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Do perspective-sensitive anaphors and subjective adjectives exhibit perspectival uniformity? An experimental investigation

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Many kinds of linguistic expressions are perspective-sensitive, including predicates of personal taste and some anaphoric forms. This paper reports three experiments testing sentences like "Nora told/heard from Kimberly about the frightening photograph of her/herself", with two perspective-sensitive elements. The studies investigate how perspectival factors – in particular, a referent's status as a source or perceiver of information – guide interpretation of these two types of expressions and whether participants' interpretation of whose opinion is expressed by a subjective adjective is linked to their interpretation of who is the antecedent of the reflexive or pronoun. The results replicate and extend earlier findings concerning the source/perceiver biases of reflexives and pronouns in picture-NPs, and also reveal a clear preference to interpret the attitude holder of PPTs as the individual who is the source of information (subject of 'told', object of 'heard from'). However, the results fail to provide clear evidence for a systematic link between interpretation of the attitude-holders of PPTs on the one hand, and the antecedent of the pronouns and reflexives in picture-NPs on the other. Consequences of these results for theories of PPTs, anaphor resolution and perspective-shifting are discussed.

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1 Introduction

There are many perspective-sensitive expressions in language, including subjective predicates (e.g. predicates of personal taste, PPTs, e.g. *tasty, fun*), epithets (e.g. *the idiot*), perspective-sensitive reflexives (e.g. in picture-NPs, *picture of herself*), and relative spatial terms (*left, right*). Intuitively speaking, these expressions make reference to someone's perspective or point-of-view. The present paper reports three psycholinguistic experiments on the interpretation of and relationship between two kinds of perspective-sensitive elements, namely (i) subjective predicates like *fun* and *frightening* and (ii) anaphoric expressions such as *herself/himself* that have been argued, in certain syntactic configurations, to be perspective-sensitive. Using sentences like (1a,b), the experiments ask (a) how perspectival factors – in particular, a referent's status as a source or perceiver of information – guide interpretation of these two types of expressions and (b) whether participants' interpretation of whose opinion is expressed by a subjective adjective is linked to their interpretation of who is the antecedent of the reflexive or pronoun.

Experiments 1–2 investigate structures like (1a). Experiment 3 tests sentences like (1b), where the anaphor and its candidate antecedents are in different tensed clauses. This work builds on prior work observing that – contrary to what classic Chomskyan Binding Theory predicts – there are various configurations where both pronouns and reflexives[1] are acceptable (e.g. Jackendoff 1972; Cantrall 1974; Lebeaux 1984; Chomsky 1986; Kuno 1987; Zribi-Hertz 1989; Pollard & Sag 1992; Reinhart & Reuland 1993; Baker 1995; Brinton 1995; Chomsky & Lasnik 1993; Tenny 2003; 2004).

(1)   a.   Kate told/heard from Lisa about the funny photograph of her/herself.
       b.   Kate told/heard from Lisa that there was a funny photograph of her/herself in
            the newspaper.

The rest of this section reviews research on the perspective-sensitivity of anaphors, especially in picture-NPs (Section 1.1), including psycholinguistic experiments supporting claims that reflexives and pronouns in picture-NPs are sensitive to source-of-information and perceiver-of-information respectively (Section 1.2). Section 1.3 reviews claims from the syntactic literature that the interpretation of perspective-sensitive anaphors is 'yoked to' the interpretation of other broadly perspectival expressions, as well as challenges for such claims. Section 2 outlines the aims of this work. Sections 3 through 5 report three experiments investigating how the interpretation of reflexives and pronouns in picture-NPs relates to the interpretation of PPTs modifying the picture-NP in English. The paper concludes with Section 6.

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[1] I use the term *anaphor* to refer to both reflexive pronouns (*herself/himself*) and personal pronouns (*her/him*).

1.1 Perspective-sensitivity with anaphors

Perspective-sensitive anaphors constitute the first ingredient relevant to this paper. Some languages (e.g. Ewe, Donno Sɔ) have specific logophoric pronouns that refer to the 'subject of consciousness', the person whose speech, thoughts or feelings are being reported (e.g. Hagège 1974; Clements 1975; Sells 1987; Culy 1994; Huang 2000; Pearson 2015). Although English does not have a distinct class of logophors, it is widely agreed that in some contexts, certain anaphoric forms – in particular reflexives – are not governed by the syntactic principles of classic Binding Theory and exhibit perspective sensitivity (e.g. Cantrall 1974; Kuno 1987; Zribi-Hertz 1989; Reinhart & Reuland 1993; Fludernik 1993; Buering 2005; Rooryck & Vanden Wyngaerd 2011; see also Ross 1970, inter alia). Although some researchers use the term 'logophor' for these English anaphors (e.g. Kuno 1987; Reinhart & Reuland 1993; Charnavel 2020 and others), I mostly use the term 'perspective-sensitive.' This is because the grammatical distribution and behavior of perspective-sensitive anaphors in English is not the same as logophoric pronouns in languages like Ewe.

The perspective-sensitivity observed in English relates to the well-known observation that the complementary distribution of pronouns and reflexives (e.g. Chomsky 1981) breaks down in certain contexts. For example, in possessorless picture-NPs (ex.2) – often viewed as a 'poster-child' for lack of complementarity – both a pronoun and a reflexive are acceptable when coindexed with the subject (e.g. Reinhart & Reuland 1993; Stirling & Huddleston 2002; Tenny 2003):

(2)   Lisa$_i$ found a picture of her$_i$/herself$_i$.

The existence of various syntactic configurations where both pronouns and reflexives are acceptable is well-established by theoretical, functionalist and corpus-based research (e.g. Lees & Klima 1963; Chomsky 1965; Jackendoff 1972; Cantrall 1974; Lebeaux 1984; Chomsky 1986; Williams 1987; Kuno 1987; Zribi-Hertz 1989; Parker, Riley & Meyer 1990; Pollard & Sag 1992; Chomsky & Lasnik 1993; Reinhart & Reuland 1993; Baker 1995; Brinton 1995; König & Siemund 2000; Stirling & Huddleston 2002; Tenny 2003). Researchers have noted that in many of these contexts, perspectival factors play a role – in particular, that a reflexive signals that the perspective being conveyed is that of the reflexive's antecedent (rather than the first-person speaker or narrator) – i.e., the reflexive refers to the perspectival center.[2]

While perspectival effects are observed in various contexts, the present paper focuses on picture-NPs. This construction has the advantage of being extensively researched (e.g. Jackendoff 1972; Chomsky 1986; Williams 1987; Pollard & Sag 1992; Reinhart & Reuland 1993; Stirling &

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[2] The term 'perspective' is used in different ways. The experiments here explore the notion of source-of-information (and the perceiver-of-information), but do not investigate spatial point-of-view.

Huddleston 2002; Tenny 2003).[3] The second reason for focusing on picture-NPs is that there exists prior psycholinguistic work on this construction (Kaiser et al. 2009) that provides a basis for the current study. This earlier work provides experimental evidence for divergent perspectival behaviors of pronouns and reflexives in picture-NPs (without subjective predicates). The third reason is that picture-NPs allow subjective predicates to co-occur with pronouns and reflexives in the same nominal structure (e.g. *funny photograph of her/herself*), i.e., in close proximity.

Let us review prior claims on the perspective-sensitivity of pronouns and reflexives in picture-NPs.[4] As noted by authors like Kuno (1987), factors like point-of-view can influence whether a given referent can antecede a reflexive. Consider (3a,b):

(3)   a.   John heard from Mary$_i$ about a damaging rumor about herself$_i$ that was going around. (Kuno 1987: 175)

        b.   ?? John told Mary$_i$ about a damaging rumor about herself$_i$ that was going around.

Kuno notes that if the antecedent is the source of information (Mary in (3a)), it can trigger use of a reflexive in a picture-NP. However, if Mary is the perceiver of information (recipient), a reflexive sounds worse (3b). These patterns lead to the hypothesis that reflexives in picture-NPs prefer antecedents that are sources-of-information. I follow Sells (1987) and define the 'source' as the intentional agent of the communication. The 'source-of-information' hypothesis for reflexives in picture-NPs echoes the behavior of specialized logophoric pronouns that refer to the source of reported speech or thought (e.g. Clements 1975; Sells 1987).

Strikingly, prior research shows that pronouns in picture-NPs are also sensitive to perspectival information. First, consider (3c,d), from Reinhart & Reuland (1993) (see also Jackendoff 1972; Chomsky 1986, i.a.). In (3c), the pronoun's antecedent is a perceiver of information, whereas in (3d) the pronoun refers to the source. Crucially, (3c) is reported to sound better than (3d).

(3)   c.   Max$_j$ heard a story about him$_j$.

        d.   * Max$_j$ told a story about him$_j$.

Tenny (2003) calls pronouns in this context short-distance pronouns (SDPs), and notes that "verbs that provide a sentient, perceiving antecedent are especially conducive to SDPs" (Tenny 2003:14). She further states that "SDPs in representational contexts [.....] are especially felicitous with perceiving subjects." These kinds of patterns lead to the hypothesis that pronouns in picture-

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[3] The present work tests picture-NPs without possessors, widely regarded as perspective-sensitive. For experiments on picture-NPs with possessors (e.g. *Lisa's picture of her/herself*), see e.g. Keller & Asudeh (2001), Runner & Sussman & Tanenhaus (2003), Kaiser et al. (2009).

[4] The term 'picture-NP' is used for structures with the noun 'picture' (e.g. *picture of her/herself*) as well as other kinds of representational and depictive NPs (e.g. *portrait of, rumor about*).

NPs prefer antecedents that are *perceivers*-of-information – the opposite of reflexives' source preference.

The idea that perceivers also play a privileged role has a typological precedent: Some languages (e.g. Mapun, Angas) have specialized logophoric pronouns referring to the addressee, the person perceiving the information (e.g. Frajzyngier 1993). This suggests that, in addition to sources having a special status as perspectival centers, perceivers are also privileged in this regard.

In sum, both reflexives and pronouns in picture-NPs have been claimed to be sensitive to perspectival information – in opposing directions that correspond to the two perspectives inherent in communicative information-transfer events: (i) someone who conveys the information (source) and (ii) someone who receives it (perceiver): Reflexives are sensitive to the source, the individual whose speech/thoughts are being expressed, and pronouns to the perceiver, the one receiving the information.

1.2 Psycholinguistic experiments on perspective-sensitive anaphors in picture-NPs

To assess the judgements reported in the theoretical literature and to gain insights into real-time processing, Kaiser et al. (2009) conducted experiments to test the hypotheses that reflexives in picture-NPs (without PPTs) prefer sources of information while pronouns prefer perceivers. In this earlier work, we used sentences like (4), where the verb (*told* vs. *heard from*) was used to manipulate whether the subject or object is the source or perceiver. The sentences did not contain adjectives. We used both offline questionnaires and visual-world eye-tracking, which provides a fine-grained and time-sensitive measure. The results confirm that reflexives and pronouns in picture-NPs are sensitive to the source and perceiver-of-information respectively, and that this can be detected early during real-time processing.

(4)   Peter {told/heard from} John about the picture of {him/himself} on the wall.

We also found that pronouns and reflexives differ in *how* sensitive they are to structural information (subject/object) vs. the source/perceiver manipulation: Reflexives in picture-NPs are guided by a strong structural subject preference and a weaker but (still significant) source-of-information preference, whereas pronouns are guided by a structural object preference and a strong perceiver-of-information preference.[5] Similar patterns arise in Dutch and German (Kaiser & Runner 2008; see Kaiser & Do 2012 for further data on English).

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[5] Syntactically, the object of *heard from* is more deeply embedded than the object of *told* (due to *from*). Crucially, the results cannot be attributed to this syntactic difference: Participants are more likely to consider the object as a potential antecedent for a reflexive when the verb is *heard from* than *told*. This is the opposite of what one would expect if

These results confirm intuitions discussed in prior work. Although English picture-NP anaphors are not directly comparable to logophoric pronouns in languages like Ewe or long-distance reflexives in languages like Japanese, these studies confirm they are sensitive to the source/perceiver distinction. These experiments also provide a more gradient picture of the relative impact of structural and perspectival information, by showing that the effects of grammatical role and source/perceiver status on pronouns and reflexives are not categorical, but nevertheless have a robust effect on reference resolution.

1.3 On the relation between perspective-sensitive anaphoric expressions and subjective expressions

Research on perspective-sensitive anaphors has also yielded claims that interpretation of these anaphors is linked to interpretation of other perspectival expressions (e.g. Sells 1987; Kuno 1987; Charnavel 2020; 2021). The core observation is that multiple perspectival expressions can exhibit what I call *perspectival uniformity* – i.e., be interpreted relative to the same perspectival center. [6] In particular, many have noted that whoever is the antecedent of the perspective-sensitive anaphor is also the attitude-holder of other perspectival expressions (broadly construed) in the same sentence.[7] Here I focus solely on contexts with perspective-sensitive anaphors. (For research on the behavior of multiple *non-anaphoric* perspectival expressions, see e.g. Bylinina & McCready & Sudo 2014; 2015; see also Kneer & Vicente & Zeman 2017 for a different view. See Anand & Korotkova 2021 for an analysis of sentences with multiple PPTs, especially in attitude reports, see also Saebø 2009; Pearson 2013 for related points.)

In his influential 1987 paper, Sells discusses Japanese examples like (5) and points out (using different terminology) that the attitude-holder of the adjective *beloved* – what he calls an 'expressive term'[8] – is interpreted as the same referent as the antecedent of the reflexive *zibun* 'self.' These examples provide evidence of perspectival uniformity. (I follow Sells in translating *zibun* as 'him' here.)

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the results were being driven by depth of embedding. Thus, the different syntactic structure of *told* and *heard from* is not problematic for this work.

[6] I use the theory-neutral term *perspectival uniformity* for a situation where two perspective-sensitive elements are interpreted relative to the same perspectival center. Some researchers use terms such as 'shift-together' (Bylinina & McCready & Sudo 2014), 'shift-together-locally' (Bylinina & McCready & Sudo 2015) and perspectival homogeneity (Charnavel 2020) for the same phenomenon.

[7] In research focusing on the syntactic behavior of perspective-sensitive anaphors, the precise semantic characterization of the other perspective-sensitive expressions is often left somewhat open.

[8] Charnavel & Zlogar (2015) note that "*beloved*-ness can only be evaluated by the person experiencing the feeling."

(5) Japanese

    a. Takasi wa Taroo kara [itosii$_{Takasi}$ Yosiko ga zibun$_{Takasi}$ o nikundeiru

        Takasi Top Taroo from [beloved$_{Takasi}$ Yosiko Subj self$_{Takasi}$ Obj be-hating

        to] hansita

        Comp] told

        'Takasi told Taroo that his beloved$_{Takasi}$ Yosiko hated him$_{Takasi}$' [Japanese]

    b. Taroo wa Takasi kara [itosii$_{Takasi}$ Yosiko ga zibun$_{Takasi}$ o nikundeiru

        Taroo Top Takasi from [beloved$_{Takasi}$ Yosiko Subj self$_{Takasi}$ Obj be-hating

        to] kiita

        Comp] heard

        'Taroo heard from Takasi that his beloved$_{Takasi}$ Yosiko hated him$_{Takasi}$'

Sells notes that (5b) also allows a reading where Taroo is the antecedent of the reflexive, and that in this case, *beloved* reflects Taroo's perspective. This further suggests that *zibun* and *beloved* exhibit perspectival uniformity. He also points out that "English shows the same properties as Japanese: *beloved* links with whichever referent is understood as the antecedent of the pronoun" (p.465).

Additional examples illustrating perspectivally-uniform behavior between anaphors and subjective expressions, from Japanese, Korean, Swedish and English (Oshima 2004; Giorgi 2006; Park 2018; Hellberg 1980; Strahan 2001; Gast 2004) are in Supplementary File 1. Research on multiple languages suggests that perspective-sensitive reflexives and subjective expressions exhibit perspectival uniformity, i.e., are interpreted relative to the same perspectival center.

Evidence specifically for **picture-NPs** and **predicates of personal taste** – the ingredients that this paper focuses on – comes from Charnavel's (2020) work on French. She notes that in (6), the attitude-holder of the PPT (e.g. *horrible*) is whoever the emphatic reflexive in the picture-NP (*elle-même/lui-même* 'herself/himself') refers to. Charnavel also discusses adjectives like *étrange* 'strange' and *ignoble* 'despicable, horrible' in related structures such as 'the media's horrible remarks about herself,' where she notes that the referent of *herself* is whoever is the attitude-holder of *horrible* (see her ex.109).

(6) French

    Loïc mistakes photos of Marie (taken from behind) for portraits of himself and finds them beautiful while Marie thinks they are horrible

    a. Loïc pense que Marie espère que [les affreuses$_{Marie}$ photos d'elle-même$_{Marie}$ /

       *lui-même$_{Loïc}$ vont se vendre.

      'Loïc thinks that Mary hopes that [the horrible$_{Marie}$ photos of herself$_{Marie}$ / *himself$_{Loïc}$ will sell.'

b. Loïc pense que Marie espère que [les beaux$_{Loïc}$ portraits de lui-même$_{Loïc}$ / *d'elle-même$_{Marie}$] vont se vendre.
'Loïc thinks that Mary hopes that [the beautiful$_{Loïc}$ portraits of himself$_{Loïc}$ / *herself$_{Marie}$] will sell.'

1.3.1 Predicates of personal taste

The preceding section shows that the general idea of perspective-sensitive anaphors and subjective expressions of various types being 'yoked together' has been around at least since Sells (1987), and continues to play a role in current analyses of perspective-sensitivity and reflexive binding. The three experiments reported in this paper test sentences with picture-NP anaphors and PPTs (ex.1), following Charnavel (2020).[9]

Traditionally, PPTs – e.g. *tasty*, *fun, frightening, amazing* – have been analyzed as judge-dependent predicates – i.e., as expressing subjective opinions anchored to an attitude-holder/judge.[10] According to Lasersohn's (2005) analysis, PPTs contain a judge parameter *j*, such that the truth value of an utterance like (7a) is relativized to a judge (7b). (See Bhatt & Pancheva 2017 for a review of other related approaches.) The default attitude-holder/judge is the first-person speaker.

(7)   a.   Cross-country skiing is fun.
       b. $[[\text{fun}]]^{c; \, w,t,j} = [\lambda x \, . \, x \text{ is fun for } j \text{ in } w \text{ at } t]$

Choosing PPTs as the class of subjective expressions to investigate has three advantages: First, it allows us to build on prior observations about perspectival uniformity (e.g. Charnavel 2020; 2021) and to assess their crosslinguistic robustness with a larger number of participants and using statistical analyses. Second, PPTs have received a lot of attention in semantic work (e.g. Lasersohn 2005; Glanzberg 2007; Stephenson 2007; Anand 2009; Cappelen & Hawthorne 2009; Pearson 2013; Snyder 2013; Bylinina 2014; Coppock 2018; Zakkou 2019; Willer & Kennedy 2020; Anand & Korotkova 2021) and, relatively speaking, are better understood than many other types of subjective elements. Third, PPTs can be naturally combined with picture-NPs with *and* without anaphors (e.g. *frightening photograph of her/herself, frightening photograph*). This makes it possible to test interpretation of PPTs both in the presence and absence of anaphoric elements, which is important for evaluating their behavior.

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[9] There is some debate in the literature concerning adjectives' membership in the class of PPTs vs. a potentially broader class of subjective, judge-dependent predicates, sometimes called multidimensional predicates (e.g. Bylinina 2014, see also McNally & Stojanovic 2017). However, this distinction is not crucial for the current paper. Furthermore, recent research by Lee & Kaiser (to appear) on Korean suggests that both PPTs and non-PPT multidimensional adjectives pattern alike in terms of the process of attitude-holder identification.

[10] See Bhatt & Pancheva (2017), Anand (2009), Pearson (2013) and Moltmann (2010) on generic uses of PPTs, see also MacFarlane (2014) for related work. The present paper does not specifically test whether PPTs are interpreted as expressing the opinions of 'people in general.'

1.3.2 On the underpinnings of perspectival uniformity

According to Charnavel's analysis, perspectival uniformity in sentences like (6) stems from the presence of a logophoric operator at the edge of the spellout domain, which generates a covert logophoric pronoun *pro*$_{log}$ that binds the reflexive (satisfying Binding Principle A), and "imposes on its complement the first-personal perspective of the referent of its subject pro$_{log}$." In essence, Charnavel proposes that reflexives typically viewed as exempt from Binding Theory are in fact bound by a *pro*$_{log}$ generated by a logophoric operator OP$_{LOG}$, thereby satisfying Binding Principle A (see also Sloggett 2017). She posits that with an exempt anaphor, because of the semantics of the logophoric operator, "all perspectival elements of its domain must be evaluated from the first-personal perspective of its antecedent."

The idea that the perspectival center of perspective-sensitive anaphors and the attitude-holder of PPTs exhibit perspectival uniformity is stated in more general terms by Bylinina et al. (2014), see also Bylinina et al. (2015).[11] Bylinina et al. refer to this phenomenon as 'Shift together.'

(8)   Perspective-sensitive items in the same 'domain' must refer to the same perspectival center. (Bylinina & McCready & Sudo 2014)

Bylinina et al. (2014) use the term 'perspective-sensitive items' to refer to a broad class of expressions that includes PPTs, spatial terms, evidentials and perspective-sensitive reflexives. Bylinina et al. propose that the perspectival center index can be shifted away from the speaker (default) by the Π operator, which binds perspective-sensitive elements in its scope to the same perspectival center. Consequently, all perspective-sensitive elements that are anchored to someone other than the speaker are predicted to have the same perspectival center. Although this approach does not specifically address anaphor binding, it also predicts that non-speaker-anchored (i.e., shifted) perspective-sensitive elements should exhibit perspectival uniformity.[12] In essence, in operator-based approaches, the perspective-shifting operator manipulates the 'judge' parameter associated with PPTs.

Simplifying somewhat, under these kinds of accounts, perspectival uniformity typically hinges on the relevant subjective expressions (i) having an element (e.g. a judge parameter) that can be

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[11] The relevant domain in which this constraint applies not yet well-understood (e.g. Bylinina et al. 2014; Charnavel 2020). The three experiments in this paper use picture-NP constructions with the PPT adjective in attributive position (like (10–11)), in an attempt to get the relevant elements as close to each other as possible (on PPTs in attributive position, see also Anand & Korotkova 2021). In recent experimental work, Kneer (2021/manuscript under review) tested PPTs (but not anaphors) in contexts such as *The wine was delicious and the water slide was a lot of fun* and showed that they can be anchored to different perspectival centers; in the examples discussed in Kneer's manuscript the PPTs are in different finite clauses, which can presumably be characterized as different perspectival domains.

[12] In earlier work, a similar kind of uniformity restriction – called Shift-Together – was proposed for indexicals (see Anand & Nevins 2004; see also Deal 2020 and Sundaresan 2021). However, the present paper makes no claims about indexicals such as 'I' or 'you'. The relation between these two phenomena, indexical shift and perspectival anaphors, is an important question, but it is beyond the scope of the present work (see e.g. Sundaresan 2021).

manipulated by a perspective-shifting operator and (ii) being sensitive to the same parameters and/or operators. However, so far there is no consensus regarding these assumptions. The first is challenged by recent approaches on subjective predicates that do not posit a semantically encoded 'judge' element that could be manipulated by an operator (e.g. Coppock 2018; Rudin & Beltrama 2019; Kennedy & Willer 2016; see also Anand 2009). Consequently, under these accounts, there is no reason to expect PPTs (or other 'judge'-dependent expressions) to exhibit perspectival uniformity with perspective-sensitive anaphors. The second assumption – that PPTs and perspective-sensitive anaphors are subject to the same shifting operator – is also not a given. Even if both elements have a manipulable parameter, they may not be uniformly targeted by the same kind of operator. The possibility of different perspectival elements being subject to different operators already has a precedent in work on indexical shift, where Deal (2020) argues that operator-based accounts of indexical shift need to be enriched with multiple operators.

In sum, although there are crosslinguistic observations about perspective-sensitive anaphors and subjective expressions exhibiting perspectival uniformity, the theoretical underpinnings of this phenomenon are not settled.[13] One crucial question that arises concerns the nature of the judgments. Because the relevant judgments can be delicate, it is unclear whether judgments about perspectival uniformity reflect a rigid grammatical requirement for perspectival uniformity, or merely a tendency, or perhaps two independent preferences that sometimes point in the same direction and create a potential illusion of a perspectival uniformity in some contexts. This question has far-reaching implications for theories of perspective-sensitivity. The present paper aims to take steps towards clarifying this empirical landscape.

2. Aims of this work

The **first** aim is to systematically explore two kinds of perspective-sensitive phenomena – (i) reference resolution of picture-NP anaphors and (ii) attitude-holder identification of PPTs – to see whether, in sentences like (1), there a relation between the antecedent of the pronoun or reflexive and the attitude-holder of the PPT.

Relatedly, although prior work provides evidence of reflexives and pronouns being sensitive to the source vs. perceiver manipulation, it is not yet known how the attitude-holders of PPTs

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[13] Another complication comes from the various differences in the linguistic behavior of PPTs and picture-NP anaphors. For example, anaphors are more syntactically constrained – both in terms of interpretation and distribution – than PPTs and other subjective predicates. Furthermore, the referential behavior of these two types of expressions is different. With PPTs (and other subjective predicates), the first-person speaker is the default attitude-holder (e.g. Lasersohn 2005), but these expressions can also be used generically (footnote 10) and non-autocentrically (see e.g. Anand & Korotkova 2018). Although the question of how these different interpretations of PPTs should be analyzed is still debated, it's clear that perspective-sensitive anaphors do not exhibit the same range of referential options. These diverges between perspective-sensitive anaphors and PPTs seem to cast further doubt on the assumption that interpretation of these forms is determined by the same kind of operator.

pattern in this regard. Thus, the **second** aim is to test if – independently of pronouns and reflexives – the process of identifying the attitude-holder of PPTs is sensitive to source vs. perceiver status.

Furthermore, as noted above, prior discussion of perspectival uniformity has, to the best of my knowledge, largely focused on reflexives, not on pronouns, and has not systematically investigated the source/perceiver preferences of reflexives and pronouns in relation to the attitude-holders of PPTs. Thus, the **third** aim is to investigate both reflexives and pronouns to test whether the two anaphoric forms show (a)symmetrical levels of perspectival uniformity with PPTs.

Fourth, Kaiser et al.'s (2009) studies on pronouns and reflexives in picture-NPs (without PPTs) only tested configurations where the anaphors and the potential antecedents are in the same finite clause (9a). In the present work, Experiments 1–2 test structures like (9a), while Experiment 3 extends the domain of inquiry to sentences where the anaphors and the candidate antecedents are in distinct finite clauses (9b), i.e., anaphor and antecedent are clearly not in the same local domain.

(9) a. Kate told/heard from Lisa about the funny photograph of her/herself.
     b. Kate told/heard from Lisa that there was a funny photograph of her/herself in the newspaper.

It is important to emphasize that experimental investigation of other perspective-sensitive elements beyond PPTs and picture-NP anaphors is an important future direction. The present studies are an initial step that aims to provide a foundation for future work.

2.1 Possible outcomes

As regards the **interpretation of reflexives and pronouns**, the expectation is that Experiments 1, 2 and 3 will replicate prior work showing that (a) reflexives in picture-NPs show a preference for the subject, modulated by a weaker preference for the source-of-information, while (b) pronouns show a preference for the object as well as a strong preference for the perceiver-of-information (Kaiser et al. 2009).

What about the question of **who is interpreted as the attitude-holder (judge) of PPTs** in sentences like (1a,b)? It seems reasonable to posit that the individual who is the source of information is the most plausible attitude-holder. The source can be inferred to possess relevant knowledge/information/experience of the photograph that allows them to judge it to be funny, frightening etc.[14] Indeed, a source preference has been suggested by Kuno (1987) and Sells (1987).

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[14] There is increasing agreement that the attitude-holder of PPTs is the individual with the relevant first-hand experience (e.g. Bylinina 2014; Ninan 2014; McNally & Stojanovic 2017; Anand & Korotkova 2018, see also Kaiser & Herron Lee 2017; 2018 for experimental evidence). While it is reasonable to infer that the source is most likely to

According to Sells, this is because what he calls "speaker-evaluative" expressions are anchored to the individual who is the intentional agent of the communication (p.462–462), and in structures like (1), expressing communicative events with *tell/hear*, that is the source-of-information. The idea that the source tends to be interpreted as the attitude-holder of a PPT has not been experimentally tested. Indeed, the first-person speaker could also be construed as the attitude-holder (e.g. Lasersohn 2005).

What about the **relation between the antecedent of a perspective-sensitive anaphor and the attitude-holder of a PPT**? In the structures tested in Experiment 1, the PPT modifies the noun *photograph*, and the pronouns and reflexives are inside a prepositional phrase modifying that noun (see also (6) from Charnavel 2020). For now, I make the simplifying assumption that the PPT and the anaphor are inside the same perspectival domain. I mostly focus on the following four outcomes (though these are not the only possibilities):

Option 1: Strong version of perspectival uniformity. If PPTs and picture-NP pronouns and reflexives in structures like (9) are subject to perspectival uniformity, (i) the attitude-holder of the PPT and (ii) the antecedent of the pronoun or reflexive should coincide. This is what's expected if a high, general perspective-shifting operator binds all perspective-sensitive elements in its scope to the same perspectival center. However, in light of prior work showing complementary source/perceiver biases for reflexives and pronouns, this kind of strong, across-the-board approach already faces challenges. This leads to the second prediction:

Option 2: Form-specific perspectival uniformity. It could be that perspectival uniformity applies selectively to some perspective-sensitive anaphors but not others. In particular, if the source is preferred as a PPT's attitude-holder, it might be that perspectival uniformity holds between reflexives (also sensitive to sources) and PPTs, but not between pronouns (sensitive to perceivers) and PPTs. Such form-specific perspectival uniformity predicts that *the antecedent of reflexives in picture-NPs and the attitude-holder of PPTs will be categorically yoked together*, whereas the antecedent of pronouns and the attitude-holder of PPTs diverge. In operator-based accounts, this pattern could arise if the perspective-shifting operator binds reflexives and PPT in its scope, but not pronouns.

Option 3: Overlapping preferences create an appearance of partial perspectival uniformity. Another possibility is that PPT attitude-holder identification and the interpretation of pronouns and reflexives are *not* intrinsically linked, but that these processes are guided by

have first-person experience, I do not claim that first-hand experience is required for a source preference. It seems plausible that non-PPT subjective adjectives (e.g. McNally & Stojanovic 2017) could also exhibit a preference for the source to be the attitude-holder. Indeed, recent experimental work in Korean by Lee & Kaiser (to appear) indicates that both PPTs and non-PPT subjective adjectives pattern alike in terms of preferring the source as the attitude-holder. A question that I leave as an intriguing issue for future work concerns attitude-holder identification with verbs like *show* that do not involve linguistic communication.

potentially overlapping constraints and thus may show similarities in certain contexts. This prediction is based on Kaiser et al. (2009), who propose that the interpretation of pronouns and reflexives is guided by multiple weighted constraints – specifically, that reflexives are guided by a heavily-weighted subjecthood constraint and a weaker source constraint, whereas pronoun interpretation is guided by fairly evenly weighted perceiver and object constraints. Under this view, if PPT attitude-holder identification is an independent process guided by a source constraint, then in certain contexts we may see what looks like a trend towards perspectival uniformity but is actually only a coincidence of the relevant factors happening to overlap. For example, if reflexives prefer subjects and PPTs prefer sources, an illusion of perspectival uniformity will emerge where the subject is the source (with *told*) – a pattern that is predicted to vanish when the subject is the perceiver (with *heard*).

Option 4: No relation. A logical possibility is that the interpretation of PPTs and perspective-sensitive pronouns/reflexives are not only distinct from each other, but also not guided by any related constraints. In this case, no relation is expected to hold between (a) the antecedents of pronouns and reflexives and (b) the attitude-holders of PPTs.

These possible outcomes are summarized below:

Overview of predictions regarding perspectival uniformity

Strong perspectival uniformity	Anaphor's antecedent = PPT attitude-holder
Form-specific perspectival uniformity	Reflexive antecedent = PPT attitude-holder Pronoun antecedent ≠ PPT attitude-holder
Partially overlapping constraints	Antecedent and attitude-holder are not consistently correlated, but may show overlap in contexts where constraints converge
No relation	Reflexive antecedent ≠ PPT attitude-holder Pronoun antecedent ≠ PPT attitude-holder

3. Experiment 1

3.1 Method

3.1.1 Participants

Participation took place over the internet. Participants were recruited via Amazon Mechanical Turk. To ensure that participants understood the task and were paying attention, they had to get 3 out of 4 unambiguous practice items correct as well as 7 out of 8 attention-check items correct during the experiment (e.g. *The musician called the construction workers. He was American. Question: Who was American?*). Data for 42 native, adult English speakers is included in the final

analyses. One person was excluded for not being a US-born native English speaker, thirteen for poor performance on attention-check trials and three for poor performance on the practice trials.[15] In addition, four randomly-selected participants were excluded to balance the number of people per list.

3.1.2 Materials and design

I manipulated (i) whether the subject or the object is the source or the perceiver by using *told* and *heard from*, and (ii) whether the picture-NP contains a reflexive, a pronoun or no anaphor. This yields a 2 × 3 design (verb type × anaphor type), see (10a–c). The no-anaphor condition tests how source/perceiver status influences attitude-holder identification without anaphoric elements present.

(10)   a.   *Reflexive*:
           Nora {told/heard from} Kimberly about the frightening photograph of herself.

        b.   *Pronoun*:
           Nora {told/heard from} Kimberly about the frightening photograph of her.

        c.   *No anaphor*:
           Nora {told/heard from} Kimberly about the frightening photograph.

The picture-NPs use the noun *photograph* (not *picture*). This aims to minimize variation in semantic construal regarding the type of depiction. All targets used two proper names with unambiguous gender (two female or two male names). Half of the items used two female names and the other half used two male names. The targets used definite nouns to be as parallel as possible to Kaiser et al.'s (2009) items.

    The study consisted of 36 targets, presented using a standard Latin-Square design with six lists. The PPTs modifying the noun *photograph* were selected based on published work and existing semantic criteria (e.g. *frightening, funny, irritating, disgusting*). The list is in Supplementary File 2. 36 different PPTs were tested. Each participant saw each PPT once. A mix of positively-valenced (e.g. *funny, amazing*) and negatively-valenced (e.g. *irritating, frightening*) PPTs were used. (Further analyses of the results reported below confirm that, as expected given the Latin-Square design, the key patterns discussed in this paper cannot be 'blamed on' adjective valence.)

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[15] A potential concern with MTurk is the decrease in data quality that researchers began to observe in summer 2018 (e.g. Chmielewski & Kucker 2020; Kennedy et al. 2020). Given these concerns, I used a variety of data-validity indicators (both practice items and catch trials) to exclude participants, in line with Chmielewski & Kucker's advice. The exclusion numbers in this paper may seem high, but are lower than Chmielewski & Kucker's: They found 38–62% of MTurk participants failing at least one data quality validity indicator in summer/fall 2018 and spring 2019.

The study contained 50 filler trials. Fillers did not contain PPTs or picture-NPs, and did not ask questions about opinions. The fillers were of different types. For example, some involved lexical ambiguity (e.g. *The baseball team took a trip to a nearby cave with their equipment. There were lots of bats inside.* Question*: What was there a lot of inside the cave? items of sports equipment used to hit balls/small nocturnal mammals that can fly*). Some fillers had unambiguous personal pronouns with cross-sentential antecedents, balanced for subject and object antecedents (e.g. *The writer called the mechanics. She was thirsty. Question: Who was thirsty? the writer/the mechanics; The animators called the welder. He was at the elementary school. Question: Who was at the elementary school? the animators/the welder*). I included unambiguous pronominal fillers to expose participants to various kinds of referential dependencies.

3.1.3 Procedure

Participants completed the experiment on the internet at their own pace, via the web interface Qualtrics. The study used a forced-choice paradigm. On targets in the pronoun and reflexive conditions, participants first saw a screen with the critical sentence and a question about who is shown in the photograph. This 'who shown' question (**Figure 1a**) probes the interpretation of the anaphoric expressions. The answer choices are the subject and the object. The subject was consistently presented at the first answer choice and the object as the second answer choice. This was done to keep the question layout simple and to avoid introducing an additional attention/processing burden on participants, in light of the fact that the experiment was already complex due to the variety of question types. (See Kaiser 2015 for evidence that counterbalancing answer choices yields the same results as keeping answer choices constant.)[16]

On the next screen, participants again saw the critical sentence (i.e., they did not need to memorize it) as well as a question about whose opinion the PPT conveys (**Figure 1b**). This is the 'whose opinion' question. The answer choices are the subject, the object, or the narrator. As with the 'who shown' questions, the order of the answer choices was held constant. On target trials in the no-anaphor condition, participants only encountered the 'whose opinion' question.

At the start of the experiment, participants were instructed to read the sentences as if they were reading excerpts from novels. This was done to make the presence of a narrator plausible. The term 'narrator' was clarified in the instructions that preceded the experiment.

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[16] Furthermore, if one is still worried about the lack of counterbalancing of answer choices it's worth noting that – as we will see in the results section – the 'who shown' results replicate the findings of Kaiser et al. (2009), who did not use this kind of multiple-choice format. This, combined with the results (to be discussed) that show participants are willing to consider both subject and object answer choices, means that there is no reason to think that the constant ordering of the answer choices is creating any problems.

Figure 1a: Example of a 'who shown' question (depicted after the choice 'Sarah' has already been selected by the participant).

Figure 1b: Example of a 'whose opinion' question.

Because two thirds of the target sentences (all targets except those in the no-anaphor condition) were associated with two questions, half of all filler sentences were also associated with two questions.

3.2 Experiment 1 Results

Statistical analysis In all experiments reported here, data was analyzed using R (R Core Team 2013). To analyze participants' answers to the '**who shown' questions** I fit logistic mixed effects regression models (glmer, using lme4 1.1-20, Bates et al. 2015) to the data. Subject responses were coded as 1, object responses as 0. Models contained pronoun type (pronoun vs. reflexive), verb (*told* vs. *heard*) and their interaction as fixed effects. As random effects, all models had

intercepts for subjects and items whenever possible,[17] as well as by-subject and by-item random slopes for the fixed effects when justified by model comparison. (For each model, I started with the maximal random effect structure for subjects and items, and used model comparison to identify the maximal random effect structure justified by the design and supported by the data. Only random effects that contributed significantly to the model ($p < 0.05$) were included, Baayen et al. 2008.) All experiments are analyzed in the same way.

To analyze answers to the **'whose opinion' questions**, glmer models were fitted for each possible answer choice: one model for subject-opinion responses, where subject opinion responses are coded as 1, and all other responses are coded as 0; another model for object-opinion responses, where object-opinion responses are coded as 1 and all other responses are coded as 0, and a third model for narrator-opinion responses, where narrator-opinion responses are coded as 1 and all other responses as 0. 'Condition' was entered as a fixed effect into the model. Random effects were determined as described above. The *emmeans* package (emmeans 1.5.0, Lenth 2018) was used to obtain Bonferroni-corrected pairwise comparisons. 'Whose opinion' data for all three experiments reported in this paper is analyzed the same way. (In Experiments 2 and 3, in addition to analyzing subject-opinion, object-opinion and narrator-opinion choices, the combination responses possible in those experiments, e.g. subject + narrator opinion, were also analyzed.)

3.2.1 Reference resolution

Participants' responses to the 'who shown' question that probes interpretation of pronouns and reflexives are in **Figures 2a** and **2b**. **Figure 2a** shows the proportion of trials where participants selected the preceding subject as the antecedent. **Figure 2b** shows the proportion of trials where participants selected the preceding object as the antecedent. (The corresponding bars in **Figure 2a** and **2b** sum to 1). As the figures show, reflexives elicit mostly subject responses, whereas pronouns are more split between subjects and objects. (The no-anaphor condition is not shown.) Furthermore, the two verbs clearly do not pattern alike: There is a higher rate of subject interpretations with reflexives than with pronouns ($\beta = 1.722$, $SE = 0.155$, $z = -11.109$, $p < 0.0001$) and with *heard* than with *told* ($\beta = 0.427$, $SE = 0.$ 0.151, $z = 2.821$, $p < 0.005$), but these effects are modulated by a significant interaction ($\beta = 1.636$, $SE = 0.304$, $z = 5.383$, $p < 0.0001$). See Supplementary File 3 for statistical models. More specifically, pronouns are more sensitive to the verb manipulation than reflexives. Indeed, planned comparisons show that pronouns elicit more subject interpretations with *heard* than *told* ($\beta = 1.7897$, $SE = 0.558$, $z = 3.206$, $p < 0.002$) – exhibiting the predicted perceiver preference. Reflexives exhibit a numerical source preference, in line with prior work, but this effect is only marginally significant

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[17] In some cases, inclusion of by-subject or by-item intercepts yielded singularity (presumably due to lack of variation/highly consistent responses); in such cases singularity was avoided, whenever possible, by dropping the relevant subject or item intercept. (See also Supplementary File 3.)

(β = –0.368, SE = 0.223, z = –1.652, p = 0.0985). In light of Kaiser et al.'s finding that pronouns prefer perceivers more strongly than reflexives prefer sources, the absence of a strong verb effect with reflexives in the current offline task is not unexpected.

Overall, the 'who shown' data replicates prior work. In sentences like *Nora {told/heard from} Kimberly about the frightening photograph {of herself/her}*, participants tend to interpret (i) a reflexive as referring to the subject, especially when the subject is the source-of-information, i.e., when the sentence contains the verb *told*, and (ii) participants tend to interpret a pronoun as referring to whichever argument is the perceiver of information (the subject of *heard* and object of *told*).
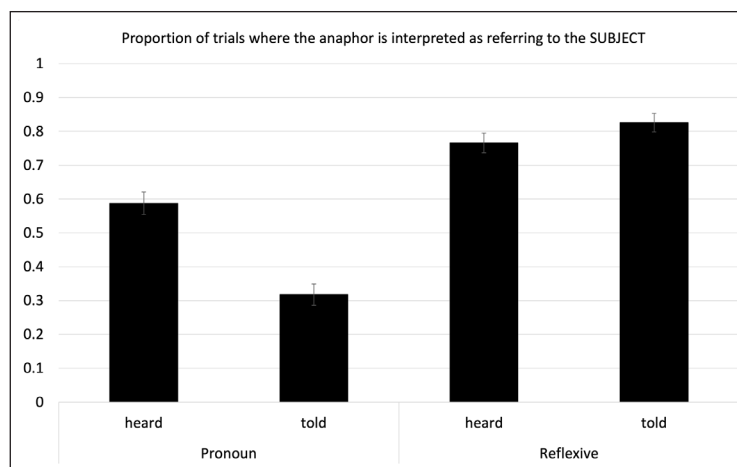
Figure 2a: Experiment 1: Proportion of trials where participants interpreted the anaphor as referring to the subject (Error bars show +/− 1 SE). Throughout the paper, SEs were calculated according to Cousineau (2005) and corrected according to Morey (2008).
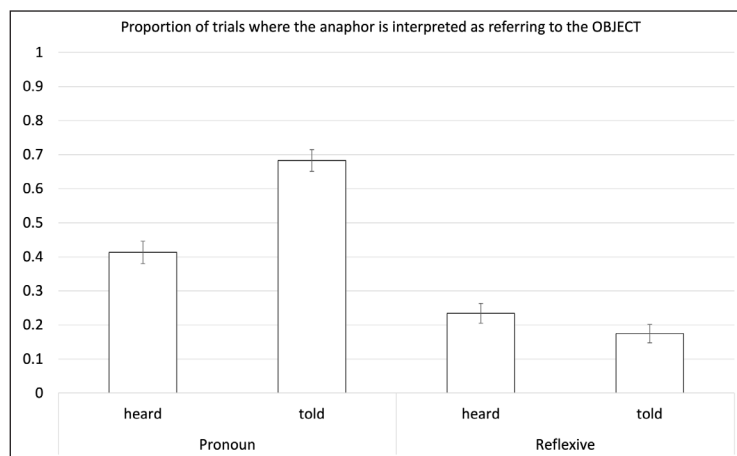
Figure 2b: Experiment 1: Proportion of trials where participants interpreted the anaphor as referring to the object (This data is the inverse of the subject response data shown in Figure 2a, error bars show +/− 1 SE).

3.2.2 Attitude-holder identification

Participants' responses to the 'whose opinion' question, which probes attitude-holder identification, are in **Figure 3**. All three anaphor-type conditions (pronoun, reflexive, no-anaphor) elicit significantly more subject-opinion responses with *told* (subject = source) than with *heard*. (See **Table 1** for statistics). Conversely, all three anaphor-type conditions elicit significantly more object-opinion responses with *heard* (where the object is the source) than with *told* (see **Table 2**).

The proportion of narrator-opinion responses does not differ depending on the verb (see **Table 3**) and is quite low. This may seem surprising, since PPTs are often regarded as having a default bias for the speaker (here the narrator) to be the attitude-holder, but prior work on Free Indirect Discourse and related phenomena (Kaiser 2015) indicates that in narrative contexts, it is easy to shift from the speaker (narrator) to a character as the perspectival center.

In sum, there is a preference to interpret the source as the attitude-holder of the PPT, which is *independent* of (i) whether the sentence contains an anaphor or not, and (ii) whether that anaphor is a pronoun or a reflexive. PPT interpretation is guided by a *strong source preference.*

Furthermore, as is apparent in **Figure 3**, this source preference is stronger when the source is the subject (with *told*) than when the source is the object (with *heard*). This difference is significant in all three anaphor-type conditions (no anaphor, reflexive, pronoun; **Table 4**).[18] This suggests that in addition to a *strong source preference*, the attitude-holder identification process is guided by a *weaker subject preference*. This fits with the well-known finding that subjects are more prominent/more topical than objects (e.g. Chafe 1994; Crawley et al. 1990, inter alia).

Overall, these results show that the identification of PPT attitude-holders is guided by a strong source constraint and a weaker subjecthood constraint.

3.2.3. Combining the data types

So far, the reference resolution data ('who shown' questions, **Figures 2a,b**) corroborates earlier results showing that reflexives have a strong subject bias modulated by a source bias, while pronouns have a strong object bias and a strong perceiver bias. But the attitude-holder identification data ('whose opinion' questions, **Figure 3**) shows no effect of anaphoric form, and instead identification of PPT attitude-holders is guided by a strong source bias and a weaker subject bias.

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[18] In the *heard* conditions, the subject gets a significant boost in the presence of reflexives compared to the no-anaphor conditions (*heard* + pronoun is in-between). This pattern (the opposite of what perspectival uniformity predicts) may be due a subject activation process triggered by encountering the reflexive: Since reflexives have a strong preference to corefer with subjects, perhaps encountering a reflexive reactivates the subject, increasing its prominence and making it more likely to be interpreted as the PPT attitude-holder. (Subjects in the *told* condition are presumably already at ceiling.) Whatever the reason is for reflexives boosting the subject preference with *heard*, this is not problematic for the claims in this paper and fits well with the already-mentioned subjecthood effect: These patterns suggest that subjecthood (perhaps topicality) guides attitude-holder identification.
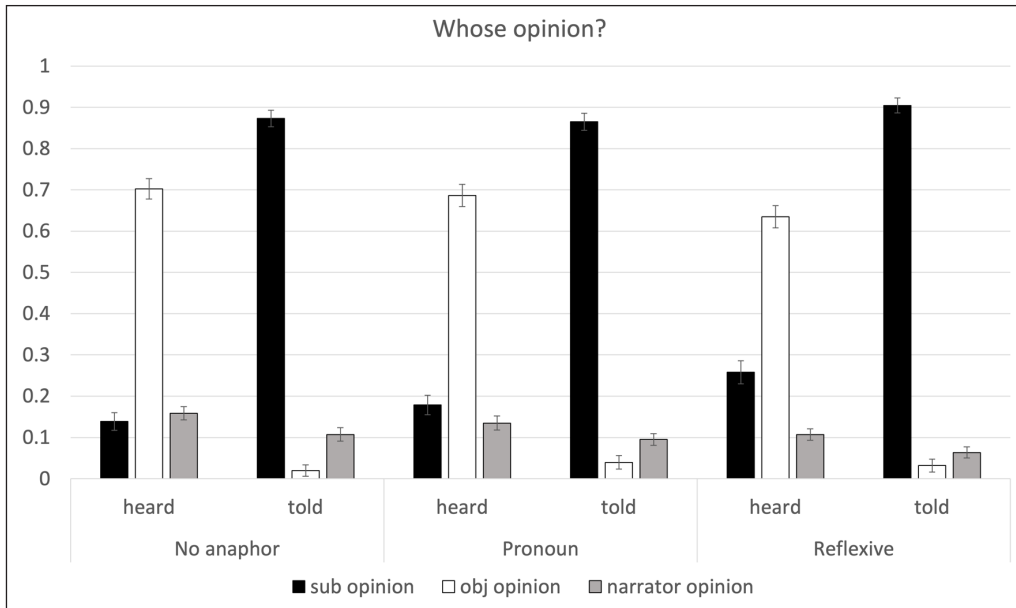
Figure 3: Experiment 1: Proportion of trials where, for each condition, participants responded that the PPT is the opinion of the subject, object or the narrator (attitude-holder identification). (Error bars: +/–1 *SE*).

contrast	*estimate*	*SE*	*z*	*p value*
Told_none vs. heard_none	4.985	0.339	14.721	<.0001
Told_pro vs. heard_pro	4.497	40.316	14.217	<.0001
Told_ref vs heard_ref	4.412	0.331	13.312	<.0001
Heard_none vs. heard_pro	–0.379	0.284	–1.334	1.0000
Heard_none vs heard_ref	–1.003	0.271	–3.703	0.0019
Heard_pro vs heard_ref	–0.625	0.255	–2.449	0.1289
Told_none vs. told_pro	0.109	0.303	0.358	1.0000
Told_none vs. told_ref	–0.430	0.330	–1.303	1.0000
Told_pro vs told_ref	–0.539	0.327	–1.650	0.8909

Table 1: Experiment 1: "Subject's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tests, shading indicates $p < .05$ here and elsewhere).

contrast	estimate	SE	z	p value
Told_none vs. heard_none	–6.350	0.550	–11.538	<.0001
Told_pro vs. heard_pro	–5.441	0.435	–12.505	<.0001
Told_ref vs heard_ref	5.322	0.459	–11.586	<.0001
Heard_none vs. heard_pro	0.124	0.249	0.498	1.0000
Heard_none vs heard_ref	0.502	0.245	2.050	0.3635
Heard_pro vs heard_ref	0.378	0.242	1.560	1.0000
Told_none vs. told_pro	–0.785	0.581	–1.350	1.0000
Told_none vs. told_ref	–0.526	0.603	–0.874	1.0000
Told_pro vs told_ref	0.259	0.510	0.507	1.0000

Table 2 Experiment 1: "Object's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tests).

contrast	estimate	SE	z	p value
Told_none vs. heard_none	–0.995	0.408	–2.437	0.1334
Told_pro vs. heard_pro	–0.834	0.420	–1.984	0.4249
Told_ref vs heard_ref	–1.146	0.476	–2.410	0.1434
Heard_none vs. heard_pro	0.444	0.391	1.135	1.0000
Heard_none vs heard_ref	0.985	0.407	2.420	0.1397
Heard_pro vs heard_ref	0.541	0.411	1.317	1.0000
Told_none vs. told_pro	0.282	0.429	0.656	1.0000
Told_none vs. told_ref	1.136	0.475	2.392	0.1507
Told_pro vs told_ref	0.854	00.482	1.772	0.6874

Table 3 Experiment 1: "Narrator's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tests).

| contrast	estimate	SE	z	p value
Told_none vs. heard_none	1.726	0.299	5.769	<.0001
Told_pro vs. heard_pro	1.693	0.292	5.796	<.0001
Told_ref vs heard_ref	2.688	0.326	8.237	<.0001

Table 4: Experiment 1: "Source opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 3 tes*ts*).

Put together, these data challenge claims about strong perspectival uniformity. To see this more clearly, let's visually combine the two data types. **Figures 4a** and **4b** combine the data from **Figures 2a**, **2b** and **3**, to show how choice of antecedent for the anaphoric expression relates to choice of PPT judge on each trial (with the no-anaphor condition omitted). In **Figure 4**, the *height of each bar* shows the proportion of trials where a certain anaphor was interpreted as referring to the preceding subject (**Figure 4a**) or the preceding object (**Figure 4b**). Thus, the heights of the bars in **Figures 4a–b** are the same as the heights of the bars in **Figures 2a–b**. For ease of exposition, the proportion of subject responses and object responses are plotted separately (like **Figures 2a–b**), and sum to 1. Crucially, in **Figures 4a** and **4b**, the *segments within each bar* show what proportion of responses were associated with the PPT being interpreted as the subject's, object's or the narrator's opinion. Thus, the segments inside each bar convey the information from **Figure 3**, now relativized to the antecedent-choice proportions.

According to the strong version of perspectival uniformity, (a) all subject-antecedent interpretations (**Figure 4a**) should also be subject-opinion PPT interpretations (all subject-antecedent choice bars should only contain black) and (b) all object-antecedent interpretations (**Figure 4b**) should be object-opinion PPT interpretations (all object-antecedent choice bars should only contain white). However, this is clearly not the case for subject-antecedent or object-antecedent interpretations, and it is not the case for reflexives or pronouns. Instead, **Figures 4a** and **4b** confirm data patterns already discussed, namely a preference to interpret the source of information as the attitude-holder: Regardless of anaphoric form, *told* conditions elicit high proportions of subject opinion responses (black shading; the subject is the source) and *heard* conditions elicit high proportions of object opinion responses (white shading; the object is the source).

Could this data be taken as evidence for form-specific perspectival uniformity – specifically, that only reflexives and PPTs pattern together, but that pronouns and PPTs diverge? The answer is no. Even if one only looks at the reflexive conditions, there are clear signs of reflexives and PPTs diverging. For example, in the *heard* condition, most trials where participants said the reflexive refers to the <u>subject</u> are still interpreted as having an <u>object</u> attitude-holder (third bar

in **Figure 4a**). Furthermore, even on the trials when participants interpreted the reflexive as referring to the subject in the *told* condition (the <u>source</u>; fourth bar in **Figure 4a**), there is no perfect correlation between antecedent choice and attitude-holder identification, as participants sometimes report that the object (perceiver) or the narrator is the attitude-holder of the PPT.
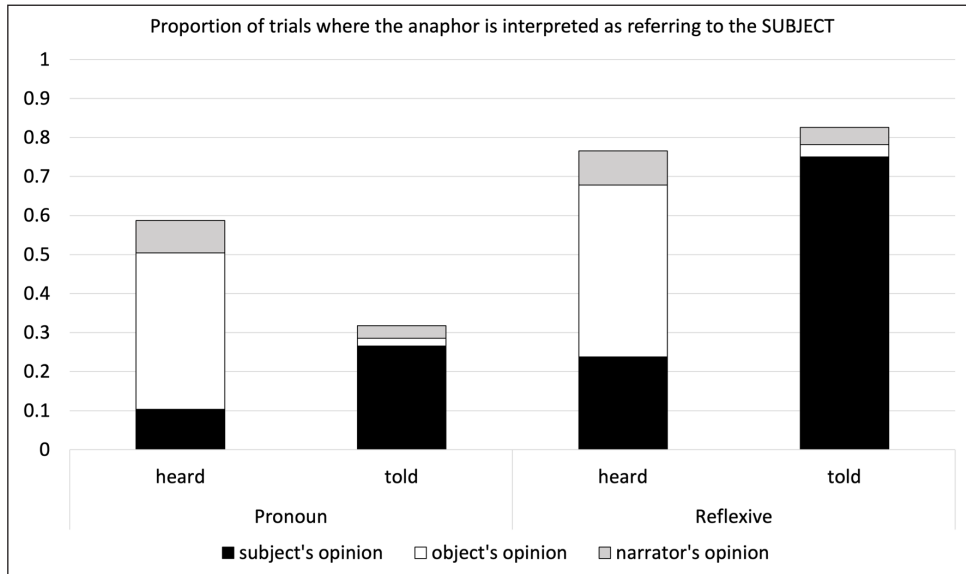
Figure 4a: Experiment 1: Whose opinion does the PPT reflect on trials where participants said that the anaphor refers to the subject?
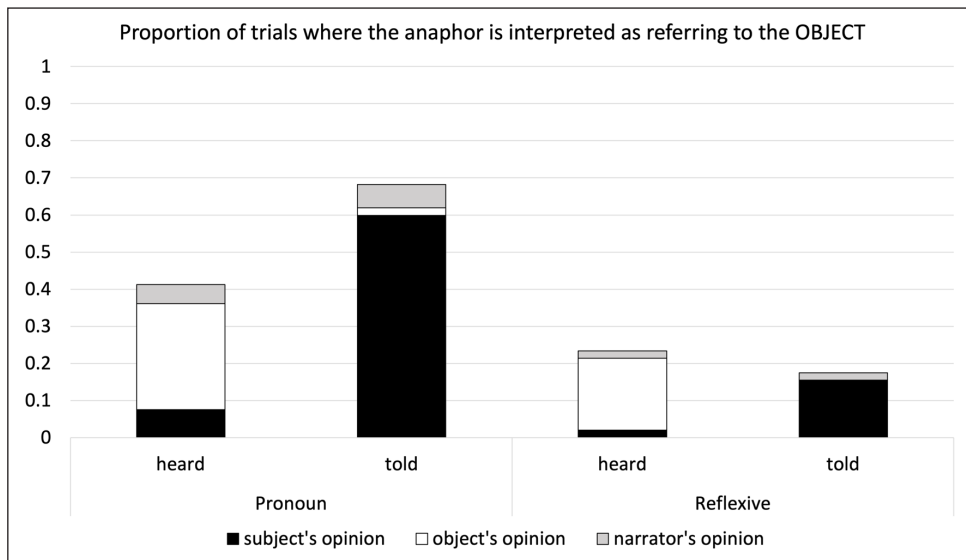
Figure 4b: Experiment 1: Whose opinion does the PPT reflect on trials where participants said that the anaphor refers to the object?

3.3 Experiment 1 Discussion

The antecedent-choice patterns for pronouns and reflexives in Experiment 1 largely replicate earlier findings (Kaiser et al. 2009) showing that pronouns and reflexives in picture-NPs are sensitive to the distinction between source and perceiver, but in different directions and not equally strongly. The attitude-holder identification data in Experiment 1 shows a strong source bias and a weaker subject bias. The source bias is in line with suggestions in prior work (e.g. Sells 1987).

Crucially, this preference to interpret the source of information as the attitude-holder obtains regardless of whether the sentence contains a pronoun or a reflexive, and regardless of whether that pronoun or reflexive is interpreted as referring to the subject or object. There is no evidence for (i) a strong perspectival uniformity constraint that would yoke together the attitude-holder of PPTs and the antecedent of perspective-sensitive pronouns and/or reflexives, nor (ii) for a form-specific perspectival uniformity constraint that only applies to reflexives.

As a whole, Experiment 1 provides no clear evidence that the interpretation of PPTs and anaphors in contexts such as ex.(10) exhibit perspectival uniformity. Instead, the data seem to be more compatible with the multiple-constraints, form-specific account discussed in Kaiser et al. (2009). Under this view, anaphor resolution and attitude-holder identification are guided by multiple weighted constraints. Reflexives are guided by a strong subject preference and a weaker source preference, pronouns by a perceiver preference and an object preference, and PPT attitude-holder interpretation is guided by a strong source preference and a weak subject preference. Thus, the preferences of reflexives and PPTs happen to resemble each other in the right configuration (when the subject is the source, with *told*) – creating what might look like a preference for form-specific perspectival uniformity. But even this is revealed as an illusion when we consider configurations where the preferences of reflexives and PPTs come apart, i.e., where the object is the source (with *heard from*): it's clear that, like pronouns, reflexives in picture-NPs are not inherently linked to PPTs' attitude-holders.

In sum, these results indicate that interpretation of picture-NP anaphors and identification of the attitude-holders of PPTs are not yoked together, although they may show some overlap in contexts where the constraints guiding these processes happen to partially converge

4. Experiment 2: A potential concern? Multiple attitude-holders

A potential concern with Experiment 1 is that on each trial, participants could only choose *a single* attitude-holder – either the subject, object or narrator. Thus, even if participants felt that the PPT reflects an opinion shared by multiple entities or that a PPT is ambiguous between two (or more) attitude-holders, they were unable to indicate this. Could the outcome of Experiment 1 be an artifact of the 'single answer choice' format? In other words, could the binary format be hiding a closer link between attitude-holder identification and antecedent choice? In particular,

on trials where the anaphor is interpreted as referring to the perceiver, is there evidence of *the perceiver being considered as a secondary attitude-holder*, in addition to the expected bias to interpret the source as the preferred attitude-holder? If yes, this would point to a closer relation between attitude-holder identification and anaphor resolution than the results of Experiment 1 alone indicate.

To tackle this question, in Experiment 2, for 'whose opinion' questions participants could select "all that apply" – in other words, they could select as many attitude-holders for the PPT as they wanted and were not faced with only a binary choice.[19] Thus, Experiment 2 aims to assess whether the dissociation observed in Experiment 1 between attitude-holder identification and anaphor resolutions persists even when participants are able to provide a fuller measure of their attitude-holder interpretations.

4.1 Method

4.1.1 Participants

Participation, recruitment and exclusion criteria were as in Experiment 1. Data for 42 native, adult English speakers is included in the final analyses. None had participated in Experiment 1. One person was excluded for not being a US-born native English speaker, and one for not reporting normal or corrected to normal vision. Seventeen people were excluded for poor performance on attention-check trials, two for poor performance on the practice trials, and two for poor performance on both. In addition, four randomly-selected participants were excluded to balance the number of people per list.

4.1.2 Materials and design

The materials and design of the targets and fillers were the same as in Experiment 1.

4.1.3 Procedure

The method was the same as in Experiment 1, except that for the 'whose opinion' questions, participants were explicitly instructed to select "all that apply." They could select as many as attitude-holders for the PPT as they wanted (and whatever combination of judges they wanted). A reminder was shown on the screen for every 'whose opinion' trial. The 'who shown' questions were the same as in Experiment 1.

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[19] Experiment 2 does not aim to distinguish between multiple judges competing for association with a PPT vs. multiple judges simultaneously associated with a PPT. I leave this for future work, especially in light of literary research on 'dual voice' in free indirect discourse (Pascal 1977; Fludernik 1993): Many have suggested that free indirect discourse allows for a blending of the character's and the narrator's perspectives and/or voice, but this issue is hard to resolve (Fludernik 1993).

4.2 Predictions

For antecedent choice data and attitude-holder identification data, the predictions are the same as Experiment 1. The key question is whether, on trials where the anaphor is interpreted as referring to the *perceiver,* is the perceiver now also selected as an attitude-holder (perhaps in addition to the source referent)? Data along these lines would provide stronger evidence for perspectival uniformity than suggested by the results of Experiment 1.

4.3 Experiment 2 results

4.3.1 Reference resolution

Figures 5a and **5b** show participants' responses to the 'who shown' questions. There are more subject interpretations with reflexives than pronouns ($\beta = -2.618$, $SE = 0.217$, $z = -12.075$, $p < 0.0001$), as well as a significant interaction between anaphor and verb ($\beta = 3.43$, $SE = 0.431$, $z = 7.955$, $p < 0.00001$), with pronouns showing greater sensitivity to the verb manipulation than reflexives. There is no main effect of verb ($\beta = -0.076$, $SE = 0.396$, $z = -0.192$, $p = 0.848$). As is visible in **Figures 5a** and **5b** – and echoing Experiment 1 – pronouns are more sensitive to the verb manipulation than reflexives. Indeed, planned comparisons reveal that pronouns elicit more subject interpretations with *heard* than *told* ($\beta = 1.47$, $SE = 0.211$, $z = 6.95$, $p < 0.0001$), replicating Kaiser et al. (2009)'s findings as well as the results of Experiment 1. Reflexives exhibit a numerical source preference, although it does not reach significance ($\beta = -1.007$, $SE = 0.722$, $z = -1.393$, $p = 0.164$). Nevertheless, this reflexive pattern goes in exactly the same direction that was observed in earlier work and in Experiment 1. As a whole, the referential patterns in Experiment 2 largely replicate prior work.
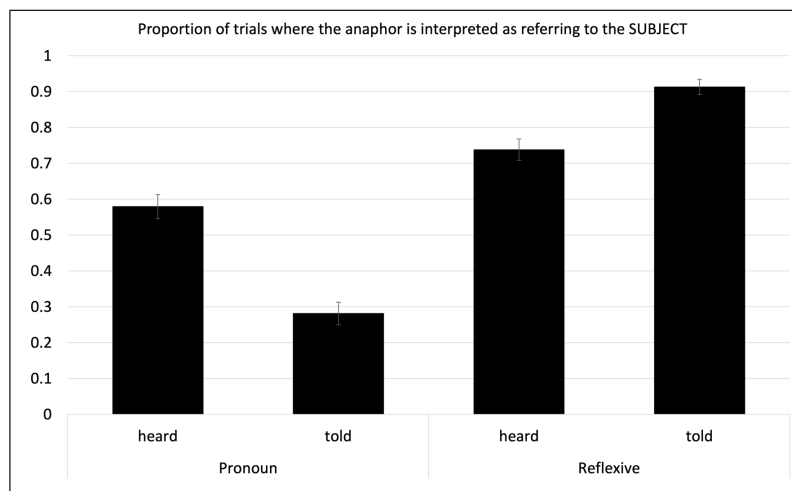
Figure 5a: Experiment 2: Proportion of trials where participants interpreted the anaphor as referring to the subject. (Error bars show +/− 1 *SE*.)
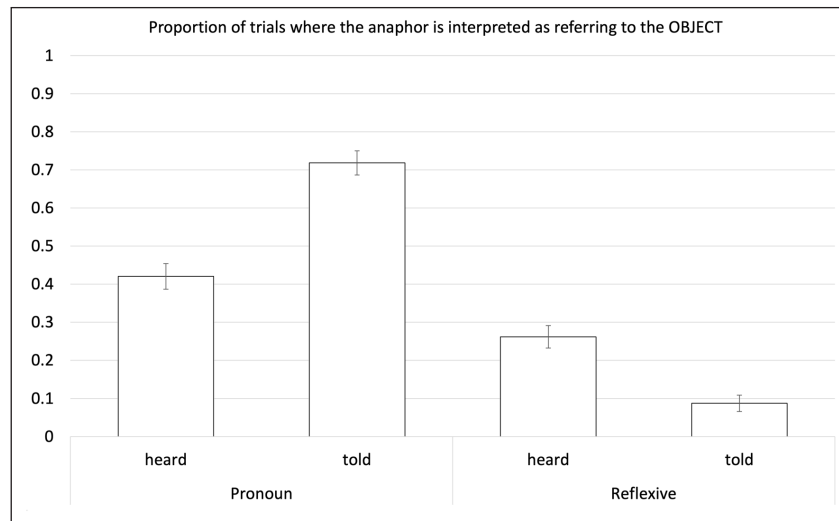
Figure 5b: Experiment 2: Proportion of trials where participants interpreted the anaphor as referring to the object (This data is the inverse of the subject response data in Figure 5a). (Error bars: +/− 1 *SE*).

4.3.2 Attitude-holder identification

Participants' responses to the 'whose opinion' question are in **Figure 6**. As in Experiment 1, all three anaphor-type conditions (pronoun, reflexive, and no-anaphor) elicit (i) more subject-only opinion responses with *told* than *heard* and (ii) more object-only opinion responses with *heard* than *told* (**Tables 5** and **6**). Furthermore, although combined "subject + narrator" responses and "object + narrator" responses are relatively infrequent (never higher than 20% in any condition), they echo the same pattern as "subject-only" and "object-only" responses: there are more "subject + narrator" responses with *told* than *heard*, and more "object + narrator" responses with *heard* than *told*, with all three anaphoric form options (no anaphor, pronoun, reflexive). This is in **Tables 8** and **9**. "Narrator-only" opinion responses are infrequent (never above 10% in any condition) and, as in Experiment 1, are not influenced by the verb manipulation (see **Table 7**). Thus, narrator responses on their own exhibit no sensitivity to the source/perceiver distinction, in line with Experiment 1, but participants are willing to consider shared perspectives (albeit not very frequently) such that the narrator shares the perspective of the source-of-information referent. This could be taken as evidence that the narrator's perspective is a neutral default that can 'come along' when a character's perspective is being assumed.

The results also show that combined "subject + object" opinions are quite rare (always below 10%) but, interestingly, are more frequent with *heard* than with *told*, in all three anaphoric form conditions (**Table 10**). In other words, regardless of whether the sentence contains no anaphor, a pronoun or a reflexive, participants are more likely (although it's still quite rare) to judge the PPT as reflecting the opinion of both the subject and the object when the verb is *heard* than *told*.

All three candidates (subject, object, narrator) were rarely selected; the data is too sparse to analyze statistically.

Overall, the 'whose opinion' results replicate Experiment 1, namely that the single source of information (the subject with *told,* the object with *heard*) tends to be interpreted as the attitude-holder of the subjective predicate, even if multiple options could be chosen. This preference for the source is present in the no-anaphor condition, the pronoun condition and the reflexive condition (**Tables 5** and **6**).

As in Experiment 1, there is evidence of subjecthood effects on attitude-holder interpretation: The source preference is again stronger when the source is the subject (with *told*) than when it is the object (with *heard*), in in all three anaphor type conditions (no anaphor, reflexive, pronoun), see **Table 11**.[20]

Overall, the results again show that PPT attitude-holder identification is guided by a strong source preference and a weaker subject preference.
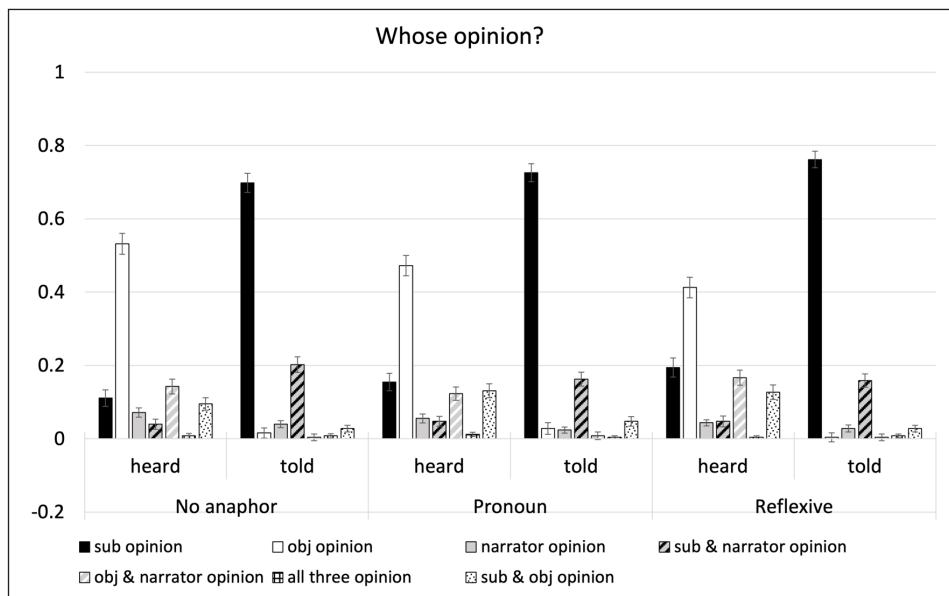
Figure 6: Experiment 2: Proportion of trials where, for each condition, participants responded that the PPT is the opinion of the subject, the object or the narrator (attitude-holder identification). (Error bars: +/− 1 *SE*).

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[20] Further, similar to Experiment 1, in the *heard* conditions, the subject gets a boost in the presence of reflexives as compared to the no-anaphor conditions (with *heard* + pronoun numerically in-between). This effect is also marginally reflected in the rate of object-opinion responses. As mentioned, this may be due to the reflexive reactivating the subject referent, thereby increasing its prominence and rendering it more likely to be interpreted as the PPT's attitude-holder.

contrast	estimate	SE	z	p value
told_none vs. heard_none	4.000	0.304	13.153	<.0001
told_pro vs. heard_pro	3.727	0.284	13.128	<.0001
told_ref vs heard_ref	3.699	0.285	12.977	<.0001
heard_none vs. heard_pro	–0.487	0.296	–1.646	0.8978
heard_none vs heard_ref	–0.821	0.287	–2.861	0.0380
heard_pro vs heard_ref	–0.334	0.264	–1.265	1.0000
told_none vs. told_pro	–0.213	0.247	–0.863	1.0000
told_none vs. told_ref	–0.520	0.255	–2.035	0.3763
told_pro vs told_ref	–0.307	0.258	–1.190	1.0000

Table 5: Experiment 2: "Subject's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 test*s*).

contrast	estimate	SE	z	p value
told_none vs. heard_none	–4.254	0.520	–8.188	<.0001
told_pro vs. heard_pro	–3.444	0.404	–8.534	<.0001
told_ref vs heard_ref	–5.173	1.010	–5.122	<.0001
heard_none vs. heard_pro	0.238	0.178	1.336	1.0000
heard_none vs heard_ref	0.480	0.180	2.670	0.0682
heard_pro vs heard_ref	0.242	00.180	1.344	1.0000
told_none vs. told_pro	–0.572	0.633	–0.903	1.0000
told_none vs. told_ref	1.398	1.121	1.247	1.0000
told_pro vs told_ref	1.970	1.073	1.837	0.5962

Table 6: Experiment 2: "Object's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 test*s*).

contrast	estimate	SE	z	p value
told_none vs. heard_none	–1.269	0.588	–2.160	0.2769
told_pro vs. heard_pro	–1.714	0.700	–2.448	0.1292
told_ref vs heard_ref	-0.911	0.688	–1.323	1.0000
heard_none vs. heard_pro	0.551	0.530	1.041	1.0000
heard_none vs heard_ref	1.069	0.570	1.876	0.5464
heard_pro vs heard_ref	0.518	0.592	0.875	1.0000
told_none vs. told_pro	0.995	0.722	1.378	1.0000
told_none vs. told_ref	0.711	0.697	1.020	1.0000
told_pro vs told_ref	–0.285	0.756	–0.376	1.0000

Table 7: Experiment 2: "Narrator's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 test*s*).

contrast	estimate	SE	z	p value
told_none vs. heard_none	3.019	0.472	6.395	<.0001
told_pro vs. heard_pro	2.237	0.440	5.083	<.0001
told_ref vs heard_ref	2.165	0.442	4.894	<.0001
heard_none vs. heard_pro	–0.2801	0.511	–0.548	1.0000
heard_none vs heard_ref	–0.293	0.515	–0.569	1.0000
heard_pro vs heard_ref	–0.013	0.494	–0.026	1.0000
told_none vs. told_pro	0.502	0.325	1.545	1.0000
told_none vs. told_ref	0.561	0.328	1.708	0.7882
told_pro vs told_ref	0.059	0.334	0.175	1.0000

Table 8: Experiment 2: "subject and narrator opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 test*s*).

contrast	estimate	SE	z	p value
told_none vs. heard_none	–4.596	1.063	–4.322	0.0001
told_pro vs. heard_pro	–3.588	0.787	–4.561	<.0001
told_ref vs heard_ref	–4.899	1.066	–4.595	<.0001
heard_none vs. heard_pro	0.286	0.339	0.843	1.0000
heard_none vs heard_ref	–0.306	0.325	–0.940	1.0000
heard_pro vs heard_ref	–0.591	0.334	–1.770	0.6910
told_none vs. told_pro	–0.722	1.252	–0.577	1.0000
told_none vs. told_ref	–0.003	1.440	–0.002	1.0000
told_pro vs told_ref	0.72	1.253	0.574	1.0000

Table 9: Experiment 2: "object and narrator opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tes*ts*).

contrast	estimate	SE	z	p value
told_none vs. heard_none	–1.86	0.532	–3.502	0.0042
told_pro vs. heard_pro	–1.61	0.429	–3.763	0.0015
told_ref vs heard_ref	–2.34	0.523	–4.484	0.0001
heard_none vs. heard_pro	–0.534	0.348	–1.536	1.0000
heard_none vs heard_ref	–0.481	0.349	–1.377	1.0000
heard_pro vs heard_ref	0.0533	0.326	0.163	1.0000
told_none vs. told_pro	–0.784	0.574	–1.365	1.0000
told_none vs. told_ref	–0.0000292	0.633	0.000	1.0000
told_pro vs told_ref	0.784	0.574	1.365	1.0000

Table 10: Experiment 2: "subject and object opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tes*ts*).

contrast	estimate	SE	z	p value
Told_none vs. heard_none	1.199	0.242	4.946	<.0001
Told_pro vs. heard_pro	1.833	0.250	7.322	<.0001
Told_ref vs heard_ref	2.558	0.264	9.685	<.0001

Table 11: Experiment 2: "Source opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 3 tes*ts*).

4.3.3 Combining the data types

To assess the relationship between perspective-sensitive anaphora and attitude-holder identification more directly, let's again visually combine the two data types analyzed above. **Figures 7a** and **7b** replot the same data from **Figures 5a**, **5b** and **6**. Akin to Experiment 1, there is a dissociation between reference resolution and attitude-holder identification. (As a reminder, perspectival uniformity predicts all subject-antecedent interpretations will be subject-opinion PPT interpretations – all bars should be fully black in 7a – and all object-antecedent interpretations will be object-opinion PPT interpretations – all bars should be fully white in 7b.) This is not the case in either **Figure 7a** or **7b**. Instead, what emerges is the same kind of dissociation between reference resolution and attitude-holder identification as in Experiment 1.

The dissociation is especially clear on those trials where the anaphor refers to the perceiver (subject of *heard*, first and third bars in **Figure 7a**, object of *told*, second and fourth bars in **Figure 7b**). On these trials, there is no sign of a corresponding bias to interpret the perceiver (*subject* of heard, object of *told*) as the judge of the PPT. Instead, there is again a preference to interpret the source as the attitude-holder. Even on trials where the anaphor refers to the source (subject of *told*, second and fourth bars in **Figure 7a**, object of *heard*, first and third bars in **Figure 7b**), there is no evidence for strong perspectival uniformity.

But now let's consider if there is any evidence from participants' *multiple-opinion responses* to support the prediction that, on trials where the anaphor is interpreted as referring to the perceiver (subject of *heard*, first and third bars in **Figure 7a**; object of *told*, second and fourth bars in **Figure 7b**), the perceiver is selected as an *additional attitude-holder*, in addition to the source of information. In other words, is there an interaction between verb type and antecedent choice? Are there more "subject + object" responses when the anaphor refers to the perceiver (subject of *heard*, first and third bars in **Figure 7a**; object of *told*, second and fourth bars in **Figure 7b**) than when it refers to the source (subject of *told*, second and fourth bars in **Figure 7a**, object of *heard*, first and third bars in **Figure 7b**)? The answer is no. Although there are more "subject + object" opinion responses in **Figure 7a** with *heard* than with *told*, this is not the case in **Figure 7b**. In fact, as above, "subject + object" opinions are overall more frequent with *heard* than with *told*, in all three anaphoric form conditions.

Thus, there is no evidence of an interaction, no evidence of participants preferentially selecting the perceiver as an additional attitude-holder alongside the source when the anaphor refers to the perceiver.
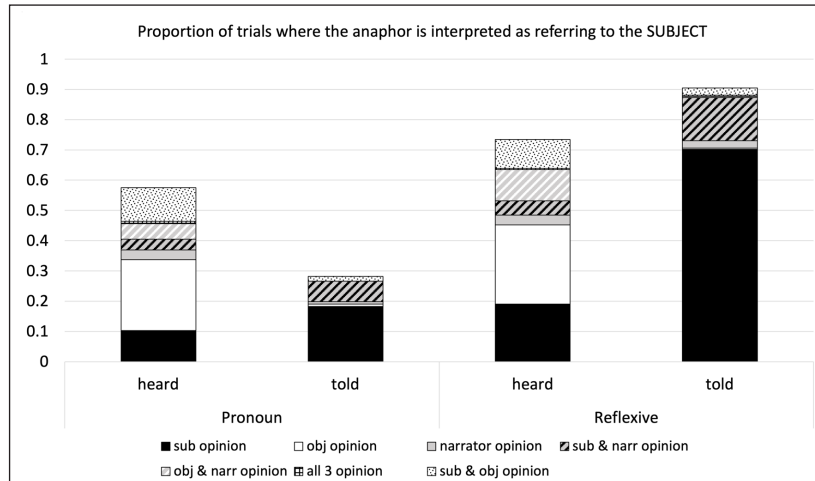
Figure 7a: Experiment 2: Whose opinion does the PPT reflect on trials where participants said that the anaphor refers to the subject?
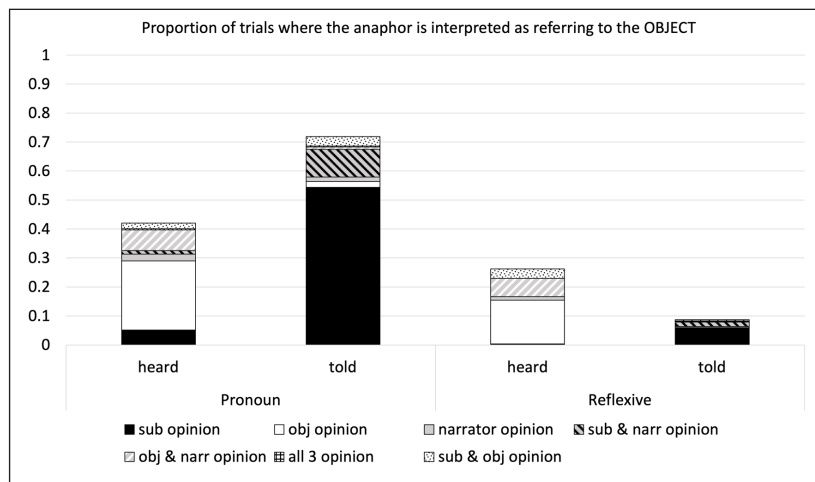
Figure 7b: Experiment 2: Whose opinion does the PPT reflect on trials where participants said that the anaphor refers to the object?

4.4 Experiment 2 discussion

The results of Experiment 2 largely replicate Experiment 1. The reference resolution data show that reflexives have a strong subject preference and a numerical source preference, while pronouns have a strong object preference and a perceiver preference. The attitude-holder identification

data reveal that participants still mostly opt for only a single attitude-holder: Averaging across conditions, participants chose only one attitude-holder on 73% of all trials. The results again show that PPTs have a strong source preference and a weak subject preference.

I also checked whether, on trials where the anaphor is interpreted as referring to the *perceiver*, participants selected the perceiver as a secondary attitude-holder, in addition to the source. The results show that this is not the case.

As a whole, these results fit with the multiple-constraints approach proposed for Experiment 1, where anaphor resolution and attitude-holder identification are guided by multiple constraints, which happen to partially resemble each other in the case of reflexives (weak source preference, strong subject preference) and PPTs (strong source preference, weak subject preference) but not with pronouns (perceiver preference and object preference).

In sum, Experiment 2 replicates the results of Experiment 1: both support the 'partially overlapping constraints' situation sketched out in Section 2.1. This shows that Experiment 1's conclusions about a lack of perspectival uniformity between attitude-holder identification and interpretation of perspective-sensitive anaphora is not an artifact of the single-answer format.

One might wonder about a follow-up where participants can indicate multiple potential *antecedents* for anaphors. There are at least two reasons why this is unlikely to provide evidence for perspectival uniformity. First, given that offering participants the possibility of selecting multiple PPT attitude-holders did not yield support for perspectival uniformity, it is logically unlikely that a multiple-antecedent study would do so: If perspectival uniformity holds, it should have been detected in Experiment 2. Second, singular anaphors in English can be ambiguous but cannot refer to multiple referents at once – unlike plural *them/themselves*, and presumably unlike PPTs that could (at least intuitively) reflect shared opinions. If two antecedents are competing for selection, the expectation is that when the data is aggregated, one would see at least weak reflexes of this competition. However, this was not the case. Thus, the results suggest that a 'multiple-antecedent' follow-up study would be unlikely to provide clear evidence for perspectival uniformity.

5. Experiment 3: Across finite clauses

So far, the experiments tested contexts where the anaphor and its candidate antecedents are in the same tensed clause, to allow for maximum comparability with Kaiser et al. (2009). Experiment 3 tests whether contexts where the anaphor and its antecedent are in different finite clauses, as in ex.(11),[21] also reveal a dissociation between attitude-holder identification and interpretation of perspective-sensitive anaphor.

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[21] Prior research agrees that picture-NP reflexives with antecedents in another clause can be acceptable (e.g. Jackendoff 1972; Cantrall 1974; Kuno 1987; Pollard & Sag 1992; Stirling & Huddleston 2002; Sloggett 2017). The acceptability of the types of sentences used Experiment 3 is also corroborated by an acceptability-rating study. On a scale of 0 to

(11)　Nora {told/heard from} Kimberly that there was a frightening photograph {of herself/ of her/Ø} in the newspaper.

Testing structures like (11) is important, as they offer an even more stringent means of testing how perspective-sensitive reflexives behave: the reflexive in (11) is undisputedly not locally bound. It is not in the same finite clause as its antecedent. Thus, structures like (11) address a potential concern regarding Experiments 1–2: Could it be that the failure to detect perspectival uniformity stems from reflexives in structures like (10) not being 'sufficiently' perspective-sensitive? To test this, in Experiment 3, the targets from Experiments 1–2 were adjusted to create two distinct finite clauses. The methodology and design were otherwise the same.

5.1 Method

5.1.1 Participants

Participation, recruitment and exclusion criteria were as in Experiments 1–2. Data for 42 native, adult English speakers, none of whom had participated in the earlier experiments, is included in the final analyses. Three people were excluded for not being US-born native English speakers, and one for reporting impaired hearing and vision. Seventeen people were excluded for poor performance on attention-check trials and two for poor performance on both practice items and attention check trials. In addition, five randomly-selected participants were excluded to balance the number of people per list.

5.1.2 Materials and design

As in Experiments 1–2, the anaphor (reflexive, pronoun or no anaphor) and the verb (t*old/heard from*) were crossed. The target items used in Experiments 1–2 were adjusted to fit the biclausal structure used in Experiment 3, as exemplified in (11). This study used *there*-constructions, as these are often used in prior work showing that picture-NP reflexives can have antecedents outside their tensed clause (e.g. Jackendoff 1972; Cantrall 1974; Lebeaux 1984; Kuno 1987; Pollard & Sag 1992).[22] The targets were otherwise unchanged. The fillers were the same as in Experiments 1–2.

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　5 (0 = completely unacceptable; 5 = completely acceptable), constructions with the preferred antecedent choice configuration for all four conditions *(X {told/heard from} Y that there was a picture of {him/himself} in the newspaper)* received ratings between 4.4 and 4.7 (mean 4.6). Thus, this fits with prior claims that these kinds of sentences are acceptable.

[22] *There*-constructions necessitate use of an indefinite, unlike Experiments 1–2. As will become clear, the relevant patterns hold regardless of definiteness. In light of Anand & Korotkova's (2021) observations about the behavior of PPTs inside *there*-sentences, future work with sentences like "X told/heard from Y that a frightening photograph of her/herself is in the newspaper" would also be informative.

5.1.3 Procedure

The procedure was the same as in Experiment 2.

5.2 Predictions

In terms of attitude-holder identification, the prediction is again that the source is the preferred attitude-holder; there is no reason to expect a change in syntactic configuration to change this.

In terms of reference resolution, if presence of an intervening tensed clause boundary has no effect, the 'who shown' data for Experiment 3 is predicted to pattern like the results from Kaiser et al (2009) and Experiments 1–2. However, if truly perspective-sensitive anaphors only occur when they are in a separate finite clause from their antecedents, Experiment 3 will show how such elements behave in response to the verb-based source/perceiver manipulation. Relatedly, if the reason for the lack of perspectival uniformity in Experiments 1–2 was that the anaphors being tested were not sufficiently perspective-sensitive, evidence for perspectival uniformity may arise in Experiment 3.

## 5.3 Experiment 3 results

5.3.1 Reference resolution

In participants' answers to the 'who shown' question (**Figures 8a** and **8b**), the proportion of subject choices reveal main effects of anaphor type ($\beta = -0.822$, $SE = 0.15$, $z = -5.494$, $p < 0.0001$), verb ($\beta = -1.772$, $SE = 0.151$, $z = -11.727$, $p < 0.0001$) and a verb x anaphor interaction ($\beta = -1.789$, $SE = 0.299$, $z = -5.980$, $p < 0.0001$). The interaction reflects the fact that pronouns are again more sensitive to the verb manipulation than reflexives – echoing Experiments 1–2. Planned comparisons show that pronouns again exhibit a significant perceiver preference: more subject choices with *heard* than with *told* ($\beta = -2.648$, $SE = 0.23$, $z = -11.501$, $p < 0.0001$). The source preference for reflexives that was previously found by Kaiser et al. and that was marginal in Experiment 1, is now significant: more subject choices with *told* than with *heard* ($\beta = -1.42$, $SE = 0.633$, $z = -2.244$, $p < 0.03$).

5.3.2 Attitude-holder identification

Participants' responses to the 'whose opinion' question are in **Figure 9**. Echoing Experiments 1–2, all three anaphor-type conditions (pronoun, reflexive, and no-anaphor) elicit (i) more subject opinion responses with *told* than with *heard* and (ii) more object opinion responses with *heard* than with *told* (see **Tables 12** and **13**). As is clear from **Figure 9**, the rate of narrator opinion responses is very low and shows no sign of being influenced by the verb manipulation (no statistical analyses could be conducted due to scarcity of data). The rates of 'multiple attitude-holder' opinion responses are also low.
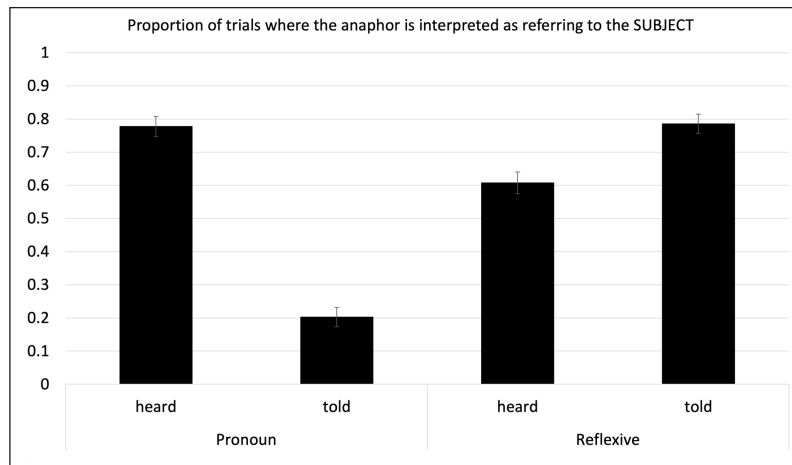
Figure 8a: Experiment 3: Proportion of trials where participants interpreted the anaphor as referring to the subject. (Error bars: $+/- 1$ *SE*).
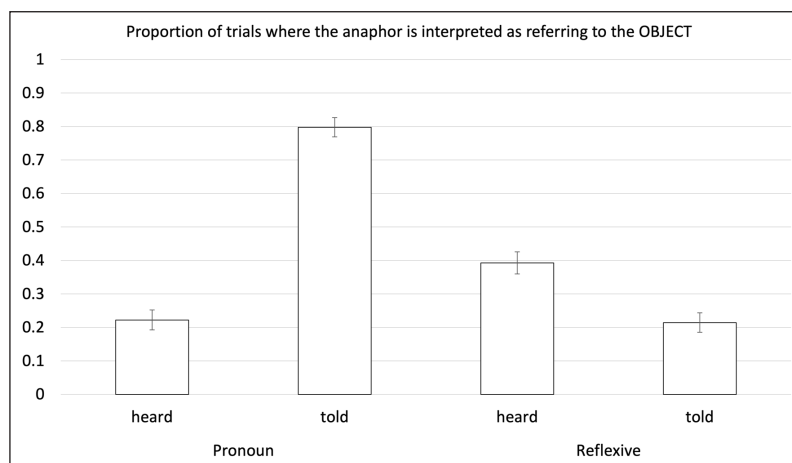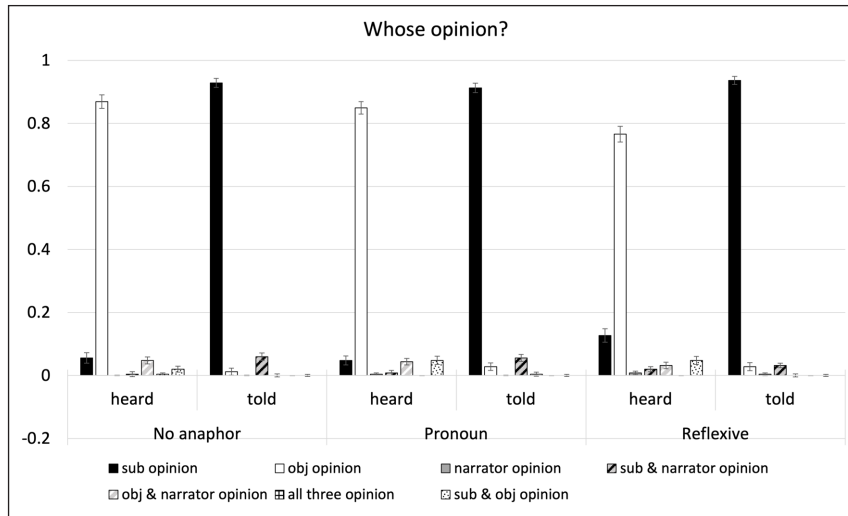

Figure 8b: Experiment 3: Proportion of trials where participants interpreted the anaphor as referring to the object (This data is the inverse of the subject response data in Figure 8a). (Error bars: $+/- 1$ *SE*).

Overall, then, Experiment 3 replicates the first two experiments: there is a strong preference to interpret the source of information (the subject with *told,* the object with *heard*) as the attitude-holder of the PPT. Thus, this preference extends to the cross-clausal context.

As in the two earlier studies, attitude-holder identification is also guided by a subject preference: there is a stronger source preference in source = subject conditions (with *told*) than source = object conditions (with *heard*), regardless of anaphor type (**Table 14**).[23]

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[23] As in the other two studies, there are also more subject choices in the *heard* conditions with reflexives than with pronouns or without an anaphor (Tables 12 and 13).

Figure 9: Experiment 3: Proportion of trials where, for each condition, participants responded that the PPT is the opinion of the subject, the object or the narrator (attitude-holder identification).(Error bars: +/− 1 *SE*).

contrast	*estimate*	*SE*	*z*	*p value*
told_none vs. heard_none	8.083	0.588	13.746	<.0001
told_pro vs. heard_pro	7.929	0.579	13.691	<.0001
told_ref vs heard_ref	7.081	70.538	13.152	<.0001
heard_none vs. heard_pro	0.220	0.471	0.468	1.0000
heard_none vs heard_ref	−1.220	0.394	−3.097	0.0176
heard_pro vs heard_ref	−1.440	0.417	−3.453	0.0050
told_none vs. told_pro	0.374	0.435	0.860	1.0000
told_none vs. told_ref	−0.218	0.468	−0.466	1.0000
told_pro vs told_ref	−0.592	0.451	−1.314	1.0000

Table 12: Experiment 3: "Subject's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tests).

5.3.3 Combining the data types

Figures 10a and **10b** visually combine the two data types analyzed above, to show how choice of antecedent relates to PPT attitude-holder identification. The results replicate the outcomes of the first two experiments.

contrast	estimate	SE	z	p value
told_none vs. heard_none	–8.659	0.777	–11.146	<.0001
told_pro vs. heard_pro	–7.432	0.595	–12.493	<.0001
told_ref vs heard_ref	–6.547	0.549	–11.919	<.0001
heard_none vs. heard_pro	0.230	0.317	0.724	1.0000
heard_none vs heard_ref	1.059	0.300	3.531	0.0037
heard_pro vs heard_ref	0.829	0.290	2.862	0.0379
told_none vs. told_pro	–0.996	0.764	–1.304	1.0000
told_none vs. told_ref	–1.053	0.760	–1.386	1.0000
told_pro vs told_ref	–0.057	0.605	–0.094	1.0000

Table 13: Experiment 3: "Object's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 9 tests).

contrast	estimate	SE	z	p value
told_none vs. heard_none	–8.659	0.777	–11.146	<.0001
told_pro vs. heard_pro	–7.432	0.595	–12.493	<.0001
told_ref vs heard_ref	–6.547	0.549	–11.919	<.0001

Table 14: Experiment 3: "Source's opinion" responses, pairwise comparisons (*P*-value adjustment: bonferroni method for 3 tests).

5.4 Experiment 3 discussion

In essence, Experiment 3 replicates Experiments 1–2: 'Who shown' responses indicate that reflexives have a subject preference modulated by a source preference, while pronouns have an object preference and a perceiver preference. The fact that the referential biases are similar to Experiments 1–2, and also to prior work by Kaiser et al. (2009) – all of which used a structure with only one tensed clause – shows that the lack of perspectival uniformity cannot be attributed to reflexives not being 'sufficiently' perspective-sensitive in structures like (10).

Granted, reflexives' sensitivity to the source manipulation is stronger in Experiment 3 than in Experiments 1–2. However, the fact that Experiments 1–2 show a numerical and/or marginal source effect in the exact same direction, and given that Kaiser et al. (2009) obtained significant evidence for a source preference in structures like ex.(10) in several experiments, there is no
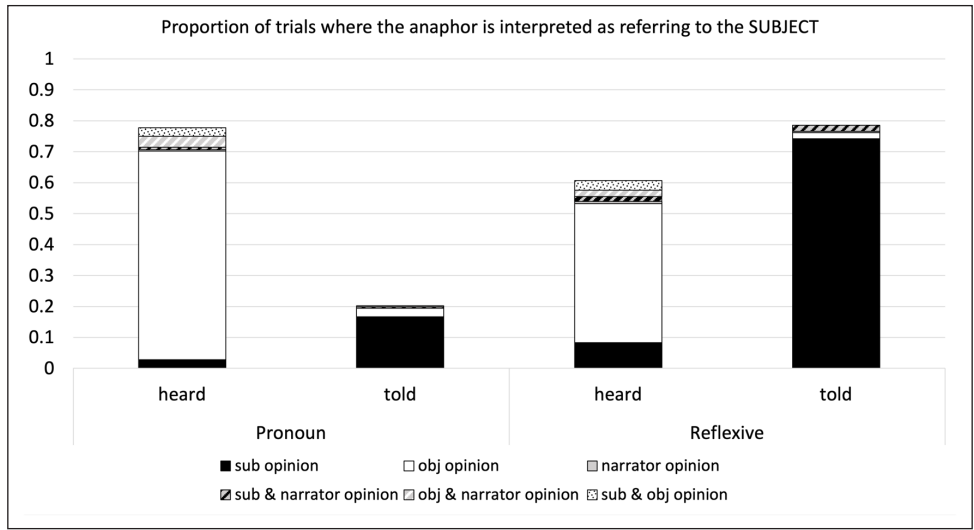
Figure 10a: Experiment 3: Whose opinion does the PPT reflect on trials where participants said that the anaphor refers to the subject?
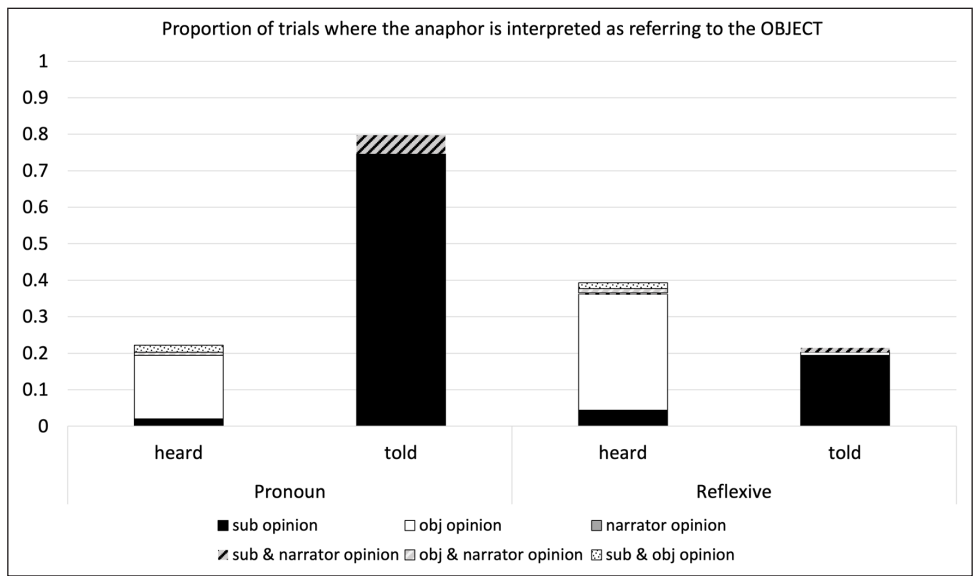

Figure 10b: Experiment 3: Whose opinion does the PPT reflect on trials where participants said that the anaphor refers to the object?

basis to conclude that the interpretative processes in contexts like ex.(10) (one tensed clause) and ex.(11) (two tensed clauses) are qualitatively different.

In Experiment 3, responses to the 'whose opinion' questions also replicate Experiments 1–2: Identification of the attitude-holder of the PPT has a strong source preference and a weaker subject preference. Thus, the results fit with the two preceding studies.

As a whole, Experiment 3 is line with Experiments 1–2 and provides no evidence that anaphora in a two-clause structure exhibit perspectival uniformity with PPTs. The results again support the idea that identification of PPTs' attitude-holders and interpretation of pronouns and reflexives are not linked in an intrinsic way, but that these processes are guided by partially overlapping constraints.

6 General discussion and conclusions

The three studies reported here use experimental methods to explore two phenomena: (a) reference resolution of pronouns and reflexives in picture-NPs and (b) attitude-holder identification with subjective predicates (specifically predicates of personal taste, PPTs). The studies investigate (i) whether perspective-sensitive anaphors and PPTs exhibit perspectival uniformity in examples like (12a–d), (ii) whether the process of identifying the attitude-holder of PPTs is sensitive to source vs. perceiver status, as has already been observed for reflexives and pronouns in picture-NPs, and (iii) whether interpretation of these two classes of expressions depends on whether it's in a mono-clausal context or bi-clausal context where reflexives are clearly not syntactically bound in the standard way (e.g *Lisa told Mary that there was a frightening picture of her/herself in the newspaper*).

(12a)   Lisa told Kate about the frightening picture of herself.
(12b)   Lisa heard from Kate about the frightening picture of herself.
(12c)   Lisa told Kate about the frightening picture of her.
(12d)   Lisa heard from Kate about the frightening picture of her.

Given that intuitions about reference resolution and PPT interpretation can be delicate, conducting multiple studies with groups of naïve participants allows us to complement traditional judgment-based approaches by gathering fine-grained information about the relative strength of different patterns.

It has been claimed in prior work that different kinds of perspective-sensitive expressions, including perspectival anaphors and PPTs, exhibit *perspectival uniformity* – i.e., are interpreted relative to the same perspectival center, such that whoever is the referent of the anaphor is also the attitude-holder of the subjective predicate. Whether the interpretation of these two types of linguistic elements is yoked together has deep implications for theories of how perspectival information is encoded in language (Section 1).

However, prior work does not yet allow us to determine whether interpretation of picture-NP anaphors and PPTs is categorically linked together in the grammar, or whether we are dealing with a non-categorical tendency/preference for the interpretation of these two elements to be correlated, or whether this is a case of two distinct preference patterns that, in certain contexts, yield the illusion of a correlation. Thus, this paper aims to take steps towards a systematic,

experimental investigation of the interpretation of picture-NP anaphors and PPTs, in order to put the relevant intuitions on a firm empirical footing and to provide a more detailed understanding of the relation between these two classes of perspective-sensitive elements, and thereby provide a foundation for subsequent theoretical and experimental work.

6.1 Overview of the results within a multiple-constraints framework

In a nutshell, the results show that attitude-holder identification with PPTs and reference resolution with picture-NP anaphors, although sensitive to some of the same factors, do not exhibit inherent perspectival uniformity.

As regards *anaphor resolution*, the results corroborate earlier findings that reflexives and pronouns in picture-NPs show divergent and asymmetric sensitivities to source and perceiver (and grammatical role) and further show that these patterns extend across finite clauses. Interpretation of reflexives is guided by a strong subject preference and a weaker source preference, whereas interpretation of pronouns is guided by an object preference and a perceiver preference. The patterns are not categorical, and instead point to a system with multiple interacting constraints. Thus, these results replicate and extend the findings of Kaiser et al. (2009) who propose, building on the form-specific account from Kaiser & Trueswell (2008), that pronouns and reflexives are guided by multiple weighted constraints (see also Kaiser 2003; Brown-Schmidt & Byron & Tanenhaus 2005 on form-specific effects in reference resolution; Cunnings & Sturt 2014; 2018 for relevant discussion; Ariel 1990; Arnold 1998 for earlier work on a multiple-constraints approach to reference resolution; McRae & Matsuki 2013 for a general overview of constraint-based approaches to sentence processing).

When it comes to *PPTs*, all three experiments reveal a strong preference to interpret the source of information as the attitude-holder of the PPT, regardless of whether an anaphor (pronoun or reflexive) is present, in a way that is also modulated by subjecthood.[24] Thus, identifying the attitude-holder of PPTs is guided by a strong source preference and a weaker subject preference. This is the first experimental evidence for a strong source preference for PPTs, and corroborates suggestions by Kuno (1987) and Sells (1987).

The existence of these constraints – subject preference, object preference, perceiver preference, source preference – is independently motivated by existing work, including prior research on Binding Theory, pronoun resolution, PPT semantics, and source-oriented vs. addressee-oriented logophoric pronouns.

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[24] This subjecthood constraint may be related to the status of subjects as 'default topics' in English, as discussed earlier, but I make no strong claims about the relation between subjects and topics. The issue of whether it is subjecthood or perhaps subjecthood combined with topicality is not crucial for the claims in this paper.

Crucially, the present results yield no evidence for a categorical perspectival-uniformity principle that yokes together the attitude-holder of PPTs and the antecedent of perspective-sensitive pronouns or reflexives, nor for a more restricted form-specific constraint that only applies to reflexives (or to pronouns, for that matter). But it would be inaccurate to conclude that these processes are entirely unrelated.

Instead, the data point to a situation where reflexives and PPTs are sensitive (but to different degrees) to some of the same constraints (source, subject status), while pronouns are sensitive to complementary constraints (perceiver, object status). Consequently, although we see perspectival uniformity tendencies with PPTs and reflexives in some contexts, a closer look at other configurations shows that these patterns are dissociable and not intrinsically yoked together.

In particular, in contexts where the subject is the source (with *told*, ex.12a), reference resolution of reflexives and attitude-holder identification of PPTs seem to show a tendency towards perspectival uniformity: Lisa is the preferred antecedent of the reflexive (the subject) and the preferred judge of the PPT (the source). Nevertheless, even here the correspondence is not categorical. This suggests that the notion of source across these two phenomena (reference resolution, attitude-holder identification) is independently processed.

Furthermore, when subjecthood and source status are dissociated (with *heard*, ex.12b), there is no perspectival uniformity: Kate is the preferred PPT attitude-holder whereas Lisa is the preferred antecedent of the reflexive. Once subjecthood and source status are disentangled, it becomes clear that reflexives and PPTs do not exhibit systematic perspectival uniformity. This point is even clearer with pronouns (12c,d) which prefer the perceiver (subject or object) while the PPT is associated with the source.

6.2 Challenges for uniform perspective-shifting accounts

Although these results fit well within the form-specific multiple-constraints architecture proposed in prior psycholinguistic work, they seem to challenge approaches where perspective shifting is accomplished categorically by a single high-level operator. This kind of approach is very schematically illustrated in (13a). (Following Charnavel's (2020) work on French, the representations in (13) use a covert logophoric pronoun pro_{log} – generated by each perspective-shifting operator – that refers to the perspectival center, ensuring that perspective-sensitive elements in the scope of the operator are anchored to the relevant perspectival center.) In this configuration, one would presumably expect all relevant perspective-sensitive elements to be categorically interpreted relative to the same perspectival center, which is not what the current experiments found for English.

(13) a. *pro*$_{\text{log-1}}$ OP$_{\text{log}}$ [frightening$_1$ photograph of herself$_1$/her$_1$]
      b. *pro*$_{\text{log-1}}$ OP$_{\text{log}}$ [frightening$_1$ photograph *pro*$_{\text{log-2}}$ OP$_{\text{log}}$ [of herself$_2$/her$_2$]]

What about positing two smaller perspectival domains, as in (13b)? Once we consider what the perspectival center associated with the second OP$_{\text{log}}$ would be, it becomes less clear how this approach could capture the asymmetric behavior of pronouns and reflexives in English picture-NPs: Not only are they sensitive to *different properties of the antecedent* (subject vs. object, source vs. perceiver), but also to *different extents* (pronouns are more sensitive to perceiver status than reflexives to source status). Thus, if one wants to keep all three pieces (PPTs, reflexives and pronouns) in the class of perspective-sensitive elements, it seems necessary to acknowledge that, at least in English, they are not equally sensitive to a uniform conceptualization of 'perspectival center'.[25] On this kind of account, even if one were to allow configurations with multiple perspectival domains, it would presumably also be necessary to, first, allow different kinds of perspective-sensitive operators or different kinds of covert logophoric pronouns, in order to derive both differences in level of sensitivity as well as the complementary-but-not-mirror-image behavior of pronouns and reflexives, and second, to constrain the system to prevent overgeneration.

6.3 Broader implications

As a whole, the results reported here regarding (a) reference resolution of picture-NP anaphors and (b) attitude-holder identification of PPTs seem to fit better with a gradient, multiple-constraints approach along the lines of what has been proposed for reference resolution in prior work. This kind of approach can acknowledge the (partial) similarities between these two phenomena in terms of the constraints at play (e.g. sensitivity to source-of-information), without ignoring their differences. Of course, open questions remain for this approach as well, including questions of overgeneration (i.e., the need to constrain the possible set of constraints). In addition, further work using other methods (e.g. visual-world eye-tracking) is welcome. The present work aims to provide an initial foundation that can be built on with other methods.

Importantly, the finding that the relationship between picture-NP anaphors and PPTs in English is not subject to a categorical principle requiring all perspective elements to be anchored to the same perspectival center does not mean that other languages could not have grammaticalized such a pattern. Indeed, it is often the case that something that is grammaticalized in one language crops up as a tendency in another language (see e.g. Heine & Narrog 2011). Thus, experimental work on other languages is an important future direction, as is work on other kinds of perspectival elements in English. The present results do not mean that perspectival uniformity effects could not occur elsewhere.

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[25] See also Section 1.3.2 on related observations by Deal (2020) regarding indexical shift.

Nevertheless, the observed lack of perspectival uniformity exhibited by picture-NP anaphors on the one hand, and PPTs on the other hand, provides insights into the division of labor that holds between syntactic and non-syntactic factors. Whereas resolution of English reflexives is highly sensitive to a syntactic constraint (subjecthood) and pronoun resolution also shows clear sensitivity to a syntactic constraint (objecthood), PPT attitude-holder identification is guided mostly by source status, which is probably best viewed as a semantic/pragmatic constraint. Although reflexives and pronouns in picture-NPs *are* perspective-sensitive (as shown by multiple experiments), these perspectival effects are at the mercy of the stronger syntactic constraints. Indeed, the observation that syntactic factors are more fundamental to the interpretation of anaphoric expressions and semantic/pragmatic factors are more central for the interpretation of adjectives seems eminently reasonable, given everything else that is known about the grammatical properties of anaphors vs. adjectives.

This observation brings us back to the importance of crosslinguistic work, as it raises questions about perspective-sensitive anaphora in other languages. Japanese *zibun* (self), for example, is known to exhibit extensive perspective-sensitivity and, though it is a reflexive anaphor, is subject to somewhat different syntactic constraints than English reflexives (e.g. Sells 1987). We should be careful to not lump all reflexive elements together – to not make predictions purely based on an expression's linguistic class – when thinking about perspectival uniformity effects and perspective-shifting. Further crosslinguistic work is needed to clarify these issues.

Data availability

The data are available from the corresponding author upon reasonable request.

Additional files

The additional files for this article can be found in an Appendix. DOI: https://doi.org/10.16995/glossa.5768.s1

This Appendix contains the following materials:

- Supplementary File 1. Further examples of the relation between perspective-sensitive anaphors and subjective expressions
- Supplementary File 2. Predicates used in the experiments
- Supplementary File 3. Statistical models

Ethics and consent

The research reported here was approved by the University of Southern California Institutional Review Board, which is accredited by the Association for the Accreditation of Human Research Protection Programs (AAHRPP).

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Competing interests

The author has no competing interests to declare.

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