensitive to parallelism effects in subject position. Definite NPs are mostly affected by parallelism in the position of direct object. There are too few samples available to make any conclusions as to indirect objects. Parallelism effects in grammatical roles other than subject, direct and indirect objects occur by definite NPs most frequently.

These observations are supported by Low's analysis (Low, 1994), according to which the parallelism effects play a significant role by the use of definite NPs, whereas Centering Theory predictions (Grosz et al., 1995) that subjects are more likely to be antecedents of definite NPs fail. Our data, though, points at a strong effect of subject role for pronouns, that may be considered as supplementary to parallelism of anaphor and antecedent in this position.

3.3. Types of pronouns and distance

Singular nominative pronouns are more frequent with the increase of both rhetorical and referential distance. The same is, in fact, true for *all* nominative pronouns and, moreover, all actant (non-possessive) pronouns. *Singular non-nominative* prounouns are rather infrequent as a whole; by RD=2 they disappear at all. *Plural non-nominative pronouns* are the least frequent referential devices of all; our data is too sparse to draw any conclusions. At the distance of 0, *singular possessive pronouns* are more frequent than other forms but their frequency decreases with RD=1. Plural possessive pronouns occur at RD=0 mainly; just one single case can be found at RD=1.

For overall tendencies, the following picture emerges. With the growth of distance, the number of possessive pronouns decreases dramatically, whereas that of non-possessives grows. Actant pronouns tend to be more frequent as the distance grows from 0 to 2, whereas the frequencies of non-actant pronouns show the opposite pattern. The overall distributions of singular and plural pronouns do not show any significant differences.

All devices show a clear preference for the position of the same sentence with their antecedent (RD=0). However, the portion of possessives in this position is the greatest, among which plural possessives seem to almost exclusively prefer this position. The distance of 1 is less preferred by all forms. As the distance increases to 2 and more, all pronouns disappear.

For possessives, preferences at RD=0 are almost the mirror image to that of RD=1. *Plural possessives* tend to prefer the shortest distances, whereas plural actant and non-actant pronouns do not reveal any substantial differences from singular.

3.4. Comparison to the English data

In this section, we compare the influence of the distance on different types of pronouns. Since the German data for longer distances (≥2) is too sparse, we will confine the comparison to short distances (0 and 1) only.
For English data, numerous differences between the considered types of pronouns are observed. Moreover, preferences at RD=0 and RD=1 are a mirror image:

RD=0 Poss > Acc > Pl > Sg, Nom, Act
RD=1 Nom, Act, Sg > Pl > Acc > Poss

For German, only possessive pronouns show a clearly different behavior from other pronominal forms. Unlike English, no differences between the latter are observed.

Further, we suggested that prototypical and peripheral types of pronouns should be distinguished. Focusing on the question of what exactly has to be considered as prototypical and what has to be considered as peripheral, there are two possibilities, Ia and Ib, cf. Table 2.

	prototypical	*peripheral*
Ia Act vs. Poss	Nom&Acc	Poss
Ib Act vs. Non-Act	Nom/Sg/Act	Non-nom/ Pl/Poss

Table 2. Alternative formulations of prototypical and peripheral pronouns

Interestingly, English data support Ib, which is more fine-grained, whereas German results distinguish only between possessives and non-possessives.

It is natural to consider those forms which are more frequent to be prototypical. In English, it is clearly the classes 1) of singular and of nominative pronouns (vs. plural and possessive); 2) of actant (vs. non-actant) pronouns. In German, actant pronouns have absolutely leading frequencies.

The higher frequency of pronouns in nominative is not unexpected, since it corresponds to the grammatical role of subject, the least marked one, and, according to the iconicity principle between markedness, phonological complexity and frequency, the most salient one (cf. Givon, 1995). Both possessive and nominative pronouns prefer short distances to their antecedents and code most accessible/salient referents. However, if possessive pronouns are no different from nominative pronouns, the former should be at least as frequent as the latter. As our data show, this is not the case.

Accusative pronouns are almost as restrictive and infrequent in English as possessives; in German, non-nominative are used more freely, although rather infrequently.

In contrast to other personal pronouns, possessives are almost completely determined by a strong locality constraint: a possessive pronoun is used to establish reference to the most salient entity in the same sentence. If a referent is the most salient entity in another sentence or discourse unit, a full possessive NP is to be expected. In other words, possessive NPs refer to the locally most salient entity.

4. Case study 2

In this study, we consider several complex factors connected with internal properties of a referent, and topological properties, discourse function and discourse structure: animacy and the effect of "first mention", thematic prominence of a referent and structural constraints.

Animacy has been claimed to be an important factor of referential choice, an indicator of discourse salience (Poesio and Nissim 2001) or a factor compensating the decrease of activation. To investigate this factor, we used NEGRA corpus (Skut et al. 1997). In contrast to PCC, NEGRA was partly annotated for animacy. Coreference annotation was carried out in accordance with another scheme and by other people than the one used in the Case Study 1.
According to our data, pronouns correlate strongly with animacy, see Table 3.

	Animate	Inanimate	Total
`Full NPs`	532 (24.25%)	1662 (75.75%)	2194
Proper names	1205 (53.37%)	1053 (46.63%)	2258
Demonstratives	21 (53.50%)	19 (47.50%)	40
Actant pronouns	1145 (90.37%)	122 (9.63%)	1267
Possessives	663 (81.65%)	149 (18.35%)	812

Table 3. Animacy of different NP types (NEGRA)

Consider distribution of animate and inanimate referents and distances to their antecedents (Table 4). Pronouns with inanimate referents were almost equally frequent as pronouns with animate antecedents by the distance of 0. With increase of distance, frequencies of actant pronouns with animate antecedents are higher than that with inanimate antecedents. This result is a clear evidence of a compensating effect of animacy: animacy compensates the decrease of activation caused by increase of distance.

Distance	Animate		Inanimate	
0	227	18.89%	205	20.46%
1	589	49.00%	596	59.48%
2	252	20.97%	159	15.87%
≥3	134	11.15%	42	4.19%
Total	1202	100.00%	1002	100.00%

Table 4. Distribution of pronouns (personal, demonstrative and possessive) depending on distance to antecedent (in clauses) in NEGRA

Position in a sentence

There is evidence that a referent mentioned in the beginning of a clause is more accessible in mental representa-

tion. This effect was accounted for as *advantage of first mention,* see Gernsbacher (1991). On the other hand, well-known is the effect of recency: a referent mentioned more recently than another one is more accessible. Both assumptions seem to be cognitively plausible, on the other hand, it is not clear how these two preferences relate to each other. We tested this by verifying the occurrences of pronouns as markers of high accessibility in dependence of two parameters: distance to their antecedents and their relative position in a clause.

The average sentence length in the corpus was 16 words. To define a relative position we tested different thresholds. Threshold values varied between 0 and 1, where 0 corresponded to the left boundary of a clause, and 1 corresponded to the right boundary. Everything below the threshold was considered as beginning of a sentence, everything higher than the threshold was the end by convention.

Consider the results corresponding to the threshold 0.3[3]. Further, pronouns used by distance of 1 and smaller will be denoted as proximal pronouns, and those used by distance higher than 1 will be labelled as distant pronouns.

Distance / Position	Distant pronouns	Proximal pronouns	Total
Beginning	2.83%	18.52%	21.35%
End	7.17%	38.59%	45.76%
Total	10.00%	57.12%	100%

Table 5. Relative position and distance to antecedent by actant pronouns in NEGRA

Pronouns by both small and larger distances correlate with the end position in a clause, 7.17% and 38.59% correspondingly. For the comparison purposes, we carried out the same analysis on the other German corpus, PCC (Table 6), and the English corpus, RST Discourse Treebank (see Table 7). It turned out that in PCC the same tendencies were observed, with pronoun antecedents preferring the end position in clause no matter the distance. However, in the English data antecedents of distant pronouns appeared to be more frequent in the beginning of a clause (24.48%). On the contrary, antecedents of proximal pronouns were more frequent at the end of a clause (27.66%).

Distance / Position	Distant pronouns	Proximal pronouns	Total
Beginning	2.83%	18.52%	21.35%
End	7.17%	38.59%	45.76%
Total	10.00%	57.12%	100%

Table 6. Relative position and distance to antecedent by actant pronouns in PCC

Distance / Position	Distant pronouns	Proximal pronouns	Total
Beginning	1,39%	28,57%	29,96%
End	5,48%	34,36%	39,84%
Total	6,87%	62,93%	100%

Table 7. Relative position and distance to antecedent by actant pronouns in the RST Discourse Treebank

We suggest the following interpretation of these results:

1) According to the English data, the effect of first mention and recency criterion interact. More exactly, they compensate each other as animacy compensated the increase of distance, see above.

2) In German, no interaction of this kind was observed. This can be explained in accordance with argumentation of the Prague School postulating existence of a focal domain in clause (Hajicova and Vrbova, Hajicova et al. 1990). Discourse-

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[3] Absolute beginning of a sentence (threshold of 0) was not considered because sentences often begin other forms than nominal ones (e.g. adverbs).

new referents within these focal domains are promoted to most salient ones. Apparently, for German this focal domain is located at the end of a clause. For similar tendencies in Dutch, see Navaretta 2002.

Thematic importance, also known as topicality, relevance, persistence are all discourse-level features which keep or make a referent more prominent and more activated[4]. More topical referents demand less explicit means for their encoding (Chafe 1976; Givón 1983; Van Dijk and Kintsch 1983). There are two basic formal criteria of measuring topicality: in number of referent mentions in a whole text (cf. Crawley 1986), or in the rest of the text after a referent was mentioned (cf. Givón 1983). The latter heuristic is a well-known notion of topical persistence computed in a number of subsequent referent mentions within 20 clauses after its current mention. This was the method we applied in this study.

We distinguished between cases in which a referent was mentioned at least one in subsequent discourse and cases in which a referent was not mentioned anymore. As a result, it turned out that proper names have the highest persistence, followed by definite NPs. Personal pronouns and demonstrative pronouns show the same persistence of about 50%. So, pronominal forms are the least dependent on persistence factor. Similar to animacy, this factor has a compensating effect when activation decreases for some reason (like distance, see above). At the distance of 0, the median value of topic persistence is 0, see Table 8.

Distance \ Form	Full NP	Pronoun	Proper name
0	0	0	1
1	0	1	1
2	0	1	1
3	0	1	0
4	1	–	0
>4	0	–	0

Table 8. Topical persistence (median) in dependence on distance values in PCC

As the distance increases, this median value increases to 1 for pronouns. Full NPs have a median of 0 irrespective of distance, except for the distance of 4. This can be an artefact, on the one hand, but on the other hand, may be evidence of compensating effects for full NPs as well.

Referential and rhetorical distance were introduced in 2.2 as measures of recency of mention and, consequently, of activation. In Chiarcos and Krasavina (2005) it was assumed that rhetorical and referential distance have a certain division of labor: rhetorical distance is a more effective measurement in global contexts, whereas simple referential distance is more effective in local ones. Thus, rhetorical closeness compensates the increase of a gap between a pronoun and its antecedent in a linear structure of discourse. However, these results were extracted from a very small data sample. Now we verified these hypothesis on somewhat extended data.

	Full NP	Proper name	Demonstrative	Actant pronoun	Possessive
Mean rhetorical distance	5.68074	16.81882	83.15972	9.815574	21.38393
Mean referential distance	1.366224	1.808989	0.472222	0.118033	0.192857
Covariation	25.70174	-0.70716	-49.5689	-4.3273	-0.30318

Table 9. Interaction of referential and rhetorical distance (PCC)

	Full NP	Proper name	Demonstrative	Actant pronoun	Possessive
Mean rhetorical distance	18.41032	19.97267	687.4803	12.92	26.22917
Mean referential distance	4.007752	4.886086	2.157895	0.374876	0.279116
Covariation	100.5039	114.6138	-363.587	-1.64826	-8.85577

Table 10. Interaction of referential and rhetorical distance (RST Discourse Treebank)

For evaluation we used a covariation statistics. That is if its value is negative, then the assumed compensating effect takes place.

In the PCC corpus, the compensating effect was found by all pronominal forms, by demonstratives most evidently, whereas for definite NPs and proper names there were no such effect (see Table 9). For comparison we carried out the

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[4] The discussion as to differences of these terms in literature are out of the scope.

same evaluation on the English corpus (see Table 10). The results were similar, with a difference concerning proper names (they received a minimal negative value of covariation) and possessives with a relative small covariation value. These findings proved the expectation.

5. Conclusive remarks

In this paper we focused on the use of personal pronouns as a part of referential choice domain. In the beginning of this paper, we suggested that the class of personal pronouns is heterogeneous. Our results provided first empirical verification of this claim: different types of pronouns proved to be sensitive to distance.

Besides distance, there are other factors which have to be regarded. Though this has been noticed before (e.g. Ariel, 1990, Chapter 9), most models apply complex systemsof interacting factors with sophisticated preference rules, which might be considered as an extremely costly and a hardly feasible procedure, cf. Kehler (2002). Rather, it is more intuitive and empirically valid to assume a number of independent co-existing strategies, which are switched on and off under certain contextual conditions, as proposed in Section 2. Salience-based factors should be neatly separated from others which are not salience-based.

As to the impact of factors additional to distance, the following tendencies were observed. Though topicality and animacy affect prominalization, these are not independent factors, but rather co-operating with distance. Syntactic parallelism is a supporting factor, which is, combined with a subject position, increases the chance of a pronoun to be used. Parallelism by definite NPs is an additional, not necessarily salience-based factor. For references with full NPs, topical persistence is irrelevant, which is different for pronouns. If activation level of their referents is affected by increasing distance, the overall prominence of a referent is important for coreference establishment. A significant effect on the compensating effect between rhetorical and referential distance was found. These results are consistent with Chiarcos and Krasavina (2005).

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