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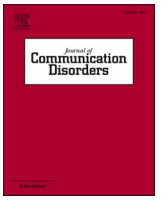

Distributional patterns in recast therapy do not systematically align with patterns in conversational data

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A B S T R A C T

Recast therapy is an intervention for morphosyntactic targets but the demanding nature of this child-centered input raises questions about whether the target exemplars differ from their instantiation in naturalistic child-directed speech. We analyzed a corpus of two infrequent structures – object relative clauses (ORC) and passives – produced by 4 clinicians and 9 caregivers (20 dyads) conducting recast therapy to compare performance across groups and utterance types and then compare these findings to distributional patterns reported in the psycholinguistic literature. As compared to caregivers, clinicians overwhelmingly produced more recasts of all kinds and included greater structural variety in their recasts. Differences in the degree, but not direction, were observed for noun phrase types in specific locations in ORCs and passives. Compared to attested patterns in the literature, recasts matched animacy patterns and passive auxiliary choice, but were much more likely to include a relativizer or a by-phrase (i.e., full passives) and place ORCs in sentence-initial positions. Recasting noncanonical frames may lead to input that is neither aligned with conversational patterns nor similar to items from common assessment tools. Consideration of the role that recast rate (dose), variety, and alignment play in learning should drive decisions about intervention approaches and providers.

Recasts are an effective evidence-based language intervention for promoting grammar learning in children, yet this approach requires high intensity and a skilled provider (Cleave et. al, 2015). Unlike other forms of specialized input (e.g., modeling, elicited imitation), in recasting a provider promptly provides a model of the targeted form using words from a child's preceding utterance and maintaining their semantic force. For instance, if a child says "*she jump*" a clinician targeting regular past tense might respond "*She jumped!*" (Nelson, 1977). Recasting may be effective because it promotes comparison between the child's own utterance and the recast, reduces working memory load by using already-activated lexical items, and follows the child's attentional focus. When done at a rate of 0.5–1 recasts/minute over 10–20 h of therapy, therapeutic gains have been observed for a variety of morphological and syntactic targets (Cleave et al., 2015). Yet, providing recasts at such a high rate is difficult, given that children's utterances – the platforms upon which recasts are built - are unpredictable. Recent meta-analyses suggest that active ingredients of successful recast therapy include intense input, varied models, and engaging the child's attention (Choi-Tucci et al., 2025). Theoretical accounts of recasting connect these active ingredients to persistent priming (e.g., Leonard, 2011; Montgomery et al., 2024). Within this perspective, input properties, such as the degree to which the listener recognizes underlying abstract forms (Rowland et al., 2012; Savage et al., 2003, 2006), input variability (Krok & Leonard, 2018; Plante et al., 2014), and alignment of syntactic frames (Kidd, 2012; Shimpi et al., 2007), drive learning and recall over time (Messenger, 2021).

In the research literature, successfully delivered recasts have been narrowly defined by the relationship to the child's prior utterance and the inclusion of target structure (Cleave et al., 2015). However, evidence suggests that other factors may also influence

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efficacy. These include the degree to which the recast aligns with distributional patterns in naturalistic conversation (Redington et al., 1998) or draws attention to core elements of the target structure (Leonard et al., 2024). Saxton (2000, 2005) argued that recasts that correct child errors are critical for intervention success because they highlight the child's error via comparison. Yet, it has also been shown that both corrective and noncorrective recasts are effective (Hassink & Leonard, 2010). Furthermore, specific recast properties, such as use of question forms and nonfinite complements during recasting, may reduce the efficacy of a recast for tense and agreement because children do not process the full sentence but only the final clause (Fey et al., 2017; Leonard & Deevy, 2017; Leonard et al., 2024). Thus, input characteristics are thought to be relevant to the uptake of linguistic patterns by children, yet are absent from the oft-used narrow definition of recasts.

Generally missing from this literature is a consideration of the degree to which input from recasting is similar to input the child hears more broadly. On the one hand, children with language impairment likely require therapeutic interactions with enhanced language input. For instance, systematically recasting verbs that are rarely inflected with past tense at high rate has been shown to enhance generalization of -ed to new verbs (Owen Van Horne et al., 2017, 2018). Likewise, increasing the diversity of noun + auxiliary combinations above what parents naturally provide appears to enhance learning third person forms (Hadley et al. 2017). As such, diverging from conversational input with regard to both quantity and quality may be helpful for children with language impairments. On the other hand, children live in the world, not in the therapy room. A vast body of literature shows that comprehension and production is enhanced when the task aligns with conversational input in terms of lexical frequency (Kidd et al., 2010), animacy (Lempert, 1985, 1990), syntactic role (Lau & Tanaka, 2021) and use of pronouns (Kidd et al., 2007). However, this literature has not yet evaluated alignment in the context of recast therapy.

Another consideration is that recast therapy can be challenging to provide. This is because children's utterances – the platforms upon which recasts are built - are highly unpredictable and the provider must be responsive to these utterances while continuing to maintain the interaction and monitoring their own spoken responses. Thus, the provider's skill and meta-linguistic knowledge may affect characteristics of recasts (Brimo & Melamed, 2017). While it is relatively well established that clinicians are able to deliver recasts effectively (Choi-Tucci et al., 2025; Cleave et al., 2015), the data on caregiver provision are more mixed (Fey et al., 1993; Baxendale & Hesketh, 2003). Particularly for syntax targets, novice providers are most successful when the amount of caregiver training approximates the number of hours that might be spent in direct service delivery by the clinician (20+ hours; Baxendale & Hesketh, 2003; Wang et al., 2024; Yoon et al., 2007). At the same time, it is not clear whether optimal input diverges from naturalistic conversations to enhance variability or converges on conversational patterns to highlight input regularities.

To that end, in this study we draw upon extant data from an ongoing randomized controlled trial to evaluate the extent to which recasts and models provided by clinicians working for the research team (i.e., with intense training and high metalinguistic skills) and caregivers (i.e., with limited training and variable metalinguistic skills) are comparable when treating one of two noncaononical structures: either passives or object relative clauses (ORCs). In addition, we draw upon previously published corpus analyses to compare the production patterns for caregivers and clinicians to the expected patterns in conversational use of these two grammatical structures.

1. Recast therapy

In recast therapy, adults support children's acquisition of a particular linguistic form by restating or rephrasing a child's own utterance to include a targeted form while maintaining the core sense of the child's utterance (Cleave et al., 2015). Through reusing key parts of a child's own utterance, recast may be more effective than modeling, in which the adult produces the target without trying to reuse parts of the child's utterance (Nelson, 1977), or elicited imitation, in which the child is prompted to copy an adult model (Camarata et al., 1994; but see Calder et al., 2018 for more recent evidence suggesting that production practice is key). A recent meta-analysis indicated that enhanced recast therapy, which includes presenting varied exemplars of target morphemes, working intensely one-on-one, and securing a child's attention prior to the recast, is more effective than other variations on recasting, such as adding auditory bombardment, providing intervention in groups, or using less varied input (Choi-Tucci et al., 2025).

Provider knowledge and skill is one relevant variable affecting recast efficacy. While most adults can be trained to provide recasts (e.g., Fey et al., 1999), dose provided and treatment fidelity vary with provider skill and linguistic knowledge of the target. Most studies of recasting with caregivers as providers include intensive training and focus on morphological targets (e.g., *am, is, are,* Cleave et al., 2015; Fey et al., 1993). While parents likely have more contact with a child than an SLP, their lack of specialized grammatical and linguistic training compared to an SLP may constrain their ability to provide recast therapy for complex syntax targets with high fidelity. Indeed, even certified SLPs find treating syntactic targets to be challenging (Brimo & Melamed, 2017; Wang et al., 2024).

Recasting can be a demanding language task because providers must maintain a natural interaction with the child, recognize that a "recastable" utterance has occurred, and then, under time pressure, begin their recast before the next conversational turn (Fey & Proctor-Williams, 2014; Nelson, 1977). In contrast, models, which are also effective therapeutic input (Eisenberg, 2013; Fey & Proctor-Williams, 2014), do not reuse the child's own lexical items nor are they tightly timed relative to the child's own utterance. This allows an adult to develop the target utterance with fewer constraints on form. While production pressures associated with recasting and modeling have not been directly studied to our knowledge, we speculate that models may be less demanding than recasts because they do not require contingently planning the utterance content under time pressure (Corps et al., 2018; Meyer, 2023). Comparing the characteristics of different providers (therapists/caregivers) and types of input (recasting/modeling) can inform our understanding of the degree to which particular intervention tools in the hands of different providers align with conversational input. This may guide future studies that examine efficacy.

Another variable thought to affect recast efficacy is the degree to which the recast highlights the targeted grammatical form. This

has been termed *input informativeness* in the literature and has been framed as the degree to which the information provided in the recast gives evidence for the presence or absence of certain linguistic features in the language (Hadley et al. 2017; Legate & Yang, 2007). For instance, Hadley et al. argue that using diverse sentence subjects and relying on noun phrases helps children notice that the noun + contracted form comprise two grammatical elements, whereas hearing pronouns + contracted forms (*it's, she's, he's*) may be processed as a single word. Thus, subject diversity that exceeds that naturally found in conversation promotes learning that English requires over tense marking (Legate & Yang, 2007). Other cues, such as salience (Leonard, 1989), utterance length, embedding (Leonard et al., 2024; Sweeney et al., 2024), and massed vs. spaced presentation of the input (Ambridge et al., 2006) are also thought to draw attention to relevant contrasts. Though there is a growing body of literature examining online processing of noncanonical frames (i.e., frames that adopt a nontraditional word order), these studies emphasize moment to moment comprehension rather than the role of input structure on learning (e.g., Lai et al., 2023; Peristeri et al., 2024 & Pinar et al., 2017). Thus, more information is needed about how different input patterns might promote learning passives and relative clauses. Examination of the variation in input across different providers and types of utterances (recasts vs. models) provides a preliminary look at this topic.

1.1. Syntactic frames of interest

Sentence structures exhibit regularities between form-to-meaning mappings, and at scale, they generate distributional patterns which children use to learn grammar and interpret meanings (Redington et al., 1998; Gleitman, 1990; Mintz, 2003). For example, although passives and actives differ in their interpretation, both follow a noun-verb or a noun-verb-noun word order (e.g., *The dog was chased by the cat* or *the bone was eaten*), primarily differentiable by cues such as the inclusion of the verb in a participle form, the auxiliary choice, or a by-phrase. ORCs also adopt a noncanonical word order, but in this case adjacent nouns occur without a medial verb (e.g., *Look at the dog that the cat chased* or *The dog the cat chased was sleeping*). Passives and ORCs share similar characteristics in that they topicalize the patient, the receiver of an action (Ashwell, 2018; Weiner & Labov, 1983; Reali & Christiansen, 2007). That said, there is substantial variation in elements within sentence frames (e.g., animacy, use of relativizers or by-phrases, form of head noun, location within the sentence), which are documented to enhance sentence comprehension among typical learners (Baldie, 1976; Kidd et al., 2007; Lempert, 1985, 1989). However, little is known about their impacts on comprehension and learning in non-typical learners. ORCs and passives frequently occur in academic texts (Curran, 2020) and less frequently in ambient input to children (Montag, 2019), making them ideal intervention targets for clinical trials.

In what follows, we briefly review distributional patterns reported in published corpus analyses and summarize these patterns in Tables 1 (ORCs) and 2 (passives). We draw on a variety of sources to report these distributional patterns, and while we prioritize evidence from child-directed spoken corpora; in some cases patterns are derived from studies of adult-directed spoken corpora, written corpora, and sentence completion tasks.[1] We acknowledge that the summary of patterns in this section relies primarily on white, monolingual, middle-class speakers from the United States and Britain.

To preview the upcoming sections, we show that an ORC heard in conversation is most likely to sound something like, *My sister dropped the vase I loved.* Here, the ORC (underlined), modifies the object of a sentence, which also serves as the inanimate head noun (*the vase*), and uses an animate personal pronoun (*I*) as the embedded noun. The relativizer, *that,* is omitted because the interpretation is clear without it. A passive heard in child-directed speech might be something like, *It was cooked* which uses an inanimate pronoun as the head, a form of *be* as the auxiliary, and elides the agent. A passive like, *The worm got eaten by the bird* is relatively rare conversationally, as this example includes two animate full NPs, a by-phrase, and the use of *get* as the auxiliary. That said, fully reversible forms, which are rarely attested in conversational speech (e.g., ORCs: *the cat that the dog chased ate the mouse*; passives: *the cat was chased by the dog*) often appear as stimuli in language studies (e.g., MacDonald et al., 2020; Messenger et al., 2011) and on standardized tests.

1.1.1. Characteristics of object relative clauses

An object relative clause (i.e., *the book that I read*) is a noun phrase (NP) made up of a head noun (i.e., the patient) modified by a clause containing an embedded subject (i.e., the agent) and an embedded verb. The head noun is the object of the embedded verb.

Across sentence types, listeners expect the agent to be an animate noun and the patient to be an inanimate noun (Ferreira, 1994; Lempert, 1985). In English, the agent is most often the subject of the sentence. Indeed, conversational corpora analyses and sentence completion tasks show that animacy, agency, and syntactic role are tightly linked (Gennari & MacDonald; 2008, 2009; Race & MacDonald, 2003).

In contrast to canonical transitive structures, the first noun in ORCs is likely to be inanimate, acting as a patient, while the embedded noun is likely to be an animate agent (Gennari & MacDonald, 2009). In child-directed speech, personal pronouns (i.e., *he, she, they, you, I*) are more common than common or proper nouns in the embedded NP (Hsiao et al., 2023).

The relative marker (usually *that* or a *wh*-pronoun) is optional and speakers overwhelmingly omit *that* from child-directed speech (Hsiao et al., 2023; Montag, 2019). Sentence-final ORCs (e.g., *I saw the ball the boy kicked*) are more common than sentence initial ones (e.g., *The ball the boy kicked went through the* window) and appear to be easier for listeners to comprehend (Hermann, 2003).

[1] Child directed speech (Altmiller, 2022; Caputo, 2017; Hsiao et. al 2023; Montag & Macdonald 2015; Montag, 2019); Spontaneous language data from adults (Brannigan, 1996; Fox & Thompson 1990; Hermann, 2003; Huang et al., 2017); Sentence completion data from adults (Gennari & MacDonald 2008, 2009; Race & MacDonald, 2003); Juvenile literature (Montag & Macdonald 2015, Montag, 2019); Written corpus data (Gennari & MacDonald 2008; 2009; Race & MacDonald, 2003). Mixture of spoken and written corpora (Reali & Christianson 2007).

1.1.2. Characteristics of passives

A passive (i.e., *the cake was baked by the girl*) is a sentence where the patient NP appears in the subject position of the sentence (rather than the object) and the agent is optionally included via a by-phrase. The passive nature of the sentence is signaled by the use of a passive auxiliary (*be* or *get*) and participle verb-form.

Like ORCs, passives are noncanonical forms and the first noun is frequently inanimate, while the noun in the by-phase is most often animate (Fox & Thompson, 1990). We are unaware of analyses that examined NP types in child-directed speech; however, in adult-directed corpora, pronouns are more likely than full NPs to be sentence subjects in passives (Huang et al., 2017).

There is variation in the use of the auxiliary (*be/get*) and inclusion of the by-phrase, which is linked to interpretation of the frame as an adjectival or true passive. The distinction between adjectival (or stative) passive vs. eventive (or true) passive is long-standing (e.g., Chomsky, 1979; Harris & Flora, 1982; Budwig, 1990; Weigner & Labov, 1983, inter alia). Adjectival passives describe state (i.e., condition of being) while eventive passives describe agent-patient relations within a transitive event (i.e., X doing-something-to Y). Some sentences unambiguously refer to a state (e.g., "The chair was red") while others unambiguously refer to an event (e.g., "The chair was hit"). Some sentences are ambiguous. For example, "The chair was broken…" could be referring to the state (e.g., "…before I came") or an event (e.g., "…by the boy"). Both be- and get-passives can refer to events, but be-passives have a probabilistic tendency to describe states. For example, you can say "we were married for 40 years" to refer to the state, but the same sentence with a get-passive sounds infelicitous (e.g., *"we got married for 40 years").

Adults overwhelmingly produce short passives (i.e., without by-phrases) as opposed to full passives (i.e., with by-phrases; Altmiller, 2022; Caputo, 2017; Montag, 2019). In child-directed speech, passives tend to include *be* auxiliaries. As such, *get* passives with by-phrases are exceedingly rare in child-directed spoken corpora (Altmiller, 2022; Caputo, 2017; Montag, 2019). That said, *get* passives are more recognizable as a passive since the only time that *get* serves as an auxiliary is in passive frames, whereas forms of *be* also commonly appear as auxiliaries in progressive frames (e.g., *They were eating cookies*).

1.2. Questions posed in this study

In this study, we ask whether input provided in recast therapy has distributional patterns that align with those reported as present in spoken language corpora. In particular, we are interested in whether recasts and models produced by treatment providers, who have varying levels of grammatical knowledge and clinical skills, differ in their distributional patterns as compared to each other and as compared to the patterns reported in corpus analyses (see Section 1.2). Thus our specific research questions are:

1. To what extent do ORC productions by clinicians and caregivers for models and recasts, differ from each other with regard to animacy, head NP types, relativizer use, and head position?
2. To what extent do passive productions by clinicians and caregivers for models and recasts, differ from each other with regard to animacy, subject NP type, auxiliary type, by-phrase use, and auxiliary type-by-phrase pair?

In addition to these primary questions, we qualitatively compare response patterns to the distributional patterns reported in analyses of corpus data reported in the literature. We predict that caregivers will produce recasts and models that differ from clinicians' productions because caregivers will produce more naturalistic response and will be more likely to align with patterns described in conversational corpora. We also predict that models will differ from recasts in that models will align more closely with patterns reported in corpus studies because the providers, both clinicians and caregivers, face less production pressure when they are not constrained by the need to rapidly reuse elements of the child's own utterance.

2. Methods

All data collection was completed under supervision of the University of Delaware Institutional Review Board, FWA #00004379. Informed consent was obtained from all participants.

2.1. Participants

Data for this study were drawn from 20 adult-child dyads enrolled in an ongoing RCT (1R01DC018276). Child participants were monolingual English speakers between the ages of four and nine years old with a diagnosis of Developmental Language Disorder (DLD; Bishop et al., 2017) and documented difficulty using targeted grammatical forms. All children passed a hearing screening (or have no parental concerns of hearing impairment), passed a nonverbal IQ screening, and had no history of autism spectrum disorders or other neurodevelopmental conditions that would influence language learning (e.g., epilepsy, cerebral palsy, Down syndrome). See Table 3 for complete child demographic data.

Children were randomly assigned to receive therapy from a caregiver or from a clinician. Nine children received therapy from a caregiver (n= 9). Families identified one caregiver to provide therapy. Most home providers were mothers, although they varied in age, education, and occupation (see Table 4). Eleven children received therapy from clinicians ($n = 4$) working as members of the research team. All clinicians were speech-language pathologists (SLPs) that held current American Speech-Language-Hearing Association certification; two had master's level degrees and two held PhDs, which included formal linguistics training. By design, all clinicians were extensively trained in the research protocol. This meant they had high levels of knowledge of the target structure and had practiced providing therapy until they hit internal fidelity metrics.

2.2. Data source

In the RCT, children were randomly assigned to receive recast therapy targeting either ORCs or passives. The descriptions of therapy that follow are identical for both structures.

For clinician-delivered therapy, the child and clinician met via Zoom for approximately two-hours per week (accommodating absences due to illness or holidays) over a 10-week period to meet the treatment goal of 16 h of therapy. All therapy sessions were recorded.

For caregiver-delivered therapy, a clinician and caregiver met via Zoom for three hour-long meetings, all of which were recorded. In the first meeting, caregivers received didactic training, in which they were taught to identify the target structure, instructed on key active ingredients of recast therapy, and learned to construct recasts specific to the target structure with the support of the clinician. This included practice eliciting transitive sentences to serve as platform utterances, instruction on retaining core-elements of the child's own utterance, practice identifying subjects and objects of sentences and reformulating those sentences to form the target structure, and tips and tricks for knowing that you have provided the recast correctly. Instructional slides are available on OSF (https://osf.io/zrta3/?view_only=24ab1cf28fd64f009ec9db4cfae11571). Training sessions were reviewed for fidelity of administration by research assistants who identified core instructional elements in a checklist. Clinicians provided these training sessions with acceptable rates of fidelity (proportion of training elements provided as planned: $M = 0.874$, SD = 0.088). In the second meeting, clinicians reviewed didactic content, answered caregiver questions, and then provided active coaching while caregivers attempted recasting with their child. As a core goal of the RCT is to determine the degree to which caregivers provide recasting faithfully with minimal clinician support, no instruction or coaching was provided beyond these two hour-long sessions. In the third meeting, the caregiver and the clinician arranged logistics for service delivery (i.e., planning the frequency and duration of home therapy, reviewing how to record home therapy sessions). Caregivers also completed a 30-minute recasting session with their child, without coaching from the clinician, ensuring a minimum level of data was available in all cases. After these three meetings, caregivers completed recast therapy at home with their child over the 10-week period, with the goal of completing 16 h of treatment. They were asked to audio record therapy sessions and return 16 recordings to the research team.

2.3. Transcription, coding, and reliability

We transcribed and coded approximately four hours (25 %) of recorded therapy sessions selected across the intervention period. For participants with fewer than four hours of recorded therapy, we transcribed and coded all available recordings. All children in clinician-delivered therapy had a minimum of four hours; there was more variability for children in caregiver-delivered therapy. Supplemental Table 1 shows length of recorded therapy included in analysis.

Transcribers identified all instances where an adult attempted the target structure (ORCs, passives). We transcribed the adult production, along with the preceding utterance produced by the child. Adult utterances were categorized as a recast if the utterance included a) at least two constituents from the child's platform utterance, b) were grammatical examples of the target, and c) were produced immediately following the child's utterance. Ungrammatical attempts were discarded from further analysis. Adult utterances were categorized as a model if it was a grammatical example of the target but the child did not produce a platform utterance, if a recast attempt did not include sufficient elements from the child's immediately preceding utterance and/or if the recast was produced following intervening talk. Models and recasts were then further coded based on distributional properties of the target forms. Example sentences are included in the results section as each analysis is reported.

For ORCs, we isolated relativizer, head noun, embedded subject, and embedded verbs. We coded all head nouns and embedded subjects for animacy. We coded head nouns' sentence position using the categories: subject, object, prepositional object, and fragment (i.e., head noun + ORC alone), but ultimately collapsed to categories of subject and other as later statistical analyses were highly unbalanced when multiple categories were included. Embedded NPs were coded for NP type using the categories pronoun, common noun, and proper noun. Relativizers were coded as 'that' or 'null' (i.e., no relativizer used). Oblique relative clauses were included with object relatives for this study.

Coding for passives was similar. All passive structures (eventive/true passives, stative/adjectival passives, passive SRCs, passives in an embedded clause i.e. a complement clause) were considered a passive exposure and coded as a recast or model. Subjects, auxiliaries, main verbs, and by-phrase agents (if applicable) were isolated. Both subjects and by-phrase agents were coded for animacy and NP type using the same criteria as the ORCs. Auxiliaries were coded as a form of *get* or *be*.

One-fourth of data was re-transcribed and re-coded for reliability. We calculated reliability for individual codes aligned with the variables included in regression models (count per session). We report reliability as intraclass correlation coefficients (ICCs) and 95 % confidence intervals (Gamer et al., 2019) calculated using the *irr package* in R. Our ICC estimates were based on a single rater, two-way mixed-effects model with absolute agreement (Koo & Li, 2016; McGraw & Wong, 1996). Agreement for occurrence of the target structure in each session was excellent (ICC= 0.99, 95 % CI [0.97, 1]). Agreement was excellent for classification of recasts (ICC= 0.97, 95 % CI [0.92, 0.99]), and moderate for classifications of models (ICC= 0.74, 95 % CI [0.46, 0.89]). In general, coding of ORCs for animacy, head position, and noun type was excellent, with the exception of identification of objects and inanimate embedded nouns for which agreement was moderate and good, respectively. For passives, all elements had excellent agreement except for inanimate subjects and proper nouns which met the criteria for good agreement. See Supplemental Tables 2 and 3 for ICC estimates and confidence intervals.

3. Analytic plan

We calculated descriptive statistics (See Supplemental Tables 4 and 5 for descriptive statistics for ORCs and passives respectively). We used analyses of variance (ANOVAs) to evaluate the differences in the frequency of models and recasts that were observed by different providers for each target structure. Then, we employed binomial mixed effects models to compare the fixed effects of provider (caregiver/clinician) and utterance type (recast/models) on different syntactic patterns while including child as a random effect. We tested both main effects and interactions in all models. When there was more than one outcome variable (e.g., common nouns, proper nouns and pronouns for NP type), we first tested the differences by collapsing outcomes into two categories (e.g., pronouns vs nouns). Then, we tested for differences within collapsed categories (e.g., common vs. proper nouns).

Following completion of statistical analyses, we compared the direction of differences observed to those in published analyses of corpora. See Tables 1 and 2 for summaries of significant differences in ORCs and passives, respectively. We do not statistically compare with published corpus analyses, but rather compare directionality, with the citations of the studies informing each comparison included as superscripts in the first column of Tables 1 and 2.

Results from individual analytic models are provided in supplemental materials. All analyses were completed using R language and environment (R Core Team, 2023). We used the *readxl* and *here* packages to read in data (Müller, 2025; Wickham & Bryan, 2023). To clean data and calculate descriptive statistics, we used the *tidyverse, tidyr, dplyr*, and *gt* packages (Iannone et al., 2024; Wickham et al., 2019; Wickham, François et al., 2023, 2023). We used the *lme4* and *lmerTest* packages for modeling (Bates et al., 2015; Kuznetsova et al., 2017). To access information about models, we used the following packages: *forcats, car, effects*, and *stats* (Fox, 2003; Fox & Weisberg, 2019; R Core Team, 2023; Wickham, 2023). We used *ggplot2* and *patchwork* for data visualizations (Pedersen, 2024; Wickham, 2016).

3.1. Results

As an overview, we note clinicians produced more exemplars of the target and more recasts than caregivers, across both ORCs and passives. Clinicians also produced more varied exemplars that diverge from analyses of conversational corpora (e.g., more overt relativizers, more subject-headed ORCs, more animate head nouns, more common nouns in the embedded NP position, more *get* passives, fewer by-phrases) than caregivers. Caregivers tended to rely more on types of ORCs observed in conversational speech, and on *be* passives with a by-phrase. Differences in production patterns between models and recasts were fewer than predicted.

Table 1
Distributional properties of object relative clauses as reported in the literature (Column 2) and in our data.

Feature	Frequency distribution reported in literature	Clinician delivered treatment	Caregiver delivered treatment	Differences between clinicians and caregivers	Differences between models and recasts	Interaction
Head animacy	inanimate > animate[1,2,3,4]	inanimate > animate	inanimate > animate	clinician animate > caregiver animate	none	none
Embedded NP animacy	animate > inanimate[2,3,4]	animate > inanimate	animate > inanimate	none	none	none
Embedded NP type	personal pronouns > nouns[2,3,4] (common & proper)	pronouns > nouns	pronouns > nouns	clinician: common NP > proper NP; caregiver: common NP = proper NP	none	none
Grammatical role of head noun	object > subject [6, 7]	***subject > object***	***subject > object***	none	none	**Significant:** Clinicians are more likely to produce ORCs with heads in the subject role while recasting than models. Caregivers are balanced across recasts and models
Relativizer	null > that [3,8,9]	***that > null***	***that > null***	clinician that > caregiver that	none	none

Note. Patterns reported in italicized boldface font and with shaded cells are divergent from frequency distributions reported in literature. NP = noun phrase.

[1] Fox & Thompson 1990
[2] Gennari & MacDonald 2008
[3] Hsiao et al. 2023.
[4] Montag & Macdonald 2015
[5] Reali & Christianson 2007.
[6] Brannigan 1996.
[7] Herrmann 2003.
[8] Race & MacDonald 2003.
[9] Montag 2019.

Table 2
Passive corpus distributions and results.

Feature	Frequency distribution reported in literature	Clinician delivered treatment	Caregiver delivered treatment	Differences between clinicians and caregivers	Differences between models and recasts	Interaction
NP animacy	inanimate-animate > animate-animate	inanimate-animate > animate-animate	inanimate-animate > animate-animate	none	none	none
Subject NP type	pronoun > common noun [1]	***common noun > pronoun > proper noun***	***common noun > pronoun > proper noun***	none	recast common noun > model common noun	**Significant:** Common NPs are even greater in recasts than models by caregivers. Common NPs in models are equally likely as in recasts for clinicians
Auxiliary verb	be > get [2,3,4]	be > get	be > get	none	recast be > model be	**Significant:** *be* is proportionally more common in recasts than models for caregivers. Clinicians use *get* more often in recasts than in models.
By-phrase	no by-phrase > with by-phrase [2,3,4]	***with by > no by***	***with by >no by***	none	recast with by> model with by	**Significant:** by is proportionally more common in recasts than models for caregivers. Clinicians produce recasts and models more evenly with by-phrases
By-phrase-auxiliary pairs	be with no-by > all else; get with by-phrase is vanishingly rare [2,3,4]	***be + by > all else; get + by > 0***	***be + by > all else***	Caregiver be +by > clinician be + by	recast be + by > model be + by	**Significant:** caregivers rely heavily on be + by in recasts. In models they use all possible forms. Clinicians rely on be +by most in recasts, but also use get + by frequently. Clinician models are mainly be –by

Note. Patterns reported in italicized boldface font and with shaded cells are divergent from frequency distributions reported in literature. NP = noun phrase [1]Huang et al. 2017.
[2] Altmiller 2022.
[3] Caputo 2017.
[4] Montag 2019.

Table 3
Characteristics of child participants receiving recast therapy.

Record ID	Child characteristics		Test scores		SLP
	Age	Gender	DELV standard score	DAS t-score	
Clinician delivered ORC					
009	4.17	Boy	80	54	A
107	4.04	Boy	58	44	A
362	6.56	Girl	71	46	B
614	7.03	Girl	74	69	A
1039	8.49	Girl	73	40	D
1364	5.12	Boy	73	68	C
Caregiver delivered ORC					
007	5.19	Boy	79	57	
255	7.00	Boy	74	45	
455	5.27	Boy	74	46	
946	6.41	Boy	55	40	
Clinician delivered Passive					
363	7.21	Boy	73	40	B
794	4.46	Girl	76	53	B
1226	5.97	Girl	84	42	A
1290	5.31	Boy	73	43	A
1570	4.13	Boy	77	48	D
Caregiver delivered Passive					
220	8.56	Girl	82	66	
253	8.89	Girl	84	40	
1383	4.37	Boy	80	44	
1588	6.25	Boy	74	46	
1695	7.76	Girl	63	36	

Table 4
Demographic information for caregivers delivering recast therapy.

Record ID	Age	Gender	Education (years)	Occupation
ORC				
007	40	female	16	life coach
455	NA	female	NA	retired teacher
255	41	female	16	not reported
946	31	female	16	caretaker
Passive				
220	43	female	16	garment designer
253	45	female	18	teacher
1383	34	female	18	teacher
1588	33	female	16	substitute teacher
1695	34	female	12	employed

Occupation is what was reported by the caregiver at the time of participation.

3.2. Overall rates of models and recasts

First, we considered the rate of models and recasts across target structures and providers. We conducted two ANOVAs to examine differences in the use of ORCs and passives by provider and utterance type. For ORCs, clinician sessions included more ORCs than caregiver sessions, $F(1, 8.2) = 9.40$, $p = 0.014$, and more recasts than models, $F(1, 75.6) = 5.20$, $p = 0.03$. The interaction between provider and utterance type, $F(1,75.6) = 16.42$, $p < 0.0001$, was also significant, such that clinicians produced almost twice as many recasts as models (clinician recasts: $M = 52.08$, $SD = 24.5$; clinician models: $M = 28.1$, $SD = 12.80$) and nearly three times as many recasts as caregivers (caregiver recasts: $M = 18.5$, $SD = 15.3$). Caregivers were more likely to model ORCs than recast them (caregiver models: $M = 24.2$, $SD = 15.3$), but this difference was not statistically significant. Three sessions from caregivers had no recasts at all. See supplemental Table 6 shows the linear mixed model results.

For the passives, we observed similar patterns. Clinicians produced more passives than caregivers, $F(1, 8.9) = 20.4$, $p < 0.001$, and recasts were more common than models, $F(1, 81.2) = 68.6$, $p < 0.0001$. There was a significant provider by utterance type interaction, $F(1,81.2) = 22.8$, $p\ 0 < 0.0001$, such that both clinicians and caregivers used more recasts than models (clinician recasts: $M = 58.5$, $SD = 18.1$, clinician models: $M = 23.4$, $SD = 17.6$; caregiver recasts: $M = 19.0$, $SD = 14.9$, caregiver models: $M = 8.6$, $SD = 6.7$). Clinicians produced recasts at a higher rate relative to models than caregivers did. Three sessions from caregivers had no recasts at all. See supplemental Table 7 shows the linear mixed models for passives.

3.3. Distributional patterns – ORCs

Refer to Fig. 1 for a visualization of the count data for the different elements divided by the provider and the utterance type for Object Relative Clauses.

3.3.1. Animacy

Head nouns were predominantly inanimate, and embedded nouns were overwhelmingly animate (e.g., *The ball [head noun] that the dog [embedded noun] chased….)*. Within these broad categories, clinicians were somewhat more likely to use animate head nouns (*the girl [head noun] that the dog [embedded noun] chased…*) than caregivers, $p = 0.04$. This pattern was observed across recasts and models, $p = 0.18$, and no interactions were observed, $p = 0.42$. No differences in the animacy patterns for embedded nouns were observed across provider or utterance type (all p-values > 0.09). See supplemental Tables 8 and 9 for linear mixed model results of ORC head and embedded noun phrase animacy respectively.

3.3.2. Embedded noun phrase

Embedded NPs were more likely to be personal pronouns (*the ball that you chased…*) than full NPs (common/proper nouns; *the ball that the girl/Sally chased…*) and this held across provider and utterance types ($p > 0.31$). That said, clinicians were more likely than caregivers to use a common noun than a proper noun when we restricted our analysis to only full NPs ($p = 0.005$). This did not differ by utterance type. See supplemental Tables 10 and 11 for results of linear mixed models examining the use of pronouns, common nouns, and proper nouns.

3.3.3. Grammatical role of head noun

We compared ORCs with a. head noun occurring in the subject position *(The ball that the girl threw went far)* to ORCs with a head noun that occurred toward the end of the sentence in either a prepositional phrase (*I went to the park that my sister loves)* or in object position (*He chased the ball that the girl threw*) . ORCs occurred more frequently in the subject position of the sentence, $p < 0.011$. While there were no main effects for provider, $p = 0.57$, or utterance type, $p = 0.88$, there was a significant interaction, $p < 0.0001$, such that clinicians, but not caregivers, were more likely to produce an ORC in the subject position when recasting than when modeling. Although, there was considerable within-group variability in the rate at which the ORC occurred in each grammatical role. See supplemental Table 12 for the linear mixed model results examining the location of the head noun within the sentence.

3.3.4. Relativizer

Relativizer (e.g., *that, which, who*) use was high, occurring in over 95 % of ORCs. Though there were model convergence concerns due to the heavily unbalanced data, examination of the data indicates that clinicians were more likely to use a relativizer in recasts than in models, while caregivers had equal likelihood across utterance types. Visual inspection of the data suggests that this interaction is driven by differences in the base rate of recasts, rather than different likelihoods of use across providers and utterance types. See supplemental Table 13 for the linear mixed model results associated with relativizer use.

3.4. Distributional patterns – passives

See Fig. 2 for a visualization of the count data for the different elements divided by the provider and the utterance type for passives

3.4.1. Animacy

In passives, subjects were more likely to be inanimate and by-phrase nouns were more likely to be animate. When we modeled the likelihood of an inanimate-subject and an animate-object (the most common combination) in comparison to other combinations, there were no significant main effects for provider or utterance type, nor were there interactions, $p > 0.43$. See supplemental Table 14 for linear mixed model results associated with subject and by-phrase accuracy.

3.4.2. Subject noun phrase type

Across providers and utterance types, the subject of a passive was more likely to be a common noun than a pronoun or proper noun, particularly in recasts as compared to models, $p = 0.001$). However, clinicians produced common nouns at an equal rate in both models and recasts, while caregivers were more likely to produce common nouns in recasts than in models, $p = 0.003$. Inspection of the rate of use of common nouns and proper nouns suggested further differences. Though proper nouns were rare overall, they were used more often by caregivers than clinicians, $p = 0.04$. When clinicians did use proper nouns, they used them in recasts more often than in models, while this difference was not observed among caregivers, $p = 0.002$. See supplemental Tables 15–17 for model results examining pronouns, common, and proper nouns.

3.4.3. Passive auxiliary

Overwhelmingly, *be* auxiliaries were more common than *get* auxiliaries. While *be* occurred more often in recasts than *get* for both clinicians and caregivers, $p = 0.0003$, clinicians were more balanced across the two forms when recasting, $p = 0.045$. That said, there were meaningful differences in usage across individual clinicians. Caregivers used *be* passives in both models and recasts >75 % of the time. On the other hand, clinicians used *be* passives in recasts approximately 66 % of the time. Combined with a higher rate of recasting on average this means that children were exposed to a particularly high rate of *get* passives in recasts provided by clinicians. See

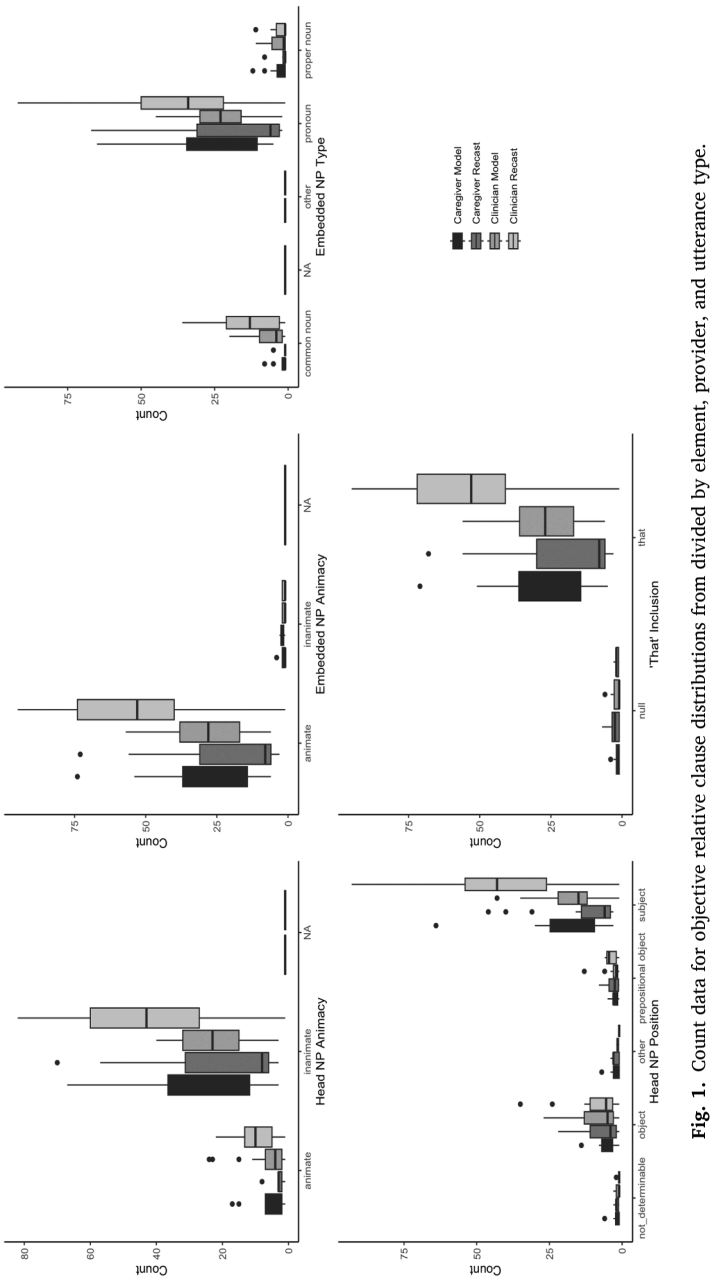

Fig. 1. Count data for objective relative clause distributions from divided by element, provider, and utterance type.

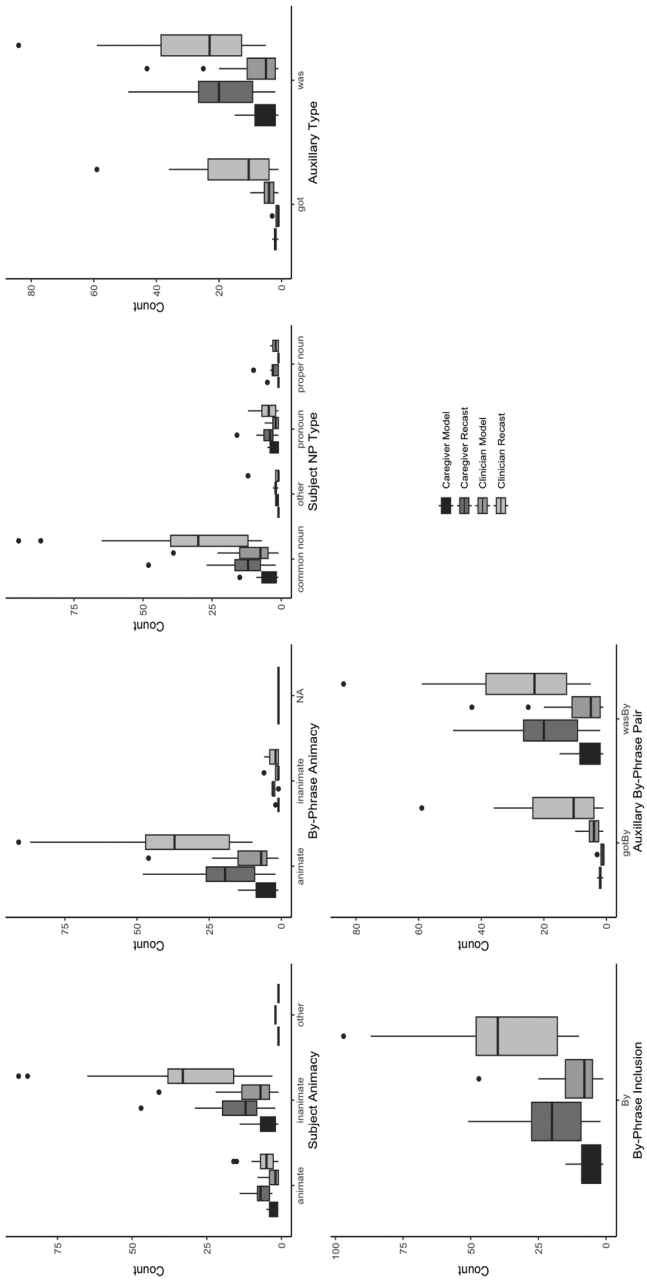

Fig. 2. Count data for passive distributions from divided by element, provider, and utterance type.

supplemental Table 18 for results of the model comparing be and get passives.

3.4.4. By-phrase inclusion

Clinicians and caregivers produced by-phrases and short passives at approximately equal rates in models, but were more likely to use passives with by-phrases in recasts, $p < 0.001$. Although caregivers had a lower rate of passive recasts overall, they were relatively more likely than clinicians to produce a by-phrase passive when they did attempt a recast, $p < 0.001$. See supplemental Table 19 for linear mixed model results examining use of by-phrases.

3.4.5. By-phrase auxiliary pairs

Be + by-phrase pairs were most common in our data, although our data also included *get* + by-phrase pairs. *Be* + *by-phrase* pairs were more likely to occur from caregivers, $p = 0.009$, and were more likely in recasts than models, $p < 0.001$. There was also a significant interaction between provider and utterance type, $p < 0.0001$. Visual inspection of the data suggests that caregiver recasts were mostly *be* + *by-phrase* combinations, other combinations rarely occurred. In contrast, there was a more even distribution of auxiliary + by-phrase pairs in clinician recasts and models, although *be* + *by-phrases* remained the most common pair. For clinician models, short passives using *be* were the most common form. See supplemental Table 20 considering the relationship between auxiliaries and by-phrases.

4. Discussion

We investigated the degree to which recasts and models produces by recast therapy providers with different levels of expertise differed from each other with regard to various elements that have been of interest in previously published corpus analyses. Overall, clinicians produced more exemplars of targets compared to caregivers, and these exemplars were more likely to be recasts than models. Clinicians also produced more varied exemplars that diverged from what is observed in naturalistic corpora, whereas caregivers tended to produce exemplars consistent with these corpora. For clinicians and caregivers, models were more closely aligned with naturalistic language patterns than recasts. That said, differences between recasts and models in our data tended to be ones of degree rather than direction.

In many ways it may be best to think about these data as example utterances most likely to be a) heard in conversation b) produced during recast therapy and c) used in experimental tasks or on standardized tests. To that end, we can imagine that a conversational ORC may be something like *My dog found the ball you kicked.* That is, the ORC likely modifies the object of a sentence, uses an inanimate noun as the head noun and an animate personal pronoun as the embedded noun and avoids the use of *that*. On the other hand, a recast ORC may sound like *The ball that Susie kicked went over the fence.* This example includes a proper noun as the embedded NP, an overt *that,* and the relative clause is early in the sentence. In experimental tasks or on a standardized test, a typical ORC may be *The dog that the cat chased followed the cow* or *show me the sheep the seal was splashing.* Here, the relative clause is altered even further, manipulating animacy to ensure that the child is relying on syntax, rather than plausibility or semantics, to understand the sentence.

To extend this classification to passive sentences, a conversational passive may sound like *It was dropped,* using an inanimate pronoun as the subject, omitting the by-phrase, and relying on a *be*-verb as the auxiliary. A recast passive, when produced by a clinician, would likely use a common noun and a by-phrase, and might include a form of *get* rather than *be,* as in *The vase got dropped by the boy.* Passives in experimental or standardized tests likely prompt for a reversible passive using a by-phrase such as, *The dog got chased by the cat.* This highlights not only the differences between intervention and conversation, but also how both types of interactions differ from the assessment tasks used to document learning. Assessment tasks are intentionally designed to ensure that the child is relying on syntax but, in doing so, alter core elements that influence children's accuracy (Arnon & Clark, 2011; Kidd et al., 2007).

Some patterns observed in analyses of conversational data are preserved in our intervention data. For instance, reported animacy patterns are overwhelmingly consistent with our results (Fox & Thompson 1990; Gennari & MacDonald 2009; Hsiao et. al 2023; Montag & Macdonald 2015). Speakers strongly prefer animate, agentive subjects and inanimate, patient-like objects (Dowty, 1991). As a core element of recasting is maintaining the child's semantic force and reusing key lexical elements, and children prefer animate-agent pairings (Fox & Thompson, 1990; Gennari & MacDonald, 2008; Hsiao et al., 2023; Montag & MacDonald, 2015), it follows that the recasters would match this pattern as well.

Likewise, we observe that the type of NP produced appears to be linked to the child's utterances. In ORCs, pronouns were more frequent than nouns as the embedded NP (e.g., the ball that *he* kicked), which is in alignment with what is observed in corpus data (Hsiao et. al, 2023). Kidd et al. (2007) hypothesize that the use of personal pronouns highlights the animacy-agent link for these noncanonical sentences and eases processing. Thus, recasters were highlighting animacy as a cue to identifying the agent while preserving large chunks of the child's speech. (e.g., Child: *John/the boy/he kicked the ball.* Adult*: the ball that he kicked went far*). In passives, common nouns, rather than pronouns or proper nouns, were used as the first NP in recasts, diverging from published analyses of corpora in which pronouns more commonly fill this role (Altmiller, 2022; Huang et al., 2017; Montag 2019). During therapy, children frequently produced *Verb* + *Noun* combinations in response to questions posed by the recaster. Clinicians were more likely to use common nouns in recasts than caregivers. Anecdotally, we observe that clinicians were strategically arranging interaction to support a higher rate of recasting by prompting with questions that elicited a transitive frame that included nouns in response (e.g., *Should the dog eat his dinner or eat a treat?).*

A core divergence between recasters and corpus data is the location of the ORC within the sentence. This reflects the tension between the distributional preference for head noun position (sentential object) and the time pressures of recasting. It is generally

accepted that speakers produce ORCs that modify the object of a sentence (e.g., *I saw the picture that she painted*) to ease production pressures (Branigan, 1996; Branigan et al., 1995). In recast therapy, we observed the opposite. Recasters aim to reuse several elements of the child's utterance and by incorporating the ORC into the subject of the sentence, recasters ensure that they have included the correct clause type while reducing their own working memory load. While both clinicians and caregivers placed the ORC in the subject position, clinicians were more likely to do so. Another strategy that we observed was fronting an object-headed ORC to the sentence initial position and introducing a resumptive pronoun (e.g., *The dollar that you need, you gotta earn it. The drawing that I'm making, you wanna see it?*). This type of utterance is unusual, but it satisfies the need to reuse elements from the child's utterance, to respond right away, and to place the head of the ORC in the object position. This approach was very frequent among several caregivers. Thus, both caregivers and clinicians diverge from conversational patterns, albeit through different strategies.

Inclusion of a by-phrase is a cue that differentiates eventive or 'true' passives from adjectival passives, and use of a by-phrase was encouraged during training. Indeed, caregivers were more likely than clinicians to include a by-phrase and both groups did so more often with recasts than for models. Unlike caregivers, clinicians were more likely to produce a passive through the use of *get* passives, which are unambiguously passive frames. Young children do tend to produce more get- than be-passives (Harris & Flora, 1982; Turner & Rommetveit, 1967), which may be related to a tendency to remark on non-prototypical events (Budwig, 1990). Children have difficulty inferring agent-patient roles when verbs are non-actional compared to actional (e.g., *He is liked/scared by her* vs. *He is hugged/pushed by her*; Gordon & Chafetz, 1990; Maratsos et al., 1985). Thus use of *get* passives, including *get* passives with by-phrases may actually facilitate learning, even though they are not highly common in corpus analyses of child directed speech.

Some of the differences observed in the use of relativizers and by-phrases may be driven by the training that all recasters (i.e., clinicians and caregivers) received. For instance, recasters were told to emphasize the core elements of the structure and highlight the syntactic frame being taught, as well as to use a relativizer consistently in ORCs. For ORCs, we observe that clinicians were more likely than caregivers to include *that,* though both groups use the relativizer frequently. Emphasis on the production of eventive passives and inclusion of the by-phrase was also part of the training and the fact that *get* passives are highly associated with eventive passives may have been one element that clinicians particularly drew upon to track their own recast rate.

It is worth noting that clinicians diverged more frequently from distributional patterns reported in corpora than caregivers. Clinicians provided higher rates of recasts and models compared to caregivers. Clinician models appeared largely to be recasts that were unsuccessful for some reason (e.g., child spoke again as the recast was being initiated; prosody signaled that a recast was intended). Caregivers, on the other hand, produced a relatively low rate of the target structure overall and the models they did produced appeared to be unintentional rather than failed attempts at a recast (there was no available platform utterance, prosody was in line with conversational input). Our coders report differences in prosody (intonation, hesitations) for failed recast attempts as compared to unintentional models. Similar prosodic differences are reported in the second language literature (Kong & Bui, 2019) but developing coding schema for these differences in intonational contours is beyond the scope of this paper. Such a coding scheme may substantiate the argument that the clinician models were more "recast-like" than caregiver models precisely because they were intended as recasts but did not meet admittedly strict criteria to be coded as such.

5. Limitations

As in other corpus studies that report patterns derived from a small set of dyads, findings from the present study are based on data from four to six dyads per structure and provider combination. This relatively small dataset limits the generalizability of our findings. Another limitation of our study is that we that did not recode data included in the corpora that we used as a point of comparison in this study. Thus, we are unaware of variations in corpora (e.g., differences in coding; linguistic idiosyncrasies in the language of white, monolingual English speakers; differences in parent-child interactions versus adult-adult conversation; differences in parent interactions with children who are TD or have DLD; spoken vs. written language) that may impact our findings. Also, this paper focuses on input patterns for complex syntax without reference to outcomes. Without direct efficacy data on child outcomes, it is not yet clear which exemplars are most likely to promote learning of complex syntactic frames. Future work with larger data sets should consider the role of input variation on child outcomes for complex sentences.

6. Conclusions and clinical implications

Our findings suggest meaningful divergence in the rate and type of recasts and models provided by clinicians and caregivers for complex syntax. Although training caregivers to provide recast therapy may increases the dosage to the child without requiring a substantial time commitment from a certified SLP, our findings suggest that caregivers are less skilled recast providers than clinicians. Caregivers in this study received two hours of recast therapy training, which is much lower than training time reported in other efficacy studies (e.g., Baxendale & Hesketh, 2003; Fey et al. 1999). Thus, it is important to consider the amount of training time required for effective recasting from caregivers, and how feasible this may be under current service delivery and reimbursement models. Future implementation research should consider the degree to which training parents leads to a return on the investment over and above direct provision by clinicians.

We also showed that there are differences between the input provided and that reported for conversational corpora in some, but not all, aspects of passives and ORCs. The degree to which these differences influence learning has not yet been directly studied, though related morphological literature suggests that divergence is beneficial. For instance, divergent input patterns in treatment for past tense *–ed* s were associated with improved generalization to new lexical forms compared to highly aligned input (Owen Van Horne et al., 2017, 2018). Thus, it is possible that input that differs from conversation may be helpful. On the other hand, data from Childers

and Tomasello (2001) and Mintz (2003) suggest that stability in a syntactic frame can promote extraction of the pattern. In our case, systematically including core markers of the targeted structure (*that* for ORCs or *by*-phrases for passives) diverges from conversational patterns, but provides overt cues for mapping the recast to a consistent syntactic frame. Nonetheless, over-use of full NPs, relying on low frequency auxiliaries (*get*), or placing the ORC early in the sentence may introduce a level of structural variability that interferes with learning. Future work should consider how stable vs. variable distributional cues influence children's ability to extract the relevant patterns from the input for different target types. Connecting these data to what is feasible for recasters at different skill levels would inform caregiver training for recast therapy.

Although recast therapy is an effective approach for improving children's morphosyntactic skills (Cleave et al., 2015), the constraints on what counts as a 'good' recast may affect the degree to which this type of input promotes learning. Our results suggest that recasting may neither lead to utterances that are aligned with conversational patterns nor with test items used in assessment, which may have implications for how we document child outcomes. Other evidence-based treatment approaches, such as syntax stories (Hesketh et al., 2016; Pemberton & Watkins, 1987; Serratrice et al., 2015), explicit instruction (Balthazar et al., 2020), and production practice (Calder et al., 2018) may allow the provider to pre-plan utterance characteristics in a way that recast therapy does not. Thus, in these other approaches, the provider may be able to control degree and types of variability in the different structural elements (NP type, inclusion of by-phrase, choice of auxiliary, location of relative clause) that appear to vary across providers during recasting. Should it become clear that these variations are critical for learning, it may be important to directly compare recast therapy, particularly when provided by parents, to other forms of instruction.

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CRediT authorship contribution statement

Anna Koppy: Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Maura O'Fallon:** Writing – review & editing, Validation, Software, Formal analysis. **Yi Ting Huang:** Writing – review & editing. **Amanda Owen Van Horne:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The authors report there are no competing interests to declare.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jcomdis.2025.106576.

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