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RESEARCH

When *you* isn't you: The attraction of self-ascription in children's interpretation of pronouns in reported speech

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In language comprehension, *you* is a *de se* pronoun, which means that its interpretation is guided by a simple *de se* rule (*you* = self-ascription by addressee), while the interpretation of other pronouns requires more complicated reasoning. This predicts that *you* should be easier to process than *I* or *he*, especially for children. But not all occurrences of *you* can be correctly interpreted via self-ascription. We consider two cases where *you* does not indicate self-ascription: interpretation as an eavesdropper and direct speech. In our experiment, we compare children's interpretation of the pronouns *I*, *you* and *he*, in both direct and indirect reported speech, and in both addressee and eavesdropping situations. We tested 71 five-year-olds, 63 nine-year-olds, and 52 adults in a referent-selection task and found a clear *de se* effect for children when directly addressed: they performed better with *you* than with *I/he* in indirect speech, but worse with *you* than with *I/he* in direct speech. We explain the latter finding in terms of the attraction of the *de se* interpretation strategy, which leads addressees to automatically self-ascribe *you* even in a direct speech report.

Keywords: *de se*; second person; pronoun interpretation; child language; direct and indirect reported speech

1 Introduction: *I* and *you* as *de se* pronouns

When we refer to ourselves we are usually aware that we are doing so. But, as philosophers like to point out, this is not always the case. Consider for instance the classic example of John Perry going around in circles following a trail of sugar down the aisle of the supermarket, hoping to find the messy shopper (Perry 1979). When asked what he thinks he is doing, he says, *I'm trying to chase down this guy who is walking around with a torn sack of sugar. He is making a mess*. In fact, Perry himself is the one with the torn sack, so when he is talking about catching the messy shopper, he is actually referring to himself without realizing it. Note that at this point Perry is using a third-person form (cf. (1a)) rather than a first-person pronoun (cf. (1b)) to refer to himself.

- (1) a. He is making a mess.
b. I am making a mess.

After going around the aisle a few times it suddenly dawns on Perry that he himself is the one with the torn sack of sugar. Only then will he be in a position to sincerely assert (1b). Now, semantically speaking, both the third-person assertion (1a) and the first-person

version (1b) express the same (singular) proposition, viz. that John Perry is making a mess. However, the use of the first-person pronoun encodes a special, first-person perspective on the thought expressed (Lewis 1979; Perry 1979; Kaplan 1989). The special status of the pronoun *I* as unambiguously expressing first personal, or *de se*, thoughts is sometimes referred to by saying that *I* is a *de se* pronoun.

A potential source of confusion in the linguistic literature on the *de se* comes from the fact that semanticists like Schlenker (2003) and Anand (2006) typically use the term *de se* as a property of indirect attitude reports, rather than as a property of thoughts or simple, unembedded statements. The reportative notion of *de se* is defined in terms of the current notion of *de se* attitudes: an attitude report of the form *x believes that p* is a *de se* report if it ascribes a *de se* thought to *x*. This seems to lead to a different notion of a *de se* pronoun, viz. a pronominal element that forces a report to be read *de se* putative list of reportative *de se* pronouns includes PRO (as in *John hopes PRO to win*; cf. Chierchia 1989), West-African logophors and long-distance reflexives (cf. Pearson 2012 for overview and discussion). The English first-person pronoun, by contrast, is not a *de se* pronoun in the reportative sense because *Perry thought that I was making a mess* cannot be used to ascribe a *de se* attitude to Perry.¹

Our excursus to *de se* reporting highlights the fact that *de se* is a relative notion. *I* is a *de se* pronoun relative to the current speaker, while PRO is a *de se* pronoun relative to its controller, i.e., the subject (or object) of the superordinate matrix clause. What is less often discussed in the literature is that *you* is also a *de se* pronoun, but relative to the current addressee. To see this, imagine another shopper who sees pre-realization Perry chasing himself, stops him, and says:

(2) You are making a mess.

Correctly interpreting this remark will result in Perry forming a *de se* belief, i.e., realizing that it is he himself that is making the mess and that he has been chasing himself. In this paper we focus on this neglected *de se* pronoun *you*.

In sum, just as *I* is a *de se* pronoun for the speaker (i.e., it unambiguously expresses that the speaker has a *de se* attitude), *you* is a *de se* pronoun for the addressee (i.e., its correct interpretation triggers a *de se* attitude in the addressee). In the next section, we sketch how Wechsler (2010) turns this idea into a theory of the production and comprehension of pronouns. In the remainder of the paper we then put this theory to the test.

We close this section with a quick note on terminology. Following Lewis (1979) and Chierchia (1989), having a *de se* thought is typically analyzed in terms of the self-ascription of a property, rather than as an attitude towards a classical proposition. Thus, Perry's first-person utterance in (1b) above indicates that he self-ascribes the property of making a mess, while the other shopper's second-person utterance in (2) triggers a self-ascription of that same property by Perry. Other pronouns do not unambiguously express self-ascription in this way. With the third-person utterance in (1a), for instance, Perry simply expresses that he believes the proposition that this other person is making a mess. Below we will use the terms *de se* attitude and self-ascription interchangeably.

¹ Arguably, even with a first-person matrix subject, such a report can have a non-*de-se* reading (in the Schlenker/Anand sense). For instance, after realizing his mistake, Perry might report his utterance of *He is making a mess as well, as it turns out, I actually did say (about myself) that I was making mess, but at the time I didn't realize it was me* (cf. Maier 2009).

2 The *de se* theory of pronouns

2.1 Production vs. comprehension

Looking at semantics from a communication-theoretic perspective, i.e., as coordinating the attitudes of speaker and hearer, *you* and *I* are each other's mirror image. As Kamp (1990) puts it:

[...] the person who uses 'I' uses it to express self-attribution. But what an utterance containing 'I' conveys to the hearer is not a self-attribution; rather, it is an attribution to some external individual [...]. There is an intimate connection between the meaning of 'I' and the special access that we have to ourselves, but this connection is restricted to the context of language production. [...] With 'you' the story is much the same, only reversed. 'You' also bears a special relationship to *i* [= the self]. But here it is the construction [= comprehension] rule, and not the verbalization [= production] rule that must exploit the special relation to the self. (Kamp 1990: 69)

More recently, Wechsler (2010) in an influential paper revives this philosophical idea about the production–comprehension asymmetry with respect to *de se* interpretation. His aim is to turn this insight into a communication-theoretic semantics of personal pronouns. In a nutshell, Wechsler's model works as follows. Given a communicative act between a speaker and a hearer, *I* is a *de se* pronoun for the speaker (i.e., its occurrence means the speaker self-ascribes a property); *you* is a *de se* pronoun for the addressee; and for all other combinations of person value and speech-act role the pronoun's reference is determined indirectly, through reasoning about the other speech-act participant's attitudes.

For example, take Mary's utterance of *I'm a genius*. The meaning rule that captures the production of the first-person pronoun is simply that *I* means self-ascription of the speaker. There is no similar rule for the hearer to interpret Mary's utterance of *I*. Hence the hearer will have to derive the meaning of *I* based on the production rule used by the speaker. We can informally represent the hearer's reasoning as follows: I hear Mary produce *I*, so she must have used the production rule for *I*, i.e., *I* means speaker's self-ascription. It follows that Mary herself expressed a *de se* attitude, so *I* refers to Mary. For *you* the situation is reversed. There is a direct *de se* rule capturing the addressee's comprehension of *you*: *you* means self-ascription by the addressee. To correctly produce *you*, the speaker must reason as follows: I want to tell (or ask) Mary something about herself, i.e., I want her to self-ascribe some property. There is no simple rule in the production grammar that allows me to do that, but let's consider it from the addressee's point of view: in her comprehension grammar there is a rule that directly associates self-ascription with *you*. Consequently, to achieve her self-ascription, I must use *you*. We refer to Wechsler's paper for a more precise formalization.²

Summing up, Wechsler captures the semantics of pronouns in communication with the following two *de se* rules:

- (3)
 - a. *de se* production rule: to express a self-ascription, use *I*.
 - b. *de se* comprehension rule: to interpret *you*, self-ascribe the predicate.

Other configurations, such as the production of *you* and the comprehension of *I* are reducible to these rules plus some added perspectival reasoning, as sketched above. Extrapolating

² Roughly, Wechsler proposes a non-representational variant of the communication-theoretic DRT model sketched by Kamp (1990), using Crimmins and Perry's (1989) *notions* instead of DRSs. Recent further developments of the original DRT model of *de se* communication include Kamp (2011) and Maier (2016).

Wechsler's theory to the third-person, note that the semantics of third-person pronouns is usually defined negatively, in terms of the semantics of first- and second-person (Lyons 1977). In both production and comprehension, *he* refers to the most salient (male) individual that is not the speaker or addressee, so it too requires extra reasoning on top of the simple rules in (3).

In the remainder of this paper we focus on the interpretation side of communication. We want to test an empirical prediction from Wechsler's *de se* theory, viz. that a dedicated self-ascription rule makes *you* easier to interpret than other pronouns. This contrasts with more traditional views on the semantics of pronouns. According to Kaplan (1989), for instance, *I*, *you* and (deictic) *he* are all indexicals, getting their referents from the context of utterance ($[[I]]^c$ = the speaker of *c*; $[[you]]^c$ = the addressee of *c*; $[[he]]^c$ = the most salient, male non-speaker/non-addressee in *c*). In particular, based on such a semantics we would not expect a *de se* bonus for the interpretation of *you*.³ In the remainder of this section, we discuss some already existing evidence for Wechsler's *de se* theory, before introducing our own experimental design and hypotheses in Section 3.

2.2 Empirical support for self-ascriptive *you*

Wechsler discusses a number of predictions of his model. In addition to some typological and semantic facts about plural pronouns, he claims that it correctly predicts previously observed patterns of first- and second-person pronoun acquisition. The crucial link to acquisition is the idea that computing the non-*de-se* values of *I* and *you* requires reasoning about what interpretive rules the other speech-act participants may have applied or could apply and that that requires Theory of Mind (ToM) abilities. On this assumption, Wechsler's system predicts that populations with underdeveloped ToM abilities, such as young children and children with autism, will have difficulty with non-*de-se* pronouns – i.e., with the comprehension of *I* and the production of *you*.

This prediction seems to be borne out. First, children correctly produce *I* before they are able to correctly interpret others' use of *I*. And for *you*, we see the reverse pattern: comprehension of *you* is mastered before production (Charney 1980; Loveland 1984). Second, children with autism, who have impaired ToM abilities, are also known to have difficulties with pronouns, which suggests a link between ToM and pronoun interpretation (Baron-Cohen, Leslie, & Frith 1985; Lee, Hobson, & Chiat 1994; Tager-Flusberg 1994; Brehme 2014; Shield, Meier, & Tager-Flusberg 2015). New and more specific evidence for Wechsler's theory comes from a study by Markova & Smolík (2014). They found that children's production of second-person pronouns (but not first-person pronouns) is uniquely related to their use of mental state language. This supports Wechsler's claim that reference to others (but not to oneself) requires sophisticated reasoning about other people's minds.

Additional circumstantial evidence for the special, *de se* status of *you* in comprehension can be found in psycholinguistic studies. In the studies of Brunyé et al. (2009) and Sato and Bergen (2013), participants listened to statements such as *You are slicing the tomato* and had to verify whether a picture matches the described action. They found that with the second-person pronoun *you*, participants were quicker in verifying pictures where the slicing action was depicted from an internal, first-person perspective than from an external perspective. This suggests that people mentally simulate statements with second-person pronouns from their own perspective. Moreover, when directly addressed as protagonist in a narrative, participants had a better spatial representation of the

³ If anything, in Kaplan's semantics, *I* might be predicted to be the easiest pronoun, as it gets its referent directly from one of the core context parameters.

scenes, a better memory of the actions, and they showed more emotional responses and a higher identification with the characters (Ditman et al. 2010; Brunyé et al. 2011; Andeweg et al. 2013).

3 When you is not you

Wechsler's explanation of the comprehension data above would be that *you* is easy to process because of the direct self-ascription rule. But the correct interpretation of *you* does not *always* involve self-ascription. Some occurrences of *you* arguably require a more complicated reasoning on the part of the hearer, putting them in the same camp as other non-*de-se* pronouns. To properly distinguish Wechsler's *de-se*-based explanation from potential competing explanations of the ease of second-person pronoun processing, we should not just compare *you* with *I* and *he*, but also compare *de-se you* with non-*de-se you*. This is the aim of our experiment.

In this section we discuss two environments in which *you* denotes someone other than the addressee himself: overheard speech and direct quotation. In these contexts, simply applying the *de se* interpretation rule for *you* would give the wrong interpretation.⁴

3.1 Overheard conversations

When Sue says to Mary, *You're a genius*, Mary is expected to self-ascribe being a genius. But John, who overhears this exchange as a third person will interpret it quite differently – he does not self-ascribe the property of being a genius, but instead forms the *de re* belief about Mary that she is a genius. In other words, while Mary applies the direct *de se* interpretation rule, John has to figure out the correct referent of Sue's *you* in much the same way as he would for a first- or a third-person pronoun (he could for instance reason as follows: I see that Mary is addressed with *you* so she can apply the *de se* rule to self-ascribe the predicate, which means the pronoun refers to her). It follows that, on Wechsler's *de se* theory, *you* is not always easy to process.

In sum, while addressees can rely directly on the *de se* interpretation rule for *you*, overhearers need to derive the correct interpretation of all pronouns indirectly. In our experiment we compared the interpretation of first-, second- and third-person pronouns by addressees and by overhearers.

3.2 Direct vs. indirect speech

There are two ways to report what someone said. In indirect reported speech, the reporter paraphrases the content of an original utterance in her own words, adjusting indexicals and other context-dependent elements if necessary. For example, consider the following situation – featuring the three animals we will be using in our child-friendly experimental stimuli. Dog tells Monkey, *He gets the football*, referring to Elephant. Monkey then goes to Elephant and reports:

(4) Dog said that you get the football.

From a production perspective, we see that the original utterance's *he* is changed to *you* in the report complement. From an interpretation perspective this adjustment means that

⁴ A third candidate for a non-*de-se you* in English is the generic or impersonal usage of *you* as in “You only live once”. We return to generic *you* briefly in the discussion section below. Note that in our Dutch experimental materials we avoid this issue by using the strong pronoun *jij*, which can only be used as a second-person singular, rather than the weak form *je*, which has a number of different uses, including a generic, a plural possessive, and even a first person use (*Je kreeg de bal van Huntelaar en toen schoot je op het doel* ‘I got the ball from Huntelaar and then I shot on the goal’; Zeijlstra 2015). Interestingly, according to Zeijlstra's analysis of speaker-referring *je*, the *de se* nature survives in the implicature that the addressee would have done the same.

pronouns and other indexicals in an indirect speech complement are interpreted as usual. In particular, the *you* in (4) triggers its customary *de se* interpretation. The hearer will self-ascribe the property λx . Dog said that x the football (i.e., roughly, 'getting the football according to Dog').

In quoted direct speech the reporter reports the words more or less verbatim. Pronouns and indexicals are not adjusted to fit the reporting context but instead are just copied from the original speech act. Consider a different situation with our three animals. Say, Monkey tells Dog, *You get the car*. Dog can report this to Elephant with the direct speech report (5):

(5) Monkey said, "You get the car".

Direct speech production is essentially reproduction, but now interpretation is more complicated. To correctly interpret a direct speech report like (5), the hearer needs to perform a perspective shift, from the current reporting context (Dog addressing Elephant), to the original utterance's context (Monkey addressing Dog). This perspective shift makes pronoun interpretation in direct speech more demanding than in indirect speech for both adults and children, as evident from a higher error rate and longer reaction times (Köder, Maier & Hendriks 2015; Köder & Maier 2016). Crucially, the directly quoted *you* in (5) cannot be interpreted directly via self-ascription by the addressee, Elephant, as that would lead to Elephant incorrectly self-ascribing getting the car. Rather, the listener has to reason as follows: quotation induces a perspective shift, so the frame of reference needs to be shifted to the reported speech context, i.e., Monkey addressing Dog with the quoted utterance. That utterance contains a second-person pronoun and is addressed to Dog, so, by the *de se* rule, it means that Dog should self-ascribe getting the car, i.e., the correctly shifted referent of *you* is Dog.

The perspective shift of direct speech reports thus blocks the application of the simple *de se* rule for *you* and instead introduces more complicated indirect reasoning for interpreting *you*, as for *I* and *he*. In our experiment we will compare the interpretation of pronouns in direct and indirect speech reports, predicting that the ease of a *de se* interpretation only affects the interpretation of *you* in indirect reports.

Since we will be looking at children's interpretation, it is important to make sure that the direct-indirect distinction is clearly marked in our experimental stimuli. In spoken English, without recourse to written quotation marks, an utterance of *Elephant said you get the car* is ambiguous between a direct and an indirect reading. To disambiguate, we imbued our stimuli with the known, presumably universal, prosodic cues for direct speech: (i) a pause between the reporting clause and the quote (Jansen, Gregory & Brenier 2001); and (ii) a clear change of voice, mimicking the original speaker's characteristic voice in the report clause (Wade & Clark 1993; Klewitz & Couper-Kuhlen 1999). In addition, we chose for our experiment a language with a very clear syntactic marking of the direct-indirect distinction: Dutch. In Dutch, the minimal pairs used as stimuli are of the following form:

- (6) a. Aap zei, "Jij krijgt de auto".
 monkey say.PST you get.PRES the car
 'Monkey said, "You get the car".'
 b. Aap zei dat jij de auto krijgt.
 monkey say.PST that you the car get.PRES
 'Monkey said that you get the car.'

What we see here is that indirect speech in Dutch is marked syntactically with the obligatorily overt complementizer *dat* 'that', and the, likewise obligatory, adjustment from verb-second to verb-final word-order.

3.3 Hypotheses

Concretely, our research question is as follows: What is the effect of the two manipulations described in 3.1 and 3.2 on children's (as compared to adults') interpretation of *you* (as compared to *I* and *he*)? Based on a traditional, straightforward analysis of pronouns as simply picking out the speech act participant corresponding to the phi-features, we do not expect that these manipulations affect *you* differently than they affect *I* and *he*. Based on Wechsler's *de se* theory of pronouns, we do expect an effect specifically for *you*, viz. that self-ascriptive *you* is easier to process than non-self-ascriptive *you* (e.g., quoted or overheard *you*). To test these predictions, we created a referent selection task where participants either overheard or participated in a communicative situation involving direct and indirect speech stimuli with the pronouns *I*, *you*, and *he/she* (e.g. *Monkey said that you get the ball*, or *Dog said, "I get the car"*). The participants' task was to determine the correct referent of the pronoun.

We derive the following three concrete hypotheses from the *de se* theory: (i) when directly addressed, without quotation, children will perform better with *you* than with other pronouns, because they can use the simple *de se* interpretation rule, rather than going through the more complicated reasoning involved in finding the referents of other pronouns; (ii) when children overhear a report, this *de se* bonus for the second-person pronoun should disappear, since in overhearing speech the *de se* rule does not apply (or rather, does not suffice to determine the referent); and (iii) when interpreting a direct speech report, the *de se* bonus for *you* should likewise disappear, for the same reason.

4 Method

4.1 Participants

The participants were 134 children between the ages of 4;5 and 10;5 and 52 adults (see Table 1), all native speakers of Dutch. We divided the children into younger and older children and will for convenience refer to these groups as the "five-year-olds" and the "nine-year-olds", based on the mean age. Children were recruited from elementary schools in the North of the Netherlands and received a small reward (a sticker for five-year-olds, a pen for nine-year-olds) for participating. Written parental consent was obtained prior to the experiment. The participants in the adult control group were mainly students from the University of Groningen.

Each participant took part in one experimental condition where she was either the addressee (addressee condition) or she overheard speech reports (overhearing condition). Note that the data of the overhearing condition is discussed as part of a larger population in Köder and Maier (2016). In the following, we will explain in detail how these two modes of participation differ.

Age group	Participation mode	Number	Mean age	Range	Gender (f/m)
5-year-olds	Addressee	34	5;3	4;5–6;0	16/18
	Overhearing	37	5;3	4;5–6;0	20/17
9-year-olds	Addressee	38	9;0	8;4–10;2	20/18
	Overhearing	25	9;7	8;3–10;5	10/15
adults	Addressee	19	23	19–38	15/4
	Overhearing	33	22	18–32	21/12

Table 1: Participants.

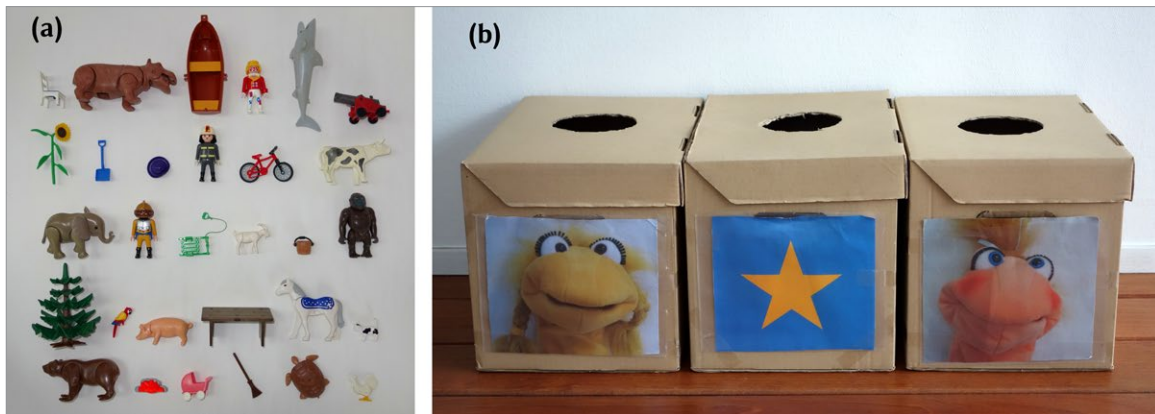


Figure 1: Test materials used in the addressee (a) Objects; (b) Boxes (female participants).

4.2 Stimuli and procedure

Addressee condition. In the addressee condition, participants interacted with two gender-matched hand puppets. Female participants interacted with the female puppets Mimi and Lola, male participants with the male puppets Bobo and Rudi. The experiment is set up as a game in which the participant needs to determine who gets a certain toy object (e.g., a cow or a table, see Figure 1a). The rules of the game are that puppet Lola decides who gets which object. However, Lola and the participant are not allowed to communicate directly with each other. This is why Lola whispers – unintelligibly for the participant – into Mimi’s ear who gets a certain object. Subsequently, Mimi picks up the object and transmits the message to the participant using either a direct (7) or indirect (8) speech report.

- (7) Lola zei, “Ik krijg de koe”.
‘Lola said, “I get the cow”.’
- (8) Lola zei dat jij de tafel krijgt.
‘Lola said that you get the table.’

The participant has to put the object into the correct box: either her own box (marked with a yellow star) or that of Mimi or Lola (see Figure 1b). In order to identify who gets a particular object, participants need to interpret pronouns in direct and indirect speech reports.

Overhearing condition. In the overhearing condition, participants observed the interaction of three animals on a tablet. In short animated scenes, Elephant, for instance, whispers in Monkey’s ear who gets a certain object (Figure 2a) and Monkey subsequently reports it to Dog with a direct or indirect speech report (Figure 2b). The participants could select the recipient of the object, i.e., the referent of the pronoun, by touching one of the highlighted animals (Figure 2c). Note that in this tablet setting, as opposed to the puppet interaction, participants themselves are not available as referents for the pronouns. The stimuli in the overhearing condition are described in more detail in Köder and Maier (2016).

Stimuli. In both conditions, participants listened to 30 speech reports: 15 direct and 15 indirect reports, presented in random order. The Dutch direct and indirect speech stimuli are clearly distinct in syntactic (verb-second vs. verb-final word order), lexical (absence vs. presence of complementizer) and prosodic respects (in direct speech: pause before quotation and change of voice in quotation). Each speech report contains either the singular pronoun *ik* ‘I’, *jij* ‘you’ or *hij/zij* ‘he/she’. In the addressee condition, the test sentences

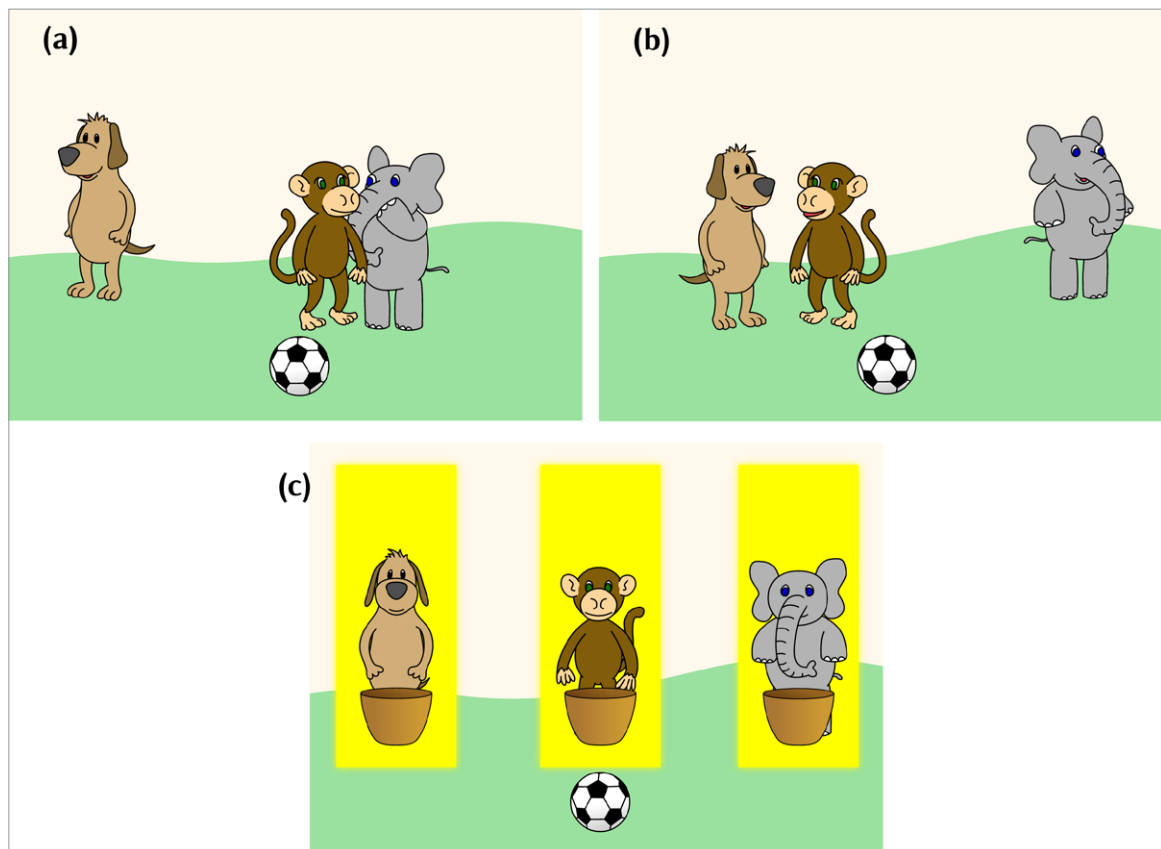


Figure 2: Example of a test item in the overhearing (a) Incomprehensible whispering (reported speech context); (b) Uttering of a speech report (e.g., *Elephant said that I get the football*) (reporting speech context); (c) Selection phase.

contained the feminine pronoun *zij* ‘she’ for female participants and the masculine pronoun *hij* ‘he’ for male participants to ensure that the on the third-person pronoun does not serve as an additional cue for reference resolution. In the overhearing condition, all three animals were male and therefore only the masculine form of the third-person singular pronoun was used, regardless of the gender of the participant.

Crucially, the second-person pronoun *you* only refers to the participants themselves when they are addressees and *you* is embedded in an indirect speech report. Hence, only in addressed indirect speech do we expect the positive effect of the *de se* rule on the interpretation of *you*.

5 Results

To find out what factors explain participants’ accuracy of pronoun interpretation in speech reports, we created separate generalized linear mixed models for each age group. With a procedure of model comparison, we added stepwise the fixed-effect factors REPORT TYPE (direct, indirect), PRONOUN TYPE (first-person, second-person, third-person) and PARTICIPATION MODE (addressee, overhearing) as well as the interactions between these factors to the baseline models (including random intercepts and slopes per REPORT TYPE for subjects). A fixed-effect factor or an interaction was included in the model if it led to a decrease of the Akaike Information Criterion (AIC) of more than 2. Table 2 shows that the models for both the five- and nine-year-old children contain a three-way interaction between REPORT TYPE, PRONOUN TYPE and PARTICIPATION MODE. In contrast to children, adults’ accuracy model does not contain the factor PARTICIPATION MODE. This

	5-year-olds	9-year-olds	Adults
Random-effect factors (random intercepts and slopes per REPORT TYPE for subjects)			
+ REPORT TYPE	86.1	53.5	13.5
+ PRONOUN TYPE	13.5	151.9	41.5
+ REPORT TYPE * PRONOUN TYPE	153.5	83.5	6.5
+ PARTICIPATION MODE	1.1	6.0	-1.2
+ REPORT TYPE * PRONOUN TYPE * PARTICIPATION MODE	51.8	22.3	-0.5

Table 2: Akaike Information Criterion (AIC) decrease for the inclusion of fixed-effect factors and interactions to the models explaining accuracy of pronoun interpretation in different age groups. An AIC decrease of more than 2 indicates that the goodness of fit of the model improves significantly (Akaike 1974).

means that adults' performance did not differ significantly in the addressee and overhearing condition.

In order to learn more about the three-way interaction in five- and nine-year-old children's accuracy models, we compared the means of all combinations of REPORT TYPE, PRONOUN TYPE and PARTICIPATION MODE in these two age groups, using multiple comparisons from the "multcomp" package (Hothorn, Bretz, & Westfall 2008). The significant differences relevant for testing our predictions are marked in Figures 3 and 4.

Figure 3 shows five-year-olds' accuracy of pronoun interpretation in the addressee condition (left) and the overhearing condition (right). The multiple comparisons analysis reveals two main differences between children who assumed the communicative role of an addressee and children who overheard speech reports. First, consider the five-year-olds, contrasting their comprehension of direct and indirect speech. In direct speech reports, addressees outperformed overhearers in correctly interpreting pronouns *I* ($p < .001$) and *he/she* ($p < .001$), but not *you*. But in indirect speech reports, we found the opposite: overhearers outperformed addressees in interpreting *I* ($p < .01$) and *he/she* ($p < .1$), but

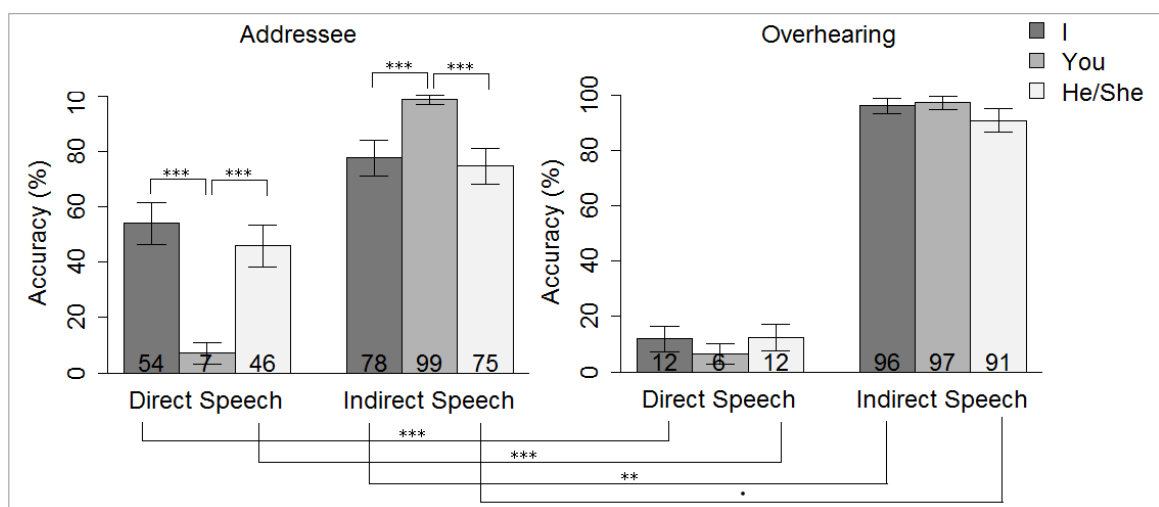


Figure 3: Percentage of correct pronoun interpretation of five-year-olds in addressee condition (left) and overhearing condition (right); relevant significant differences marked at different significance levels: * $p < .05$, $p < .01$, *** $p < .001$. Error bars indicate 95% confidence intervals.

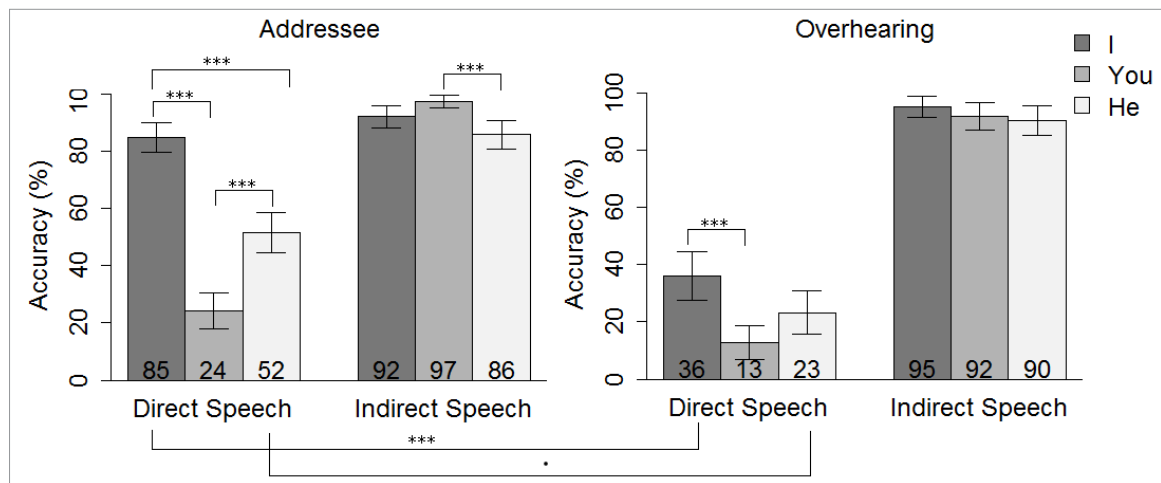


Figure 4: Percentage of correct pronoun interpretation of nine-year-olds in addressee condition (left) and overheard condition (right); relevant significant differences marked at different significance levels: * $p < .05$, $p < .01$, *** $p < .001$. Error bars indicate 95% confidence intervals.

not *you*. Second, the type of pronoun (first-, second-, third-person) in direct and indirect speech has only an effect on children in the addressee condition, but not in the overheard condition. In the addressee condition, there were two notable effects of second person: (i) in direct speech reports, children performed significantly worse with *you* than with *I* ($p < .001$) and *he/she* ($p < .001$); while (ii) in indirect speech reports they performed significantly better with *you* than with *I* ($p < .001$) and *he/she* ($p < .001$).

Let's now turn to the data of the nine-year-olds, which is presented in Figure 4. Similar to five-year-old children, addressees outperformed overhearers in the interpretation of direct speech reports with first-person ($p < .001$) and third-person ($p < .1$) pronouns, but not second-person pronouns. However, unlike the five-year-olds, nine-year-olds' indirect speech performance did not differ significantly between addressees and overhearers. Focusing on pronoun type, we find again effects of second person for children in the addressee condition: (i) in direct speech reports, children had the lowest accuracy for *you*, significantly lower than that of *I* ($p < .001$) and *he/she* ($p < .001$); while (ii) in indirect speech reports, they performed significantly better with *you* than with *he/she* ($p < .001$). Note that children in the overheard condition were also significantly better in interpreting *I* than *you* in direct speech reports ($p < .001$).

6 Discussion

Before we get into the *de se* effect, first some general observations about the effects of report type and participation mode, respectively.

As for report type, we find that quoted direct speech reports are harder to interpret than indirect speech reports. As discussed elsewhere, this is due to the processing effort associated with perspective shifting (Köder et al. 2015).

As for participation mode, we see that those children who were directly addressed were significantly better in direct speech interpretation than those who only overheard speech. We suggest that this result could be due to two, not mutually exclusive, factors. First, as previous studies show, interpreting deictic expressions is easier for children when they are addressees rather than overhearers (Charney 1980; Murphy 1986). This advantage of the addressee's perspective might also be in play when deictic pronouns are embedded in direct speech reports. Second, the better direct speech performance in the addressee

condition could also be due to the more naturalistic scenario, involving real objects and puppets instead of animations presented on a tablet. In particular, the bodily presence of the reported speaker could serve as a physical anchor in the situation and make the reported speaker a more salient deictic orientation point. This might make it easier for the listener to shift to the reported speaker's perspective, which is required for the interpretation of direct speech reports.

Interestingly, being an addressee had negative consequences for five-year-old children's indirect speech performance. To explain this finding, it is important to know that in the overhearing condition (reported in more detail in Köder and Maier 2016) children exhibit a strong bias to evaluate pronouns with respect to the actual reporting context, even if pronouns are embedded in a direct speech report. The finding that children's accuracy of direct speech interpretation improves when children are addressees suggests that they consider the reported speaker's context as possible context of evaluation. However, a potential side effect of the increased salience of the reported context is that it creates a competing context of evaluation when interpreting indirect speech reports. In younger children, with a presumably less rigid direct–indirect distinction in the grammar (Goodell & Sachs 1992; Hickmann 1993), this could lead to a drop in the accuracy for pronoun interpretation in indirect speech reports.

Against this background, let us now revisit the three hypotheses about the interpretation of *you* from Section 3.3.

Our first hypothesis was that there should be a *de se* effect for (unquoted) *you* when children are directly addressed. This is confirmed. In the data from the puppet game, we see a clear effect of the second person. *You* is the pronoun with the highest accuracy in indirect speech, as predicted. Five-year-old children made fewer mistakes for *you* than for *I* and *he/she*, nine-year-olds fewer for *you* than for *he/she*.

The second hypothesis was that this *de se* effect should disappear in the overhearing condition. This is also confirmed. We found no effect of second-person being easier (or harder) than first-person or third-person pronouns in the overhearing condition.⁵ This is as expected because children playing the tablet game are effectively eavesdropping on the communicative acts of the animals and hence could not rely solely on the *de se* interpretation rule to interpret *you*. Note however that a stronger prediction, that *you* in indirect speech reports should be easier for addressees than for overhearers, could not be confirmed. Looking at *you* in indirect speech, we did not detect a significant difference between the overhearing and the addressee condition. This is probably due to the fact that in the tablet task even the younger children are already at ceiling in pronoun interpretation in indirect speech reports.

Our third and final hypothesis was that the *de se* effect should likewise disappear in quoted direct speech. This prediction is not confirmed. In the puppet game there is a significant effect of second person in direct speech reports, but in the opposite direction: The interpretation of *you* appears to be harder than that of *I* or *he/she* in direct speech reports.

We did not anticipate this anti-*de-se* pattern for direct speech reports in advance, but it can be fully explained within the *de se* theory, viz., as an incorrect application of the *de se* rule. The idea is that in their role as addressees, children who hear *you* immediately apply the simple and hence attractive *de se* rule, before taking into account the more difficult

⁵ Note that nine-year-olds made significantly fewer mistakes with *I* than with *you* in direct speech reports. This can be explained by the fact that the referent of *I* in our direct speech stimuli (e.g., *Elephant said, "I get the football"*) is explicitly mentioned in the reporting clause, which makes it more salient and accessible for reference (cf. Köder et al. 2015).

perspective shifting induced by the linguistic direct speech embedding.⁶ In processing *you* in quoted direct speech, addressees thus start off with an incorrect *de se* interpretation, to which they should then apply a perspective shift to arrive at the correct interpretation. Now, unlike adults, children have difficulties with this second step. This is in line with previous research showing that children find it hard to revise their initial interpretation (Trueswell et al. 1999; Epley, Morewedge & Keysar 2004), and with our earlier observations about the heavy processing costs associated with perspective shifting in general and perspective shifting in direct speech in particular (Köder & Maier 2016). The fact that even nine-year-old children mostly fail to overrule the attraction of the *de se* rule for *you* suggests that *de se* interpretation is indeed a highly automatic mechanism.

In our study, we have investigated children's and adults' comprehension of pronouns in assertions. We speculate that the *de se* bias might be even stronger in the comprehension of speech acts such as imperatives or questions that are inherently more addressee-oriented. In production, however, the pragmatic addressee bias of these speech acts might lead to a preference for *you* over *de se I*. Support for this speculation comes from a study by Tanz (1980) that found that in the production of questions, children tend to overuse *you*. For instance, when told "ask John what color your eyes are", they asked John "What color are your eyes?" instead of "What color are my eyes?". Further research is necessary to investigate how speech act type (e.g., assertion, question, request) interacts with the comprehension and production of pronouns. Results from these types of studies could make an important contribution to the validation and refinement of the *de se* theory of pronouns.

7 Conclusion

In a communication-theoretic framework like that of Kamp (1990; 2011) or Wechsler (2010), *you* and *I* are said to be each other's mirror image: just as *I* is a *de se* pronoun for the speaker, *you* is a *de se* pronoun for the hearer. Hence, the interpretation of *you* is guided by a simple *de se* rule, while the other pronouns require more complicated reasoning. Such a theory makes interesting predictions about language processing. For instance, *you* should be easier to interpret than non-*de-se* pronouns, especially by children.

Previous research confirms that *you* has a special status in comprehension, but what is generally ignored is that not all occurrences of the second-person pronoun can be interpreted with the self-ascription rule. When *you* is embedded in a quotation, or when the interpreter is not directly addressed, the *de se* rule does not apply – or at least, it does not suffice to determine the referent – and the *de se* effect for second person should disappear.

Our experiment first of all confirms that the *de se* interpretation rule does indeed make interpretation of *you* by addressees easier. We found that, when directly addressed with an indirect speech report, children made fewer mistakes with *you* than with *I* or *he*. No such effect was found for children overhearing the stimuli as external observers playing a tablet game. So, children from age five can detect when they are directly addressed and will, correctly, only apply the *de se* rule in that case.

Turning now to quoted direct speech we found first of all that children have difficulties performing the required perspective shift, independently of any *de se* effect. Second, we found again an effect of the second person for addressees, but in the opposite direction: directly addressed children made more mistakes with quoted *you* than with quoted *I* and *he*.

⁶ This two-stage processing model for quoted *you* resembles de Hoop and Tarenskeen's (2015) suggestion about the processing of generic *you*: The addressee first interprets *you* as usual, via self-ascription, and only then does she take into account the linguistic context, which in their examples triggers a shift to a generic interpretation.

To explain this we suggest that the simple *de se* interpretation strategy is so attractive that addressees will automatically apply it when confronted with *you*, regardless of its linguistic embedding context. Adults have the cognitive resources to subsequently apply the perspective shift signaled by the direct speech marking to arrive at the correct interpretation, but children have difficulty overruling their initial incorrect *de se* interpretation.

In sum, our study is the first to empirically demonstrate that for addressees the processing of second-person singular *you* is special because it is based on a simple self-ascription rule. As predicted by the *de se* theory of pronoun interpretation, we found that addressees, but not overhearers, have an interpretation bonus for *you* compared to *I* and *he/she*. But this *de se* bonus disappears and in fact becomes a liability when addressees have to interpret *you* in quoted direct speech. All of our findings are fully explained by Wechsler's *de se* theory, but not by the traditional semantic analysis of pronouns as indexicals getting their referents directly from the context of utterance. Our paper thus provides strong empirical support for the *de se* theory of pronouns.

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Competing interests

The authors have no competing interests to declare.

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