

DEVELOPMENTAL CHANGES IN FREQUENCY, FLEXIBILITY, LENGTH, AND CONTEXTUAL ASPECTS OF ECHOLALIA IN NEUROTYPICAL CHILDREN

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Abstract: Echolalia is a common phenomenon in early language development, but there are very few studies on immediate echolalia in neurotypical (NT) children. Because this repetitive and stereotyped behavior is considered one of the hallmarks of autistic children, professionals often need to differentiate between typical, developmental echolalia and the increased repetitive, stereotyped behavioral characteristic often seen in autistic children. This study aimed to determine developmental changes in the characteristics of immediate echolalia in one- to three-year-old NT children.

We present longitudinal data from spontaneous speech samples collected from three NT children aged 1-3 years (130 recordings in total). Developmental changes in the frequency of echolalia over time, the proportion of echolalia in total language production, the flexibility of echolalic utterances and their length, and the linguistic context of echolalia occurrence, i.e., parental utterances before and after the occurrence of echolalia, were analyzed.

The findings revealed great variability in the frequency of echolalia, with a general peak at approximately 1;3-1;5. During this period, a high frequency of echolalia (30%) was observed in one child, suggesting that the frequency of echolalia in NT children may be significant at early age. However, a significant decrease in echolalia was observed up to the age of 2;6 years, and the incidence was extremely low thereafter (below 5%). In our sample, echolalia was characterized by the selective shortening of utterances, and it occurred more frequently after low-constraint utterances. This study provides novel insights into typical language development and guidelines for clinical work.

Keywords: immediate echolalia, pure echolalia, verbal imitation, language production, infants, toddlers

INTRODUCTION

Echolalia is the repetition of other people's verbal utterances. Historically, views of echolalia have gradually changed from being viewed mostly as meaningless repetition of words (e.g., Fay, 1967a) to an increasing number of authors currently emphasizing the linguistic, cognitive, and communicative roles of this behavior (Ryan et al., 2022; Yang, 2022).

Although many (if not all) children go through the echolalia stage as part of their typical communication and language development, very few (systematic) studies have examined echolalia in neurotypical (NT) children. Echolalia very of-

ten has a negative connotation and is associated with delays or disorders, most commonly autism spectrum disorder (ASD) (see McFayden et al., 2022). Indeed, this repetitive and stereotyped behavior is considered one of the hallmarks of autistic children's behavior (DSM-5; American Psychiatric Association, 2013). Data on the characteristics of this behavior among NT children, its developmental changes, and the possible situational determinants of its occurrence are lacking. Almost five decades ago, Adriana Schuler (1979) noted the need to find the line between the expected amount of echoing in NT children and the amount of echolalia seen in children with

delays/disorders, and this need is still present (Luyster et al., 2022).

Types of echolalia

Based on common categorizations, echolalia can be divided according to two criteria—the time that has elapsed since another person’s utterance and the child’s repetition of that utterance and the structural features of the repeated utterance. In terms of time, there are two basic categories of echolalia—*immediate* and *delayed* (e.g., Prizant & Rydell, 1984; Manning & Katz, 1989; Schuler, 1979). Accounting for the criterion of the similarity of repeated utterances, we can distinguish two other subtypes of echolalia—*pure* and *mitigated* echolalia. Pure echolalia involves the identical or rigid repetition of other people’s utterances, whereas mitigated echolalia involves the repetition of utterances with minor changes, such as additions, omissions, substitutions of words, and changes in intonation (Prizant & Duchan, 1981).

Developmental changes in immediate echolalia in NT children

Most authors have reported that echolalia appears around the first birthday and peaks at 1;6 (e.g., Ramer, 1976) and that it is usually present by approximately 2;6 (e.g., van Riper, 1963). Over seven decades ago, Zipf (1949) observed that the proportion of echolalia decreases with time, and “until 29 months, it is practically negligible” (p. 148). Similar observations on the maintenance of echolalia until 2;6-3;0 in NT children were made by Fay (1967b) and Howlin (1982).

The frequency of echolalia reported across studies varies greatly; i.e., different studies have reported different imitation rates and developmental trends (Table 1), literally from 0% to 100% percent. Such variable results are partly the result of the different methodologies and procedures used, different definitions of echolalia, and the age and number of children included.

Table 1. Review of studies on immediate echolalia in spontaneous communication in NT children. Some studies are NT studies, and others are studies of autistic children. In the latter case, the control-group results are presented.

Reference	Longitudinal study?	Number of timepoints	N	Age (range)	Method	Range of echolalia	Developmental changes
Ervin, 1964	No	-	7	1;10-2;10	Interviews with the children using speech-evoked stimuli	5%-20%	-
Fay, 1967a	No	-	24	2;11-3;6	Interviews with the children using highly evoking material	0.0%-4.0%	-
Shapiro et al., 1970	No	-	18	2;0, 3;0, 4;0	Transcriptions (interviews with children)	3%-36%	2;0–13.0% 3;0–7.6% 4;0–6.3%
Nakanishi & Owada, 1973	Yes	24	10	1;0-3;0 for 9 subjects and 1;4;0 for one with delayed verbal expression	Transcriptions (home settings)	0-80 echolalic utterances/hour*	The echolalic utterances increased until approximately 2;0 or 2;6, and gradually decreased afterward
Bloom et al., 1974	Yes	4-7	6	1;4-2;1, unevenly	Transcriptions (home settings)	4.0-42.0%*	In all children, either a decrease or a stagnation of the proportion of echolalia is observed over time
Ramer, 1976	Yes	4-11	7	1;4-2;3, unevenly	Transcriptions (home settings)	0.0-100%	A decrease of echolalia was observed as children aged.

Folger & Chapman, 1978	No	-	6	1;7-2;1	Transcriptions (home settings)	12.8%-28.1%	-
Snow, 1981	Yes	3	1	2;3-2;7	Transcriptions (home settings)	38.8%-51.7%	2;3-51.7% 2;5-38.8% 2;7-40.7%
Stine & Bohannon, 1983	Yes	2	1	2;8, 3;0	Transcriptions (21 different adults; home settings)	6%-8%	8% of child's utterances were imitative at 2;8 and 6% at 3;0
Mc-Glone-Dorian & Potter, 1984	No	-	13	3;00-3;11	Experimental sessions (stimulus with picture cards followed by asking questions)	3.8% of responses to questions were echolalic	-
Casby, 1986	Yes	4	1	2;1-3;1	Transcriptions (home settings)	3%-15%	MLU stages I & II (according to Brown, 1973) – 15% of all utterances were repetitions MLU stage III – 5% MLU stage IV – 4%
Réger, 1986	Yes	3-9	2	1;7-2;3 (unevenly)	Transcriptions (home settings)	19.9%-34.8%	The highest ratio of echolalia is found around 1;10-1;11 (approximately 34%)
Tager-Flusberg & Calkins, 1990	No	-	4	1;9-2;8	Transcriptions (home settings)	4.0%-10.3%	-
Olson & Masur, 2012	Yes	3	20	1;1, 1;5; 1;9	Transcriptions (home settings)	-	Episodes of echolalia were 2.47 at 1;1, 10.53 at 1;5 and 11.47 at 1;9 during the 15 minutes sessions.
Casla et al., 2022	Yes	3	17	1;9-2;6	Transcriptions (home settings)	16.0-17.0%	There was no age effect on mean proportion of repetitions
Fusaroli et al., 2023b	Yes	6	35	Approximately 1;8 – 3;8	Transcriptions (home settings)	Exact lexical repetitions (“pure echolalia”) for all samples was 0.8%. 31.6% contained some lexical alignment	At first visit (1;8) there was 1.1% of exact lexical repetitions and at 3;8 there was 0.4% of exact lexical repetitions.

*estimation from the figures presented in the article

Several studies have examined the length of echolalic vs. spontaneous utterances in children's production and found that at first, both grow at a similar pace, after which the length of independent utterances continues to increase, while the length of echolalic utterances remains approximately the same (e.g., Moerk, 1977; Nakanishi &

Owada, 1973). In contrast, the reverse pattern or prolonged use of echolalia may be a sign of developmental disorders (Howlin, 1982; Tager-Flusberg & Calkins, 1990).

Situational and contextual aspects of echolalia

To better understand the nature of echolalia, it is important to consider this behavior in a situational and contextual framework, i.e. to determine the overall communication context in which it occurs - what precedes it and how the environment responds to it. Fay (1975) claims that the extent of echolalia depends on the context and that the frequency of echolalia is higher when children do not understand the speech they hear. In his study, echolalia was found to be mostly followed by declaratives, then imperatives, and finally questions (Fay, 1975). Rydell and Miranda (1991; 1994) examined the relationship between echolalia and parental interaction style in autistic children, namely the differences between high-constraint utterances (directive utterances such as questions, requests, or negative feedback) and low-constraint utterances (comments, affirmations, and positive feedback). High-constraint utterances, to which a child must respond with specific semantic or syntactic structures, elicited more verbal utterances as well as a majority of the subjects' echolalia.

Although most research efforts have focused on identifying the utterances that precede echolalia, Schuler (1979) notes that behaviors that occur as a result of echolalia must also be considered possible reasons for its occurrence. Adults' reactions to echolalia and whether they consider it part of the conversation or a sign of misunderstanding have not yet been adequately examined.

To gain better insight into the characteristics of echolalia in NT children, as well as the developmental changes in these characteristics, this paper aimed to do the following:

- 1) Determine the frequency of echolalia in spontaneous speech samples and the developmental changes among NT children aged 1;0-3;0 years;
- 2) Determine the relationships between types of echolalia (pure vs. mitigated) and the developmental changes in these relationships;
- 3) Compare the length of echolalic utterances in relation to changes in the growth of the MLU of total language production;

- 4) Describe the situational context of the occurrence of echolalia (what precedes echolalia and how parents respond to echolalic utterances).

Studying echolalia in NT children from various perspectives (frequency-related, developmental, and contextual) can provide insights that may eventually contribute to findings on typical communication and language development and can serve as a starting point for theoretical considerations and hypotheses in future studies. Moreover, the data obtained can also serve as reference values in clinical assessments, especially in the diagnosis of ASD.

METHODS

Speech samples

The literature review shows that only 10 longitudinal studies have been published to date that included data on any aspect of echolalia in NT children (see Table 1). Of these studies, four had one or two participants, three studies had 6–10 participants and three studies had 17–35 participants. However, it is important to note that studies with more than two participants are typically based on analyzing a much smaller number of time points (3-6 time points in most studies), a shorter time period (e.g., only a span of a few months), and/or, perhaps most importantly, only one or two particular aspect of echolalia (e.g., frequency or language features). Our study involves longitudinal observation at a large number of time points (an average of 43 different time points per child) over a longer time span (1-3 years) and an analysis of a range of features of echolalia occurrence both in the child (frequency, flexibility and length of echolalic utterances) and in the social environment (situational determinants and environmental responses).

The analysis was based on the Croatian Corpus of Child Language (Kovačević, 2002) which consists of language samples of spontaneous interactions between three NT Croatian children and adult speakers in their home environments. The corpus is freely available in the public Childes TalkBank domain at <https://childes.talkbank>.

org/. All the data included in the TalkBank database are covered by the TalkBank Code of Ethics.

All three children grew up with middle-class parents and in urban settings. Their typical communication and language development was confirmed at three points in time: 1) during data collection (parents indicated no risk for neurodevelopmental disorders); 2) when the language analysis was performed (e.g., MLU in words is within expectations for the given age); and 3) today, as they are NT adults and show no signs of a developmental disorder.

The analysis included all available transcripts of children between the ages of 1;0 and 3;0 (Table 2), 130 in total. All transcripts were categorized into one of eight age groups. The recordings lasted from 8 to 75 minutes, with an average of 31.6 minutes (SD=14.5).

The TalkBank database describes the entire process of data collection and transcription, as

well as all possible uses and information about the project in which the data were collected (<https://childes.talkbank.org/access/Slavic/Croatian/Kovacevic.html>). The coding of echolalia and the categorization of utterances preceding and following echolalic utterances was carried out specifically for this study. After coding was completed, another researcher recoded 15% of all utterances preceding and following echolalia and recategorized the types of echolalia in 15% of the echolalic utterances. In addition, 10% of each child's transcripts were reanalyzed to determine the occurrence of echolalic utterances. After point-by-point analysis, the agreement between the two coders was 91.6% for utterances defined as echolalic, 98.6% for coding the types of echolalia (four categories), 94.0% for classifying parental utterances before echolalia (eight categories), and 92.7% for classifying parental utterances after echolalia (five categories). The Cohen's kappa for all measurements was greater than 0.85.

Table 2. Analyzed speech samples from the Croatian corpus of Child Language. The number of analyzed recordings/timings, the total number of utterances and the average MLU in words of all utterances for each child and each age group are presented.

	CHILD 1			CHILD 2			CHILD 3		
	N recordings/ timepoints	N utterances	MLU	N recordings/ timepoints	N utterances	MLU	N recordings/ timepoints	N utterances	MLU
1;0-1;2	3	148	1.27	-	-	-	-	148	-
1;3-1;5	5	465	1.43	5	260	1.46	2	987	1.33
1;6-1;8	7	1631	1.99	4	418	1.80	7	2710	1.65
1;9-1;11	6	1669	2.06	8	778	2.40	4	2995	1.99
2;0-2;2	8	3755	2.20	9	1136	2.64	6	6230	2.88
2;3-2;5	12	6233	2.18	9	2055	2.64	6	10045	2.46
2;6-2;8	7	2529	2.72	7	1271	2.50	9	6678	3.19
2;9-3;0	4	1757	2.39	-	-	-	2	2645	2.82
TOTAL	52	18187		42	5918		36	32438	

Measures

Each recording was first analyzed separately, and the following measures were calculated: total number of utterances, number of echolalic utterances (immediate echolalia) and MLU (in words) of each utterance (echolalic and nonecholalic separately). A high correlation between MLU in words and MLU in morphemes has been confirmed in various languages (Parker & Bror-

son, 2005; Tomas & Dorefeeva, 2019) and this measure facilitates cross-linguistic comparison (see Ezeizabarrena & Garcia Fernandez, 2018; Thordardottir, 2005).

An adapted version of the definition of echolalia from Prizant and Duchan (1981) was used: immediate echolalia must follow the interlocutor's utterance and must have segmental similarities to the previous speaker's utterance, including rigid

form (pure echolalia) or selective repetition of elements (mitigated echolalia) that occur within one speech change from the original utterance.

A child's repetition of his or her own utterances was not considered echolalia, nor was the repetition of words when an adult explicitly asked a child to repeat a particular utterance.

The boundary between mitigated echolalia and functional speech was sometimes difficult to define due to the morphological complexity of the Croatian language. The decision was made to not consider an utterance to be echolalic if modifications in gender, number, case, or formation of a diminutive/augmentative were made, as in Nakanishi and Owada's study (1973) in Japanese. In case of uncertainty when coding the echolalic utterances, the authors played the audio recordings in search of prosodic cues. If both morphology and intonation were changed, the utterance was not classified as echolalic. If a child repeated a word several times in a row in the same communication unit, this was counted as one echolalic utterance.

Subsequently, each echolalic utterance was further analyzed and categorized according to the type of echolalia (pure, mitigated-reduced, mitigated-expanded or mitigated-combination), utterances preceding echolalia (eight categories) and utterances following echolalia (five categories) (Table 3).

Pure echolalia is defined as identical repetition of the entire preceding statement, while mitigated echolalia includes utterances with minor changes, such as additions, omissions and/or substitutions of words. Each example of mitigated echolalia was then categorized into three types: 1. reduced echolalia (omission of the linguistic elements); 2. expanded echolalia (addition of the elements); and 3. combination of the first two. This categorization was partially based on the categorization by Snow (1981).

In addition, during the analysis, the utterances of adults that preceded the echolalia, as well as the utterances that followed as a response to the echolalia, were coded. The utterances that preceded echolalia were categorized into one of eight categories originally derived by McDonald and Pien (1982) and reported in Rydell and Mirenda (1991), that is, high-constraint utterances and low-constraint utterances. High-constraint utterances require a child to respond with specific semantic or syntactic structures (directives, high-constraint questions, prompts, attention devices, negative feedback for verbalizations), while low-constraint utterances do not have this requirement (low-constraint questions, positive feedback for verbalizations, and spontaneous declaratives).

The utterances that followed echolalia were classified into one of the following categories: 1) imitation of the child's utterance; 2) imitation with semantic expansion; 3) comment on the topic; 4) question about the topic and 5) change in topic. This categorization was partially based on the classification developed by Masur and Olson (2008), where the "no reaction" category corresponds to topic continuation, the "return imitation" category is related to our two imitation categories and the "social response" category includes comments and questions about the topic (topic continuation).

Therefore, for each recording, the total number of utterances, including each type of immediate echolalia, each type of utterance preceding echolalia and each type of utterance following echolalia were calculated. Table 3 presents a more detailed description of the measures. When values for each age group were calculated, they included the mean and/or total number of all recordings within a given timeframe.

Table 3. Measures and procedures used to calculate and define/categorize the measures in this study.

Variables	Description
Frequency of echolalia	Number of echolalic utterances in a 10-minute speech sample.
Proportion of echolalia	The percentage of a child's communication units that represent echolalia in relation to the total number of communication units they produce.
Proportion of pure echolalia	The percentage of communication units that represent an identical repetition of a verbal statement by another person in the total number of echolalic communication units.
Proportion of mitigated echolalia	The percentage of communication units that represent the repetition of another person's statement with certain segmental changes in the total number of echolalic communication units.
Proportions of various types of mitigated echolalia	The percentage of communication units that represent the repetition of another person's statement with 1) reduced echolalia 8, 2) expanded echolalia, 3) combination of the first and the second, in the total number of mitigated echolalic communication units.
Mean length of all utterances (MLU-total)	The average length of utterances that a child produces independently, expressed as the number of words. Utterances marked as babble (@b) were excluded from the analysis. MLU was calculated using the MLU command (mlu - t%mor) in the CLAN program.
Mean length of echolalic utterances (MLU-echolalia)	The average length of an utterance that a child repeats after another person, expressed as the number of words. Utterances marked as babble (@b) were excluded from the analysis.
Utterances preceding echolalia (situational context – before)	Utterances preceding echolalia were categorized into one of the eight categories taken from the research by Rydell and Mirenda (1991). The five categories fall under statements of high-constraint utterances (directives, high-constraint questions, prompts, attention devices, negative feedback for verbalizations). The other three categories fall under low language constraint utterances (low-constraint questions, positive feedback for verbalizations, and spontaneous declaratives).
Utterances following echolalia (situational context – after)	Statements that immediately follow echolalia are placed in one of the following categories: 1) imitation of the child's utterance, 2) imitation with semantic expansion, 3) comment on the topic, 4) question about the topic and 5) change of topic.

*A C-unit is based on a T-unit, which is defined as the 'one main clause plus whatever subordinate clauses happen to be attached or embedded within it' (Hunt, 1966, p. 735). Thus, C-units include all T-units but have the advantage that isolated phrases that are not accompanied by a verb but have communicative value can be coded. Such phrases typically appear in an answer to a question (Crookes, 1990).

RESULTS

The frequency of echolalia

The frequency of immediate echolalia varied significantly both over time for each child and across children. The frequency of echolalic utter-

ances in the 10-minute speech samples varied between 0.8 and 18.4, with an average of 4.6 echolalic utterances/10 minutes for all samples (Table 4).

The highest frequency of echolalia was observed in the periods of 1;9-1;11 for Child 1, 1;6-1;8 for Child 2 and 1;3-1;5 for Child 3.

Table 4. Mean number of echolalic utterances in a 10-minute period for each child individually and for all children together. The mean values are followed by the SD values in brackets.

Age	Child 1	Child 2	Child 3	TOTAL
1;0-1;2	2.2 (1.7)	-	-	2.2 (1.7)
1;3-1;5	7.4 (10.5)	1.7 (1.2)	9.5 (4.2)	5.4 (7.3)
1;6-1;8	4.6 (1.9)	2.4 (1.3)	3.1 (2.9)	3.5 (2.3)
1;9-1;11	18.4 (24.2)	1.1(1.1)	4.9 (3.9)	7.7 (15.4)
2;0-2;2	11.4 (9.7)	2.1 (1.8)	3.7 (1.7)	5.9 (7.2)
2;3-2;5	9.7 (6.1)	1.9 (1.5)	3.4 (1.8)	3.8 (4.0)
2;6-2;8	3.4 (2.9)	1.6 (1.4)	1.9 (1.5)	2.2 (2.0)
2;9-3;0	3.6 (0.8)	-	4.2 (3.6)	3.8 (1.8)
TOTAL	8.1 (11.4)	1.7 (1.4)	3.6 (2.9)	4.6 (7.5)

Proportion of echolalia

When the occurrence of echolalia was analyzed as the proportion of echolalic utterances in all speech samples, great variability was also evident (Table 5, Figure 1). Minimal and maximal values in each speech sample/recording varied greatly within the timeframe for every child as well as between children. The values in individual speech samples were between 0.9% and 34.9%

for Child 1, 0.0% to 13.0% for Child 2, and 1.0% to 17.2% for Child 3.

Child 1 had the highest percentage of echolalia at age 1;0-1;2, and two other children had the highest percentage of echolalia at age 1;3-1;5 (Table 5). During the peak period, Children 1, 2, and 3 exhibited average frequencies of echolalia of 25.0%, 6.5% and 13.7%, respectively.

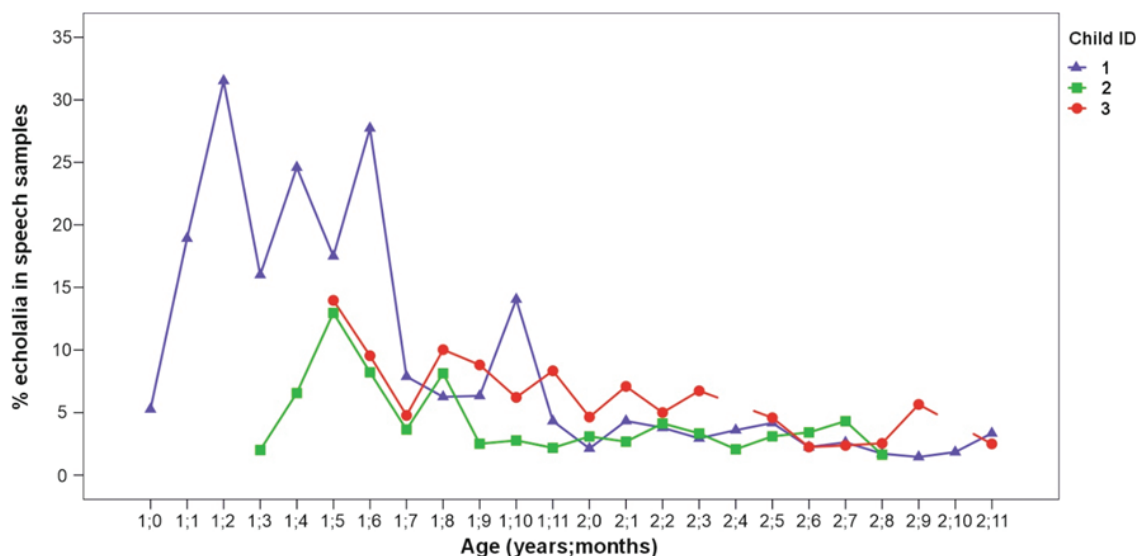
Table 5. The frequency of echolalic utterances in relation to the total number of utterances for each child individually and for all children together. The percentage of echolalic utterances in all speech samples is shown in bold.

Age	Child 1			Child 2			Child 3			TOTAL		
	N of utterances		%	N of utterances		%	N of utterances		%	N of utterances		%
	Total	Echolalic		Total	Echolalic		Total	Echolalic		Total	Echolalic	
1;0-1;2	148	37	25.0	-	-	-	-	-	-	148	37	25.0
1;3-1;5	465	107	23.0	260	17	6.5	262	36	13.7	987	160	16.2
1;6-1;8	1631	148	9.1	418	24	5.7	661	56	8.5	2710	228	8.4
1;9-1;11	1669	145	8.7	778	20	2.6	548	60	10.9	2995	225	7.5
2;0-2;2	3755	129	3.4	1136	38	3.3	1339	74	5.5	6230	241	3.9
2;3-2;5	6233	210	3.4	2055	61	3.0	1757	85	4.8	10045	356	3.5
2;6-2;8	2529	54	2.1	1271	40	3.1	2878	63	2.2	6678	157	2.4
2;9-3;0	1757	35	2.0	-	-	-	888	40	4.5	2645	75	2.8
TOTAL	18187	865	4.8	5918	200	3.4	8533	414	4.9	32438	1479	4.6

A more detailed analysis based on a one-month timescale (Figure 1) revealed that the percentage of echolalia decreased and remained below 5% in Child 1 by the age of 1;11, in Child 2 by the age of 1;8/1;9, and in Child 3 by the age of 2;5. At 2;5

and later, the average frequency of echolalia was less than 5% in all children. On average, when all the data were summed, the children did not show more than 5% echolalic utterances after the age of 2;0 (Table 5).

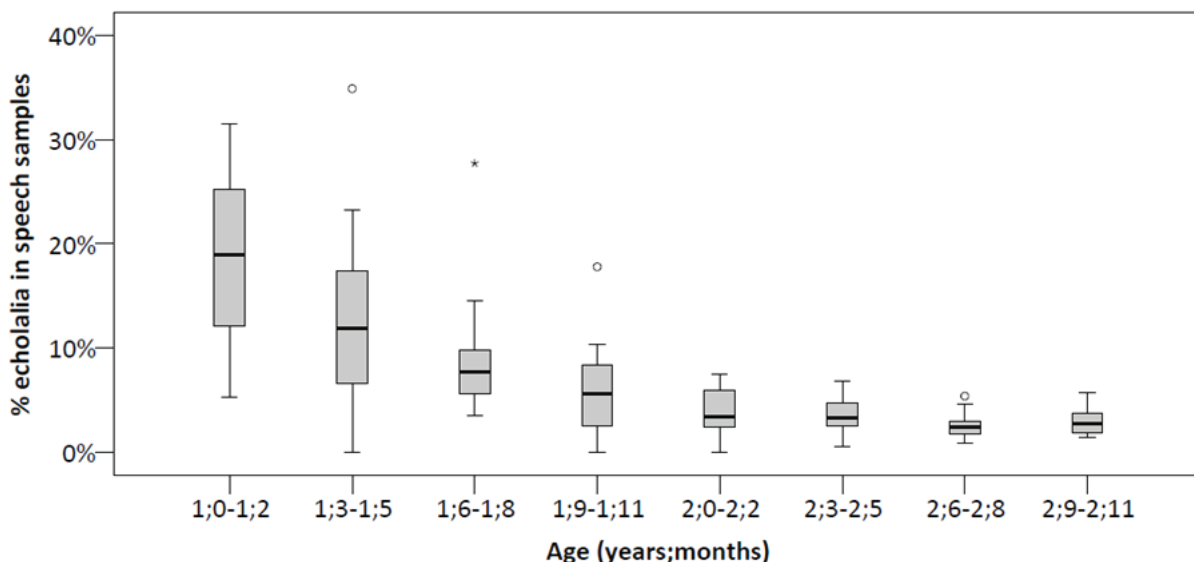
Figure 1. Percentage of echolalic utterances among the total number of utterances over time in spontaneous speech samples of three children aged 1;0 to 3;0 years at one-month intervals.



Important data on the variability of the echolalia ratio are shown in Figure 2. When analyzing the data from all the children, a strong decrease in the variability of the occurrence of echolalic ut-

terances over time was observed (Figure 2). This means that although the children differ greatly in the proportion of echolalia, this variability is much less pronounced at later ages.

Figure 2. Boxplot of the proportion of echolalic utterances among the total number of utterances over time in spontaneous speech samples of three children aged 1;0 to 3;0 years at three-month intervals. Note the decrease in variability with increasing age.



Proportions of different types of echolalia

The percentage of pure echolalia exceeded 50% only in one child at one measurement point (Child 3, age 2;9-3;0). At all other measurement points, the proportion of pure echolalia was generally much lower than that of mitigated echolalia

(Table 6). The developmental changes in the percentage of pure echolalia show an increase in pure echolalia until the end of the second year in all subjects. The continuation of growth in the third year of life was observed in one child (Child 3), while in the other two children, there was a decrease in pure echolalia in the third year of life.

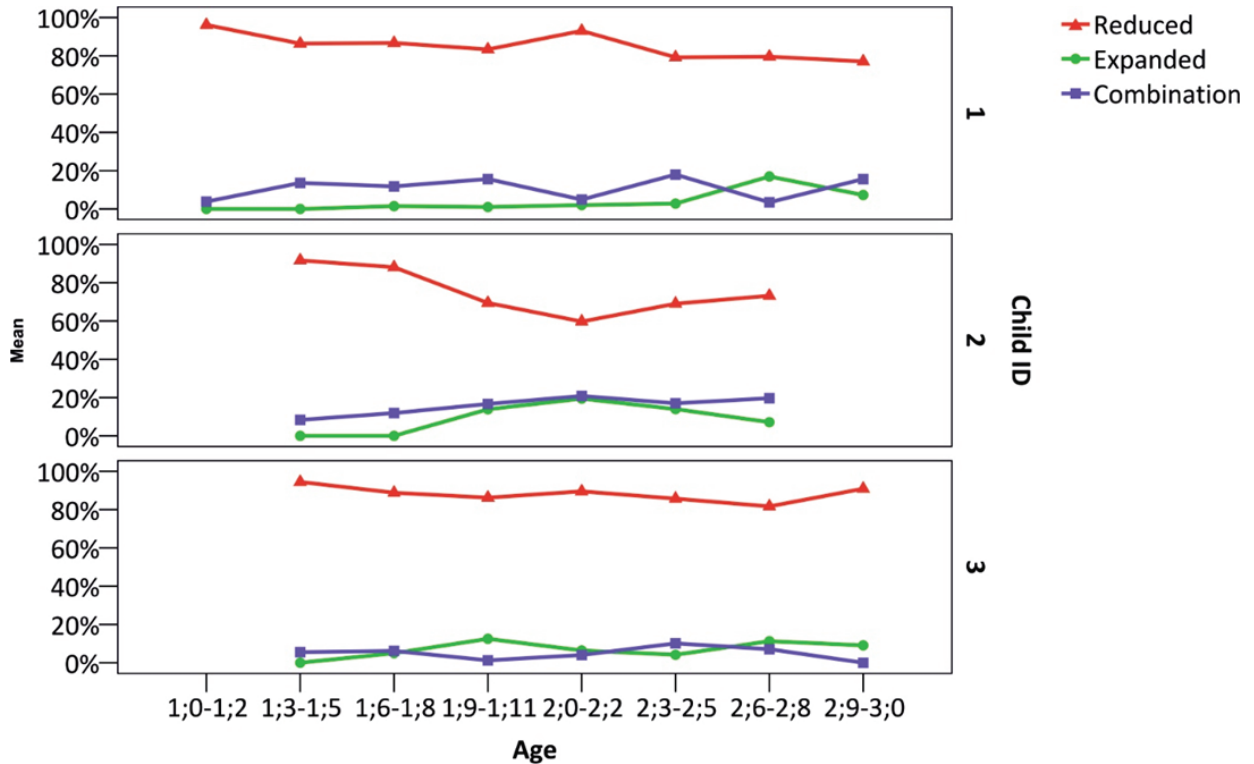
Table 6. Frequencies and percentages of pure echolalia in all echolalic utterances over time for each child individually and for all children together.

Age	Child 1			Child 2			Child 3			TOTAL		
	Total echo	N Pure	% pure	Total echo	N Pure	% pure	Total echo	N Pure	% pure	Total echo	N Pure	% pure
1;0-1;2	37	6	16.2	-	-	-	-	-	-	37	6	16.2
1;3-1;5	107	19	17.8	17	3	17.6	36	6	16.7	160	42	26.3
1;6-1;8	148	18	12.2	24	4	16.7	56	11	19.6	228	33	14.5
1;9-1;11	145	46	31.7	20	5	25.0	60	16	26.7	225	67	29.8
2;0-2;2	129	29	22.5	38	14	36.8	74	21	28.4	241	64	26.6
2;3-2;5	210	67	31.9	61	16	26.2	85	35	41.2	356	118	33.1
2;6-2;8	54	16	29.6	40	12	30.0	63	28	44.4	157	56	35.7
2;9-3;0	35	9	25.7	-	-	-	40	25	62.5	75	34	45.3
TOTAL	865	210	24.2	200	54	27.0	414	142	34.3	1479	420	28.4

An analysis of the types of mitigated echolalia revealed a clear predominance of reduced echolalia, with low proportions of expanded echolalia and a combination of omission and addition (Figure 3). Therefore, the most common form

of mitigated echolalia in all three children is the omission of elements of the original statement (80%-100% in Child 1, 50%-100% in Child 2 and 86%-92% in Child 3, at different ages).

Figure 3. Proportion of types of mitigated echolalia (reduced, expanded and combination of reduced and expanded) over time (three-month periods) for each child.

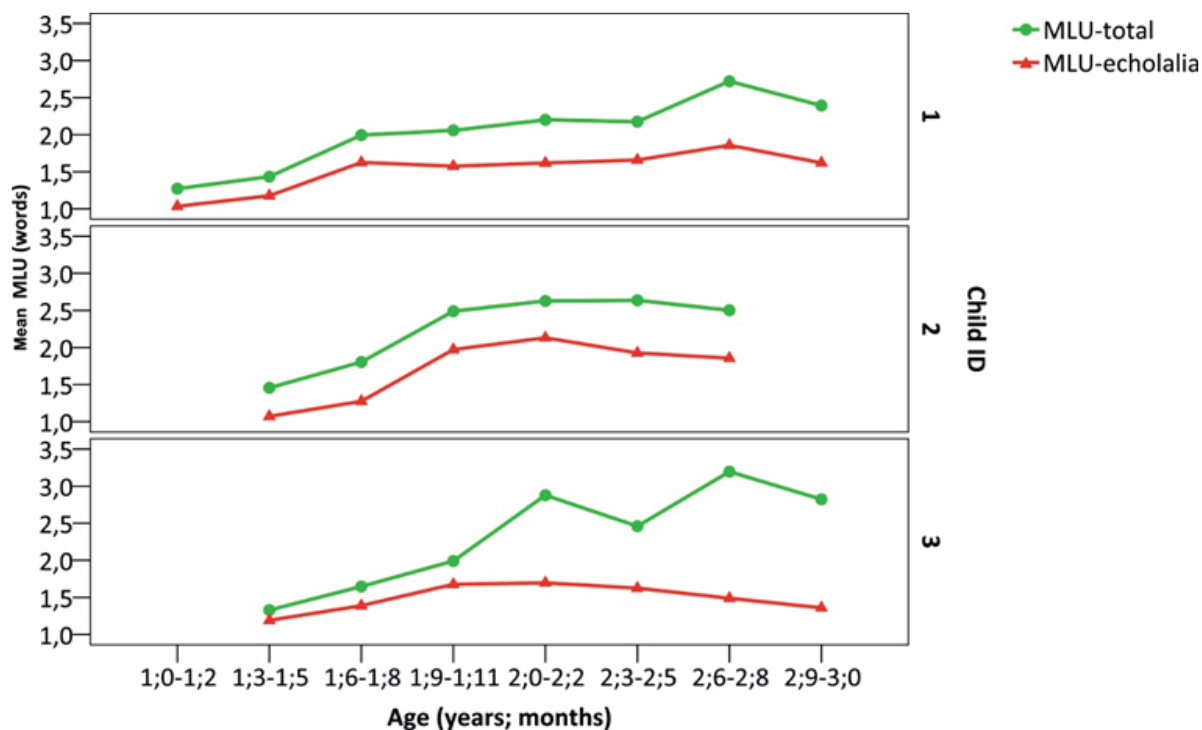


Length of echolalic utterances

The average length of echolalia for all children in all age groups was shorter than the average length of their independent utterances (Figure 4). A gradual increase in the difference between the length of all utterances (MLU-total) and the length of echolalic utterances (MLU-echolalia) was observed in all three children. That is, the length of

echolalic utterances and the length of independent utterances increased together until approximately 1;8/2;0, and then the length of independent utterances continued to increase, while the average length of echolalic utterances remained approximately the same and never exceeded the average value of two words per utterance.

Figure 4. The developmental relationship between the MLU of all utterances (MLU-total) and the MLU of echolalic utterances (MLU-echolalia) over time (three-month periods) for each child. MLU is measured in words.



Situational context of echolalia occurrence

The parental utterances preceding echolalia and those that appeared as a response to echolalia were analyzed to provide insights into the context in which echolalia occurs in NT children. Analysis of the data by three-month periods mostly revealed no clear developmental trends; therefore, the data were processed summatively.

The results show that echolalia mostly occurs after low-constraint utterances, although the difference between high- and low-constraint utterances is not large (Table 7). A greater difference is seen only in Child 2, for whom echolalia occurred much more often after low-constraint utterances (70.5%) than after high-constraint utterances (29.5%).

Table 7. Frequencies and percentages of high-constraint and low-constraint parental utterances preceding echolalia (categorization by Rydell & Mirenda, 1991) over time for each child individually and for all children together.

	Child 1		Child 2		Child 3		TOTAL	
	N	%	N	%	N	%	N	%
Directives	74	8.6	14	7.0	30	7.3	118	8.0
High-constraint questions	188	21.7	18	9.0	99	23.9	305	20.6
Prompts	25	2.9	4	2.0	13	3.1	42	2.8
Attention devices	30	3.5	8	4.0	8	1.9	46	3.1
Negative feedback	73	8.4	15	7.5	35	8.5	123	8.3
Low-constraint questions	101	11.7	13	6.5	62	15.0	176	11.9
Positive feedback	67	7.7	32	16.0	42	10.1	141	9.6
Spontaneous declaratives	307	35.5	96	48.0	125	30.2	528	35.7
High constraint TOTAL	390	45.1	59	29.5	185	44.7	634	42.9
Low constraint TOTAL	475	54.9	141	70.5	229	55.3	845	57.1
All utterances TOTAL	865	100	200	100	414	100	1479	100

A more detailed analysis of the individual subcategories reveals that some types of utterances are very rare (prompts and attention devices with a frequency of less than 5% each), and other types of utterances are slightly more frequent (directives, negative and positive feedback for vocalizations with a total frequency of less than 10% each); overall, a relatively high frequency of

questions is observed (20.6% for high-constraint questions and 11.9% for low-constraint questions) (Table 8). Most striking is the high proportion of spontaneous declaratives, which account for more than one-third of all statements (35.7%). The proportion of spontaneous declaratives is greater than 30% among all children, with a prevalence of almost 50% in Child 2.

Table 8. Types of parental response to echolalia (imitation of the child's utterance, imitation with semantic expansion, comment on the topic, question about the topic and change of topic).

	Child 1		Child 2		Child 3		TOTAL	
	N	%	N	%	N	%	N	%
Imitation	213	24.6	54	27.0	115	27.8	382	25.8
Imitation + expansion	111	12.8	38	19.0	49	11.8	198	13.4
Imitation TOTAL	324	37.5	92	46.0	164	39.6	580	39.2
Comment (topic)	193	22.3	57	28.5	53	12.8	303	20.5
Question (topic)	191	22.1	28	14.0	101	24.4	320	21.6
Topic TOTAL	384	44.4	85	42.5	154	37.2	623	42.1
Change of topic	157	18.2	23	11.5	96	23.2	276	18.7
TOTAL	865	100	200	100	414	100	1479	100

Parental responses to echolalia were categorized as echolalia imitation (with or without semantic expansion), topic continuation (asking a question or commenting on the topic), or topic change. Overall, we find that approximately a quarter of the parents' responses were "pure imitation", i.e., echolalia from echolalia, so to say. When all imitations are considered together, they account for approximately 40% of the parents' responses. To the same extent, parents continued the conversation about the topic by either asking questions or making comments (the ratio of questions to comments was the same). Parents were least likely to change the subject (less than 20% in the entire sample).

DISCUSSION

The analysis of spontaneous speech samples of NT children aged 1-3 years showed that echolalia is a variable phenomenon that occurs with varying frequency in children, with ratios and characteristics that change over time. For example, in a period of 10 minutes, only one episode of echolalia might be observed, while in another period or with another child, there may be as many as 18 instances of echolalia, similar to other studies (Nakanishi &

Owada, 1973; Olson & Masur, 2012). Therefore, echolalia can be quite a prominent phenomenon in some NT children, and there are developmental periods when almost every fifth utterance is echolalic. In fact, in some recordings (see Figure 1), every third statement is echolalic.

Furthermore, there are extremely large changes in the frequency of echolalia, which are particularly pronounced in the second year of life. The highest rate of echolalia in our study is recorded at age 1;0-1;6 (especially 1;3-1;5), after which it decreases significantly. This developmental trend is in accordance with Zipf (1949), who concluded that by the age of 29 months, echolalia is almost negligible in NT children and Fay (1967a), who found 1.3% echolalia in three-year-olds. However, other studies have reported a (slightly) higher ratio of echolalia in older children (Shapiro et al., 1970; Snow, 1981; Stine & Bohannon, 1963).

Our data show that the peak of echolalia occurs at a slightly earlier age (1;3-1;5) than that observed by other authors (Myklebust, 1957; Nakanishi & Owada, 1973; Olson & Masur, 2012; Réger, 1986; Shapiro et al., 1970; Stine & Bohannon, 1963), who place it closer to the second birthday or even later. Data similar to ours, with the

highest frequency at 1;4-1;7, are found in Bloom et al. (1974) and Ramer (1976). Similarly, Masur and Rodemaker (1999) noted an extremely strong increase in verbal imitation between 1;1 and 1;5. Therefore, we might conclude that immediate echolalia occurs predominantly during the second year of life, with the highest occurrence occurring before children start combining words. Therefore, echolalia likely plays a more significant role in vocabulary development than in morphosyntactic development, but further research is needed to clarify the role of echolalia in early language development in general.

A comparison of the data on the frequency of echolalia in NT children with data from studies of autistic children revealed that the echolalia rates are much higher, generally 25% or greater, in autistic children (Prizant & Duchan, 1981; Loca & Wotton, 1995; Roberts, 1989). High variability is common to both groups of children (e.g., Fay, 1969). Another important note is that in most studies, the autistic children were significantly older than the children in our sample, which implies an extremely high rate of echolalia at a later age (in most studies, age greater than 5 years). At older ages, the prevalence of echolalia in autistic children appears to vary considerably depending on their cognitive and verbal status but remains high (e.g., La Valle et al., 2020, reporting a 20% rate of echolalia in fluent autistic adolescents).

Ford (1989) confirmed that persistent echolalia after three years of age is a sign of developmental delay/disorder. Our data support this thesis, as all NT children in our sample at 2;5 and later had a very low echolalia rate (less than 5%).

Many authors emphasize that mitigated echolalia, as opposed to pure echolalia, is associated with better language skills and that mitigated echolalic utterances can be considered a sign of developmental language progress (Fay, 1967a, 1967b, 1969; Prizant, 1983). Shapiro et al. (1970) found that the percentage of pure echolalia (“rigidly congruent echoes”; p. 552) decreases in NT children between 2;0 and 4;0.

Our results confirm the dominance of mitigated over pure echolalia in the NT sample. When

the data from all children and all periods are considered, pure echolalia accounts for approximately one-third of all examples of echolalia. However, some studies have even found a negligible percentage of pure echolalia in NT children (less than 1% in Fusaroli et al., 2023b).

However, it was not possible to find a clear developmental pattern in our data. Two children showed a slight increase in the proportion of pure echolalia, one at the age of approximately 2;0 and the other at approximately 2;6, after which it decreased; the third child showed a systematic increase in pure echolalia throughout the second and third years of life. It is difficult to explain such varying data, both among the three children in our study and in comparison with the results of other studies. These variations may arise from methodological differences, but another possibility is that children rely on different styles and information processing. The methodological considerations are important because the studies differ in the definition of echolalia, as the authors distinguish between echolalia and spontaneous functional speech, which is particularly complex in languages with rich morphology (see examples for Japanese in Nakanishi & Owada, 1973 or Hungarian in Réger, 1986). Our definition of mitigated echolalia (excluding utterances with modifications of gender, number, case or the formation of a diminutive/augmentative) certainly contributed to the relatively high percentage of pure echolalia in our sample.

A more detailed analysis revealed that most of the mitigated echolalia was reduced echolalia, accounting for 50% or more of all mitigated echolalia in all children at all ages (Figure 2). These data show that NT children indeed do make changes to the statements they repeat by selectively repeating some words and omitting others. Qualitative data analysis, which was not the focus of this study, revealed that the items that children repeat most often are content words, as already reported in other studies (Brown & Bellugi, 1964; Ervin, 1964; Moerk, 1977). This is an additional sign that echolalia represents a functional use of language and requires a certain amount of processing

because children omit the elements that are least important for conveying a message.

In contrast to Snow (1981), who observed a fairly high rate of expanded echolalia (37-47%) in the NT age 2;3-2;7 and who concluded that it might be a sign of advanced syntactic ability, the proportion of expanded echolalia in our sample was much lower (Figure 2), ranging from 0 to 20% of all mitigated utterances and 0-9% of total echolalic utterances. These large differences are probably due to methodological factors since Snow used a rather broad definition of extended echolalia, defining it as the presence of even one word occurring in an adult utterance.

To gain insight into the relationship between echolalia and syntactic progress, we analyzed the difference in the length of echolalic utterances compared to all utterances. The average length of echolalic utterances for all children in all age groups was shorter than the average length of all utterances. Interestingly, a pattern of gradual increase in the difference between the two was observed in all three children. That is, it can be observed that the length of both categories of utterances increases at a similar rate until approximately 1;8-2;0, when the length of total utterances continues to increase, while the length of echolalia remains approximately the same and never exceeds the average value of two words per utterance (Figure 3). This developmental pattern has been observed in other studies (Moerk, 1977; Nakanishi & Owada, 1973; Tager-Flusberg & Calkins, 1990). Studies with children with developmental disabilities data suggest that the lengthening of independent utterances to become longer than that of echolalic utterances occurs significantly more slowly (Tager-Flusberg & Calkins, 1990) and/or later in children with developmental disabilities (Nakanishi & Owada, 1973). Moreover, some studies of autistic children have shown that echolalic utterances are longer than spontaneous utterances (Howlin, 1982). If we consider the available data from studies with NT and autistic children, this could point to the conclusion that the prolonged use of echolalic utterances that are equally as long as (or longer than) independent utterances may be a sign of a developmental dis-

order. However, further studies are needed to confirm this hypothesis.

When the situational determinants of echolalia, i.e., the characteristics of the parents' linguistic utterances before and after echolalia, are considered, it was not possible to identify a clear developmental trend, so we considered these characteristics as a group over the entire 1;0-3;0 period. We found that echolalia follows low-constraint utterances to a greater extent in all children, most frequently spontaneous declaratives, which account for more than one-third of all utterances preceding echolalia (Table 7). In comparison, reversed phenomenon was observed in autistic children (Rydell & Mirinda 1991, 1994) where higher level of high-constraint utterances preceding a child's overall language production was found, which may indicate an overall directive style used by adults when communicating with autistic children. As our study analyzed only parental utterances preceding echolalia (and not those preceding overall language production), future research should reveal the extent to which the ratio of high- and low-constraint utterances differs in independent and echolalic utterances in NT children.

When parental responses are considered, the results confirm an extremely high rate of reverse imitation. In approximately 40% of cases, parents responded to imitation with imitation, mostly without extending the statement. Since research has shown that expanding children's speech is a very important strategy for promoting language development (Masur et al., 2005; Tamis-LeMonda et al., 2001), we expected this response category to constitute a higher proportion. Fusaroli et al. (2023a) found that exact repetition by a parent is a relatively rare phenomenon but noted high occurrences of linguistic alignment, which varied in relation to individual differences in the child (see also Fusaroli et al., 2019) and could be seen as a feature of child-directed speech that decreases the cognitive load of the conversation. In our study, to almost the same extent as imitation, there was a semantic continuation of the conversation (approximately 40%), both in the form of comments and questions on the subject. The parents did not

respond to the imitation, i.e., they changed the topic of the conversation, only to a much lesser extent.

Notably, the parents very often responded to echolalia with a question, and during the data collection itself, it was found that children often responded to this question with echolalia. The fact that children tried to contribute to the conversation and fulfill their role in turn-taking despite a possible lack of understanding (as already described in autistic children; Prizant & Duncan, 1981; Tager-Flusberg & Calkins, 1990) shows that echolalia might indeed have an important social and communicative function in NT children.

Study limitations

Due to the small number of participants, the data from this study cannot be generalized. In the process of comparing the results of this research with the results of other studies, it is extremely important to account for the way in which certain variables were operationalized since there is a rather large discrepancy in operationalization across studies. In the future, it would be important to strive for comparability of measures, especially when studying topics for which there is such a small number of studies, so that certain phenomena can be described more clearly even with a smaller number of respondents. Particular attention should be given to the operationalization of the types of echolalia and the distinction between mitigated echolalia and functional speech in different languages, especially when morphological changes are involved.

Moreover, to obtain a more comprehensive description of the environmental situations that contribute to the occurrence of echolalia, it is important to analyze the parents' statements in the overall interaction so that it becomes clearer whether the ratios of the individual utterance categories change in the situation of the occurrence of echolalia.

CONCLUSIONS

The number of studies on echolalia in ND children is small, and only a few of them are longitu-

dinal, with only one (Nakanishi & Owada, 1973) covering a large period of 1-3 years of age. The number of time points analyzed in this study was 36-52 per child, which makes this the most comprehensive study of echolalia in NT children, to our knowledge. In addition, the description of the context in which echolalia occurs provides additional information, which is important for understanding the function of echolalia in typical language acquisition.

The results of this study provide several important messages that can form the basis for future research and serve as basic guidelines in clinical settings when deciding whether a child displays typical echolalia or whether echolalia represents a possible sign of a developmental delay or disorder.

The findings revealed extremely high variability in the occurrence of echolalia, but generally, it seems that in NT children, echolalia is a common phenomenon in the first half of the second year of life, with a peak at approximately 1;3-1;5. During this period, a high incidence of echolalia (30%) was observed in one child, supporting the notion that the frequency of echolalia may be significant high in NT children. Furthermore, our data show that we should expect a decrease in echolalia from the age of 1;6 (approximately when children begin to combine words), which continues until the age of three. After the age of 2;5, the incidence of echolalia is extremely low (less than 5%). While a high variability in echolalia rate has been observed in NT children and at different time points early in life, a marked decrease in variability is observed over time. This information can help experts compare echolalia rates in children in the complex process of diagnosing stereotyped language as part of the diagnosis of ASD.

Echolalia in NT children is characterized by increased flexibility, usually in the form of the selective shortening of an echolalic utterance. At the same time, there is significant developmental progress in the lengthening of utterances in overall language production, which is reflected only to a very small extent in changes in the length of echolalic utterances. It appears that this developmental shift is an essential element in the devel-

opment of echolalia in NT children. However, whether it can serve as a potential clinical marker needs to be further investigated.

Previous studies have indicated the possible influence of the environment on the occurrence of echolalia. Overall, we found that echolalia in our sample occurred more frequently after low-constraint utterances. However, to obtain clearer conclusions, it is crucial to conduct a comprehensive analysis of the entire conversation and not just the

interactive parts immediately prior to the occurrence of echolalia.

Parents often respond to echolalia by returning the echolalia and continuing the conversation about the topic and rarely by changing it. This suggests that parents do not ignore echolalia but build conversation around it. Therefore, from the behavior of both children and parents, we can conclude that echolalia can be a functional element of communication in a child's early years.

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