

Difficulties with pronouns in autism: Experimental results from Thai children with autism

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ABSTRACT

Among pragmatic deficits in individuals with autism spectrum disorders (ASD), difficulties with pronouns, including pronoun reversals between first and second persons, have long been one of the notable examples of how their conceptualization of self and others and their understanding of discourse roles may affect their language. Pronouns themselves are not trivial to process. Referential options for a given pronoun form can be constrained in various ways, including via lexical presuppositions, e.g., through ϕ -features, implicated presuppositions arising from contrasts with other forms that are more marked, and – in certain languages – mechanisms of so-called ‘deictic-center shifting’. This paper explores the acquisition, across two populations, of personal reference terms in Thai, a language with a highly complex personal reference system. Children with typical development (TD) and children with ASD participated in our two studies. In both studies, they were asked to complete simple production and comprehension tasks on personal reference terms. Overall, children with ASD performed on par in production, in terms of overall communicative success, though they were less likely than children with TD to use deictic first-person pronominal forms, preferring to use fixed referential terms for self-reference, whereas children with TD preferred to use personal pronouns. The children with ASD’s performance was significantly poorer in comprehension than that by children with TD. Children with ASD were generally able to detect lexically encoded person features, but struggled the most with more pragmatic and socially deictic aspects of personal reference terms. The latter posed some challenges for children with TD as well, but to a lesser extent. In this regard, our results align with previous claims in the literature that lexical presuppositions are acquired earlier than implicated presuppositions. Our findings also add various new insights both in terms of population-specific effects in a language previously unstudied in this

regard, and on the specific ways in which aspects of implicated presuppositions, i.e., the type of content in play, give rise to particular challenges in acquisition in general and for children with ASD in particular.

KEYWORDS

implicated presupposition, pragmatic inference, pronoun, personal reference, acquisition, deixis, pronoun reversal, person deixis avoidance, Thai

1. Introduction

Autism spectrum disorders (ASD) are characterized by social communication deficits and restricted, repetitive behaviors (American Psychiatric Association, 2013). While language abilities among children with autism are heterogeneous, pragmatic and discourse deficits are generally viewed as central ingredients of their language deficits (for reviews, see Lord & Paul, 1997; Tager-Flusberg, 1999; Wilkinson, 1998). These deficits in individuals with ASDs are considered to be closely tied to their deficits in social skills. Individuals with ASD report that their lack of pragmatic skills cause them anxiety and concerns with regards to socialization, effects that seem to last into adulthood (Paul, Landa, & Simmons, 2014). Owing to the prevalence of pragmatic deficits across the spectrum, this domain has been the focal point of research for several decades (Baron-Cohen, 1988; Dewey & Everard, 1974; Kanner, 1943; Kim, Paul, Tager-Flusberg, & Lord, 2014; Tager-Flusberg, 1981; Volkmar et al., 1987). Prior work reports, for instance, an engagement in conversation with a narrower group of people (McHale, Simeonsson, Marcus, & Olley, 1980), lower rates of conversation initiation (Bernard-Opitz, 1982), less-varied speech acts (Landry & Loveland, 1989), difficulties with turn-taking (Ghaziuddin & Gerstein, 1996), more production of bizarre/inappropriate utterances (Loveland, McEvoy, Tunali, & Kelley, 1990), and difficulties engaging in mutual, cooperative conversation (Paul, Orlovski, Marchinko, & Volkmar, 2009).

Among pragmatic deficits, various difficulties in personal pronoun use have been observed since the beginning of the study of autism by Kanner (1943) and reported in many of the later studies (see, for instance, Bartak & Rutter, 1974; Charney, 1980; Chiat, 1982; Fay, 1979; Loveland, 1984). The reported difficulties include reversals of

person features (1) and errors in case marking (2).

- (1) a. ‘You want candy.’ (Intended: ‘I want candy.’)
- b. ‘Hurt yourself.’ (Intended: ‘I hurt myself.’)
- c. ‘Help you please.’ (Intended: ‘Help me please.’)

(Tager-Flusberg, 1994, p. 185)

- (2) a. ‘My get it.’
- b. ‘Me cool off.’
- c. “Do down me arm.”

(Tager-Flusberg, 1994, pp. 184-5)

In addition, Mizuno et al. (2011) found that personal pronouns *I* and *you* elicit slower and less accurate responses, compared to names, which denote fixed identity, in adults with high-functioning autism. Relatedly, they also detected an under-connectivity between right anterior insula, primarily involved in self-awareness and self-consciousness, and precuneus, essentially involved in spatial attention, especially in tasks containing second-person pronouns, where the intended referent is the addressee with autism.

Several properties of pronouns may contribute to these challenges. Firstly, first- and second-person pronouns involve *person deixis* in that they allude to speaker and hearer roles in the utterance context, and thus do not have fixed referents. Traditionally, the term ‘deixis’ covers kinds of reference that vary with the context of an utterance based on key elements of the situatedness of a discourse, such as person (e.g., ‘I’ and ‘you’), time (e.g., ‘now’ and ‘later’), place (e.g., ‘here’ and ‘there’), discourse reference (e.g., ‘this’ and ‘that’), and social markers (e.g., honorifics) (Fillmore, 1971, 1975; Levinson, 1983; Lyons, 1977). In addition to person deixis, personal pronouns in some languages may also involve social deixis. Interpreting and selecting an appropriate pronoun in these requires knowledge about the social relationship between the interlocutors or sometimes the addressed individuals. Secondly, while all personal pronouns require contextual, perspectival resolution, they differ in the specific features associated with them. Specifically, they may encode a set of so-called ϕ -features (e.g., for person or gender) as their lexical presupposition or come with a so-called *implicated presupposition* (Heim, 1991; Sauerland, 2008b) about the referent. (See Section 2.1 for more

details.)

Research on autism in previously understudied languages can shed light on new or more detailed aspects of linguistic challenges that have been previously overlooked, as languages can vary in various relevant regards. The present study extends research on pragmatic deficits and autism to the issue on deictic and person interpretation of pronouns in Thai, a language with a particularly rich system of personal reference terms, which encompasses not only over 50 personal pronouns, but also kin terms, occupational titles, and personal names that can often be used where other languages may only allow (or strongly prefer) pronominal forms (Bandhumedha 2011; Cooke 1968; Iwasaki and Ingkapirom 2009). The complex personal reference system in Thai thus allows us to explore various layers of meaning in a much more complex overall system, including lexically-encoded meaning, presupposition, implicated presupposition, person deixis, and social deixis.

2. Background

2.1. Semantics and pragmatics of pronouns

2.1.1. Semantic markedness of phi-features.

Personal pronouns are differentiated along several dimensions, including person, gender, case, and number. These dimensions are encoded in their ϕ -features. In the person dimension, first and second persons, marking the speaker and the addressee, are cross-linguistically observed to differ from third person in various ways, such as their ‘associative plural generalization’ (Cysouw, 2003; Greenberg, 1988; Noyer, 1992) and their ‘bound interpretations’ (Heim, 1994; Kratzer, 2009; Sudo, 2012). Concerning the former, first person plural (e.g., English ‘we’) typically has an associative interpretation, i.e., ‘I and my associates/my group.’ Second person plural also typically has such an interpretation, i.e., ‘you and your associates,’ with an additional possible plural addressee reference, i.e., referring to all in the present audience (Cysouw, 2003, pp.69-70). In contrast, while an associative interpretation is possible for third person plural, its typical interpretation is plural reference, unlike first and second persons. (Cysouw,

2003; Moravcsik, 1978) Turning to the second point, first- and second-person singular pronouns cannot be bound by a quantificational subject, such as *exactly one*, as seen in (3).

- (3) a. Exactly one student criticized herself, namely Mary.
 b. *Exactly one student criticized myself, namely me.
 c. *Exactly one student likes yourself. (Sudo, 2012, pp. 141-2)

First and second persons are generally defined as referring to the speaker and the hearer respectively, while third person is described as referring to neither (Lyons 1977). However, while one could encode each of those specifications explicitly in the relevant pronoun's meaning, it is commonly argued that on a given dimension, some pronouns are lexically marked for a particular feature, whereas the unmarked (or less marked) ones receive the typical feature interpretation via contrast with the more marked forms. For person, first- and second-person forms are typically taken to be more marked than third-person pronouns, e.g., in the influential analysis by Sauerland (2008b). One way of empirically supporting variation in markedness comes from Czech, where marked (as opposed to unmarked) features drive properties of verb agreement in the case of conjoined noun phrases with mixed person features. For example, (4) shows that first and second persons 'dominate' third person in this way:

- (4) a. bratr a já se učíme hrát na klavír
 brother and 1.SG self.acc teach-1.PL play on piano
 'My brother and I are learning to play the piano.'
 b. tvůj otec a ty jste si podobni
 your father and you be.2.PL self.DAT alike
 'Your father and you are alike.' (Corbett 1991, p. 262)

Parallel evidence presented by Sauerland (2008b) suggests that first person is more marked than second person, given their dominance relationship, e.g., in English (5) and in German (6). An additional test, namely the epistemic status test, can be employed as the unmarked member does not preclude the possibility of the referent having a property corresponding to a marked feature. This test also confirms that first person is the most marked, followed by second and third persons, as seen in (7-8), where it is still possible that the referent of *he* and *you* is the speaker.

- (5) You and I, **we**, are special. (Sauerland, 2008b, p.26)
- (6) Du und ich sind / *seid etwas besonderes.
 you and I be.{**1.PL/3.PL**} / *be.2.PL something special
 ‘You and I are something special.’ (Corbett 1991, p. 262)
- (7) ‘The winner will be a lucky guy. He could be me.’ (Sauerland, 2008b, p.23)
- (8) ‘To the finder: You might be me.’ (Sauerland, 2008b, p.28)

Sauerland (2008b) proposes to capture this pattern by assuming that first person has the most marked feature specification in English, containing [participant] and [speaker], while the specification for second person is only [participant]. For languages with inclusive/exclusive distinctions (where, e.g., variants of ‘we’ can either mean ‘I, you, and our associates,’ or ‘I and my associates, excluding you’), Sauerland (2008b) proposes the features [speaker] for first person and [addressee] for second person instead. With each person having one marked feature, both first and second persons are equally marked. Most importantly for our purposes, however, in both of these types of languages, third person lacks a person ϕ -feature altogether.¹

Another type of descriptive feature commonly associated with pronoun forms concerns gender. Sauerland (2008b) proposes that among all the languages with masculine/feminine distinctions in pronouns, the feminine distinction is cross-linguistically more marked than the masculine. This can again be seen in the dominance of the masculine grammatical gender over the feminine gender. Unlike person features, in a dominance test for markedness of gender features, the least marked form is dominant in coordination, as illustrated below by subject and predicate agreements in French (9) and Czech (10).

- (9) un père et une mère excellent-s
 a.M father and a.F mother excellent-**M.PL**
 ‘an excellent father and mother’ (Corbett 1991, p. 279)
- (10) Jan a Věra šl-i do biografu
 Jan and Vera go-PST-**M.PL** to movies
 ‘Jan and Vera went to the movies.’ (Vanek 1977, p. 31)

¹Kratzer (2009) advances a similar proposal, that first- and second-person pronouns contain the features [first] and [second] respectively, while third-person pronouns only contain the feature [def], as they merely are definite descriptions, i.e., containing no inherent meanings as other persons. A key difference between these proposals is that the features [first] and [second] in Kratzer’s (2009) proposal pick out an individual, while Sauerland’s (2008b) person features are of the type <e,t>. For ease of exposition, we follow Sauerland’s system throughout the paper.

In contrast, another dimension of grammatical gender, differentiating between human and non-human, varies in which level is marked across languages. For instance, in Luganda, although not fully acceptable in all circumstances, the gender class 8 which agrees with non-human subjects is preferred over, i.e., dominates, the gender class 2 for human, when the subject consists of a mixed group of humans and non-humans (11).

- (11) a. ? omu-sajja ne em-bwa-ye bi-agwa
 1-man and 9-dog-his 8-fall-PST
 ‘The man and his dog fell down.’
- b. * omu-sajja ne em-bwa-ye ba-agwa
 1-man and 9-dog-his 2-fall-PST
 ‘The man and his dog fell down.’ (Corbett 1991, p. 274)

But while it seems that the non-human gender in Luganda and other languages, especially the Bantu languages, is more marked than the human gender, there are languages, e.g., Tamil (Corbett, 1991), with the opposite dominance relationship between human/non-human genders.

2.1.2. *Semantic markedness, lexical presupposition, and implicated presupposition*

In terms of their contribution to interpretation, gender features on pronouns have long been analyzed as presupposition triggers (Cooper, 1979, 1983). Later studies extended this analysis to other ϕ -features (Charnavel, 2019; Heim, 1994, 2008; Percus, 2006; Prete & Zucchi, 2017; Sauerland, 2004, 2008a; Schlenker, 2003; Sudo, 2012; von Stechow, 2003; Yanovich, 2010). With the core referential meaning of pronouns analyzed as variables under an assignment, ϕ -features denote partial identity functions that put constraints on what values may be assigned to those variable components of pronouns. For instance, under an assignment g in a context c , which contains a speaker s_c and a hearer h_c (Kaplan, 1989), the denotations of first, second, and masculine features is commonly characterized as follows:

- (12) a. $\llbracket 1st \rrbracket^{g,c} = \lambda x : x \text{ includes } s_c. x$.
- b. $\llbracket 2nd \rrbracket^{g,c} = \lambda x : x \text{ includes } h_c. x$.

c. $[[\text{masc}]]^{g,c} = \lambda x : x \text{ is male. } x$.² (Stokke, 2022, p.1086)

Under this analysis, semantically marked features trigger a lexical presupposition, while unmarked features such as third person, as noted in the previous section, do not. Thus, their semantics is compatible with reference to the speaker or hearer. The typical third person interpretation associated with them is derived pragmatically instead. In particular, Sauerland (2008b) adopts Heim’s (1991) MAXIMIZE PRESUPPOSITION principle to explain the observed semantic effects for forms that are unmarked along a given ϕ -feature dimension.

MAXIMIZE PRESUPPOSITION formulates a requirement that the form with the strongest lexical presupposition be chosen whenever its presupposition is felicitous. For a general illustration in a case other than pronouns, consider (13). While *both* presupposes duality, *every* does not. According to the maxim, the use of *every* in (13a) is infelicitous, because since humans generally have two hands, the form *both* with the strongest lexical presupposition must be chosen.

- (13) a. #Every hand of mine is dirty. (Yatsushiro, 2008, p.666)
 b. Both hands of mine are dirty.

In line with the discussion of person ϕ -features above, first- and second-person forms are associated with lexical presuppositions, referring to the speaker and addressee/participant, respectively. Third person, on the other hand, lacks a person ϕ -feature. However, use of a third-person pronoun gives rise to a pragmatically inferred presupposition, or ‘*implicated presupposition*’ (Sauerland, 2003, 2008a, 2008b), that the pronoun does not refer to either of the discourse participants. Otherwise, according to MAXIMIZE PRESUPPOSITION, first or second-person pronoun forms would have been used. In sum, instead of having a lexical presupposition for the features [speaker] or [addressee], third person only has an implicated presupposition of being ‘*anti-participant*’.

This approach straightforwardly generalizes to other ϕ -feature dimensions as well,

²According to Sauerland (2008b), masculine features should not be marked/lexicalized for third person. For Thai, however, this paper assumes that masculine feature is present in first-person (and potentially second-person) pronouns. (See Section 2.2 for details.) Detailed theoretical analyses of pronouns and other types of personal reference terms in Thai are further needed.

the general principle being that unmarked forms derive their standard referential constraints in contrast to the feature-specifications of marked forms.

2.2. Thai personal reference terms

Thai has a highly complex personal reference system, involving not only personal pronouns, but also kin terms, occupational titles, and personal names (Bandhmedha 2011; Iwasaki and Ingkapirom 2009, among others). Referential expressions (R-expressions) in Thai, belonging to the latter three categories, are known to violate BINDING CONDITION C (Chomsky, 1981), which posits that R-expressions must be free everywhere. (Hoonchamlong, 1991; Lasnik, 1989, among many others). For instance, while an R-expression, unlike a pronoun, in English cannot be bound by an antecedent neither inside (14a) nor outside (14b-14c) its local domain, bound R-expressions of any kind in Thai are permitted outside of their local domain (15a-15c).

- (14) a. Dave_i loves *him_i/*Dave_i
 b. Dave_i thinks that he_i/*Dave_i loves elephants.
 c. Dave_i drank the orange juice she made for him_i/*Dave_i
- (15) a. da:w_i/mê:j/mǎ:k rák *da:w_i/*mê:j/*mǎ:k
 Dao/mother/doctor love Dao/mother/doctor
 ‘Dao/mom/doctor loves herself³.’
- b. da:w_i/mê:j/mǎ:k k^hít wâ: da:w_i/mê:j/mǎ:k rák c^há:ŋ
 Dao/mother/doctor think COMP Dao/mother/doctor love elephant
 ‘Dao/mom/doctor thinks that she loves elephants.’
- c. da:w_i/mê:j/mǎ:k dù:m nám-sôm t^hî: p^hle:ŋ k^hán hâj
 Dao/mother/doctor drink orange juice COMP Pleng squeeze BEN
 da:w_i/mê:j/mǎ:k
 Dao/mother/doctor
 ‘Dao/mom/doctor drank the orange juice Pleng made for her.’

Along with this special property, these R-expressions in Thai are also commonly used as personal reference terms in Thai and do not restrict their use to any person (first, second, or third) in particular. According to the list by Cooke (1968), Thai personal pronouns alone comprise 27 first-person pronouns, 22 second-person pronouns,

³da:w ‘Dao’, mê: ‘mother’, and mǎ: ‘doctor’ can also be first and second persons. Their binding properties are the same as that of a third person.

and 8 third-person pronouns. The other three categories combined consist of countless items. Choosing personal reference terms among these abundant choices requires considering different factors, such as age, sex, and societal status. Kin terms, for instance, can be used in an amicable fashion to refer to people *outside of one's family*, depending on the referent's age and relationship with the speaker.

A major factor behind the richness of the pronominal system in Thai is the possibility of encoding social deixis, i.e., the choice of a pronoun relating to the social status of the participants in a particular context. This aspect is closely related to politeness distinctions commonly found in many languages (e.g., German *du/Sie*, Russian *ty/vy*, French *tu/vous*, etc.). A much rarer form of politeness distinctions, found in only 7 languages considered in the survey by Helmbrecht (2013), is when second-person pronouns are avoided altogether for politeness. The relevant languages, Burmese, Indonesian, Japanese, Khmer, Korean, Thai, and Vietnamese, are all spoken in East and Southeast Asia, and employ other kinds of personal reference terms, e.g., encoding kinship notions, to politely address the hearer.

Yet another complexity of the Thai system is that certain personal reference terms can refer to more than one discourse participant role in a given situation, with different pragmatic effects, due to what is generally assumed to be yet another mechanism at play in pronoun interpretation. For instance, in child-directed speech, a female adult can use what is otherwise considered a male first-person pronoun $p^h\check{o}m$ to refer to a boy as a hearer, thus reversing speaker and hearer roles. This is assumed to come about via a specific strategy of its own, called 'deictic-center shifting' (DCS; Fillmore 1997; Levinson 1983).⁴ It switches reference from speaker to hearer, or vice versa, by changing the deictic center (also known as *origo* (Bühler, 1934/2011)). For example, talking to their younger child, parents can refer to their older child as $p^h\hat{u}$ 'older sibling,' shifting the deictic center by speaking from the addressee's perspective who

⁴It is worth noting that 'deictic-center shifting' or 'deictic shifting' have been used differently in the literature. In literary studies, the use of the term 'deictic shifting' is similar to how it is used here in that it requires the author of a fiction to shift to another perspective that is not theirs, i.e., taking into account the reader's perspective in a fictional world. In the autism literature, however, some authors use deictic shifting to refer to pronoun or person deixis interpretation in general. For instance, Mizuno et al. (2011) used the term 'shift to self' to refer to the interpretation of sentences such as 'What can 'you' see now?' that the experimenter utters and 'shift to self' for sentences such as 'What can 'I' see now?' In this paper, such use like Mizuno et al. (2011)'s is not considered 'deictic-center shifting' but a mere interpretation of deixis, which, by definition, varies by context.

would refer to their older child using that term. Without such a shift, parents would refer to their older child as *lû:k* ‘child.’ A formal analysis of this phenomenon is beyond the scope of this paper. But because such use of personal reference terms is associated with its own pragmatic and stylistic implications, we assume that for terms where deictic-center shifting is possible, their features are neither underspecified nor unmarked, e.g., *p^hõm* would still be considered to have a first person feature in the above example, even though its use in that case winds up referring to the addressee. Regardless of this framing adopted here, at least in the cases we will consider, all involve participant reference that we assume is lexically specified in one way or another, and thus these cases do not involve any relevant implicated presupposition.

Person features in Thai. As noted above, Sauerland (2008b) proposes that different languages encode different person features based on whether the language in question has an inclusive/exclusive distinction or not. On this view, in languages without the distinction, such as English, first person has the most marked feature specification, containing [participant] and [speaker]. The specification for second person is only [participant]. In contrast, in languages with inclusive/exclusive distinctions (where, e.g., variants of ‘we’ can either mean ‘I, you, and our associates’, or ‘I and my associates, excluding you’), Sauerland (2008b) proposes the features [speaker] and [addressee] instead. Inclusive forms can then be captured as having both [speaker] and [addressee] features. Exclusive forms only have the [speaker] feature and are unmarked for [addressee], with the exclusive interpretation derived via MAXIMIZE PRESUPPOSITION.

Whether or not Thai has an inclusive/exclusive distinction is not immediately clear. Cysouw (2013) does not list Thai as a language with inclusive/exclusive distinctions, based on the data from Noss (1964), and instead proposes that it is of yet another category that has identical forms for first person singular and plural. While this indeed holds for the pronoun *raw*, it is not generally representative of the entire Thai personal reference system. The forms *raw* ‘I, we’ or, with the plural marker for pronoun forms, *p^hûak-raw* have no inclusive/exclusive distinctions, parallel to English ‘we.’ But another pronoun *c^hán* that on its own only means singular ‘I’ can combine with the plural marker to form *p^hûak-c^hán* to mean ‘I and some others, but not you,’ i.e., it is an exclusive first person plural, comparable to *wǒmen* in Mandarin, which is considered

a language with these distinctions.

In combination with the possibility of deictic-center shifting, which introduces further possibilities for variation in reference between speaker and addressee for a given form, it is by no means clear what the full person-feature inventory for Thai should be. Since we mainly care about contrasts between third person for non-participants vs. first/second person for participants, we do not need a fully fleshed out analysis for relevant considerations about our data. Developing a more in-depth theoretical perspective on the Thai pronoun-feature system remains an important topic for future work.

Gender features in Thai. Although Sauerland (2008b) proposed that the [female] gender is uniformly the marked case cross-linguistically, we argue that this only holds for third person. In Thai, there are masculine/feminine distinctions in first- and second-person pronouns as well. In contrast to what is found with regards to third-person forms, there are pronouns in Thai that are restricted to male individuals, while there is no equivalent pronoun⁵ that is restricted to female individuals, as illustrated in (16). Therefore, we argue that the pronoun $p^h\check{o}m$ (first-person or second-person via DCS) in Thai is marked for [male], while for *third person*, the feature [female] is marked. Yet again, this complication warrants more extensive theoretical investigation, but we will have to leave it at this level.

- (16) a. $p^h\check{o}m$ hǐw
 1.M hungry
 ‘I am hungry.’
 i) ✓ referring to a male speaker ii) * referring to a female speaker
- b. $c^h\check{a}n$ hǐw
 1 hungry
 ‘I am hungry.’
 i) ✓ referring to a male speaker ii) ✓ referring to a female speaker

As mentioned above, human/non-human gender distinctions do vary across languages in terms of which feature is marked. We applied two markedness tests, namely the dominance test and the epistemic status test, to Thai third-person pronouns to

⁵The tested pronoun $c^h\check{a}n$ in Example (16b) is in the same register as $p^h\check{o}m$. There are other Thai first-person pronouns in a highly formal register, e.g., $di-c^h\check{a}n$ or $di-c^h\check{a}n$, that are restricted to female individuals as we are leaving this point for future investigation.

determine the markedness status of the features in Thai. The coordination of a human and a non-human subject in (17) shows the dominance of the non-human gender.

- (17) a. *câw-k^hɔ̃:ŋ kàp mǎ: k^hǎw dɤ:n ma: dúa.j-kan
owner and dog 3.HUM walk DEI together
- b. câw-k^hɔ̃:ŋ kàp mǎ: *man* dɤ:n ma: dúa.j-kan
owner and dog 3.NHUM walk DEI together
'The owner and the dog walked (towards the speaker) together.'
- c. *mǎ: kàp câw-k^hɔ̃:ŋ k^hǎw dɤ:n ma: dúa.j-kan
dog and owner 3.HUM walk DEI together
- d. mǎ: kàp câw-k^hɔ̃:ŋ *man* dɤ:n ma: dúa.j-kan
dog and owner 3.NHUM walk DEI together
'The dog and the owner walked (towards the speaker) together.'

The 'it'-equivalent pronoun *man* is chosen to be a resumptive pronoun for the entire coordination. The third-person human pronoun *k^hǎw*, on the other hand, cannot be used to refer to a coordination where one of the components is non-human.

The epistemic status test in (18) confirms that the non-human gender is less marked as reference to a human is not ruled out as impossible by the use of the pronoun *man*. Note that when this pronoun is used to refer to a person, it is derogatory. It is then concluded that the [human] feature in Thai is marked, while the [non-human] feature is not, giving rise to an implicated presupposition.

- (18) a. *man* kam-laŋ kin k^hâ:w jù:
3.NH PROG eat rice PROG
'It is having a meal.'
- i) ✓ referring to an animal ii) ✓ referring to a person
- b. *k^hǎw* kam-laŋ kin k^hâ:w jù:
3.HUM PROG eat rice PROG
'He/she is having a meal.'
- i) * referring to an animal ii) ✓ referring to a person

2.3. The acquisition of implicated presuppositions and pronouns

Compared to other pragmatic inferences, such as implicatures and presuppositions, the acquisition of implicated presuppositions has received much less attention, with the notable exceptions of Yatsushiro (2008), Legendre, Barrière, Goyet, and Nazzi (2011),

and later influenced studies (Aravind et al., 2018; Forsythe & Schmitt, 2021; Legendre & Smolensky, 2012; Stateva, Andreetta, Reboul, & Stepanov, 2021). Yatsushiro (2008) compares the acquisition of lexical presupposition, implicated presupposition, and scalar implicature. She examined the German universal quantifier *jeder* ‘every’, which is argued to lexically presuppose existence and to have an implicated presupposition of anti-uniqueness (as well as a scalar implicature when negated). Consider the sentences in (19). Since the definite determiner *the* lexically presupposes both existence and uniqueness, its use is felicitous. On the other hand, the universal quantifier *every*, which is in principle semantically compatible with being used here, has an implicated presupposition of anti-uniqueness. Our encyclopedic knowledge that one can only have one biological father then makes the sentence infelicitous, and use of ‘the’ rather than ‘every’ is forced by Maximize Presupposition.

- (19) a. # I interviewed every biological father of the victim.
 b. I interviewed the biological father of the victim. (Yatsushiro 2008, p. 667)

Yatsushiro (2008) reports experimental data from 120 German-speaking children and 21 adult controls. The task requires deciding whether variations of relevant sentences could describe a provided picture. For instance, the sentences in (20) were presented as choices for describing the picture of a girl playing soccer.

- (20) a. Das Mädchen hier spielt Fussball
 the girl here plays soccer
 ‘The girl here is playing soccer.’
 b. Jedes Mädchen hier spielt Fussball
 every girl here plays soccer
 ‘Every girl here is playing soccer.’ (Yatsushiro 2008, p. 671)

6-year-old children accepted (20b), where the implicated presupposition is not met, significantly more often than other groups of children and adults, but performed comparably in other conditions that tested lexical presuppositions, suggesting that the acquisition of implicated presuppositions is delayed relative to that of lexical presuppositions. Moreover, Yatsushiro (2008) notes that the former seems to more closely mirror the acquisition path of scalar implicatures, which is theoretically plausible if

both involve pragmatically deriving an inference by considering contrasts with alternative expressions.

In another relevant study, Legendre et al. (2011) examined the acquisition of pronouns in French by testing the comprehension of 3 singular and 3 plural French pronoun forms by sixteen 30-month-old toddlers (using the Fishing Task of Girouard, Ricard, and Gouin Decarie 1997, which we adapt below). They found that the comprehension of third person *elle* was at chance level, in contrast with a good performance on first person *je* and second person *tu*. All the plural pronouns seem to yield below-chance performance across all persons. Assuming third person and plural are unmarked features, this aligns with Yatsushiro’s findings, framed in the theoretical perspective of Sauerland (2008b), in that these forms require consideration of implicated presuppositions, whereas the features of first and second person singular forms are lexically specified, so that the latter would be expected to be acquired earlier.

As for Thai personal reference terms and autism, Chanchaochai (2013) observed three children with ASD over a three-month period and found that first- and second-personal reference terms with relatively more fixed referents, including kin terms, occupational titles, and personal names, were preferred over the ones with higher deictic levels like pronouns. This finding adds another dimension to our considerations with regards to pronoun acquisition in children with ASD, as the deictic nature of certain pronouns may be yet another source in behavioral patterns, specifically with regards to production, where deictic expressions requiring the speaker to consider their perspective relative to the utterance context may pose additional challenges.

2.4. General approach of the current study

This paper investigates production and comprehension of a subset of common Thai personal reference terms by children with ASD and children with typical development (TD), to compare their performance for different types of personal reference terms. The main points of interest within the tested personal reference terms include person and gender ϕ -features, the presence of deixis, and the possibility of deictic-center shifting. Two overall parallel experiments were conducted, each comprising both a production task and a comprehension task, building on the Fishing Task (Girouard et al., 1997)

also used by Legendre et al. (2011). The production task in both experiments was designed to elicit responses indicating how children with ASD and TD would refer to themselves, to their interlocutor (the experimenter), and to other individuals in the context for third-person reference. Target individuals for reference in production were prompted indirectly by referencing objects that the various participants held (or were depicted to hold) in a question, such as ‘Who is holding the pencil?’ The production task is immediately followed by the comprehension task, where different personal reference terms were put in questions to test the children’s understanding of each term, now asking about what object the targeted individual held (e.g., ‘What is [PERSONAL REFERENCE TERM] holding?’ We compare performance across different types of personal reference terms, exploring the various points of interests above in relation to hypotheses based on the theoretical literature and previous acquisition findings.

3. Study 1

3.1. Design & Materials

The main design of the experiment adapts the Fishing Task (Girouard et al. 1997; Legendre et al. 2011). The context of the experiment comprises five individuals for potential reference, including the experimenter (E), the child (C; tested individually), and 20-inch-tall cardboard figures of a boy (B), a girl (G), and a monkey (M; See Figure 1.). Each cardboard figure held a blank display space, where one of 58 pictures of different commonly known objects or animals could be attached using reusable adhesive putty for specific sets of trials. In each trial, each of the five individuals were given one picture to hold, with the five pictures depicting different things. These pictures served as pointers to fix target reference for production trials, and as points of inquiry for comprehension trials.

3.1.1. Procedure

In the beginning of each block, the children were first asked to name the pictures of objects and animals depicted in the five pictures in each trial. The pictures were then

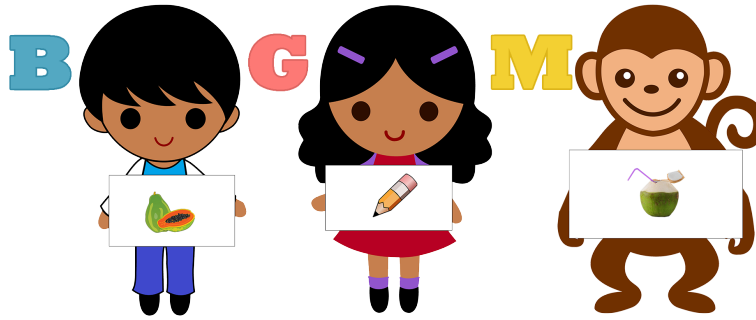


Figure 1. Extra characters in the experiment

distributed across the five individuals (E, C, B, G, and M). Prior to the production task, no pronouns were used so as to avoid priming the children with any relevant forms. In the test phase, each individual referent in the production task or each personal reference term in the comprehension task was randomly selected as the expected target at least twice. A different set of five pictures was used after every 3 trials. Below is a schematic illustration of the course of an experiment, with multiple trials occurring in each of the Test Phases.

Preparatory Phase:

E: ‘What’s (your) name?’⁶

E: ‘What is this?’ (Repeat for 5 objects per block.)

Production Task:

TEST PHASE:

E: ‘Who is holding x ?’ (Twice for each target.)

C: ‘_____ (is holding x).’

Comprehension Task:

FAMILIARIZATION PHASE:

E: ‘What is y {*the boy/girl/monkey/child’s name*} holding?’

C: ‘(y is holding) x .’

⁶Thai is a pro-drop language so pronouns can be avoided here.

TEST PHASE:

E: ‘What is $y_{\{\textit{tested personal reference terms}\}}$ holding?’

C: ‘(y is holding) _____.’

3.1.2. *Tested personal reference terms*

For the comprehension task, all of the main personal reference terms that are applicable to the context of our experiment were included in the test phase. These included 1 first-person, 4 second-person, and 3 third-person forms (all used without a plural marker). The selected terms are personal pronouns, except for two terms: $p^h\hat{i}$ ‘older sibling’ and $n\acute{o}:\eta$ ‘younger sibling,’ which are kin terms. The order of pronouns in question was pseudo-randomized such that the possible answers of each block do not refer to all the speech participants, so that referents towards the end of a given block are not predictable. Each targeted pronoun was repeated at least twice. Some terms appeared three times so as to make the last trial of each block unpredictable as described above.

Table 1 provides an informal summary of the referential constraints associated with the pronouns we used. This is merely informal, and by no means a full analysis, not the least because it is not obvious in all cases precisely what feature values are in play in a given place. However, we do specify relevant details based on the literature discussed in Section 2.1 in terms of the most relevant properties, namely a) whether a person feature (whether speaker, addressee, or participant) is encoded and whether DCS is in play, b) whether the form is assumed to be lexically marked for gender, c) whether there’s a social-deictic dimension⁷, and d) what implicated presuppositions we assume to arise. The final column indicates which individual in the experimental setup the form should refer to, based on these constraints, when uttered by the experimenter in the comprehension phase.

(1) $p^h\hat{i}$: (kin term; lit. ‘older sibling’) and $n\acute{o}:\eta$ (kin term; lit. ‘younger sibling’)⁸

⁷Social-deictic features are normally listed in the encyclopedic (non-linguistic) knowledge. It may be possible that in certain languages, some social descriptive features are encoded in the grammar. It is beyond the scope of this paper to discuss the claim. The social descriptive features are only included for the reader’s understanding of these pronouns.

⁸‘Sibling’ is not necessarily to be taken literally here, as a more general notion of ‘age of older/younger sibling’ also allows for use of these forms, as in the experiment. As $p^h\hat{i}$ and $n\acute{o}:\eta$ are also kin terms, they could

Table 1. Tested personal reference terms in Study 1.

Participant					
Term	Person		Gender	Social-deictic	Target
p ^{hi} :	participant	{1st, 2nd}	-	older sibling	E
nó:ŋ	participant	{1st, 2nd}	-	younger sibling	C
nũ:	participant	{1st, 2nd}	-	younger participant	C
p ^h õm	speaker	{1st}	male	-	C
	addressee	{2nd} (via DCS)	male	younger participant	
k ^h un	addressee	{2nd}	-	formal	C
Anti-participant					
Term	Person		Gender/ Social-deictic	Implicated Presupposition	Target
k ^h ǎw	-		human	anti-participant, non-feminine	B
t ^h ɣ:	addressee	{2nd}	peer	-	G
	-		human, female	anti-participant	
man	-		-	anti-participant, non-human	M

Note. The terms nũ: and p^hõm in the highlighted cells are only tested with female and male participants, respectively.

can be used to refer to either the speaker or the addressee as long as the referred individual is (or is believed to be) of an older-sibling or younger-sibling age, respectively, in the situation. In the setting of this experiment, both first- and second-person uses (in comprehension and potential production trials, respectively) of the term p^{hi}: referred to the experimenter, who was the older participant. Likewise, both uses of the term nó:ŋ referred to the child, who was the younger participant.

- (2) **nũ:** (pronoun; for trials with female children) is generally used as a first-person by women who are younger than their interlocutor or by children. It can also be used as a second-person to address a younger (female) interlocutor. Whether or not DCS is the mechanism behind this possible reference to addressee is still unclear and needs future research. In the context of the comprehension phase of the experiment, the pronoun refers to the child.

- (3) **p^hõm** (pronoun; for trials with male children) is a first-person polite pronoun

also refer to a third-person. However, the prosody for first- or second-person p^{hi}: is different from the third-person one, i.e., the anti-participant use is usually not phonetically reduced. Additionally, a resumptive/shadow pronoun (Iwasaki & Ingkapirom, 2009), e.g., k^hǎw/k^háw (anti-participant, human) or man (anti-participant, non-human) may also be added after kin terms to clarify that it is anti-participant.

- for men of any age. However, it may also be a second-person pronoun in child-directed speech, where DCS is employed. Since the experimenter is female, the pronoun unambiguously refers to the child in the context of the experiment.
- (4) **k^hun** (pronoun) is a formal second-person pronoun. Even though it is not an appropriate pronoun to refer to a child due to the formal dimension, it is unambiguously a second-person pronoun. Therefore, it can only refer to the child in the context of the experiment, though confusion caused by its inappropriateness might lead to more noise in the referent choice patterns for this form.
- (5) **k^hǎw**⁹ (pronoun) is a third person, human pronoun. Its gender feature is unmarked. Interpreting the term requires both an anti-participant implicated presupposition, in contrast with forms with participant features, and a non-feminine implicated presupposition, given its lack in lexical gender marking and contrast with female marked forms. To correctly select the cardboard boy as the target for this pronoun, the children thus need to draw a pragmatic inference, noticing the contrast between the pronoun *k^hǎw* and *t^hʎ:*, another third-person pronoun in the experiment which is marked with a female feature when used as third-person.
- (6) **t^hʎ:** (pronoun) has second and third person uses. To refer to the addressee, they generally need to be of equivalent age or social status. The addressee can be younger or in a lower social status as well but that is only used in an unfriendly and distant (almost degrading) sense. As a third-person form, it is constrained to human female reference. The [female] feature is introduced lexically, i.e., no implicated presupposition is required. Since the experimenter is not the children's peer and also ended each sentence with a polite final particle, the second-person reading should not be applicable in this context if all its aspects are taken into account, and the term, thus, refers to the cardboard girl in the experiment.
- (7) **man** (pronoun) is unambiguously a third-person, non-human pronoun. Being third person, it requires an implicated presupposition deriving from the contrast with participant features. The non-human interpretation is also derived by implicated presupposition (see above). It unambiguously refers to the cardboard monkey in the experiment.

⁹Its more frequently used reduced form *k^háw* is underspecified for person as well as gender. Only the full form *k^hǎw* was tested.

3.1.3. Predictions

Based on the prior findings in the literature reviewed above and assuming that children with ASD may lag children with TD in acquisition, we expect there to be lower accuracy in comprehension when implicated presuppositions are involved, and possibly see some struggles in children with TD relative to these forms as well. This chiefly predicts lower performance for third-person forms, with potential additional effects of implicated presuppositions on the gender dimension. Given the general pragmatic and social challenges in ASD, we may also expect effects on comprehension for forms with social-deictic features in play. It is less clear, but also plausible, that children with ASD show some challenges for cases requiring deictic-center shifting, since those involve flexibly taking into account different discourse participant’s perspectives in some form. Finally, based on the prior findings on Thai-speaking children with ASD, we may see decreases in use of deictic forms in productions when other suitable personal reference forms are available.

3.2. Participants

Participants were 96 children with autism spectrum disorder ($n=29$) or typical development ($n=67$).¹⁰ Nonverbal intelligence quotient (NVIQ) was measured using the Ravens Standardized Progressive Matrices (Raven, Raven, & Court, 2000), following the standardization practice done in Thailand (Department of Mental Health, Ministry of Public Health, 2012). The two groups differed in their age (TD younger than ASD) and NVIQ (TD higher than ASD), as seen in Table 2. Children in both groups were native Thai speakers with normal hearing and normal or corrected-to-normal vision. This study was approved by the Institutional Review Board at [redacted for review]. Having been informed about the study and their rights, the parents of all the participants provided written consent for their child to participate in the study. The participants were informed of the study and their rights both verbally and in writing.

¹⁰Depending on the criteria, some participants might be considered adolescents. Among the participants with ASD, 15, 12, and 4 participants were over 10, 11, and 12 years old, respectively. Among the participants with TD, 20, 12, and 1 were over 10, 11, and 12 years old, respectively.

Table 2. Characteristics of participants with autism spectrum disorder (ASD) and typical development (TD) in Study 1

	ASD	TD	<i>F</i>	<i>p</i>	<i>Cohen's d</i>
<i>n (M:F)</i>	24:5	54:13		1	
Age (<i>y</i>)*	9.85(1.8) 6.58–12.17	9.02(1.79) 6.083–12.67	4.31	.04	.46
School year (grade)	3.45(1.84) 1–6	3.52(1.64)	.04	.85	-.04
Nonverbal IQ***	97.8(22.24) 62.32–146.35	112.95(15.46) 64.52–146.35	14.73	<.001	-.85

Note. Data are presented as *M(SD)* and range. Gender ratios were compared using two-tailed Fisher's exact test.

3.2.1. ASD group

Participants were recruited from [redacted for review] and [redacted for review]. They met the DSM-IV-TR (American Psychiatric Association, 2000) diagnostic criteria for ASD. One participant with ASD was classified in his medical records as having Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), while the remaining were all classified as having Autistic Disorder (AD). No exclusion was made based on other learning or psychiatric disorders.

3.2.2. TD group

Participants in the TD group were recruited from [redacted for review]. They did *not* meet diagnostic criteria for ASD. Parents of the participants in this group reported no other learning or psychiatric disorders, although this is not an exclusion criterion for the TD group to avoid hypernormativity.¹¹

3.3. Results

3.3.1. Overall accuracy

One child with ASD (Male; *M* Age=7.75; *M* NVIQ=83.1) was excluded from further analysis because he did not answer any of the questions. An answer was marked as accurate when it involved reference to the correct referent that is unambiguously picked out, taking into consideration the relevant referential constraints for a given form,

¹¹We attempted to subgroup the children with TD into the age-matched group and the NVIQ-matched group. However, the results from different ways of subgrouping remain very similar to those from the entire group. Therefore, this paper only presents the data from the entire group of the children with TD.

as laid out for the forms used in comprehension in Table 1. The accuracy rate for production is near ceiling for both the ASD (94.6%) and the TD (90.6%) groups, with children with ASD performing significantly more accurately ($F=4.3$; $p=.04$; *Cohen's D*=.15). The accuracy rate for comprehension dropped for both groups, especially for the ASD group (60.4% for ASD; 82.3% for TD; see Figure 2). The comprehension task accuracy accordingly yields a highly significant difference between participant groups ($F=165.3$; $p<.001$; *Cohen's D*=-.53).

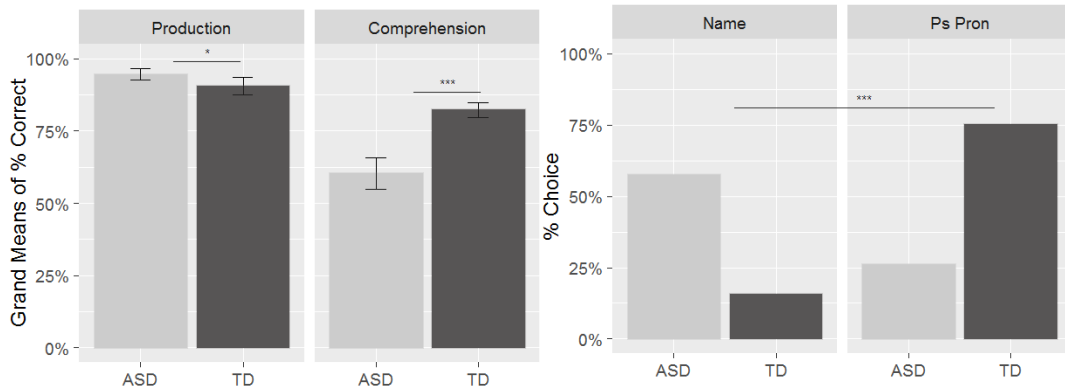


Figure 2. Study 1: Overall accuracy

Figure 3. Study 1: Choices of terms the children used to refer to themselves

3.3.2. Production

The most common personal reference terms that the children in both groups used to refer to themselves are personal names and personal pronouns. However, they were found in a reversed preference pattern (Figure 3). In the ASD group, personal names were used 57.4% of the time versus 25.9% for personal pronouns, compared to 15.7% versus 75.2%, respectively, for the TD group. The proportion of counts for the two most commonly-chosen categories for self-reference showed a very significant difference across participant groups (Fisher's Exact, $p<.001$).

As for reference to the experimenter, children with ASD used the occupational title *k^hru*: 'teacher' to refer to the experimenter the most (51.95%), followed by the use of kin term *p^hi*: 'older sibling' (42.3%). Children with TD, on the other hand, preferred the kin term (55%), over the occupational title (44.15%). However, the proportion of the choices for referring to the experimenter was not significantly different across groups (Fisher's Exact, $p=.23$). For third person reference to the cardboard figures,

both of the groups overwhelmingly used common nouns (boy, girl, monkey) to refer to them (92.1% for ASD; 97.1% for TD), and the two participant groups are not significantly different from each other (Fisher’s Exact, $p=.19$).

3.3.3. Comprehension

Overall, third person yields the poorest performance for the ASD group, with an overall decrease both relative to participant forms and children with TD’s performance for all three third-person forms (See Table 3 and Figure 4). As for the TD group, only the male third-person form, $k^h\check{a}w$, exhibits a decrease in performance among third-person forms relative to participant forms. Performance on participant referring forms was largely on par, with two exceptions: the only form overall where children with ASD outperformed children with TD is the formal second-person pronoun k^hun with a non-ambiguous referent. Furthermore, for first person use of the kinship term $p^h\hat{i}$, children with ASD were less accurate than children with TD.

Table 3. Study 1: Performance on the comprehension task by item by participant group.

Term	ASD $M(SD)$	TD $M(SD)$	F	p	Cohen’s d
$p^h\hat{i}^{***}$	.73(.41)	.88(.3)	12.29	<.001	-.39
$n\acute{o}:\eta$	.79(.35)	.82(.34)	.32	.58	-.09
$n\ddot{u}$:	.8(.27)	.96(.14)	2.5	.12	.59
$p^h\check{o}m$	.78(.33)	.89(.3)	3	.09	-.3
k^hun :	.86(.27)	.73(.41)	3.54	.06	.3
$k^h\check{a}w^{***}$	.39(.37)	.67(.35)	27.88	<.001	-.59
$t^h\gamma^{***}$	.51(.39)	.86(.26)	91.86	<.001	-.88
man^{***}	.57(.44)	.84(.29)	88.06	<.001	-.67

Error analysis To better understand what aspects may have driven inaccurate responses, it is also useful to look at the patterns in errors. Figure 5 shows the percentages of errors among all trials by form and group.

Experimenter-Targeted: Instead of choosing the experimenter as the target for the pronoun $p^h\hat{i}$: ‘older sibling’, a subgroup of both children with ASD and TD mistook the term for referring to the cardboard figures (Figure 5a); this was more frequent in the ASD group. The children with ASD also made more mistakes answering that they themselves, rather than the actually older experimenter, were the referent to the term ‘older sibling’ (ASD 8%; TD 1.5%).

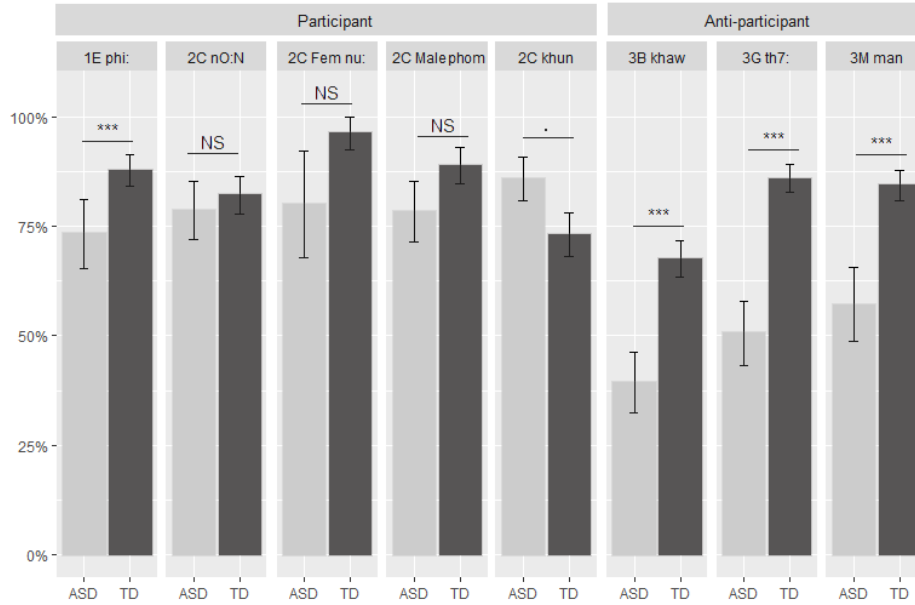


Figure 4. Study1: Accuracy in comprehension task by item by participant group

Child-Targeted: A similar pattern was observed in the comprehension of the term *nó:y* ‘younger sibling’ where the children chose the cardboard figures as the referent, instead of choosing themselves (Figure 5e). Some children with ASD also chose the experimenter as the referent for the terms *nũ:* (first/second younger female) (10%; Figure 5b), *p^hõm* (first male deictic-center shifted) (8.7%; Figure 5c), *k^hun* (second formal) (1.8%; Figure 5d), and *nó:y* ‘younger sibling’ (1.8%; Figure 5e). As for the children with TD, regardless of the number of errors they made in the comprehension of the formal second-person pronoun *k^hun*, the experimenter was never one of the wrong targets for any of the tested second-person pronouns.

Boy-Targeted: The majority of mistakes made by both children with ASD and TD was related to gender, where they chose the cardboard girl figure instead (ASD 25.9%; TD 20.5%). With regards to the person feature, the children with ASD chose more non-third-person targets than the TD group (24.1% versus 6%; see Figure 5f).

Girl-Targeted: The pronoun used for targeting the girl is *t^hɣ:*, with one of its uses being for third person human female. As noted earlier, this pronoun is also generally used to refer to a second person, with underspecified gender. Although the usage as a second person is very common, it is restricted to people of the same age or status. It is highly likely that the participants are referred to by their peers using this pronoun.

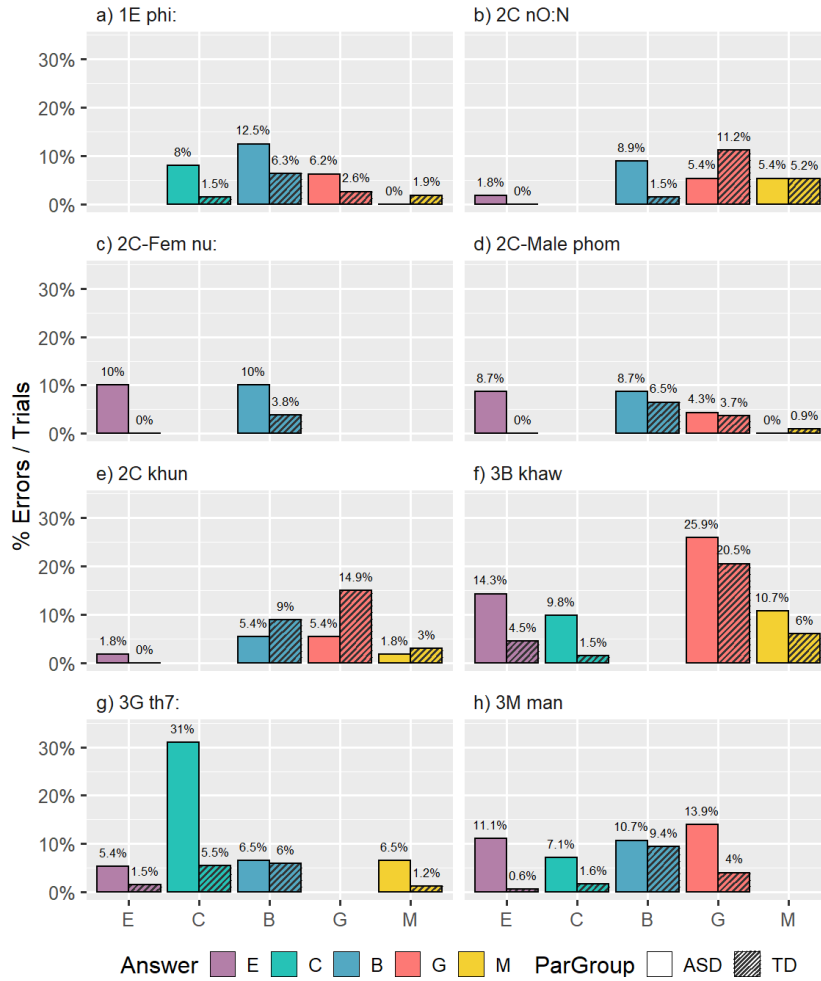


Figure 5. Study 1: Errors in comprehension task by item ($p^h\dot{i}$: (a); $n\acute{o}:\eta$ (b); $n\ddot{u}$: (c); $p^h\acute{o}m$ (d); $k^h\acute{u}n$ (e); $k^h\acute{a}w$ (f); $t^h\gamma$: (g); man (h)) by participant groups (children with Autism Spectrum Disorders (ASD) and children with typical development (TD)) by their choice of referent (experimenter (E); child (C); boy (B); girl (G); monkey (M))

If the speaker of the pronoun is an older person, the addressee and the speaker must be close to each other (stylistic use), otherwise, the term would sound very unfriendly and pragmatically inappropriate. The results seem to show that the sensitivity to this social dimension of the pronoun was largely ignored by the children with ASD, choosing themselves as the target 31% of the time (Figure 5g), despite neither being peers with nor close to the experimenter.

Monkey-Targeted: The errors for *man* covered all four other choices (Figure 5h). The children with ASD made mistakes with regards to person features, choosing the experimenter or themselves (11.1% and 7.1%, respectively) at a much higher rate than the children with TD (0.6% and 1.6%). Children with TD's errors neglected the

non-human interpretation of this form, selecting the boy or girl instead of the monkey.

3.4. Discussion

Both children with ASD and TD displayed an asymmetry in accuracy between production and comprehension, with greater communicative success in production. This difference was more pronounced in children with ASD, principally due to their greater struggle with comprehension. While both groups were near ceiling levels in production in terms of picking out the correct individual in their answer (and we even see slightly higher accuracy here for children with ASD, though this was not replicated in Experiment 2), the freedom of production allowed for variation in the referential expressions used. And indeed, we find different patterns across groups, in that children with ASD more frequently use names rather than pronouns to refer to themselves (a grammatically available option in Thai), thereby avoiding pronoun forms involving person deixis. Children with TD, on the other hand, use deictic first-person pronouns more frequently than names in this case. Overall, these results suggest that children with ASD are more likely to avoid deictic forms, at least in certain cases. As for second person, to refer to the experimenter, both of the groups mainly utilized either kin terms or occupational titles, rather than a second-person pronoun form. But recall that Thai is of the (relatively rare) language type where second-person pronouns are omitted for politeness reasons in many contexts. If a relationship between the speaker and the addressee is known, a term, such as a kin term or occupational title, indicating that relationship, is preferred over a second-person pronoun. For third person reference to the cardboard figures, children in both groups chose to use common nouns, rather than any personal reference terms, which is unsurprising given the lack of relevant discourse salience typically needed for pronouns (also see General Discussion).

Turning to the comprehension data, while children with ASD displayed lower accuracy than children with TD overall, this was primarily driven by substantially lower performance across the three third-person forms. Performance on first- and second-person forms referring to discourse participants was mostly on par across groups, in terms of not revealing any significant differences (with a couple interesting exceptions discussed below). This split suggests a crucial role for presuppositional person features

that are lexically specified via ϕ -features: recall that the discourse participant roles of first and second person have been argued to be encoded for the relevant pronouns with such features, whereas third person reference to a non-participant is established via a pragmatic inference: third-person forms do not carry a ϕ -feature for person, but receive a third-person interpretation based on an implicated presupposition due to their contrast with the pronoun forms dedicated for reference to participants, using the principle MAXIMIZE PRESUPPOSITION. The present result thus suggests that children with ASD are less able than children with TD to have this implicated presupposition inform their choice of referent. This is also reflected in the frequency of the types of errors made by the children with ASD for third-person forms, as they chose the experimenter or themselves as the referent for *k^hǎw* about 24% of the time (TD: 6%), and did so about 18% of the time for *man* (TD: 2.2%) (for errors on *t^hɣɿ*, which is a special case in that it also has a second person variant, see below). While children with TD’s comprehension performance on third-person pronouns is comparable to first- and second-person pronouns for *t^hɣɿ* and *man*, their accuracy for *k^hǎw* was lower, though still significantly higher than in the ASD group. We will comment on how this may be due to differences in the make-up of the implicated presuppositions associated with the form in the General Discussion.

Amongst the participant forms, one noteworthy exception to the overall patterns is the second-person form *k^hun*, which is socially formal, and thus in this regard an inappropriate form to address the child participant in the experiment. Interestingly, this seems to affect accuracy in the children with TD, but not in the children with ASD, whose performance is significantly higher here (and indeed the highest across all forms in this group). This further confirms that children with ASD indeed are able to resolve person-features in interpretation when those are lexically specified, but also suggests that they are less aware or affected by the socially formal dimension of this form. Additional evidence for the latter conclusion comes from the types of errors children with ASD exhibit in the comprehension of the pronoun *t^hɣɿ*. This form has both second person and third person uses, though the former have an additional social-deictic restriction for usage amongst peers in terms of age or social status. In its third person use, it is constrained to human and female referents. Since the

social-deictic condition of the second person variant is not met in the experimental setting (as the experimenter and the child are not peers), the appropriate referent targeted in this setting by use of this form is the cardboard girl figure. But children with ASD nonetheless take this form to refer to them 31% of the time (compared to 5.5% in children with TD), ignoring the social inappropriateness of second person usage in this context. Interestingly, the ASD-children’s relatively large propensity to adopt the second-person interpretation of $t^h\gamma z$, rather than the third-person one, is not principally driven by whether a referent can be unambiguously identified based on lexically encoded features alone, as the lexically specified female gender marking on the third-person variant points to the girl or the experimenter. This suggests that person marking may be more prominent than gender marking for children with ASD.

Another interesting further finding in this regard is the lower accuracy in children with ASD for the form $p^h\hat{i}z$, which can refer to either the speaker or hearer but has the additional social-deictic requirement that the referent be older. The ASD-children seem less apt to incorporate that information, and take this to refer to themselves 8% of the time (compared to 1.5% in children with TD). But they also seem to exhibit greater confusion altogether here, as they also ignore the person specification altogether close to 20% of the time (12.5% reference to the boy, and 6.2% reference to the girl). To some extent, there was a similar effect in children with TD, who also went for third person reference around 10% of the time (Boy: 6.3%; Girl: 2.6%), suggesting that more generally, the ‘sibling’-aspect of this form may give rise to some confusion in children’s grasp of this form, in that it competes with the person specification. The complementary form, $n\acute{o}:\eta$ ‘younger sibling,’ also caused similar confusion to both groups of children, where their performance was not significantly different from each other.

To some extent, both of the last two points may also be reflected in the error patterns for $n\ddot{u}z$ (first/second younger female). Though we do not see any accuracy difference between groups, there were relatively high rates of errors. For children with ASD, these most frequently involve boy-reference choices (8.9%), but also the girl and the monkey (both at 5.4%), though, interestingly, rarely the experimenter (1.8%). The children with TD most common error is reference to the girl (11.2%), followed by the monkey

(5.2%) and the boy (1.5%). So here, as with $p^h\hat{i}$ and $n\acute{o}:\eta$, the ‘sibling’ notion may generally compete with the person marking, and the female gender seems less salient to children with ASD. Finally, errors for the participant-marked form $n\ddot{u}$, which in the context unambiguously refers to the child (being marked for younger participant), also are in line with the above patterns, in that children with ASD wrongly took this to refer to the experimenter 10% of the time (with no mistakes of this type by children with TD).

4. Study 2

The overall design of Study 2, conducted one year after the first data collection for Study 1, overall mirrored that of Study 1 for purposes of replication, with some changes in the sampled populations and measures obtained from them, as well as in the included conditions, as detailed in Section 4.1. Among the 32 children with ASD in the second data collection, 19 children were the same individuals that participated in Study 1.

4.1. Design & Materials

Study 2 mainly adopted the same methods used in Study 1, with three main changes. First, the monkey was left out as an individual to refer to in the experimental setup, along with the third-person non-human pronoun *man* use to refer to it. This is mainly to streamline the design, since there were no effects of special interest particular to this case. Second, the second-person kin term $n\acute{o}:\eta$ ‘younger sibling’ was removed. Third, a new unambiguously first-person pronoun $k^h\hat{a}$ was added to directly compare with the results obtained from the unambiguously second-person pronoun k^hun in the formal register. While this newly-added pronoun $k^h\hat{a}$ is unambiguously first person, it is also pragmatically marked because of it being outdated and not widely used, except in storytelling. Apart from these changes, the forms tested and the nature of the experimental implementation and structure of trials was the same as in Study 1.

4.2. Participants

Participants were 92 children with ASD ($n=32$) and TD ($n=60$).¹² In addition to NVIQ, non-verbal working memory (NVWM) scores were obtained by administering the Corsi Block-Tapping Task (Corsi, 1972; Kessels, van Zandvoort, Postma, Kappelle, & de Haan, 2000) in the Psychology Experiment Building Language (PEBL) Test Battery, Version 2.0 (Mueller & Piper, 2014). To further minimize differences between groups, the participants with ASD and TD in Study 2 were classmates in [school name redacted for review]. Although they did not differ in their school years and Corsi memory span, they differed in their age (TD younger than ASD) and NVIQ (TD higher than ASD). All the participants with ASD in Study 2 were classified by the DSM-IV-TR (American Psychiatric Association, 2000) as having AD. All participants were native Thai speakers with normal hearing and normal or corrected-to-normal vision. The study was approved by the Institutional Review Board of [redacted for review]. The parents of all the children provided written consent. The participants were informed of the study and their rights both verbally and in writing.

Table 4. Characteristics of participants with autism spectrum disorder (ASD) and typical development (TD) in Study 2

	ASD	TD	<i>F</i>	<i>p</i>	<i>Cohen's d</i>
<i>n (M:F)</i>	29:3	49:11		.36	
Age (y)*	9.63(2.07) 6.58–13	7.94(1.86) 4.58–11.75	15.98	<.001	.88
School year (grade)	2.84(2) 0–6	2.68(1.85)	.15	.7	.08
Nonverbal IQ***	95.5(23.53) 53.65–155.79	116.63(19.16) 81.6–155.79	21.6	<.001	-1.02
Corsi memory span	3.55(1.6) 1–6.5	4.11(1.3) 1–7	3.31	.07	-.4

Note. Data are presented as $M(SD)$ and range. Gender ratios were compared using two-tailed Fisher's exact test.

¹²Among the participants with ASD in Study 2, 16, 8, and 6 participants were over 10, 11, and 12 years old, respectively. Among the participants with TD in Study 2, 13, 5, and 0 were over 10, 11, and 12 years old, respectively.

4.3. Results

4.3.1. Overall accuracy

Four children with ASD (4 Male; M Age=8.59; M NVIQ=81.27; M Corsi span=1.88) were excluded from the analysis because they either did not answer the questions or scored less than 50% in the production task. The remaining children in both groups have near-ceiling accuracy rates (97.3% for ASD; 99.38% for TD) in the production task, while having lower accuracy rates in the comprehension task (58.18% for ASD (60.64% without the outdated $k^h\hat{a}r$); 65.97% for TD (71.92% without the outdated $k^h\hat{a}r$)). The TD group scored significantly higher in both the production task ($F=5.13$; $p=.02$; $Cohen's D=-.18$) and the comprehension task ($F=12.04$, $p<.001$; $Cohen's D=-.16$) looking at overall performance.

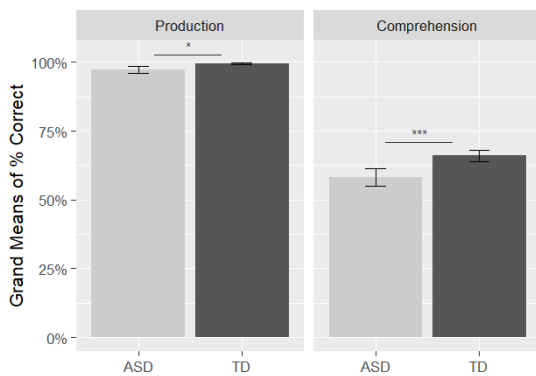


Figure 6. Study 2: Overall accuracy.

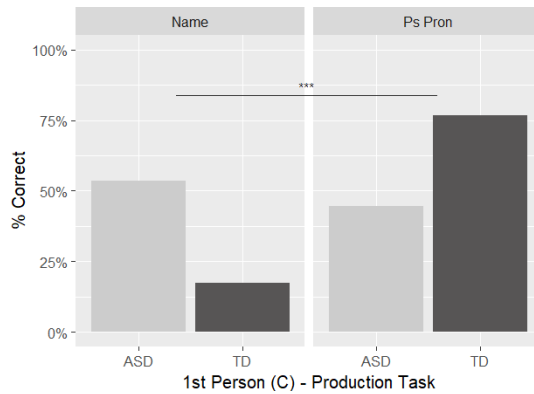


Figure 7. Study 2: Choices of terms the children used to refer to themselves.

4.3.2. Production

The results in the production task of Study 1 are replicated. The ASD group preferred to use personal names to personal pronouns (53.6% vs 44.6%) for self-reference, while the reverse pattern was found in the TD group (17.5% vs 76.7%; see Figure 7). The difference in the proportion of counts was highly significant (Fisher's Exact, $p<.001$). The choice for referring to the experimenter and all other third-persons was not significantly different across groups (Fisher's Exact, $p=.39$ and $p=.23$ respectively).

4.3.3. Comprehension

As expected, the newly added pronoun $k^h\hat{a}r$ is extremely difficult for both groups of participants, with no significant difference between them. Third-person pronouns still yield poor performance for the ASD group (See Table 5 and Figure 8). As for the TD group, the male third person still yields the poorest performance, and this time not significantly better from the ASD group, unlike in Study 1. In this experiment, the TD performance on the female third-person pronoun $t^h\gamma r$ is lower than the TD performance in Study 1, although they still scored significantly higher than the ASD group. The pattern in participant conditions included in both studies was also replicated, with no differences between groups except for two other terms: the formal second-person pronoun k^hun , which has a non-ambiguous referent but a pragmatic infelicity when addressed to the child participant, where children with ASD again significantly outperformed children with TD; and the first-person form $p^h\hat{i}r$, where children with ASD's performance was significantly worse than that by children with TD.

Table 5. Study 2: Performance on the comprehension task by item by participant group.

Term	ASD $M(SD)$	TD $M(SD)$	F	p	Cohen's d
$k^h\hat{a}r$	.29(.35)	.36(.38)	1.56	.21	-.14
$p^h\hat{i}r^{**}$	.79(.36)	.9(.25)	9.46	<.01	-.35
$n\ddot{u}r$	1(0)	.87(.17)	1.49	.23	.4
$p^h\ddot{o}m$	.83(.25)	.9(.21)	3.32	.07	.22
k^hun^*	.74(.33)	.63(.37)	4.02	.05	.23
$k^h\check{a}w$	.4(.31)	.49(.33)	2.26	.13	-.17
$t^h\gamma r^{***}$	.42(.43)	.67(.38)	21.01	<.001	-.52

Error analysis Overall similar patterns of errors to those in Study 1 were found in this experiment, as seen in Figure 9. One small apparent difference was that for first person $p^h\hat{i}r$, children with ASD were less likely than in Study 1 to take it to refer to the boy, but still showed more frequent interpretations of the form referring to the child themselves. As for the newly added pronoun $k^h\hat{a}r$, the children in both groups seem to be at chance level in choosing whether it refers to first, second, or third person. Both groups made the most errors thinking that the pronoun is Child-targeted (ASD 37.5%; TD 36.2%), instead of Experimenter-targeted. The children with ASD mistook it as referring to third person for 33% of the trials, while the TD chose third person

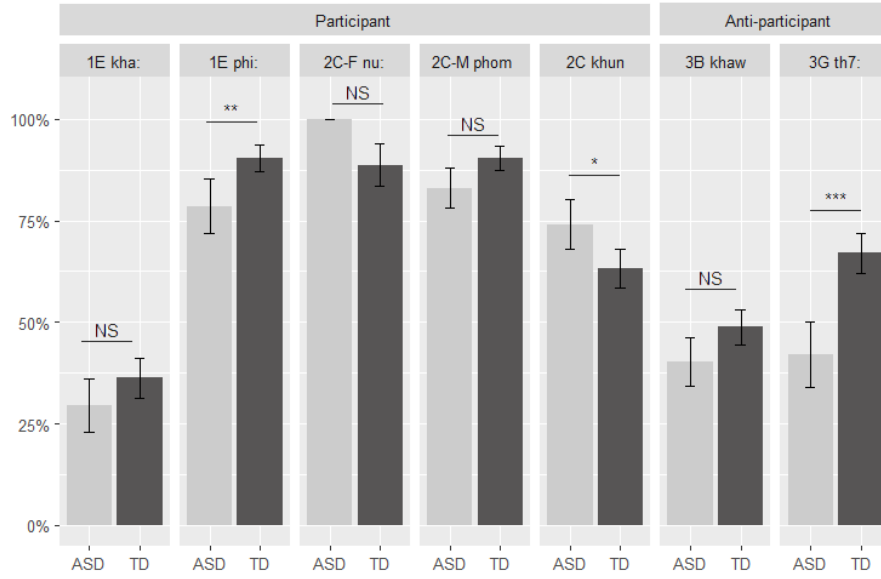


Figure 8. Study 2: Accuracy in comprehension task by item

27.4% of the time.

4.4. Discussion

The results from Study 1 were almost all replicated. In particular, we found the same asymmetry in choice of referential terms in production, with fewer first-person pronoun uses in the children with ASD. The comprehension data for the participant pronoun forms that were included in both studies essentially patterned the same, with overall similar error patterns. The third-person forms saw the same decrease in accuracy for the children with ASD, but also some decrease beyond what was seen in Study 1 for the children with TD, especially for the female third-person pronoun $t^h\gamma\iota$, though the contrast between groups remained at least for $k^h\check{a}w$. The removal of the monkey figure in Study 2 (and corresponding expressions) might contribute to the difference. Having three distinct words including a gender feature in Study 1 highlighted the [female] feature of the pronoun $t^h\gamma\iota$, providing the children with TD more clues towards selecting the intended referent. Error patterns also were largely the same, though with more frequent errors on part of the children with TD given their overall lower performance, with the same tendencies as those observed for the ASD group across both studies. For $k^h\check{a}w$, we see almost as many girl-choices in both groups, suggesting

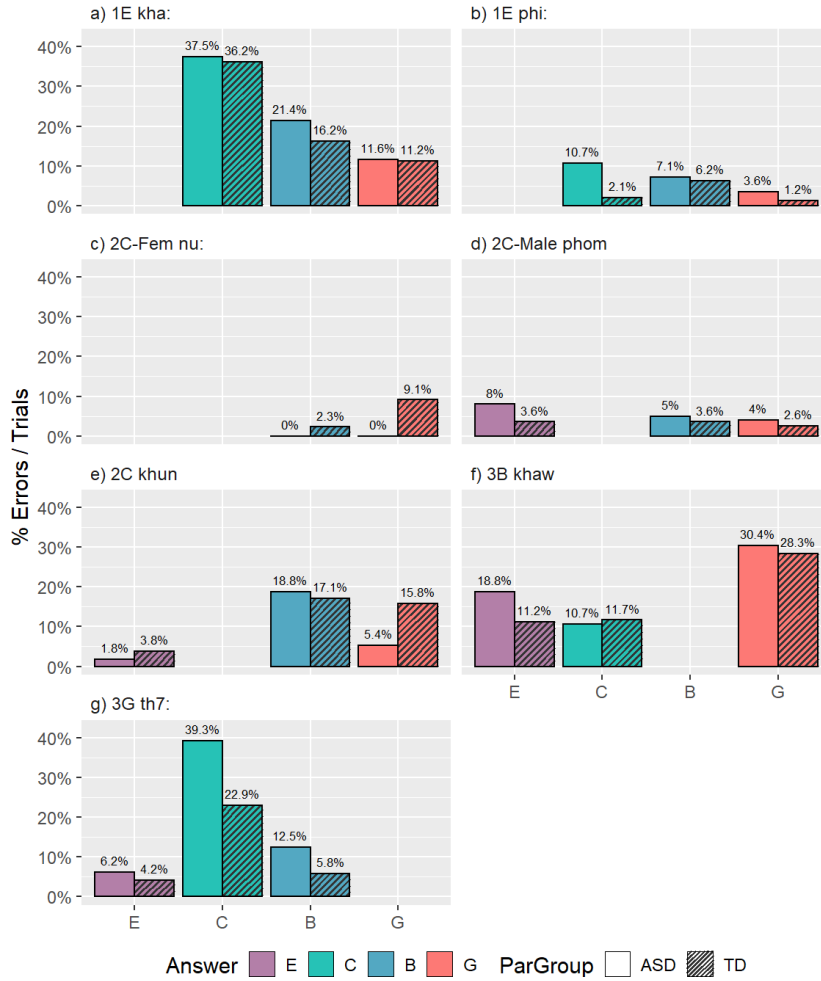


Figure 9. Study 2: Errors in comprehension task by item

that the non-feminine implicated presupposition was not taken into account. However, there are still more frequent choices of the experimenter as a referent in the ASD group, reflecting neglect of the anti-participant implicated presupposition. For $t^h\gamma$, the main source of error in the TD group came from participants choosing themselves as the referent, parallel to the pattern in the ASD group.

Beyond replicating Study 1, Study 2 also attempted to further explore effects of the sort we found for k^hun (second formal) in first person by adding the pragmatically-inappropriate but unambiguous pronoun $k^h\hat{a}$: (first outdated/story-telling). The results show that unlike the pronoun k^hun , the performance of both groups $k^h\hat{a}$: (first outdated/story-telling) was at chance level. This indicates that this pronoun may either not yet be acquired by the children or that some children may have been too

confused altogether by the pronoun being used in this particular context.

5. General discussion: Insights on Pronoun Acquisition and ASD from Thai

In the following, we summarize and contextualize our findings on Thai with regards to general challenges in pronoun acquisition, and more specifically, issues that arise for children with ASD. We group these into five main points: general asymmetries in production vs. comprehension across populations, challenges with first person deixis in ASD, challenges with forms involving implicated presuppositions (primarily in ASD), and difficulties relating to the interpretation in gender features (most prominently in ASD, but also found in TD). Along the way, we highlight ways in which looking at Thai with its rich personal reference system provides unique and novel perspectives on the general theoretical questions at stake.

5.1. Acquisition of personal reference terms: production vs. comprehension

We find pronounced asymmetries in overall success of referential communication between production and comprehension in both children with ASD and TD. Both groups are essentially at ceiling levels in production in terms of providing the right referent in the answer to questions like ‘Who has the pencil?’ This makes clear that participants across the board are able to understand the task and the questions, and to choose appropriate linguistic forms to make reference to the relevant individual.

While pronoun reversals have been reported in children with ASD’s language production in English (Baltaxe, 1977; Kanner, 1943; Naigles et al., 2016; Tager-Flusberg, 2014, among many others) and other languages (Ukrainian; Chumak-Horbatsch (2003); palm reversals in American Sign Language (ASL; Shield, Igel, and Meier (2022); Shield, Igel, Randall, and Meier (2020); Shield and Meier (2012, 2018), a.o.), they appear to be absent or highly uncommon in Thai, which has a much wider range of personal reference choices. This study suggests that the manifestation of the forces behind ‘pronoun reversal’ in a language can also be *person-deixis avoidance*. This is in line

with some earlier observations, which show the complexity of the phenomenon of pronoun reversals. In ASL, similar pronoun avoidance, i.e., preference for personal names, was found to be the most common error for deaf children with ASD (Shield, Meier, & Tager-Flusberg, 2015). Although pronoun reversals were also observed, they are not always present in the language of children with ASD. Similarly, typically developing children at a young age may also be grouped into reversers and non-reversers: Dale and Crain-Thoreson (1993) found that more personal pronouns were used by reversers, whereas non-reversers avoid using them until later when their usage is correct.

The decreases in performance accuracy in comprehension come about through a mix of factors present to varying extents in both groups. Overall, we find lower accuracy in third-person forms, especially in ASD. Specific first- and second-person forms come with challenges of their own, with varying impacts across groups, as discussed below. Again, the richness in the form inventory of Thai and the dimensions at play in terms of constraints on interpretations of personal reference terms allow key insights into acquisition challenges, especially in children with ASD.

5.2. Challenges with First Person Deixis in ASD

In production, the ASD and TD groups differ, consistently across both studies, in their preference patterns with regards to the forms they employ for first-person reference. Children with ASD strongly prefer using their personal name over first-person pronouns, while the pattern for children with TD is the opposite. The standard availability and full grammaticality of self-reference with one's name in Thai is crucial for detecting this pattern. The absence of contrasts in second- and third-person form choices is at least in part due to a) the avoidance of second-person forms for reasons of politeness, with kin terms or occupational titles used instead and b) the absence of salience normally required for third-person forms, resulting in overall preference for nouns (e.g., 'boy' and 'girl') across groups.¹³ Given these independent factors, this

¹³Contrasts such as the following, from Roberts (2004), illustrate how not only the linguistic presence, but also the form of linguistic prior mention of relevant entities is crucial for the availability of pronominal reference:

- (1) a. * In Amsterdam, if a bicyclist isn't very careful, it'll be stolen.
b. In Amsterdam, if a bicyclist isn't very careful, her bicycle will be stolen. (Roberts, 2004, p.517)

absence of contrasts between groups does not allow any strong conclusions about the extent to which avoidance of deictic forms impacts the choice of forms in these cases. Moreover, different factors could be underlyingly at play across groups while still giving rise to the same results. For instance, in ASD, deixis avoidance, rather than politeness considerations might impact the second person pattern, whereas children with TD might be more tuned in to the politeness considerations (see below for discussion of challenges with social deixis).

Children with ASD also show lower performance accuracy than children with TD in comprehension for first-person kin term $p^h\hat{i}$, in both studies. The main source of their errors is that they take this form to refer to themselves, an error that very rarely arises for children with TD. In terms of the linguistic profile in ASD, these findings for first person in production and comprehension may suggest that children with ASD exhibit a strong default to evaluate person reference relative to themselves. In production, they either may not see the need or not be able to use deictic pronominal forms to communicate self-reference by alluding to contextual properties of the context, using their name instead of a deictic form. In comprehension, they are less able to evaluate such deictic first-person forms when used by another speaker appropriately, instead taking it to refer to themselves relatively often (though third-person referential choices are also frequent in Study 1, but there, the contrast with children with TD is less clear). Furthermore, erroneous self-reference interpretations are frequent for children with ASD both for third-person forms and the outdated first-person form $k^h\hat{a}$: in Study 2 (for the latter, the same holds for TD as well). In sum, while children with ASD perform better overall on participant-referring forms than third-person forms (see discussion below), they exhibit challenges and differences from children with TD here as well, in particular with respect to the forms they themselves employ for self-reference and their ability to accurately interpret first-person forms used by other speakers.

A final point worth noting is that for the additional mechanism at play in Thai for personal reference terms for discourse participants, deictic-center shifting, we do not find any specific evidence for particular challenges that children with ASD face in this regard. This topic, of course, merits further study which might reveal such

challenges, but relative to our findings for challenges with third-person forms and implicated presuppositions below, our data support, at a general level, that deictic-center shifting has its own role in the grammar (and its acquisition), separate from the underspecification of features and corresponding need for pragmatic inferences present for, e.g., third-person forms.

5.3. Challenges with Social Deixis

Thai offers unique perspectives on the acquisition of social deixis, given its rich inventory of relevant forms. Given the general pragmatic and social challenges commonly associated with ASD, this also provides ample and highly specific testing grounds for exploring specific linguistic challenges in acquisition by children with ASD. And indeed, our results reveal telling differences between groups, which intriguingly involve both a case where children with ASD outperform children with TD and one where their performance is worse.

As for the former, the formal second-person pronoun form *k^hun* can only refer to the addressee – i.e., the child in the comprehension phase of the experiment – but in doing so, its use is associated with a certain amount of inappropriateness, given that its socially formal nature clashes with reference to a child. This inappropriateness seems to impede performance in the children with TD in both studies, while the children with ASD are basically unperturbed by it. This suggests that they are largely ignoring the social dimension associated with this form.

Similarly, the difference in comprehension performance for the form *t^hɔː* across groups also seems to be driven, at least in part, by considerations of social deixis. Recall that this form is intended for third-person reference to the girl in the experimental setting, but it also has a second-person use that is restricted to use between peers. The error patterns for children with ASD in both studies suggest that they commonly adopt this second-person interpretation (over 30% of the time), again seemingly ignoring the social-deictic ‘peer’ constraint. (Notably, the children with TD in Study 2 exhibit a similar trend in errors, but still to a lesser extent, numerically speaking, than children with ASD.)

Thus, there is ample evidence that the rich social deictic dimension in the personal

reference system of Thai poses particular challenges to children with ASD, in that they exhibit various struggles in terms of being able to use this type of information to resolve pronominal reference.

5.4. Challenges with implicated presuppositions

In line with prior findings on challenges with implicated presuppositions in acquisition in general, we find consistently lower accuracy in comprehension for third-person forms in children with ASD, and to some extent also in children with TD, though to a lesser extent. Recall that in theoretical terms, following Sauerland (2008b), the assumption is that only person features for discourse participants are lexically encoded, so that reference to non-participants involves a pragmatic inference based on the principle MAXIMIZE PRESUPPOSITION, crucially drawing on contrasting forms unmarked for person with those marked for participant reference. The lower performance in children with ASD in 4 out of 5 cases of third-person forms across our two studies thus suggest that they struggle with utilizing such implicated presuppositions in resolving pronominal reference. Given the age of the children with TD in our study, it may not be that surprising that we see much fewer challenges in this regard here (in contrast to prior work), but even so, we do find some decreases relative to participant reference in Study 2 (and also for $k^h\check{a}w$ in Study 1, though that may involve additional and separate challenges with gender features, as discussed below).

This finding of a challenge for children with ASD in drawing pragmatic inferences based on reasoning about alternative forms is particularly interesting given prior findings on scalar implicatures (e.g., the inference from ‘some’ to ‘not all’) in ASD. While this had generally been taken as a case where one would likely expect performance and acquisition time-course differences, most work (Chevallier, Wilson, Happé, & Noveck, 2010; Hochstein, Bale, & Barner, 2017; Pijnacker, Hagoort, Buitelaar, Teunisse, & Geurts, 2009) has found little grounds for establishing such differences across populations empirically. While we are not in a position to spell out a specific proposal for accounting for these apparent differences, we note the contrast as an interesting point for further research.

In theoretical terms, our findings align with the referenced prior work (e.g., Legen-

dre et al. (2011); Yatsushiro (2008)) in supporting analyses that distinguish between ϕ -features that encode lexical presuppositions and pragmatic inferences, namely implicated presuppositions, that convey meaning along the same dimensions but are based on reasoning about the absence of such lexical features.

5.5. Challenges with Gender Features

Various aspects of our findings suggest that gender features are particularly challenging for both groups of children, potentially independent from whether or not the relevant information is conveyed lexically or via an implicated presupposition. First, we find that the third-person male form $k^h\check{a}w$, intended to refer to the boy character, has the lowest performance in both groups overall. Common errors involve reference to the girl, thus failing to take gender information into account. In addition, for the non-human/human gender dimension, relevant for the pronoun form *man* referring to the monkey in Study 1, we see common errors in both groups with reference to the boy or girl instead, failing to take into account the non-human dimension. At the same time, performance for *man* is better overall. While there are some open questions about which gender features are encoded lexically, the overall evidence is at least suggestive that it is the interpretation of gender in general that causes specific challenges, rather than, say, the number of implicated presuppositions in play. But further theoretical work is needed to more firmly establish an analysis of the features in play to interpret the empirical data in this regard. Given the relative complexity and also social dimension at play in interpreting gender, it is perhaps not surprising, though, that the corresponding features pose more challenges in acquisition than person features, which allude to aspects of the utterance context that are presumably highly salient from the start.

5.6. Limitations and future directions

Experiment settings of this kind are highly context-dependent. Changing the discourse participants and tested personal reference terms in the context may alter the results. Since the Thai personal reference system is highly complex, some personal reference

terms in Thai might just be acquired later than others. Each personal reference term may also have more than one targeted referent, depending on the interlocutor's relationship. In certain contexts, even adults may need clarification. To compare these results with the adults' performance is, therefore, not a trivial task. Because of the highly social-deictic nature of Thai personal reference terms, the same set of tested personal reference terms would yield completely different answers if tested on adults, without necessarily informing us about the children's performance. A pretend play, where adults are asked to answer as if they were a child, may be interesting for future research, although it may still not be an ideal baseline.

In addition to the terms tested in this study, it would be beneficial to also test the children's comprehension of their own names as personal reference terms. While obsolete, highly formal, or highly specialized pronouns, e.g., pronouns used with the royals or with monks, may not be useful as a theoretical piece of evidence with regards to implicated presupposition, future research should still be done to get each term's average age of acquisition, which is still unknown in Thai.

Other factors may also have influenced the results we see in this paper. To begin with, even though the children in both groups in both experiments were similar in their demographics, their inputs of personal reference terms are still unknown. Their enhanced or lower performances on certain terms may be connected with the inputs they receive from their social network, i.e., the terms someone they know use to refer to them or themselves. Additionally, conducting clinical linguistic research in Thailand and perhaps other countries with understudied languages is challenging. Not all cognitive measures that are commonly reported in the English literature on ASDs were administered to the Thai participants in our studies, both owing to some measures being unavailable in Thai and our studies' logistical and practical limitations.

6. Conclusion

Our studies have explored the production and comprehension of personal reference terms in Thai-speaking children with autism spectrum disorders and children with typical development. With its rich personal reference system, Thai provides unique and

novel perspectives on the general theoretical questions at stake. Production and comprehension tasks in both studies consistently yield asymmetrical performance across populations. Given freedom of choice in production in Thai, children with ASD were found to avoid using pronouns and instead refer to themselves using personal names. This suggests that even when ‘pronoun reversals’ seem to be absent, it can be manifested as *person-deixis avoidance*. Turning to comprehension, however, while a small group of children with ASD had difficulties with marked person ϕ -features, resulting in the typical pronoun-reversal type of errors, lexically-encoded person ϕ -features may not be the most challenging aspect of personal reference terms that children with ASD face. As Thai allows us to explore various aspects of personal reference terms simultaneously, the pragmatic aspects of these terms, rather than person ϕ -features, are found to contribute the most to their struggle with personal reference terms. Both marked gender ϕ -features and social-deictic aspects of personal reference terms proved to be less prominent cues that are generally overlooked by children with ASD. In terms of types of presuppositions as proposed by Heim (1991), our results support previous works that lexical presuppositions are acquired earlier than implicated presuppositions. We add to the literature that the types of implicated presuppositions matter in the acquisition. The implicated presuppositions of non-human seemed to be relatively easier than those of masculine/feminine genders for children in both groups. At a general level, our results illustrate how an understudied language both in the realm of language and autism research and in the field of linguistics in general can shed light on aspects that may have been difficult or impossible to explore in well-studied languages. In addition to their general contribution to particular fields of study or theories, studies of this type are also needed as the cornerstone for further clinical applications in specific communities that speak understudied languages.

Disclosure statement

The authors report there are no competing interests to declare.

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[Information redacted for review]

Data availability statement

The data that support the findings of this study are openly available on the OSF:

https://osf.io/92jgd/?view_only=0aab47a6ede6499cb498ea2b5eebc0f9.

(Anonymized link)

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