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ABSTRACT

This paper explores the acquisition of personal reference terms in Thai, a language with a highly complex personal reference system. Two separate studies were conducted for this paper, each featuring two groups of participants: children with typical development (TD) and children with autism spectrum disorders (ASDs). In each study, the participants were asked to complete two tasks on personal reference terms: a production task and a comprehension task. Overall, children with ASD performed on par in production, in terms of overall communicative success. However, an important finding was that they demonstrated a tendency toward pronoun avoidance, being less likely than children with TD to use deictic first-person pronominal forms. Instead, they preferred to use fixed referential terms for self-reference, contrasting with the children with TD's preference for personal pronouns. The performance of children with ASD was significantly poorer in comprehension than that of children with TD. Children with ASD were generally able to detect lexically encoded person features but struggled with the more pragmatic and socially deictic aspects of personal reference terms. The latter also posed some challenges for children with TD, albeit 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 in terms of both population-specific effects in a language previously unstudied in this regard and 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.

1. Introduction

Autism spectrum disorders (ASDs) are characterized by distinct social communication and restricted, repetitive behaviors (American Psychiatric Association 2013). While language abilities among children with autism are heterogeneous, pragmatic and discourse differences are often central aspects of their language profiles (for reviews, see Lord & Paul 1997, Tager-Flusberg 1999, Wilkinson 1998). These traits in individuals with ASDs are closely connected to their particular social skills. Individuals with ASD have reported that their unique pragmatic skills cause them anxiety and concerns about socialization, effects that seem to last into adulthood (Paul, Landa, & Simmons 2014). Owing to the prevalence of pragmatic differences 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). Previous studies, for instance, reported patterns such as 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 unusual or nonnormative utterances (Loveland, McEvoy, Tunali, & Kelley 1990), and challenges with engaging in mutual, cooperative conversation (Paul, Orlovski, Marchinko, & Volkmar 2009).

Among these pragmatic differences, 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,(see, for instance, Bartak& Rutter 1974, Charney 1980, Chiat 1982, Fay 1979, Loveland 1984). The reported difficulties include reversals of person features (1), i.e., pronoun reversals, 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 1994:185)

(2) a. 'My get it.'
    b. 'Me cool off.'
    c. 'Do down me arm.'   (Tager-Flusberg 1994:184–5)

Challenges in pronoun use remain a significant aspect of ASD, but the perspective on the nature of these challenges has evolved along with the changing landscape of autism diagnosis. With the prevalence of ASD continuing to increase (Maenner et al. 2023), a broader spectrum of language abilities is now observed within this population. More children with ASD are being identified who do not have co-occurring language impairments. These changes, reflecting the diversity of the ASD population, may lead to shifts in the types of language errors observed. Consequently, the errors exemplified in (2) may not be representative of the types of errors that are most prevalent in today's children with ASD. Zane, Arunachalam, & Luyster (2021), in their analysis of data from a caregiver report completed by caregivers of 151 children with and without ASD, reported a higher proportion of children with ASD make meaning errors, i.e., incorrect assignment of person, number, or gender attributes to the referent, such as those in (1), rather than form errors, i.e., incorrect usage of grammatical features, such as case (as in 2) and morphology.

Meanwhile, reversal errors, such as those in (1), continue to receive much attention in the ASD literature. It is, however, crucial to acknowledge that these errors are not exclusive to ASD and can also be observed in the early speech of typically developing (TD) children (Chiat 1982; Naigles et al. 2016). In children with ASD, these reversal errors appear to occur with greater frequency and show more persistence (Naigles et al. 2016, Overweg, Hartman, & Hendriks 2018), although their rates in ASD might be lower than previously reported (Naigles et al. 2016). This point is underscored by research conducted on deaf children with ASD who primarily use American Sign Language (ASL), where no instances of pronoun reversal were found among those using pronouns (Shield, Meier, & Tager-Flusberg 2015). Furthermore, elicitation tasks suggest that the most common error in the ASD group is not pronoun reversal, but rather *pronoun avoidance*—the substitution of pronouns with proper names.

Aside from challenges with first- and second-person pronouns, studies on narrative production also highlight issues concerning third-person pronouns in ASD. These problems become apparent in storytelling or narratives by children with ASD, manifesting as a decreased use of third-person pronouns (Arnold, Bennetto, & Diehl 2009, Hobson, García-Pérez, & Lee 2010, Novogrodsky 2013). This decreased use could be considered a form of pronoun avoidance, much like the tendency to substitute pronouns with proper names. Furthermore, children with ASD also exhibit ambiguous pronoun usage, which leaves the listener unsure of the pronoun's reference (Malkin, Abbot-Smith, & Williams 2018, Novogrodsky 2013, Novogrodsky & Edelson 2016). In terms of pronoun

comprehension, a meta-analysis across 20 published studies found that individuals with autism exhibited significantly lower comprehension of clitic and reflexive pronouns (Finnegan, Asaro-Saddler, & Zajic 2021).

The pronoun difficulties that children with ASD experience have been attributed to a variety of overarching differences. These include echolalia (Fay 1979), a discrepancy in the development of social and language skills (Evans & Demuth 2012, Naigles et al. 2016), an impaired theory of mind and perspective-taking abilities (Baron- Cohen, Leslie, & Frith 1985, Tager-Flusberg 1999), a reduction in joint attention (Hobson & Meyer 2005, Lyons & Fitzgerald 2013, Mizuno et al. 2011, Shield et al. 2015), and others. One significant shortcoming in the current body of research is the infrequent intersection of clinical studies and linguistics in the context of pronouns and autism. The inherent properties of pronouns have not been adequately scrutinized through a linguistic lens. Typically, the findings are interpreted using psychological or neurological explanations of autism, leaving the linguistic properties themselves less explored.

To address this, we examine the inherent properties of pronouns that contribute to the challenges observed in individuals with autism. First, 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. This aspect of reference, termed 'deixis,' traditionally varies 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 certain languages, personal pronouns also involve social deixis, requiring knowledge about the social relationship between the interlocutors or sometimes the addressed individuals for proper interpretation and use. Second, 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 overlooked, as languages can vary in various relevant regards. This study extends such research to the interpretation of deictic and person aspects of pronouns in Thai, a language that possesses a notably rich system of personal reference terms. Encompassing over 50 personal pronouns, as well as kin terms, occupational titles, and personal names, Thai offers a more intricate set of reference tools than many languages, which only allow or predominantly prefer pronominal forms (Bandhumedha 2011, Cooke 1968, Iwasaki & Ingkapirom 2009). This complexity allows for the exploration of various layers of meaning, including lexically encoded meaning, presupposition, implicated presupposition, person deixis, and social deixis, contributing to a more comprehensive understanding of the subject matter. By exploring these linguistic nuances, we may discover findings that are not only novel to the field but also deeply rooted in the inherent characteristics of the language.

Moreover, while a large portion of the research focuses on pronoun production, studies that examine pronoun comprehension or both aspects in conjunction are limited (Finnegan et al. 2021). Furthermore, the methodological disparity between studies on first- and second-person pronouns, typically investigated through direct interactions, and third-person pronouns, usually studied through storytelling and narratives, has prevented a comprehensive, simultaneous examination of all three persons in a single study. In light of this, the present study aims to delve into this underexplored area, setting forth a series of specific research questions:

(1) How do the inherent properties of pronouns, such as lexical and implicated presuppositions or different types of ϕ-features (person, gender), affect the difficulties experienced by children with ASD? Specifically, is there a disparity in the challenges presented by first- and second-person pronouns versus third-person pronouns and by different ϕ-features such as person or gender (male-female; human-nonhuman)?

(2) To what extent do deictic aspects of Thai personal reference terms, specifically person deixis and social deixis, contribute to the difficulties faced by children with ASD?

(3) Assuming that pronoun reversal errors, pronoun avoidance, and other types of errors are not exclusive to production, how do these particular difficulties manifest in the comprehension abilities of children with ASD?

By posing and addressing these questions, this study attempts to bridge existing gaps, leveraging the rich pronoun system in Thai to offer an integrated analysis of pronoun production and comprehension across all three persons. In doing so, we aim to deepen our understanding of the complex interplay between autism and language, a perspective that can offer significant implications for both linguistic theory and clinical practice.

2. Background

To properly situate our study, we need to introduce several pieces of background. First, to consider our pronoun acquisition data on different populations from a linguistically informed perspective, we review core insights and approaches to the semantics and pragmatics of pronouns. Next, we turn to the specifics of the Thai referential system to highlight the novel perspectives it provides on these issues. Finally, we briefly review prior acquisition work on pronouns and the key theoretical concept of implicated presuppositions. In combination, this background review not only provides the basis for discussing our own data but also points the way toward further research that needs to be done in this rich domain, in particular with regard to insights offered by examining at typologically diverse languages in acquisition work.

2.1. *Semantics and pragmatics of pronouns*

2.1.1. *ϕ-features and semantic markedness*

Personal pronouns are differentiated along several dimensions, including person, gender, case, and number. These dimensions are encoded in their ϕ-features. The first two are of particular relevance for our experiments. Starting with person, first and second person, referring to the speaker and the hearer, respectively, form a class in that they refer to discourse participants, while third person generally picks out nondiscourse participants (Lyons 1977). The former also differ cross-linguistically from the latter 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). Rather than specifying person features lexically for each pronoun, it is commonly argued that, on a given dimension, some forms are (fully) specified for a particular feature whereas unmarked (or less marked) ones receive their typically observed feature interpretation via contrast with the more marked forms. First- and second-person forms are typically taken to be more marked than third-person (Sauerland 2008b). Empirical support for variation in markedness comes from data showing that marked features drive properties of verb agreement, as illustrated by the case of conjoined noun phrases with mixed person features in Czech, shown in (3): when either first or second person is conjoined with a third person (*my brother* and *your father*, respectively), it is the former that the verb agrees with, suggesting that they 'dominate' third person in this regard because they are more marked:

(3) a. bratr   a   já   se   uč-íme   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 1991:262)

Parallel evidence suggests that first person is more marked than second, given their dominance relationship, e.g., in English (4) and German (5) (Sauerland 2008b), where mixed conjunctions lead to the use of a first-person resumptive pronoun and first-person verbal agreement, respectively.

(4) 'You and I, **we**, are special.'   (Sauerland 2008b:26)

(5) 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 1991:262)

In addition, the 'epistemic status test' shows that unmarked forms are in principle compatible with their referent having a property corresponding to a marked feature: in (6), third person *he* does not preclude potential reference to the speaker. In the same vein, (7) suggests that first person is more marked than second.

(6) 'The winner will be a lucky guy. He could be me.'   (Sauerland 2008b:23)

(7) 'To the finder: You might be me.'   (Sauerland 2008b:28)

Sauerland (2008b) captures these patterns by assuming that, in English, first person has the [participant] and [speaker] features, while second person has only the [participant] feature. Other languages exhibit an inclusive/exclusive distinction, where, e.g., variants of 'we' can mean either 'I, you, and our associates' or 'I and my associates, excluding you.' For these, Sauerland (2008b) proposes the features [speaker] for first person and [addressee] for second person instead, leaving them equally marked. Inclusive forms can then be captured as having both [speaker] and [addressee] features. Exclusive forms have only the [speaker] feature and are unmarked for [addressee], with the exclusive interpretation derived pragmatically. Most important for our purposes, however, in both types of languages, third person lacks a person ϕ-feature altogether, and they receive their standard nonparticipant interpretation by way of pragmatic contrast with the more marked forms (as spelled out in more detail in the next section).[1]

Another type of descriptive feature commonly associated with pronoun forms concerns gender. Sauerland (2008b) proposes that languages with masculine/feminine distinctions in their pronouns treat the feminine variant as marked (though we argue below that this does not uniformly hold across persons in Thai). Evidence for such markedness patterns comes from the interpretation of gender features in mixed gender conjunctions in French (8):

(8) un père et une mère   excellent-s
     a.M father and a.f mother excellent-M.PL
     'an excellent father and mother'   (Corbett 1991:279)

Another dimension of grammatical gender, which differentiates between human and nonhuman, seems to vary in terms of which level is marked across languages. For instance, in Luganda, gender class 8, which agrees with nonhuman subjects, is preferred over gender class 2 for human subjects in (9), where the subject consists of a mixed group.

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[1]Kratzer (2009) advances a similar proposal, that first- and second-person pronouns contain the features [first] and [second], respectively, while third-person pronouns contain only the feature [def], as they are merely 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.

(9)　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 1991:274)

But other languages, e.g., Tamil (Corbett 1991), seem to exhibit the opposite dominance relationship between human/nonhuman genders.

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

The meaning of gender features on pronouns has generally been analyzed as presuppositions (Cooper 1979, 1983), and later studies extended this 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 then denote partial identity functions that put presuppositional constraints on the values these variables can have. 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 can be characterized as follows:

(10)　a.　$[\![1\text{st}]\!]^{g,c} = \lambda x: x$ includes s_c. x.
　　　b.　$[\![2\text{nd}]\!]^{g,c} = \lambda x: x$ includes h_c. x.
　　　c.　$[\![\text{masc}]\!]^{g,c} = \lambda x: x$ is male. x.[2]　　　　　　　(Stokke 2022:1086)

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. Their typical third-person (i.e., nonparticipant) interpretation is derived pragmatically, e.g., by appeal to Heim's (1991) Maximize Presupposition Principle Sauerland (2008b).

Maximize Presupposition requires that the form with the strongest lexical presupposition be chosen whenever its presupposition is felicitous. Consider (11) for illustration. While *both* presupposes duality, *every* does not. According to the principle, the use of *every* in (11a) is infelicitous, because the form *both* with the strongest lexical presupposition must be chosen, since humans generally have two hands.

(11)　a.　#Every hand of mine is dirty.　　　　　　　　(Yatsushiro 2008:666)
　　　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,

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[2]According to Sauerland (2008b), masculine features should not be marked/lexicalized for gender. For Thai, however, this paper assumes that a 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 needed.

instead of having a lexical presupposition for the features [speaker] or [addressee], third person has only an implicated presupposition of being *'anti-participant'*.

This approach straightforwardly generalizes to other ϕ-feature dimensions as well, the general principle being that unmarked forms derive their standard referential constraints in contrast to the feature specifications of marked forms. Adding to relevant prior acquisition work discussed below, implicated presuppositions play an important role in our Thai acquisition data.

2.2. *Thai personal reference terms*

Thai has a complex personal reference system involving not only personal pronouns but also kin terms, occupational titles, and proper names (Bandhumedha 2011, Iwasaki & Ingkapirom 2009, among others). Some of its notable features allowing additional perspectives relevant to our acquisition data—and offering many more directions for future exploration—include the different usage of referential expressions (R-expressions), a rich system of encoding social deixis, and particulars of person and gender features.

Thai R-Expressions. R-expressions in Thai (including kin terms, occupational titles, and proper names) are known to violate Binding Condition C (Chomsky 1981), which posits that R-expressions must be free (Hoonchamlong 1991, Lasnik 1989, among many others). For instance, while in English R-expressions cannot be bound (12), Thai allows binding of R-expressions (13).

(12) Dave$_i$ drank the orange juice she made for him$_i$/*Dave$_i$

(13) daːw$_i$/mɛ̂ː$_j$/mɔ̌ː$_k$ dɯ̀ːm   nám-sôm   tʰîː   pʰleːŋ   kʰán   hâj
Dao/mother/doctor   drink   orange juice   COMP   Pleng   squeeze   BEN
daːw$_i$/mɛ̂ː$_j$/mɔ̌ː$_k$
Dao/mother/doctor
'Dao/mom/doctor drank the orange juice Pleng made for her.'

Most relevantly for us, R-expressions in Thai are commonly used as personal reference terms without person restrictions, i.e., allowing first-, second-, and third-person uses. Thai also has a rich inventory of personal pronouns, comprising 27 first-person pronouns, 22 second-person pronouns, and 8 third-person pronouns, according to the list by Cooke (1968). Choosing personal reference terms among these and the abundant choices of other R-expressions requires considering various 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. This complexity is likely to pose challenges in acquisition. But it also offers recourse to forms that may be simpler to use for one reason or another, specifically in production, to avoid issues arising for other forms. Overall, this complex system holds the promise of allowing us to identify a richer and more nuanced inventory of factors in play in relevant aspects of acquisition.

Social deixis abd deictic center shifting. A major factor behind the richness of the pronominal system in Thai is the possibility of encoding social deixis, relating to the social status or relation of the discourse participants. In addition to politeness distinctions commonly found in many languages (e.g., German du/Sie, Russian ty/vy, French tu/vous), Thai exhibits another rarer phenomenon of second-person pronouns being avoided for politeness. This is found in only seven languages considered in the survey by Helmbrecht (2013), all of which are spoken in East and Southeast Asia and allow the alternative of other kinds of personal reference terms, e.g., encoding kinship notions, to politely address the hearer.

A further complexity of the Thai system is that certain personal reference terms can refer to more than one discourse participant role, often with effects related to social deixis, due to what is generally assumed to be yet another pronoun interpretation mechanism. For instance, in child-directed speech,

a female adult can use $p^h\breve{o}m$ to refer to a boy as a hearer. This is generally considered a male first-person pronoun, but it allows for reversal speaker and hearer roles via a specific strategy of its own, called 'deictic-center shifting' (DCS; Fillmore 1997, Levinson 1983).[3] It switches reference from speaker to hearer, or vice versa, by changing the deictic center (also known as *origo* (Bŭhler 1934/2011)). Another example of this is parents talking to their younger child and referring to their older child as $p^h\hat{\imath}$: 'older sibling,' rather than simply *lû:k* 'child,' taking on the addressee's perspective. While we are not in a position to offer a formal analysis, we assume that the features of forms that allow deictic-center shifting are neither underspecified nor unmarked, but rather semantically encode the features revealed by their unshifted uses (e.g., $p^h\breve{o}m$ is considered as semantically encoding first-person features, even though its shifted use leads to reference to the addressee). We do not dive into great detail on this remarkable feature (though it is worth exploring in future work), and with regard to our focus on person information based on lexical encoding vs. implicated presupposition, the cases we consider below involve lexically encoded participant reference. But overall, it is clear that both deictic-center shifting and the rich system of social deixis found in Thai offer many new opportunities to explore aspects of referencce system acquisition that are not present in more well-studied languages.

Person features in Thai. As reviewed above, Sauerland (2008b) proposes that the person feature inventory of languages depends on whether they have the inclusive/exclusive distinction or not. In languages without the distinction, such as English, first person has the features [participant] and [speaker], and second person has only the [participant] feature. In contrast, for languages with the inclusive/exclusive distinction, Sauerland (2008b) proposes the features [speaker] and [addressee] instead.

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, $p^h\hat{u}ak$-*raw* have no inclusive/exclusive distinctions, parallel to English 'we.' But another pronoun $c^h\acute{a}n$ that on its own only means singular 'I' can combine with the plural marker to form $p^h\hat{u}ak$-$c^h\acute{a}n$ to mean 'I and some others, but not you,' i.e., it is an exclusive first-person plural, comparable to *wŏmen* 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 a thorough theoretical treatment of Thai should be. Since we mainly care about contrasts between third person for nonparticipants vs. first/second person for participants, we do not need a fully fleshed out analysis for relevant considerations about our data. Nonetheless, data on implicated presuppositions in acquisition in a language with a different type of person-marking system and corresponding feature inventory contribute to a more general understanding of these issues. Developing a more in-depth theoretical perspective on the Thai pronoun feature system, and exploring it further empirically, remains an important topic for future work.

Gender features in Thai. While Sauerland (2008b) proposed that the [female] gender is uniformly the marked case cross-linguistically, this seems to be true only for third person in Thai. For first- and second-person forms, which also can exhibit masculine/feminine distinctions, [male] seems to be

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[3]It 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 is not considered 'deictic-center shifting' but a mere interpretation of deixis, which, by definition, varies by context.

marked: some of the relevant pronouns are restricted to male individuals, but there is no equivalent pronoun that is restricted to female individuals, as illustrated in (14).[4] Therefore, we argue that the pronoun *pʰŏm* (first-person or second-person via DCS) in Thai is marked for *[male]*, while for *third-person* forms, the feature *[female]* is marked. Yet again, this complication warrants more extensive theoretical investigation.

(14) a. *pʰŏm* hĭw
   1.M hungry
   'I am hungry.'

    i) ✓ referring to a male speaker ii) * referring to a female speaker

  b. *cʰăn* hĭw
   1   hungry
   'I am hungry.'
    i) ✓ referring to a male speaker ii) ✓ referring to a female speaker

As mentioned above, human/nonhuman gender distinctions have already been noted to vary across languages in terms of which feature is marked. We apply two markedness tests, namely, the dominance test and the epistemic status test, to Thai third-person pronouns to determine the markedness status of such features in Thai. The coordination of a human and a nonhuman subject in (15) suggests the dominance of the nonhuman gender, as the nonhuman resumptive pronoun *man* is chosen over the human-marked form *kʰăw*.

(15) a. * câw-kʰɔ́ːŋ kàp mă: *kʰăw* dɤːn ma: dûaj-kan
   owner and dog 3.HUM walk DEI together
  b. câw-kʰɔ́ːŋ kàp mă: *man* dɤːn ma: dûaj-kan
   owner and dog 3.NHUM walk DEI together
   'The owner and the dog walked (toward the speaker) together.'

The epistemic status test in (16) also confirms that the nonhuman 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 [nonhuman] feature is not, giving rise to an implicated presupposition.

(16) a. *man* kam-laŋ kin kʰâːw jù:
   3.NH PROG eat rice PROG
   'It is having a meal.'

    i) ✓ referring to an animal ii) ✓ referring to a person

  b. *kʰăw* kam-laŋ kin kʰâːw jù:
   3.HUM PROG eat rice PROG
   'He/she is having a meal.'
    i) * referring to an animal ii) ✓ referring to a person

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[4]The tested pronoun *cʰăn* in Example (2.2) is in the same register as *pʰŏm*. There are other Thai first-person pronouns in a highly formal register, e.g., *di-cʰăn* or *di-cʰán*, that are restricted to female individuals, but we are leaving this point for future investigation.

Given that Thai clearly exhibits intricate additional phenomena relative to gender marking, this domain, too, offers the potential for gaining new insights and perspectives not available from the vantage point of studying English or other more commonly investigated languages.

2.3. *The acquisition of implicated presuppositions and pronouns*

The acquisition of implicated presuppositions has received much less attention compared to other pragmatic inferences such as implicatures and presuppositions. Notable exceptions are Yatsushiro (2008), Legendre, Barrière, Goyet, & Nazzi (2011), and later related studies (Aravind et al. 2018; Forsythe & Schmitt 2021; Legendre & Smolensky 2012; Stateva, Andreetta, Reboul, & Stepanov 2021). Yatsushiro (2008) compares the acquisition of lexical presupposition and implicated presupposition (as well as scalar implicatures). She examined the German universal quantifier *jeder* 'every,' which is argued to lexically presuppose existence and to have an implicated presupposition of anti-uniqueness. This is semantically compatible with (17a) but blocked by the definite determiner *the*, which presupposes both existence and uniqueness, via Maximize Presupposition.

(17) a.   # I interviewed every biological father of the victim.
     b.   I interviewed the biological father of the victim.   (Yatsushiro 2008:667)

Yatsushiro (2008)'s experimental task requires deciding whether variations of relevant sentences could describe a provided picture. For example, the variants in (18) were presented as choices for describing the picture of a girl playing soccer.

(18) 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 2008:671)

Six-year-old children accepted (18b), where the implicated presupposition is not met, significantly more often than other groups of children and adults, but they performed comparably in other conditions that tested lexical presuppositions, suggesting that the acquisition of implicated presuppositions is delayed relative to that of lexical presuppositions (in a similar way, and for similar reasons, as in the case of scalar implicatures).

Another relevant study by Legendre et al. (2011) examined the acquisition of pronouns in French by testing the comprehension of three singular and three plural French pronoun forms by 16 30-month-old toddlers (using the Fishing Task of Girouard, Ricard, & Gouin Decarie 1997, which we adapt below). Comprehension of third-person *elle* was at chance level, in contrast with a good performance on first-person *je* and second-person *tu*, and plural pronouns yielded below-chance performance across all persons. Assuming third person and plural are unmarked and thus require implicated presuppositions to derive their standard feature interpretations, this aligns with Yatsushiro's finding of acquisition delays for implicated presuppositions.

Finally, a prior study on Thai personal reference terms and autism by Chanchaochai (2013) observed three children with ASD over a three-month period and found that first- and second-personal reference terms such as kin terms, occupational titles, and personal names seemed to be preferred over ones with higher deictic levels such that pronouns. This adds another dimension to our consideration of pronoun acquisition in children with ASD, as the deictic nature of certain pronouns may be yet another source in behavioral patterns. Specifically, in production, deictic expressions

require the speaker to consider their perspective relative to the utterance context, which may pose additional challenges.

2.4. *General approach of the current study*

As a first step toward exploring the acquisition of the rich personal reference system in Thai, this paper compares production and comprehension of a subset of common Thai personal reference terms by children with ASD and children with typical development (TD). The main points of interest within the tested personal reference terms include person and gender ϕ-features and relevant implicated presuppositions, the presence of deixis (including social 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 of 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 was 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 and 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 was 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.
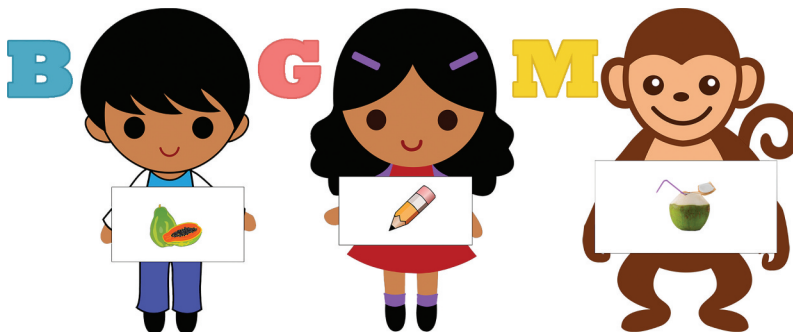

Figure 1. Extra characters in the experiment.

3.1.1. *Procedure*

At the start of each block, the children were first asked to name the objects and animals depicted in the five pictures selected randomly from a pool of 58 for each trial. The pictures were then randomly 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 three trials. Following is a schematic illustration of the course of an experiment, with multiple trials occuring in each of the test phases.

Preparatory Phase:

E: 'What's (your) name?'[5]

E: 'What is this?' (Repeat for five 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.'

> TEST PHASE:
> E: 'What is $y_{\{tested\ personal\ reference\ terms\}}$ holding?'
> C: '(y is holding) _____.'

3.1.2. *Tested personal reference terms*

For the comprehension task, all the main personal reference terms applicable to the context of our experiment were included in the test phase. These included one first-person, four second-person, and three third-person forms (all used without a plural marker). The selected terms were personal pronouns, except for two terms: $p^h\hat{\textrm{i}}$: 'older sibling' and $n\acute{\textrm{ɔ}}$ːŋ 'younger sibling,' which are kin terms. The order of the pronouns was pseudo-randomized, such that the possible answers of each block did not refer to all the speech participants and the referents toward the end of a given block were 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 informal and by no means a full analysis, not the least because it is not obvious in all cases what feature values are in play in a given place. However, we 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 is a social-deictic

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[5]Thai is a pro-drop language, so pronouns can be avoided here.

Table 1. Tested personal reference terms in Study 1.

			Participant		
Term	**Person**		**Gender**	**Social-deictic**	**Target**
pʰiː	participant	{1st, 2nd}	-	older sibling	E
nɔ́ːŋ	participant	{1st, 2nd}	-	younger sibling	C
nŭː	participant	{1st, 2nd}	-	younger participant	C
pʰŏm	speaker	{1st}	male	-	C
	addressee	{2nd} (via DCS)	male	younger participant	
kʰun	addressee	{2nd}	-	formal	C
			Anti-participant		
Term	**Person**		**Gender/ Social-deictic**	**Implicated Presupposition**	**Target**
kʰăw	-		human	anti-participant, nonfeminine	B
tʰɤː	addressee	{2nd}	peer	-	G
	-		human, female	anti-participant	
man	-		-	anti-participant, nonhuman	M

Note. The terms nŭː and pʰŏm in the highlighted cells are tested only with female and male participants, respectively.

dimension,[6] 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) **pʰîː** (kin term; lit. 'older sibling') and **nɔ́ːŋ** (kin term; lit. 'younger sibling')[7] 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 *pʰîː* referred to the experimenter, who was the older participant. Likewise, both uses of the term *nɔ́ːŋ* referred to the child, who was the younger participant.

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

(3) **pʰŏm** (pronoun; for trials with male children) is a first-person polite pronoun 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) **kʰun** (pronoun) is a formal second-person pronoun. Even though it is not an appropriate pronoun to refer to a child due to its formal dimension, it is unambiguously a second-person pronoun. Therefore, it can only refer to the child in the context of the experiment, although confusion caused by its inappropriateness might lead to more noise in the referent choice patterns for this form.

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[6]Social-deictic features are normally listed in the encyclopedic (nonlinguistic) knowledge. It is 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 included only for the reader's understanding of these pronouns.

[7]'Sibling' should not necessarily be taken literally here, as a more general notion of `age of older/younger sibling' also allows for the use of these forms, as in the experiment. As *pʰîː* and nɔ́ːŋ are also kin terms, they could also refer to a third person. However, the prosody for first- or second-person *pʰîː* 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., *kʰăw/k háw* (anti-participant, human) or *man* (anti-participant, nonhuman), may also be added after kin terms to clarify that it is anti-participant.

(5) **kʰǎw**[8] (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 nonfeminine implicated presupposition, given its lack of 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 *kʰǎw* and tʰɤ:, another third-person pronoun in the experiment that is marked with a female feature when used as third person.

(6) **tʰɤ:** (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 of a lower social status as well, but in that case, it 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 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. The term thus refers to the cardboard girl in the experiment.

(7) **man** (pronoun) is unambiguously a third-person, nonhuman pronoun. Being third person, it requires an implicated presupposition deriving from the contrast with participant features. The nonhuman interpretation is also derived by implicated presupposition (see above). It unambiguously refers to the cardboard monkey in the experiment.

3.1.3. *Predictions*

Based on the research questions outlined in the introduction, our predictions take into account previous findings in the literature and the anticipated developmental trajectory of children with ASD. Starting with the first research question, we expect inherent properties of pronouns, such as lexical and implicated presuppositions or different types of ϕ-features, to impact the difficulties experienced by children with ASD. Specifically, we anticipate that children with ASD may struggle more when implicated presuppositions are involved. This prediction primarily suggests lower performance for third-person forms, with potential additional effects of implicated presuppositions on the gender dimension. Even within the realm of lexical presuppositions, it remains to be seen whether different types of ϕ-features yield different results.

For the second research question, focusing on the role of deixis in Thai personal reference terms, we hypothesize that children with ASD might face additional challenges with person and social deixis. Given the general pragmatic and social challenges associated with ASD, we might also expect effects on comprehension for forms with social-deictic features in play. Less clear, but plausible, in the possibility that children with ASD experience some challenges related to cases requiring deictic-center shifting, since those involve flexibly taking into account different discourse participants' perspectives in some form. Difficulties with person deixis are also expected to result in person deixis or pronoun avoidance in production when other suitable personal reference forms are available.

In addressing the third research question, we predict that pronoun reversal errors, pronoun avoidance, and other types of errors are not confined to production but also extend to comprehension. We expect to observe more meaning errors within the interpretations of personal reference terms by children with ASD than children with TD. More specifically, we anticipate a higher incidence of reversed interpretation errors of first and second persons, along with a generally more erratic interpretation of third persons.

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[8]Its more frequently used reduced form *kʰǎw* is underspecified for person as well as gender. Only the full form *kʰǎw* was tested.

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

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

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

3.2. Participants

The participants were 96 children with ASD (*n* = 29) or TD (*n* = 67).[9] Nonverbal intelligence quotient (NVIQ) was measured using the Ravens Standardized Progressive Matrices (Raven, Raven, & Court 2000), following the standardization practice 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 the University of Pennsylvania. Having been informed about the study and their rights, the parents of all the participants provided written consent for their children to participate in the study. The participants were informed of the study and their rights both verbally and in writing.

3.2.1. ASD group

Participants were recruited from Kasetsart University Laboratory School, Center for Educational Research and Development and La-or Utis Demonstration School. 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 La-or Utis Demonstration School. They did *not* meet the diagnostic criteria for ASD. Parents of the participants in this group reported no other learning or psychiatric disorders, although this was not an exclusion criterion for the TD group to avoid hypernormativity.[10]

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 was unambiguously picked out, taking into consideration the relevant referential constraints for a given form, as laid out for the forms used in comprehension in Table 1. The accuracy rate for production was 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

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[9]Depending on the criteria, some participants might be considered adolescents. Among the participants with ASD, 15, 12, and 4 participants were older than 10, 11, and 12 years, respectively. Among the participants with TD, 20, 12, and 1 were older than 10, 11, and 12 years, respectively.

[10]We attempted to subgroup the children with TD into the age-matched group and the NVIQ-matched group. However, the results from different subgroupings were very similar to those from the entire group. Therefore, this paper presents only the data from the entire group of children with TD.
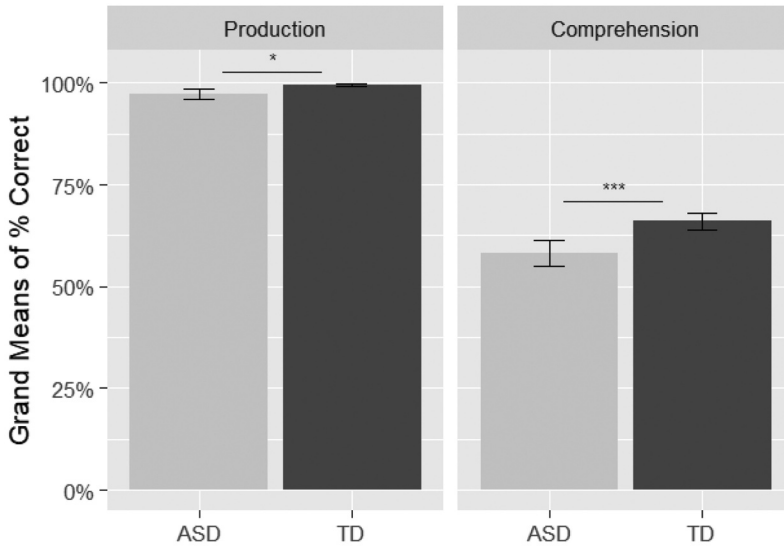
Figure 2. Study 1: Overall accuracy.

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).

3.3.2. *Production*

The most common personal reference terms used by the children in both groups to refer to themselves were 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).
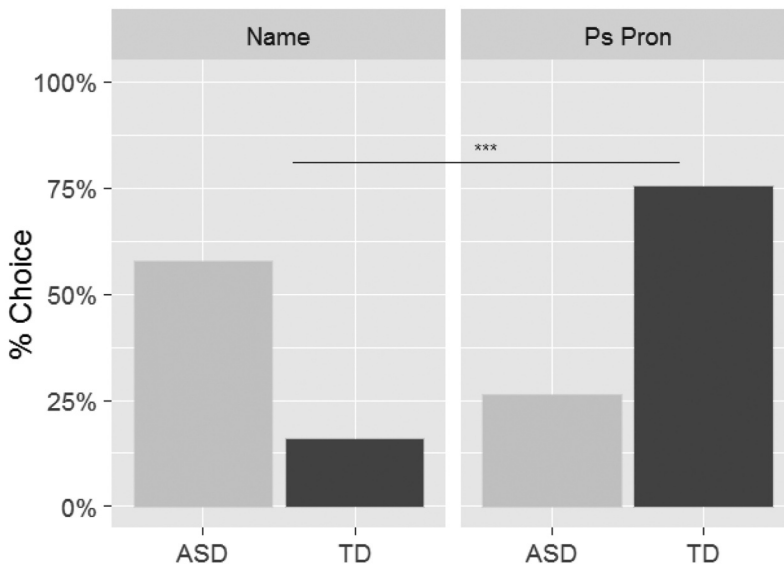
Figure 3. Study 1: Choices of terms the children used to refer to themselves in accurate trials.
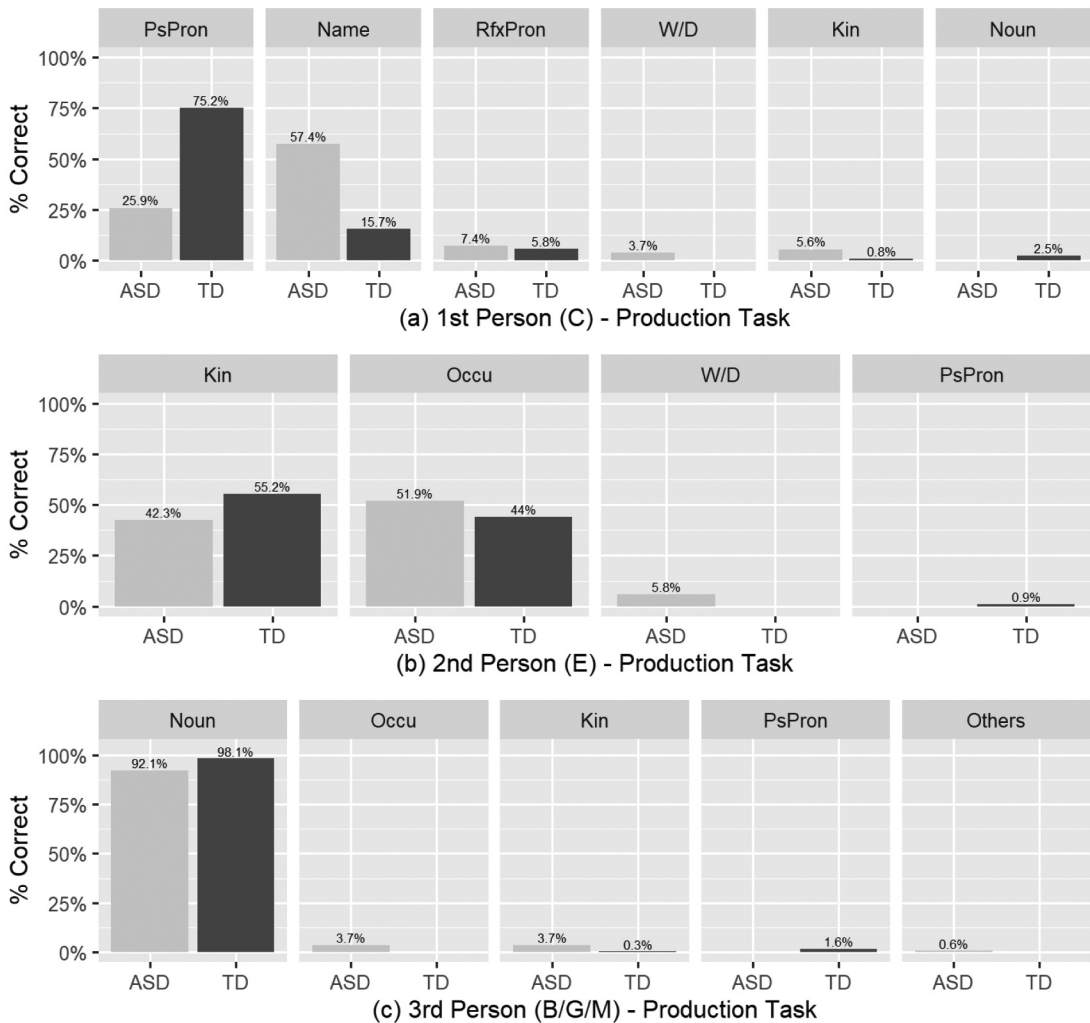
Figure 4. Study 1: Choices of terms used by children to refer to themselves (C), the experimenter (E), and the cardboard figures boy/girl/monkey (B/G/M) in accurate trials. The categorization includes kin terms (Kin), names, common nouns, occupational titles (Occu), personal pronouns (PsPron), reflexive pronouns (RfxPron), other terms, and withdrawn responses (W/D).

As for reference to the experimenter (second person) in accurate trials, children with ASD used the occupational title $k^{h}ru:$ 'teacher' to refer to the experimenter most often (51.95%), followed by use of the kin term $p^{h}\hat{i}:$ 'older sibling' (42.3%). Children with TD, in contrast, preferred the kin term (55.2%) over the occupational title (44.15%). However, the proportion of choices made to referg to the experimenter was not significantly different across groups (Fisher's Exact, $p = .37$). For third-person reference to the cardboard figures, both groups predominantly utilized common nouns (boy, girl, monkey) to denote them, with 92.1% of the ASD group and 98.1% of the TD group doing so. While both groups seemed to rely on common nouns almost universally, a significant difference was observed between them (Fisher's Exact, $p < .01$): the children with ASD sometimes used kin terms (3.7%) and occupational titles (3.7%) to refer to the cardboard figures. For a detailed breakdown of the percentages of both groups' responses, refer to Figure 4. For those interested in a more granular analysis, the breakdown of responses by individual participants for Study 1 can be found in the appendix of this document. As for Study 2, a detailed participant-wise breakdown is available in the associated repository.

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
$p^h\hat{\imath}$:***	.73(.41)	.88(.3)	12.29	<.001	-.39
$n\hat{\jmath}$:ŋ	.79(.35)	.82(.34)	.32	.58	-.09
nŭ:	.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

3.3.3. *Comprehension*

Overall, third person yielded the poorest performance for the ASD group, with an overall decrease relative both to participant forms and to children with TD's performance for all three third-person forms (see Table 3 and Figure 5). In the TD group, only the male third-person form, $k^h\check{a}w$, exhibited a decrease in performance among third-person forms relative to participant forms. Performance on participant referring forms was largely on par, with two exceptions: children with ASD outperformed children with TD for the formal second-person pronoun k^hun with a nonambiguous referent, and, children with ASD were less accurate than children with TD for first-person use of the kinship term $p^h\hat{\imath}$:.

Error analysis: To better understand what may have driven inaccurate responses, it is useful to look at the patterns in errors. Figure 6 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 $p^h\hat{\imath}$: 'older sibling,' a subgroup of both children with ASD and those with TD mistook the term as referring to the cardboard figures (Figure 6a); this was more frequent in the ASD group. The children with ASD
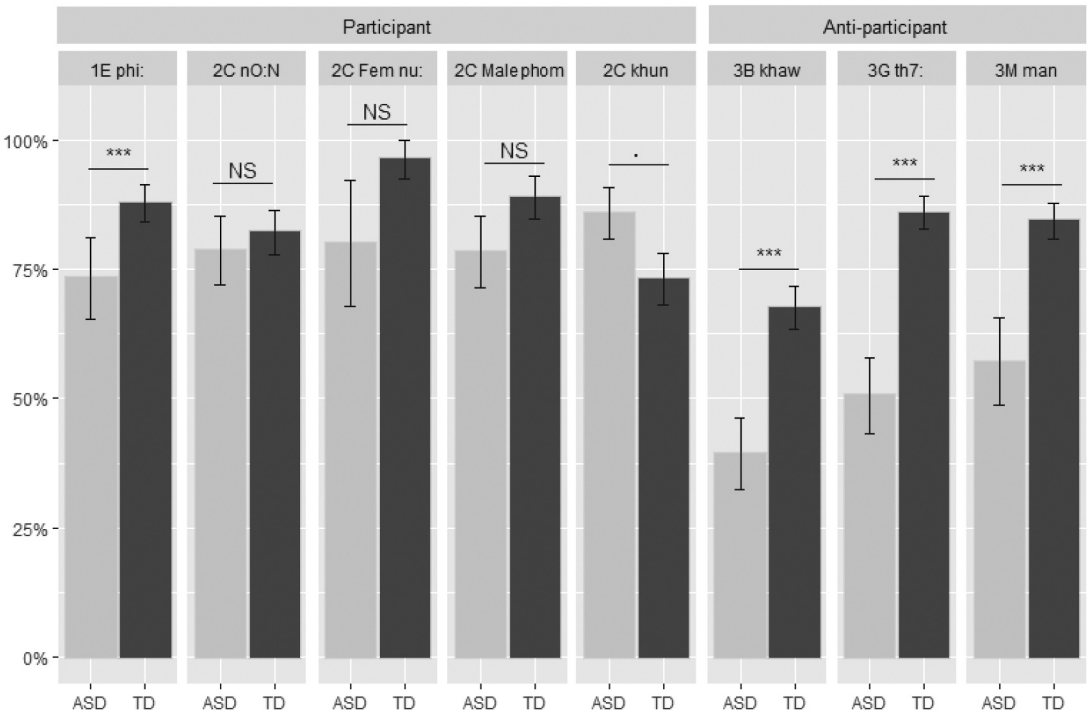

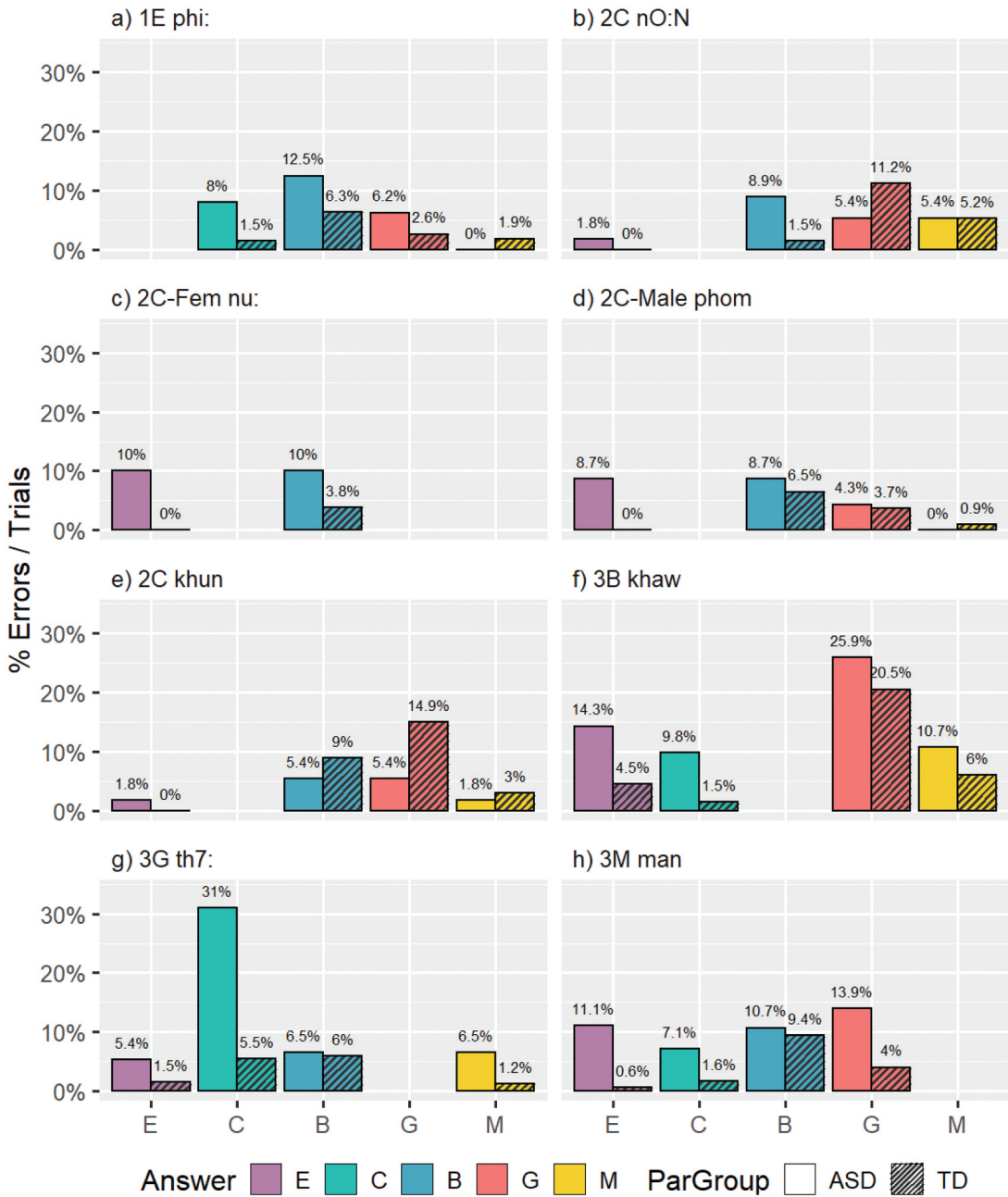**Figure 5.** Study 1: Accuracy in comprehension task by item by participant group.

Figure 6. Study 1: Errors in comprehension task by item ($p^h\hat{\text{i}}$: (a); $n\check{ɔ}:ŋ$ (b); $n\check{u}$: (c); $p^h\check{o}m$ (d); k^hun (e); $k^h\check{a}w$ (f); $t^h\textilde{x}$: (g); *man* (h)) by participant groups (children with ASD and children with TD) by their choice of referent (experimenter (E); child (C); boy (B); girl (G); monkey (M).

also made more mistakes answering that they themselves, rather than the older experimenter, were the referent to the term 'older sibling' (ASD 8%; TD 1.5%).

Child-targeted: A similar pattern was observed in comprehension of the term $n\check{ɔ}:ŋ$ 'younger sibling,' where the children chose the cardboard figures as the referent instead of choosing themselves (Figure 6e). Some children with ASD also chose the experimenter as the referent for the terms $n\check{u}$: (first/second younger female) (10%; Figure 6b), $p^h\check{o}m$ (first male deictic-center shifted) (8.7%;

Figure 6c), *k hun* (second formal) (1.8%; Figure 6d), and *nɔ̌ːŋ* 'younger sibling' (1.8%; Figure 6e). Among the children with TD, regardless of the number of errors they made in comprehension of the formal second-person pronoun *kʰun*, 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 those with TD was related to gender, where they chose the cardboard girl figure instead of the boy figure (ASD 25.9%; TD 20.5%). With regard to the person feature, the children with ASD chose more nonthird-person targets than the TD group (24.1% vs. 6%; see Figure 6f).

Girl-targeted: The pronoun used to target the girl was *tʰɤː*, as one of its uses is for third-person human female. As noted earlier, this pronoun can also be used to refer to a second person with underspecified gender. Although usage as second person is very common, it is restricted to people of the same age or status. It is highly likely that the participants' peers referred to them by using this pronoun. 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 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 6g), despite being neither peers with nor close to the experimenter.

Monkey-targeted: The errors for *man* covered all four other choices (Figure 6h). The children with ASD made mistakes with regard 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 nonhuman interpretation of this form, selecting the boy or girl instead of the monkey.

3.4. *Discussion*

Both children with ASD and those with 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 answers, we observed marginally higher accuracy in children with ASD (though this was not replicated in Study 2). This finding appears to stem from the children's strategic approach to language use. The freedom of production allowed variation in the referential expressions used. 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, in contrast, use deictic first-person pronouns more frequently than names in this case. This person deixis/pronoun avoidance may be an adaptive strategy to compensate for difficulties in grasping person deixis, enabling children with ASD to maintain high production accuracy by steering clear of problematic forms.

To refer to the experimenter, both groups mainly utilized either kin terms or occupational titles rather than a second-person pronoun form. But recall that Thai is a (relatively rare) language type in which second-person pronouns are omitted for politeness in many contexts. If a relationship between the speaker and the addressee is known, a term indicating that relationship, such as a kin term or occupational title, 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. This is unsurprising, given the lack of relevant discourse salience typically needed for pronouns (also see Section 5: General discussion).

Turning to the comprehension data, while children with ASD displayed lower accuracy than children with TD overall, this was driven primarily 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, irevealing no significant differences (with a couple of 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 nonparticipant 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 Maximize Presupposition Principle.

The present result thus suggests that among children with ASD compared with children with TD, this implicated presupposition is less likely to inform their choice of referent. This is also reflected in the frequency of errors made by children with ASD for third-person forms, as they chose the experimenter or themselves as the referent for $k^h\breve{a}w$ about 24% of the time (TD: 6%) and did so about 18% of the time for *man* (TD: 2.2%) (for errros on $t^h\mathrm{ɤ}$:, 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 was comparable to first- and second-person pronouns for $t^h\mathrm{ɤ}$: and *man*, their accuracy for $k^h\breve{a}w$ was lower, though still significantly higher than in the ASD group. We comment on how this may be due to differences in the makeup of the implicated presuppositions associated with the form in Section 5.

Among the participant forms, one noteworthy exception to the overall patterns was the second-person form $k^h un$, which is socially formal and thus ian inappropriate form to address the child participants in the experiment. Interestingly, this seemed to affect accuracy in the children with TD but not in those with ASD, whose performance was significantly higher here (in fact, the highest across all forms in this group). This confirms that children with ASD are able to resolve person features in interpretation when they are lexically specified, but it also suggests that these children are less aware of 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 comprehension of the pronoun $t^h\mathrm{ɤ}$:. This form has both second-person and third-person uses, although the former have an additional social-deictic restriction for usage among peers in terms of age or social status. In its third-person use, it is limited to human and female referents. Since the social-deictic condition of the second-person variant was not met in the experimental setting (as the experimenter and the child were not peers), the appropriate referent targeted by the use of this form was the cardboard girl figure. But children with ASD nonetheless took this form to refer to themselves 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 propensity to adopt the second-person rather than the third-person interpretation of $t^h\mathrm{ɤ}$: was not driven principally by whether a referent could be unambiguously identified based on lexically encoded features alone, as the lexically specified female gender marking on the third-person variant pointed to either the girl or the experimenter. This suggests that person marking may be more prominent than gender marking for children with ASD.

Another interesting finding in this regard is the lower accuracy in children with ASD for the form $p^h\hat{\imath}$:, which can refer to either the speaker or the hearer but has the additional social-deictic requirement that the referent be older. The ASD children seemed less apt to incorporate that information and took this to refer to themselves 8% of the time (compared to 1.5% in children with TD). But they also seemed to exhibit greater confusion overall, as they also ignored 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 chose the 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 that it competes with the person specification. The complementary form, $n\bar{\mathrm{ɔ}}$:η 'younger sibling,' caused similar confusion among both groups of children, whose performance was not significantly different.

To some extent, the last two points may also be reflected in the error patterns for *nŭ:* (first/second younger female). Though we saw no accuracy difference between groups, there were relatively high rates of errors. For children with ASD, these most frequently involved boy-reference choices (8.9%), followed by the girl and the monkey (both 5.4%), but, interestingly, rarely the experimenter (1.8%).

Among children with TD, the most common error was reference to the girl (11.2%), followed by the monkey (5.2%) and the boy (1.5%). So here, as with $p^h\hat{\imath}$: and $n\check{\jmath}$:η, the 'sibling' notion may compete with the person marking, and the female gender seems less salient to children with ASD. Finally, errors for the participant-marked form $n\check{u}$:, which in the context of the experiment unambiguously referred to the child (being marked for younger participant), were also 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 initial data collection for Study 1, primarily mirrored that of Study 1 to ensure replication and strengthen the reliability of our findings. This was especially crucial, considering that this is the first investigation into the acquisition of personal reference terms by children with ASD and TD in Thai. The decision to replicate was also informed by the inherently social-deictic nature of personal reference terms in Thai, which warranted a comparable participant population. Hence, in this study, all the participating children were from the same school and shared some classes, thus ensuring a more even social-deictic context. In addition to replication, Study 2 incorporated changes in the included conditions, as detailed in Section 4.1.

4.1. Design and Materials

Study 2 adopted the same methods used in Study 1, with three main changes. First, the monkey was left out as an individual to refer to, along with the third-person nonhuman pronoun *man* used to refer to it. This was done mainly to streamline the design, since there were no effects of special interest particular to this case. Second, the second-person kin term $n\check{\jmath}$:η 'younger sibling' was removed. Third, a new unambiguously first-person pronoun $k^h\hat{a}$: was added to directly compare with 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 it is 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 were the same as in Study 1.

4.2. Participants

The participants were 92 children with ASD ($n = 32$) and TD ($n = 60$).[11] Nineteen of the 32 children with ASD were also participants in Study 1. In addition to NVIQ, nonverbal 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 minimize differences between groups, the participants with ASD and TD in Study 2 were classmates in Kasetsart University Laboratory School, Center for Educational Research and Development. Although they did not differ in school years and Corsi memory span, they differed in age (TD younger than ASD) and NVIQ (TD higher than ASD) (see Table 4). 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 the University of Pennsylvania. The parents of all the children provided written consent. The participants were informed of the study and their rights both verbally and in writing.

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

Table 4. Characteristics of participants with ASD and TD in Study 2.

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

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

4.3. Results

4.3.1. Overall accuracy

Four male children with ASD (*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 had near-ceiling accuracy rates (97.3% for ASD; 99.38% for TD) in the production task and lower accuracy rates in the comprehension task (58.18% for ASD (60.64% without the outdated *k hâ*:); 65.97% for TD (71.92% without the outdated *k*^{h}*â*:)). 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 7).

4.3.2. Production

In Study 2, the production trends observed in Study 1 were largely replicated. For self-reference, the ASD group predominantly used personal names over personal pronouns, with frequencies of 53.6% for names and 44.6% for pronouns. In contrast, the TD group displayed the opposite pattern, opting for personal pronouns 76.7% of the time and using personal names for the remaining 17.5% (see Figure 8). The choice of terms for self-reference between the two groups was found to be highly significant (Fisher's Exact, *p* < .001).
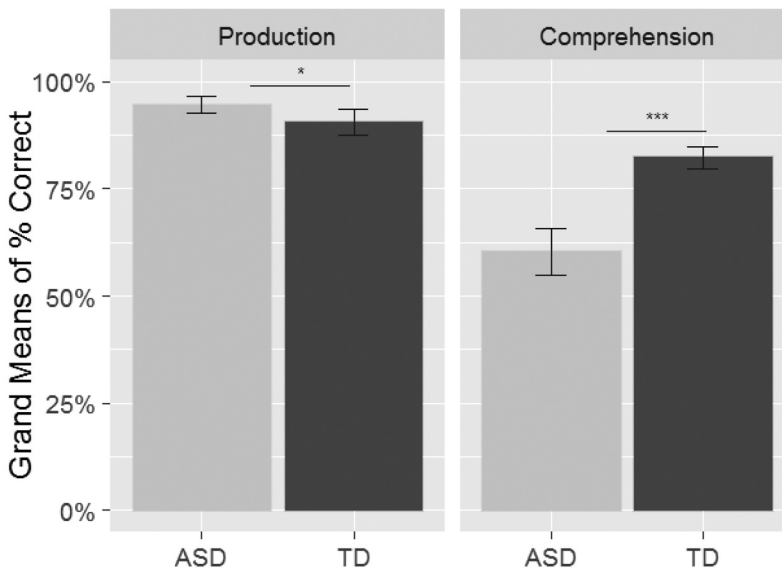
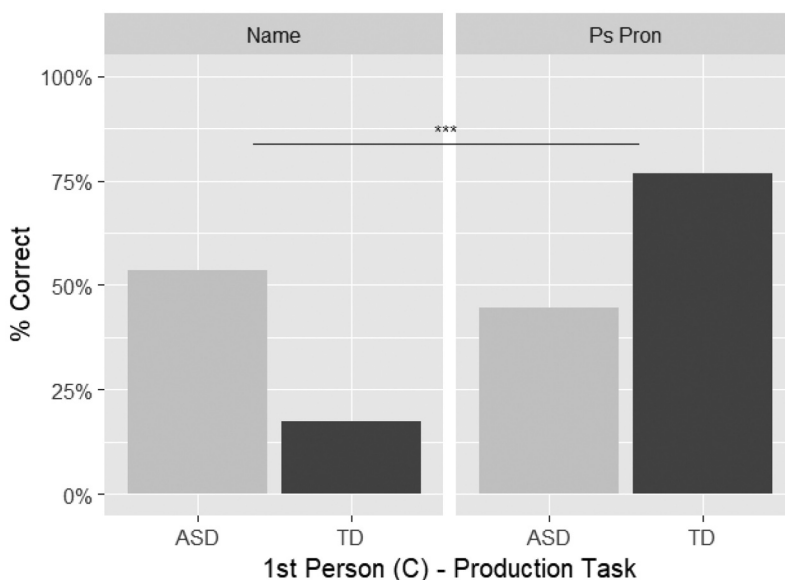**Figure 7.** Study 2: Overall accuracy.

Figure 8. Study 2: Choices of terms the children used to refer to themselves.

Turning attention to references to the experimenter (second person), the preference between kin terms and occupational titles did not differ significantly between the ASD and TD groups (Fisher's Exact, $p = 0.4$). Similarly, regarding third-person references to the cardboard figures (boy/girl), the predominant usage of nouns and all other choices of terms did not differ significantly between the ASD and TD groups (Fisher's Exact, $p = 0.12$). For a more detailed representation of the response percentages across both groups in this study, refer to Figure 9.

4.3.3. *Comprehension*

As expected, the newly added pronoun $k^h\hat{a}$: was extremely difficult for both groups of participants, with no significant difference between them. Third-person pronouns still yielded poor performance for the ASD group (see Table 5 and Figure 10). For the TD group, the male third person still yielded the poorest performance, and unlike in Study 1, the TD group did not perform significantly better than the ASD group. In this experiment, the TD group's performance on the female third-person pronoun $t^h\mathrm{y}$: was lower thanin 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 nonambiguous referent but a pragmatic infelicity when addressed to child participants, where children with ASD again significantly outperformed children with TD; and the first-person form $p^h\hat{\imath}$:, where children with ASD performed significantly worse than children with TD.

Error analysis: Overall similar patterns of errors were found in this experiment, as shown in Figure 11. One small apparent difference was that for first-person $p^h\hat{\imath}$:, children with ASD in Study 2 were less likely than in Study 1 to take it to refer to the boy, but they still showed more frequent interpretations of the form as referring to themselves. As for the newly added pronoun $k^h\hat{a}$:, the children in both groups seemed to perform at the chance level in choosing whether it referred to first, second, or third person. Both groups made the most errors in thinking that the pronoun was child-targeted (ASD 37.5%; TD 36.2%) instead of experimenter-targeted. The children with ASD mistook it as referring to third person in 33% of the trials, while the TD group chose third person 27.4% of the time.
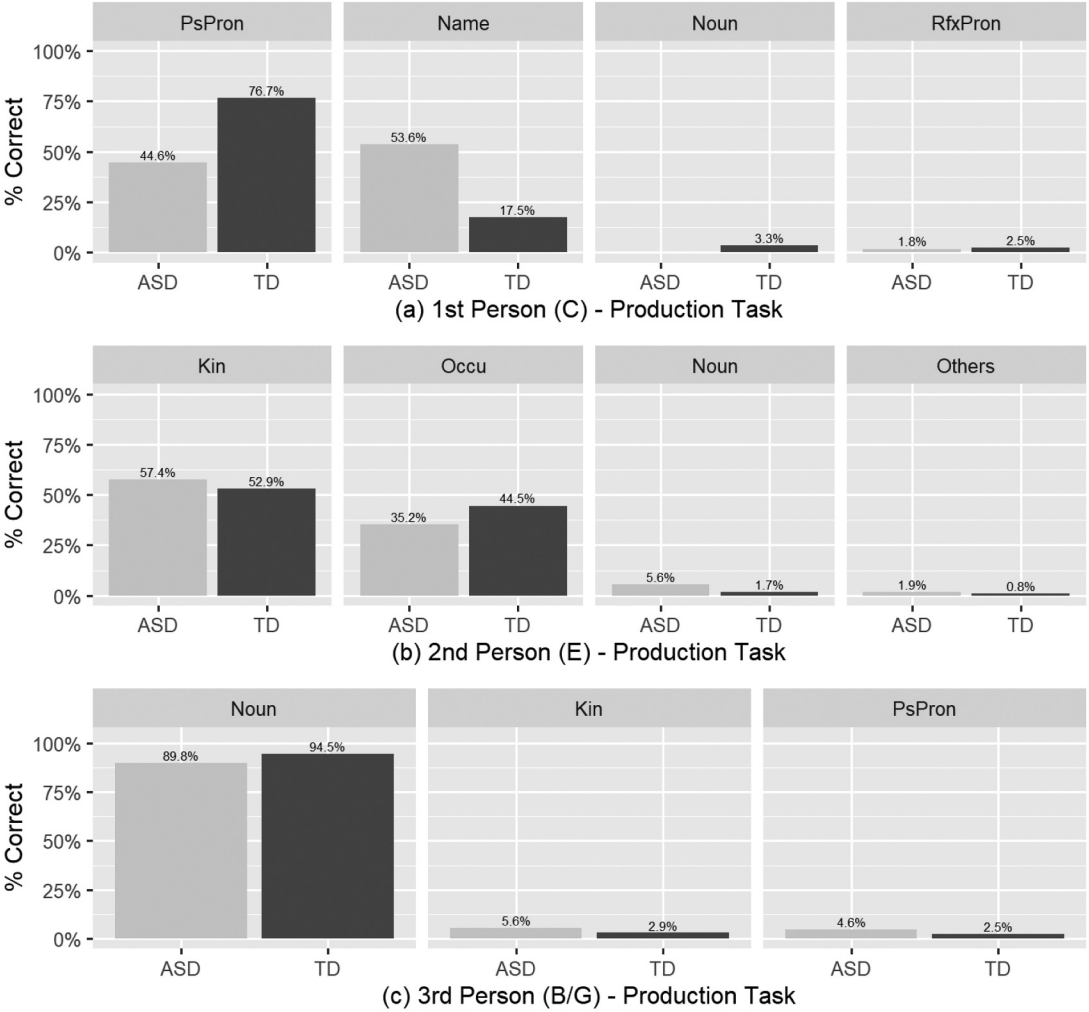
Figure 9. Study 2: Choices of terms used by children to refer to themselves (C), the experimenter (E), and the cardboard figures boy/girl (B/G) in accurate trials. The categorization includes kin terms (Kin), names, common nouns, occupational titles (Occu), personal pronouns (PsPron), reflexive pronouns (RfxPron), other terms, and withdrawn responses (W/D).

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
$k^h\hat{a}$:	.29(.35)	.36(.38)	1.56	.21	−.14
$p^h\hat{i}$:**	.79(.36)	.9(.25)	9.46	<.01	−.35
nǔ:	1(0)	.87(.17)	1.49	.23	.4
$p^{h}\breve{o}m$	.83(.25)	.9(.21)	3.32	.07	.22
$k^{h}un$*	.74(.33)	.63(.37)	4.02	.05	.23
$k^{h}\breve{a}w$	.4(.31)	.49(.33)	2.26	.13	−.17
t hɤ.***	.42(.43)	.67(.38)	21.01	<.001	−.52

4.4. *Discussion*

Almost all the results from Study 1 were replicated. In particular, we found the same asymmetry in choice of referential terms in production, with fewer uses of first-person pronouns among the children
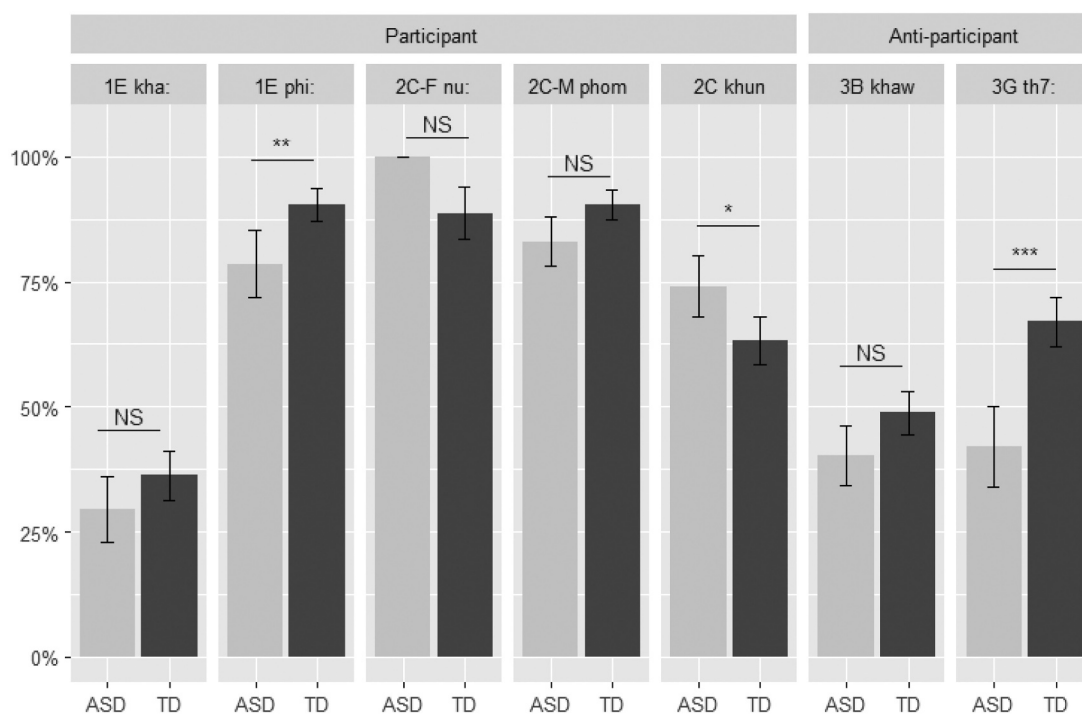
Figure 10. Study 2: Accuracy in comprehension task by item.

with ASD. The significant difference in the results for self-reference remained consistent across both studies. That consistency extended to the second-person reference data, which showed no significant difference in the two studies. However, there were variances in third-person references, which could be due to methodological differences: Study 1 had three cardboard figures, while Study 2 had two. The trio of figures offered a wider range of options for reference and potentially a more diverse set of responses for the children with ASD. Furthermore, having a larger set of figures in Study 1 increased the statistical power and the likelihood of detecting any differences that might exist.

The comprehension data for the participant pronoun forms included in both studies had essentially the same pattern, with similar overall error patterns. The third-person forms saw the same decrease in accuracy for the children with ASD, but also some decrease beyond that seen in Study 1 for the children with TD, especially for the female third-person pronoun t^hɤ:, although the contrast between groups remained for k^hăw. The removal of the monkey figure (and corresponding expressions) in Study 2 might have contributed to the difference. Having three distinct words including a gender feature in Study 1 highlighted the [female] feature of the pronoun t^hɤ:, giving the children with TD more clues for selecting the intended referent. Error patterns also were largely the same, though with more frequent errors by 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^hăw, we saw almost as many girl choices in both groups, suggesting that the nonfeminine implicated presupposition was not taken into account. However, there were still more frequent choices of the experimenter as a referent in the ASD group, reflecting neglect of the anti-participant implicated presupposition. For t^hɤ:, the main source of error in the TD group was participants choosing themselves as the referent, parallel to the pattern in the ASD group.

Beyond replicating Study 1, Study 2 also attempted to explore the kind of effects we found for k^hun (second formal) in first person by adding the pragmatically inappropriate but unambiguous pronoun k^hâ: (first outdated/storytelling). The results show that unlike for the pronoun k^hun, the performance
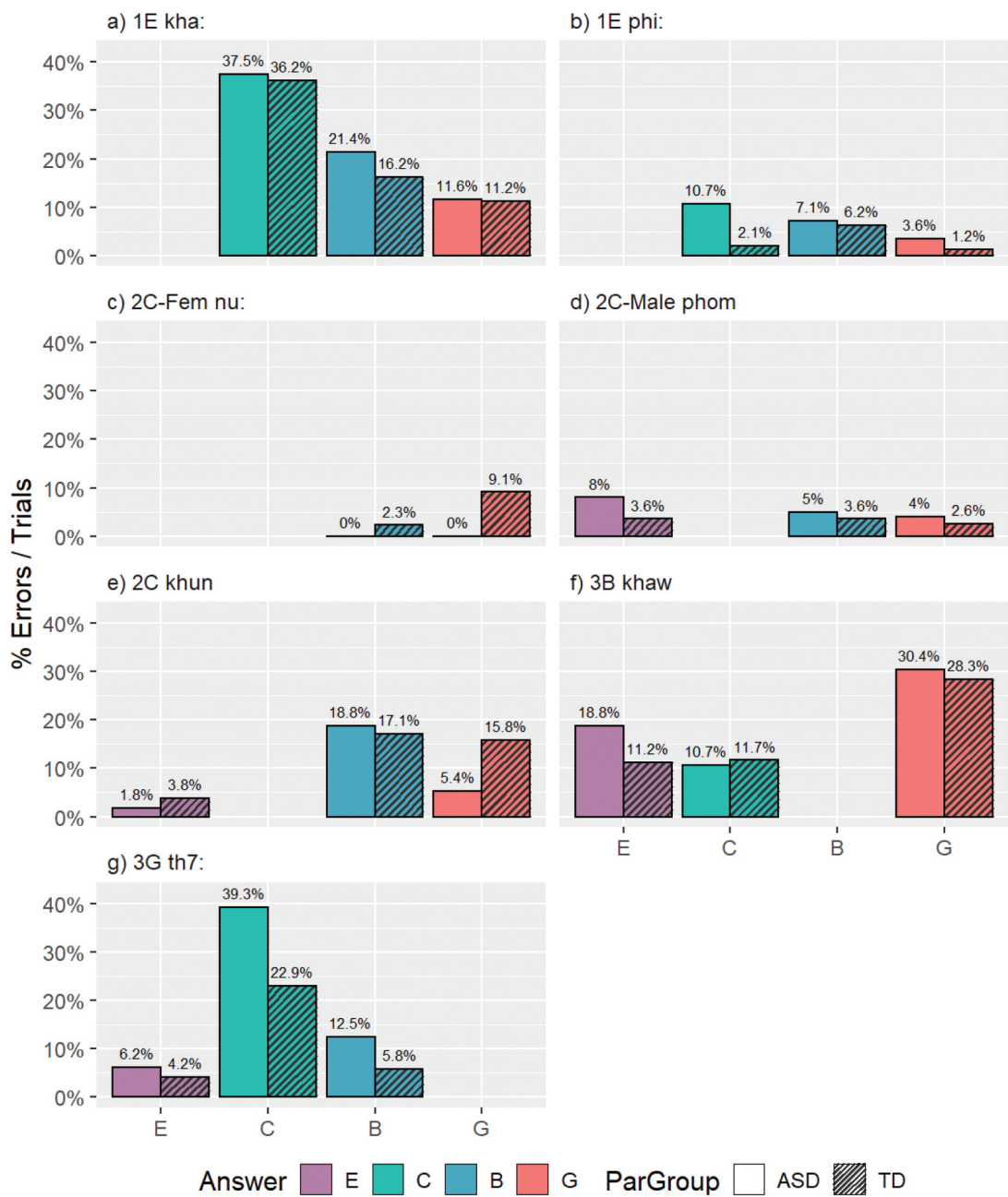
Figure 11. Study 2: Errors in comprehension task by item.

of both groups for $k^{h}\hat{a}$: (first outdated/storytelling) was at the chance level. This indicates either that this pronoun has not yet been acquired by the children or that some children were too confused 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 regard 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, issues relating to social deixis, challenges with forms involving implicated presuppositions (primarily in ASD) and difficulties relating to the interpretation of gender features (most prominently in ASD, but also found in TD). Along the way, we highlight how examining Thai, with its rich personal reference system, provides unique and novel perspectives on general theoretical questions.

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

We find pronounced asymmetries in successful referential communication between production and comprehension in children with both ASD and TD. Both groups are essentially at ceiling levels in production in terms of providing the right referent in answers to questions like 'Who has the pencil?' This makes it 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 in English (e.g., Baltaxe 1977, Kanner 1943, Naigles et al. 2016, Tager-Flusberg 1994) and other languages such as: Ukranian (Chumak-Horbatsch 2003, as well as palm reversals in American Sign Language (Shield, Igel, & Meier 2022; Shield, Igel, Randall, & Meier 2020; Shield & Meier 2012, 2018), 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 forces behind pronoun reversal in a language can also be *person deixis avoidance*. This is in line with some earlier observations that show the complexity of the phenomenon of pronoun reversal. In ASL, similar pronoun avoidance, or a preference for personal names, was found to be the most common error for deaf children with ASD (Shield et al. 2015). Although pronoun reversals were also observed, they are not always present in the language of children with ASD. Similarly, young TD children may also be grouped into reversers and nonreversers: Dale & Crain-Thoreson (1993) found that more personal pronouns are used by reversers, whereas nonreversers avoid using them until later when their usage is correct.

The decreases in performance accuracy in comprehension are atributed to 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 present challenges of their own, with varying impacts across the groups, as discussed below. Again, the richness of the form inventory of Thai and constraints on the interpretation 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 for forms of first-person reference. Children with ASD strongly prefer to use their personal names over first-person pronouns, while the pattern for children with TD is the opposite. The standard availability and full grammaticality of self-reference by one's name in Thai is crucial for detecting this pattern. The absence of contrasts in second- and third-person form choices is due at least in part 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 an overall preference for nouns (e.g., 'boy' and 'girl') across groups.[12] Given these independent factors, this 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. Moreover, different factors could be 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,

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[12]Contrasts such as the following, from Roberts (2004), illustrate that 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 2004:517)

whereas children with TD might be more tuned in to the politeness considerations (see the later discussion of challenges with social deixis).

Children with ASD also show lower performance accuracy than children with TD in comprehension for the first-person kin term $p^h\hat{\imath}$: in both studies. Their main error is that they take this form to refer to themselves, an error that rarely occurs among children with TD. In terms of the linguistic profile in ASD, these findings 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 may be unable to use deictic pronominal forms to communicate self-reference by alluding to contextual properties, 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, they take it to refer to themselves relatively often (although third-person referential choices were also frequent in Study 1, the contrast with children with TD was less clear). Furthermore, erroneous self-reference interpretations are frequent for children with ASD both for third-person forms and for the outdated first-person form $k^h\hat{a}$: in Study 2 (for the latter, the same holds true for TD as well). In sum, while children with ASD perform better overall on participant-referring forms than third-person forms (see the discussion below), they exhibit challenges and differences from children with TD here as well, particularly with respect to the forms they 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 of particular challenges faced by children with ASD. This topic merits further study, which might reveal such challenges, but our findings related to third-person forms and implicated presuppositions support, at a general level, the conclusion 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 third-person forms.

5.3. *Challenges with social deixis*

Thai offers a unique perspective on the acquisition of social deixis, given its rich inventory of relevant forms. It also provides ample and highly specific testing grounds for exploring specific linguistic challenges in acquisition by children with ASD, in addition to the general pragmatic and social challenges commonly associated with ASD. And indeed, our results reveal telling differences between the groups, which intriguingly involve both children with ASD outperforming children with TD and vice versa.

The formal second-person pronoun k hun can only refer to the addressee—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 among 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 $t^h\gamma$: across groups 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 peers. The error patterns for children with ASD in both studies suggest that they commonly adopt this second-person interpretation (more than 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 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 usjng this type of information to resolve pronominal reference.

5.4. Challenges with implicated presuppositions

In line with prior findings about challenges related to implicated presuppositions in acquisition in general, we find consistently lower accuracy in comprehension for third-person forms in children with ASD and, to a lesser extent, in children with TD. 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 nonparticipants involves a pragmatic inference based on the Maximize Presupposition Principle, crucially drawing on contrasting forms unmarked for person with those marked for participant reference. The lower performance in children with ASD in four out of five cases of third-person forms across our two studies suggests that they struggle to use such implicated presuppositions in resolving pronominal reference. Given the age of the children with TD in our study, it may not be surprising that we see much fewer challenges (in contrast to prior work), but even so, we find some decreases relative to participant reference in Study 2 (and for $k^h\check{a}w$ in Study 1, although this may involve additional and separate challenges with gender features, as discussed below).

This finding that children with ASD have difficulty 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 led to an expectation of 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 basis for establishing such differences across populations empirically. While we are not in a position to offer a specific proposal to account for these apparent differences, we note the contrast as an interesting topic for further research.

In theoretical terms, our findings align with the referenced prior work (e.g., Legendre 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 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 nonhuman/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 nonhuman 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 suggests 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 the relevant features to interpret the empirical data in this regard. Given the relative complexity and social dimension of interpreting gender, it is perhaps not surprising 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*

Experimental settings of this kind are highly context dependent. Changing the discourse participants and the tested personal reference terms may alter the results. Since the Thai personal reference system is highly complex, it is possible that some personal reference terms are just 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 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 children, may be an interesting subject for future research, although it might not be an ideal baseline.

In addition to the terms tested in this study, it would be beneficial to 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 theoretical evidence of implicated presupposition, future research should determine each term's average age of acquisition, which is still unknown in Thai.

Other factors may have influenced the results presented in this paper. To begin with, even though the children in both groups in both studies were demographically similar, their inputs of personal reference terms were unknown. Their enhanced or lower performance on certain terms may be connected with the inputs they receive from their social network, i.e., the terms people 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 ASD 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 issue. Production and comprehension tasks in both studies consistently yield asymmetrical performance across populations. Given freedom of choice in production in Thai, children with ASD avoid using pronouns and instead refer to themselves using personal names. This suggests that even when pronoun reversal seems to be absent, it can manifest as *person deixis avoidance*. In terms of comprehension, although a small group of children with ASD had difficulties with marked person ϕ-features, resulting in the typical pronoun reversal errors, lexically encoded person ϕ-features may not be the most challenging aspect of personal reference terms faced by children with ASD. Thai allows us to explore various aspects of personal reference terms simultaneously, leading to the conclusion that the pragmatic aspects of these terms, rather than person ϕ-features, contribute the most to the children's 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 the types of presuppositions proposed by Heim (1991), our results support previous findings that lexical presuppositions are acquired earlier than implicated presuppositions. We add that the types of implicated presuppositions matter in acquisition. The implicated presuppositions of nonhuman seemed to be relatively easier than those of masculine/feminine genders for children in both groups. At a general level, our results illustrate that an understudied language—in the realm of both language and autism research and in the field of linguistics in general—can shed light on aspects that may be 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 the cornerstone for further clinical applications in specific communities that speak understudied languages.

Disclosure statement

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Data availability statement

The data that support the findings of this study are openly available on the OSF: https://osf.io/92jgd/

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Appendix A. Individual Participant Responses in the Production Task for Study 1
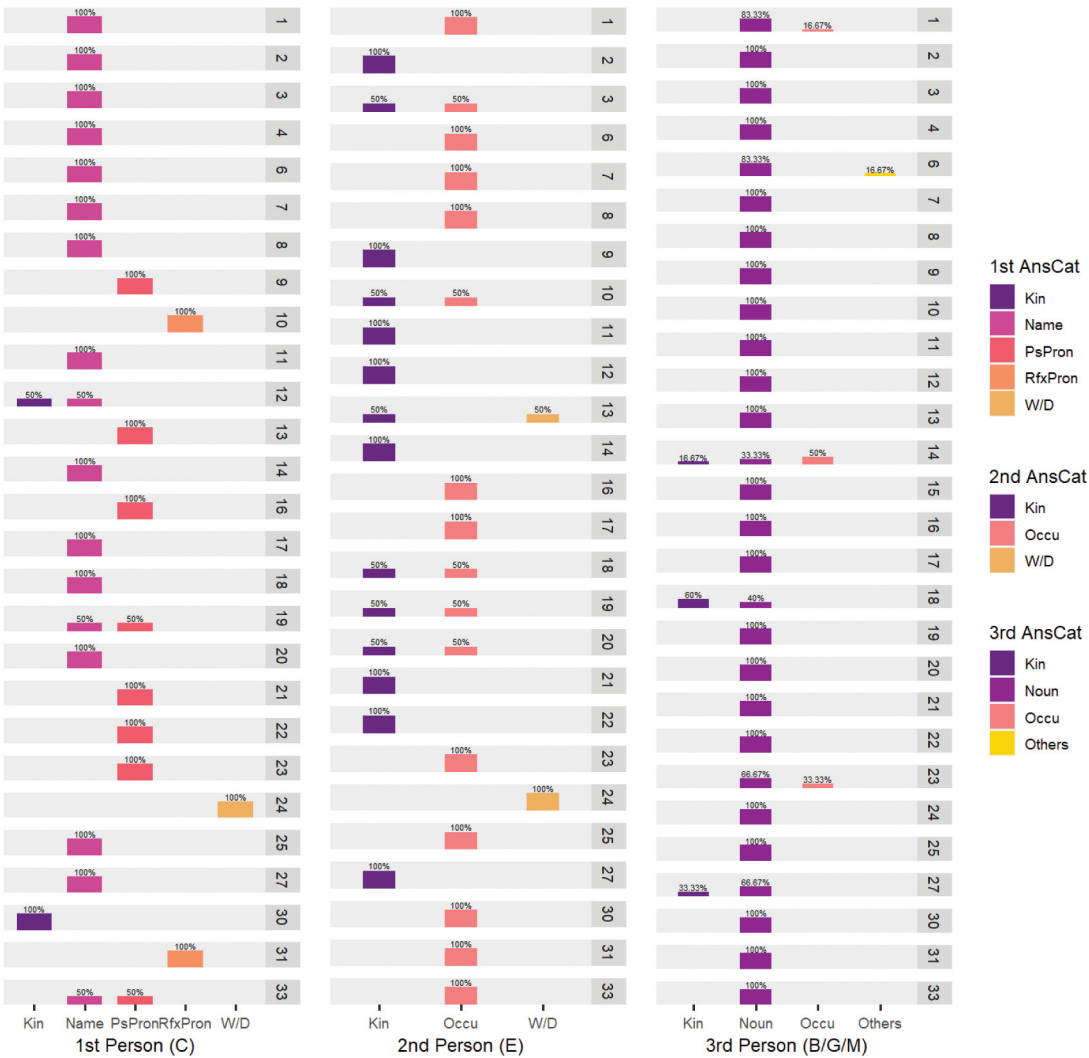

Figure A1. Study 1 (ASD group): Breakdown of terms used by children with ASD to refer to themselves (C), the experimenter (E), and the cardboard figures boy/girl/monkey (B/G/M) by participant ID in accurate trials. The categories include kin terms (Kin), names, common nouns, occupational titles (Occu), personal pronouns (PsPron), reflexive pronouns (RfxPron), other terms, and withdrawn responses (W/D).
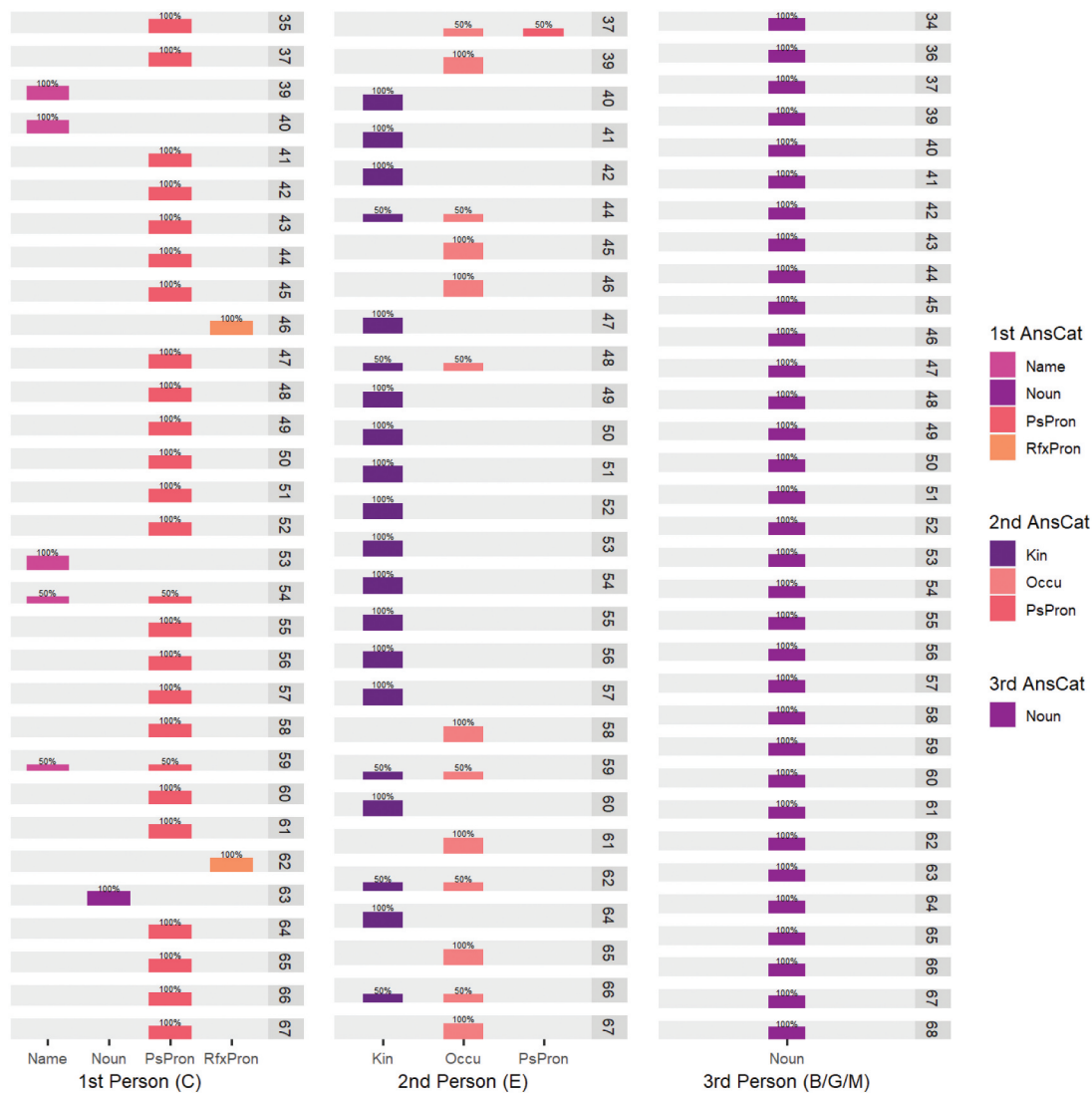
Figure A2. Study 1 (TD Group, Part 2): Breakdown of terms used by children with ASD to refer to themselves (C), the experimenter (E), and the cardboard figures - boy/girl/monkey (B/G/M) by participant ID in accurate trials. The categories include kin terms (Kin), names, common nouns, occupational titles (Occu), personal pronouns (PsPron), reflexive pronouns (RfxPron), other terms, and withdrawn responses (W/D).
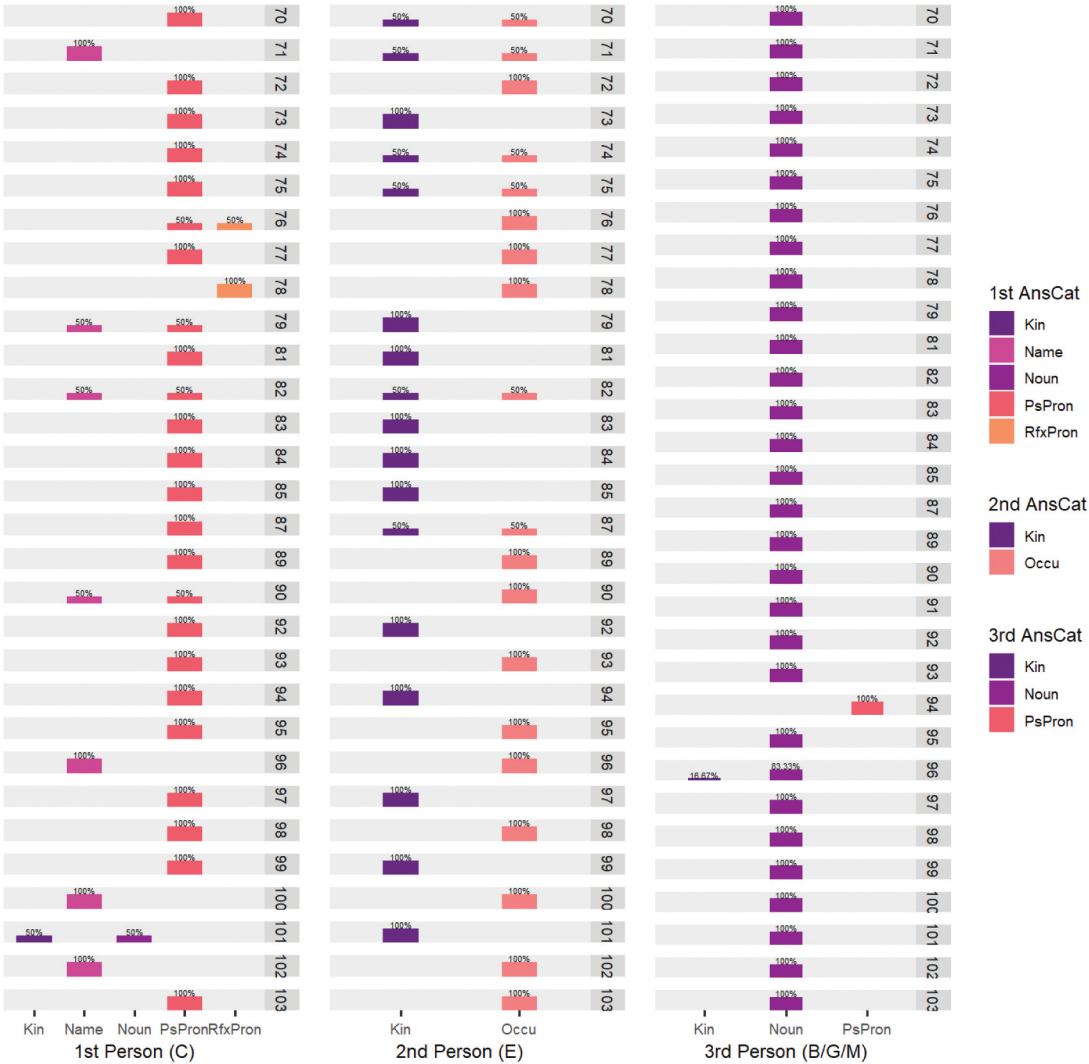
Figure A3. Study 1 (TD Group, Part 2): Breakdown of terms used by children with ASD to refer to themselves (C), the experimenter (E), and the cardboard figures - boy/girl/monkey (B/G/M) by participant ID in accurate trials. The categories include kin terms (Kin), names, common nouns, occupational titles (Occu), personal pronouns (PsPron), reflexive pronouns (RfxPron), other terms, and withdrawn responses (W/D).