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ARTICLE

Spontaneous verbal repetition in toddler-adult conversations: a longitudinal study with Spanish-speaking two- year-olds

Marta CASLA[a], Celia MÉNDEZ-CABEZAS[a], Ignacio MONTERO[b], Eva MURILLO[c], Silvia NIEVA[d], and Jessica RODRÍGUEZ[a]

[a]Dpto. Psicología Evolutiva y de la Educación. Facultad de Psicología. Universidad Autónoma de Madrid, Spain., [b]Dpto. Psicología Social y Metodología. Facultad de Psicología. Universidad Autónoma de Madrid, Spain., [c]Dpto. Psicología Básica. Facultad de Psicología. Universidad Autónoma de Madrid, Spain., and [d]Dpto. de Psicología Experimental, Procesos Cognitivos y Logopedia. Facultad de Psicología.Universidad Complutense de Madrid, Spain.
Address for correspondence: Marta Casla, Dpto. Psicología Evolutiva y de la Educación, Facultad de Psicología. Universidad Autónoma de Madrid. E-mail: marta.casla@uam.es

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Abstract

The role of children's verbal repetition of parents' utterances on vocabulary growth has been well documented (Masur, 1999). Nevertheless, few studies have analyzed adults' and children's spontaneous verbal repetition around the second birthday distinguishing between the types of repetition. We analyzed longitudinally Spanish-speaking parent-child dyads during spontaneous interaction at 21, 24 and 30 months. Linguistic level was measured using the Spanish version of the MacArthur CDI (López-Ornat et al., 2005). Children's and adults' repetitions are about 17% of the speech. Children repeated adults' utterances in a reduced manner whereas adults produced more extended repetitions. Adults' rate of repetition predicted children's linguistic level at 30 months. Children's rate of repetition did not predict linguistic level. These results suggest that parents adapt their speech to children's communicative abilities. Since children's rate of repetition did not predict linguistic level, we suggest that verbal imitation plays an indirect and complex role in communicative development.

Introduction

In the context of social interactions, children and adults imitate each other from very early on. Imitation is a complex concept that includes different behaviors and has been defined in varying ways, which are usually related to different achievements in development (Bannard, Klinger & Tomasello, 2013). Research in the field of early language development has shown that there is a link between verbal imitation and specific language milestones (Tamis-LeMonda, Bornstein & Baumwell, 2001). On the one hand, verbal imitation is interesting because it shows that the speaker is paying

attention to the utterances provided by his or her addressee, as well as following the conversation (Clark & Bernicot, 2008). On the other hand, verbal imitation during conversational interchanges increases the opportunities to hear words and syntactic structures and increases input frequency, which is related to early language development (Ambridge, Kidd, Rowland & Theakston, 2015). Thus, verbal imitation implies the repetition of the conversational partner's utterance and is related to the detection of regularities that are part of an arbitrary code (Stine & Bohannon, 1983).

In this study, we focus on a specific form of verbal imitation called SPONTANEOUS VERBAL REPETITION. We define this kind of imitation as the partial or total reproduction of an utterance that has been previously produced by the interlocutor (Snow, 1981). Since there is a proportion of utterances produced by the speaker that overlap with the utterances produced by the partner (Che, Brooks, Alarcon, Yannaco & Donnelly, 2018) we analyze the characteristics of these utterances during adult-child spontaneous interaction around the second birthday. In particular, our analysis goes beyond global frequencies of repeated utterances and considers the frequency of different types of repetition produced by adults and children.

Children's spontaneous verbal repetition

Previous research has shown that infants reproduce their mother's vocal behaviors during the first months of life (Jones, 2007). Masur (1995) showed that children repeat their mother's words and actions as early as 10 months. Moreover, they increase their repetition rate especially at 17 months and this coincides with an increment in the size of their vocabularies. Twenty-month-olds continue repeating new and familiar words in different contexts, such as during bath time or when at play (Masur & Rodemaker, 1999). Snow (1981) also showed that verbal repetitions increase after the second birthday, although not all repetitions increased in a similar way, since there is a difference between exact, expanded and reduced repetitions.

The differences between these types of repetitions are interesting because they show that spontaneous verbal repetition is not a unitary strategy and therefore these differences should be taken into account. In Snow's (1981) study, the term "exact repetitions" refers to when children repeat an adult's utterance in an exact manner, in that they repeat the whole sentence without adding or dropping any word. The study also reported that there are also "reduced repetitions" – which refers to when children may reduce the imitated utterance, repeating only part of it. It has been found, for example, that younger children usually do not reproduce the whole sentence but tend to reproduce the end of child directed utterances (Freudenthal, Pine, Aguado-Orea & Gobet, 2007). Finally, Snow (1981) also found that children reproduced adult's utterances and then expanded upon them. The term "expanded repetitions" refers to the fact that children may also repeat part or whole of the previous utterance and add other words. The act of expanding the other's utterance is interesting because it shows that spontaneous verbal imitation is not mere mimicry of the adult's behavior. Children may practice newly learnt structures by taking previous utterances as the basis for this practice. Interestingly, in Snow's study (1981), repetitions that extended an adult's utterance were more frequent after the second birthday, reaching 20% of the child's utterances. Similar results were found by Užgiris, Broome and Kruper (1989) with a larger sample of children (aged 18 and 24 months old).

Other studies, however, did not find an increase in children's repetitions of adults' utterances. For example, Stine and Bohannon (1983) report that repetitions of questions and noun clauses start decreasing after 2;8, while the repetition of adjectives increased.

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Nevertheless, these studies did not distinguish between exact, reduced and expanded repetitions. Thus, it seems that results depend on the type of repetition that each study focuses on. In another study, Clark and Bernicot (2008) analyzed the spontaneous repetitions of two groups of French speaking children aged 2;2 to 2;4 and 3;1 to 4;2. Children in the younger group frequently repeated specific parts of adults' utterances, although older children expanded their repetitions significantly more often. These results suggest that both groups of children acknowledge their addressees and ratify the content that is shared by both speakers. Along similar lines, Dale and Spivey (2006) showed patterns of recurrence in children's and adults' speech, since children's syntactic structures often repeated their caregivers' syntactic structures in different contexts. Although Dale and Spivey's (2006) work is not devoted to the study of spontaneous verbal imitation, their comparative analyses of the utterances produced by adults and children revealed a tendency for children to repeat structures that are used more frequently during the conversation, and showed how children coordinate their linguistic structures with adults.

Thus, it seems that children start repeating words in the context of early conversations, although it is not clear what happens at the level of utterances around the second birthday. Do children increase their rates of repeated utterances? More research is needed to analyze whether 24 months is a transitional phase in which the strategies of verbal repetition change.

The role of children's spontaneous verbal repetition in language development

The effects of repetition on children's participation in conversational interchanges have been well documented. Children repeat adults' utterances when other forms are not available in their repertories, so they can continue the conversational interchange (Stine & Bohannon, 1983). Nevertheless, the role of spontaneous verbal repetition in lexical and grammatical development is not so clear-cut.

It is widely accepted that children's rates of repetition play a role in vocabulary development. In other words, the children who repeat more frequently tend to have larger vocabularies (Masur & Rodemaker, 1999). Masur (1995) found significant positive correlations between 10, 17- and 21-month-olds' spontaneous repetition of actions and words and children's levels of vocabulary at each age. Moreover, proportions of repeated words at 10 months were also related with vocabulary levels at 17 and 21 months (see also Masur & Eichorst, 2002). From a developmental point of view, children were consistent with their repetition rates, since those children who were more repetitive at the beginning of the study continued repeating more when they were 21 months and were the ones with higher levels of vocabulary (Masur & Rodemaker, 1999).

Research has also shown that not all utterances in child directed speech have the same probability to be repeated. Children tend to repeat new words more often than familiar words and the repetition of new words may trigger rapid increases in vocabulary (Clark, 2007; Masur & Rodemaker, 1999). In fact, later on in development, children start producing syntactic structures in repetition contexts before they produce them spontaneously (Stine & Bohannon, 1983). This suggest that children's spontaneous verbal repetition plays an important role in the construction of lexical and grammatical representations, although not all forms of repetition may have the same impact on linguistic achievements.

In a more recent study, conducted in the English language with 14 to 32- month- olds, Che et al. (2018) did not find evidence that children were using repetition as a strategy to expand their communicative repertories, since they did not find relationships between

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spontaneous repetition at 14, 20 and 32 months and linguistic measures of development. This study is interesting because it adopted an individual differences approach. The authors analyzed spontaneous repetition longitudinally using the CHIP command from the CLAN program of the CHILDES project (MacWhinney, 2000). The CHIP command allows the number of utterances that overlap in child and adult speech to be computed. Three linguistic measures were taken from the same spontaneous production corpus used to analyze repetition: Mean Length of Utterance (MLU), vocabulary diversity, and sentence structure diversity. The authors suggest that children's measures may not reflect actual relationships between repetition and language development, but children's repetitions may still play an important role in grammatical development. Nevertheless, Che et al. (2018) did not differentiate between the repetition of new and familiar words, as Masur and Eichorst (2002) did, and the authors acknowledge that this could explain the lack of relationships between children's rates of repetition and the linguistic measures analyzed. The question that arises from these results is whether children's repetition influences language development in a straightforward way. Children's spontaneous verbal repetition may be related to other variables such as context, type of repetition and input characteristics. In fact, a number of researchers have also been interested in exploring the role of adult verbal repetition in children's linguistic development (Onnis, Waterfall & Edelman, 2008; Schwab & Lew-Williams, 2016; Wirén, Björkenstam, Grigonyté & Eir Cortes, 2016).

Adults' spontaneous verbal repetition

Repetition is a characteristic of child directed speech. As they talk to children, adults repeat lexical items or clauses across successive utterances, so words are repeated in different syntactic frames. Wirén et al. (2016) found that these repetitions are very frequent during the earlier stages, reaching 50% of child directed speech when children are between 7 and 9 months. They also found that the proportion of adults' self-repetitions decreases as children grow older (14% of child directed speech to 27 to 33- month- olds). Researchers have also found that adults' self-repetition in different syntactic frames is related to children's lexical and grammatical development (Küntay & Slobin, 1996). In addition, experimental studies have shown that word repetition across sentences is associated with better word learning, and therefore with the quality of child directed speech (Schwab & Lew-Williams, 2016).

Adults do not only self-repeat words across utterances; they also repeat children's utterances. Previous studies have found positive correlations between children's and adults' rates of repetition: children whose mothers were more repetitive tended to repeat more (Masur & Eichorst, 2002).

Research on child directed speech has shown that adults vary their utterances as a function of children's linguistic level (Tamis-LeMonda et al., 2001) and that adults' responsiveness (which includes verbal repetition of children's utterances) predicts later language milestones (Tamis-LeMonda, Kuchirko & Song, 2014). Likewise, Conway, Lvickis, Smith, Mensah, Wake and Reilly (2018) differentiated between imitations and expansions, showing that both are part of child directed speech, and that expansions are a characteristic of responsiveness that is related to subsequent vocabulary growth. Children's and adults' expansions suggest that they coordinate their syntactic sequences. Adults usually guide children's production when children are starting to produce their first two-word utterances (Dale & Spivey, 2006). Expanding children's utterances may serve several functions (MacGillion, Herbert, Pine, Keren-Portnoy, Vihman &

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Matthews, 2013; Tamis-LeMonda et al., 2014). When adults repeat children's utterances exactly, they are showing them the appropriate model, which is more frequent before the second birthday than when children's syntactic abilities have developed (and they are approaching 36 months). Moreover, exact repetitions usually precede expansions, which may serve to ratify a child's contribution and add new information in a context in which both adult and child share common ground. Usually, younger children's utterances tend to be incorrect. Therefore, adults take these incorrect utterances to show the appropriate production and offer feedback on the content (Clark & Bernicot, 2008).

The role of adults' spontaneous verbal repetition in language development

Masur and Eichorst (2002) not only found positive correlations between mothers' and children's rates of repetition, they also found that children with more repetitive mothers, had larger vocabularies – which suggests that adult repetition is an impulse for vocabulary growth (Masur & Eichorst, 2002). Moreover, the rate of adults' return imitations and exact repetitions was also related to vocabulary level, which, in turn, was also related to children's repetition of new words (Olson & Masur, 2012). Che et al. (2018) also found relationships between adult repetition rates (when children were 14 and 20 months old) and linguistic achievement when children were 32 months old. It is worth noting that in this study the authors did not find effects of children's repetition rate on these linguistic achievements.

Since adults adapt their speech to children's grammatical level, the influence of adults' repetitions may change as children grow older (Tamis-LeMonda et al., 2014). In fact, recent studies have found negative correlations between 24- month- olds' vocabularies and fathers' rates of repetition, since fathers reduce the rate at which they repeat children's words as children increase their vocabularies (Schwab, Rowe, Cabrera & Lew-Williams, 2018).

The question that arises from these results is: does adult repetition influence children's vocabulary and grammatical levels in a straightforward way? As stated above, when adults and children are actively involved in conversation, there is a finely-tuned coordination between the syntactic structures they produce. It is possible that children change their repetition strategies as they reach their second birthday and, since adults adapt their repetitions to children's conversational skills, it is possible that adults also change the way in which they repeat children's utterances. However, more research is needed to analyze the specific role of variables on vocabulary and grammatical development – such as type of repetition (whether it is exact or expanded) and type of speaker (child or adult).

The current study adopts a longitudinal perspective and focuses on a transitional phase in language development. Thus, the aim of this work is to examine the changes that take place in spontaneous verbal repetition between 21 and 30 months. We also aim to analyze the relationship between adults' and children's repetitions and take into consideration the type of repetition (exact, reduced or expanded) and their impact on children's vocabulary and grammatical levels. Additionally, our goal is to contribute with cross-linguistic evidence by analyzing data from Spanish language.

Our research questions are as follows:

1) what is the frequency of spontaneous repeated utterances in adult-child interactions? Are there differences between children's and adults' rates of repetition? Are there changes from 21 to 30 months?

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2) are there changes in the types of repetitions depending on the speaker and the age?
3) what is the relationship between repetition rates and language development? In particular, we want to know the relationship between:

- Adults' and children's rates of repetition.
- Children's rates of repetition and vocabulary and grammatical levels.
- Adults' rates of repetition and vocabulary and grammatical level.

Following previous studies, we expect a gradual decrease of child and adult repetition rates between 21 and 30 months of age. We also expect differences in the evolution of each type of repetition. Although general rates of children's and adults' repetitions may decrease with age, we expect differences in terms of the type of repetition. In particular, we expect that children's rates of reduced repetitions will be lower than exact and expanded repetitions, and we expect that children will increase their rates of expanded repetitions as their syntactic abilities grow. For adults, we expect the reverse pattern; that is, we expect that the rate of reduced repetitions will be lower than the rate of expanded and exact repetitions. We also expect a decrease in the rate of expanded repetitions, since adults will not need to extend children's utterances as their syntactic abilities are better.

Finally, we expect children's and adults' rates of repetition to have an impact at each point of development of children's grammatical growth when they are 30 months old. Nonetheless, since we expect general decrease in the rates of repetitions both for children and adults as children are reaching 30 months, we expect that this decrease will be related to grammatical levels.

In order to answer these questions, we examined longitudinally 17 parent-child dyads interacting in naturalistic settings when children were 21, 24 and 30 months old. As in Che et al. (2018), we analyzed those utterances that totally or partially overlapped the partner's utterance using the CHIP command of the CHILDES project (MacWhinney, 2000). Our study contributes to this previous study in three main ways. First, it is carried out in the Spanish language, so crosslinguistic comparisons are possible. Secondly, it differentiates between three types of repetition (exact, reduced and expanded). Thirdly, whereas Che et al. (2018) obtained data about children's linguistic level from the same corpus that they analyzed for spontaneous repetition, in the present study we obtained an independent measure of children's vocabulary and grammatical development, analyzing punctuations in the Spanish version of the MacArthur Communication Developmental Inventory (MCDI) (López-Ornat, Gallego, Gallo, Karousou & Mariscal, 2005)

Even if parental inventories are not a direct measure of children's speech production, MCDI inventories show very high levels of reliability, and they are not dependent on the same corpus from which repetitions are analyzed.

Therefore, our research adds complementary analyses to better identify the role of adult and child spontaneous verbal repetition in early language development; especially during the period between 21 and 30 months of age.

Method

Participants

The current study followed 17 child-parent dyads (11 girls and 6 boys) longitudinally in naturalistic settings when children were 21, 24 and 30 months. We were unable to

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Table 1. Number of Children, Mean age and Standard Deviations

	21 Months	24 Months	30 Months
M	21.11	24.17	30.31
SD	.320	.590	.570
Min	20.63	22.57	29.67
Max	22.17	24.97	31.50
N	17	16	17

follow up one of the dyads at the second time of assessment. Table 1 shows children's mean ages and standard deviations at the three times of assessment.

All the children in the study were Spanish monolinguals who were going to different nurseries in the Madrid area and were recruited via informed consent. The children had no history of hearing problems or developmental delays. Parents received the Spanish version of the MCDI (López-Ornat et al., 2005) and were asked to participate at three times of assessment.

The European Spanish version of the CDI has been widely used in previous studies and it allows for comparisons with other languages (López-Ornat et al., 2005). It is not a direct translation of the English version, even though the rationale and the sections are the same. Vocabulary data are based on longitudinal analyses of naturalistic data available on the CHILDES project database. The morph-syntax section is also adapted to Spanish morphology and syntax. However, unlike the English version, this section has three examples instead of two, so the instrument is more sensitive to gradual development.

Appendix A shows mean scores at the vocabulary and morpho-syntax section (raw scores) at each age, showing minimum and maximum scores. Both tables show percentile scores associated with mean scores, showing that all children are within typical development ranges in Spanish Language (Rujas, Casla, Mariscal, Lázaro López-Villaseñor & Murillo, 2019).

The dyads were participants in a longitudinal study set up by the Spanish Government. The ethical panel of the Universidad Autónoma de Madrid (Spain) approved data collection and procedures.

Procedure

Children were video-recorded in their homes, or in a quiet room at their nurseries, during a 15-minute free-play session.

The same set of toys, designed to elicit typical mother-child interaction, was used for all dyads: a set of plastic animals, a set of plastic meals (fruits, vegetables, bread, and so on), a box with blocks, a small ball and a small book with images of actions in different settings. If the child did not show interest in these objects, the mother could use other toys or objects found in their homes or nurseries. Only the mother or the father was present during the sessions. They were requested to play with their children as they would normally.

Coding

A total of 12 hours and 56 minutes were video-recorded. Table 2 shows mean durations of recordings at each age, as well as showing maximal and minimal durations.

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Table 2. Mean Duration of Recording Sessions in Minutes and Standard Deviations. Maximal and Minimal Durations

	21 Months	24 Months	30 Months
M	15.02	14.88	15.7
SD	2.67	2.41	2.37
Min	5.98	9.75	11.83
Max	17.18	19.65	20.65

Recordings were transcribed using the CHAT program of the CHILDES project (MacWhinney, 2000). Transcripts were analyzed using the CHIP command to compute conversational repetitions among participants (see Sokolov & MacWhinney, 1990, for further detail). CHAT transcripts identify the utterances produced by each participant on a different line. Thus, it is possible that the transcription includes several consecutive lines that belong to the same participant until the next participant produces an utterance. The CHIP command compares the overlap between the content of each utterance and the nearest one preceding it. (Note that the comparison is automatically made between each utterance and the six preceding utterances). The codes produced by the CHIP command allow the identification of several comparisons between each utterance and the preceding one (utterances, words, morphology). For the purposes of this investigation, we analyzed the following codes.

Utterances

The total number of utterances produced by each speaker during each observation session.

Overlaps

"The number of utterances in which there is an overlap for at least one word in the source utterance and the response utterance" (MacWhinney, 2000; p. 71). For the purposes of this study, we defined the overlaps as "Repetitions" (or number of repeated utterances).

Additionally, we also calculated the following responses provided by the CHIP command:

Exact

The number of utterances that match exactly with the preceding utterance. The following example is an extract from a 30- month- old and her mother in which the adult's repetition was coded.

**MOT: cómo está?*	**MOT: what is this like?*
**CHI: dura.*	**CHI: hard.*
**MOT: dura.*	**MOT: hard.*

Expanded

"The number of responses containing only exact matches and additions" (MacWhinney, 2000; p. 72). Note that expanded repetitions are part of exact repetitions, since an expanded repetition is scored as exact and as expanded. Therefore, expanded repetitions were not computed as exact repetitions, and the

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frequency of exact repetitions did not include the repetitions contained in expanded repetitions. The following example is an extract from a 21- month- old and her mother in which the adult's repetition was coded.

**CHI: esa manena [: madalena].*	**CHI: that muffin.*
**MOT: esa madalena es la que más te gusta a ti eh!*	**MOT: that's the muffin you like the most, isn't it?*

Reduced

"The number of responses containing only exact-matches and deletions" (MacWhinney, 2000; p.72). As in expanded repetitions, scores of exact repetitions did not include reduced repetitions.

The following example is an extract from a 21- month-old and her mother in which the child's repetition was coded.

**MOT: ese es de jugar.*	**MOT: that one is to play.*
**CHI: jugar.*	**CHI: to play*

We included two measures of repetition. The first one was the proportion of repetitions out of the total number of utterances. The second one was the rate of repetitions per minute. This additional dependent variable was included because not all recording sessions had the same duration. Additionally, the proportion of repetition is calculated over the total number of utterances, which also includes all types of repetition. Thus, considering the time as the basis of each type of repetition, independent comparisons between them were possible.

We first analyzed developmental changes regarding the overall number of utterances produced by each speaker, since these were the basis for the proportions used in further analyses. Therefore, we calculated mean comparisons between the number of utterances at each developmental point.

Second, in order to test developmental changes in repetitions (questions 1 and 2) a series of ANOVAs were carried out. In question 1, two analyses were carried out, which took Age (21, 24 and 30 months) as within subjects variable. The first took the proportion of repetitions out of the total number of utterances as the dependent variable, and the second took the rate of repetition per minute as dependent variable. In question 2 we also carried out two identical analyses except that 'Type of Repetition' was included with 'Age' as within subjects variable. In order to ensure the normality of the distribution, log transformations for proportion data and for rates of repetition per minute were calculated.

Finally, in order to test question 3, that is, the effect of adults' and children's proportions and rates of repetition on children's linguistic achievements, we calculated a series of Pearson correlations and performed a series of step-wise regression analyses. To test the relationship between repetition and vocabulary development, all the analyses took vocabulary level at 30 months of age as Criterion Variable. We took raw scores obtained by each child from the vocabulary section of the Spanish version of the MCDI. To test the relationship between repetition and grammatical development, all analyses took raw scores from the morph-syntactic complexity section obtained from the Spanish version of the MCDI at 30 months.

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Table 3. Mean Number of Utterances, Maximal and Minimal Produced by Each Speaker at Each Age

	21 Months			24 Months			30 Months		
	M	Min	Max	M	Min	Max	M	Min	Max
Child	83.65	11	186	107.56	41	184	129.18	46	229
Adult	301.94	67	558	270.63	137	404	291.88	161	437

Table 4. Mean Proportion of Repetitions and Standard Deviations for Each Group of Participants

	21 Months				24 Months				30 Months			
	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max
Child	.16	.07	.12	.20	.17	.07	.13	.20	.17	.07	.13	.20
Adult	.14	.06	.10	.17	.17	.05	.14	.19	.18	.05	.15	.20

Results

Regarding the verbal production of children and adults, Table 3 presents the mean number of utterances by each speaker at each age.

Children increased the mean number of utterances between 21 to 30 months ($t(16) = -3.633$, $p = .002$), although there were no differences between the number of utterances produced by children between 21 and 24 months ($t(15) = -1.771$, $p = .097$) and between 24 and 30 months ($t(15) = -1.405$, $p = .180$). There were no significant differences between the utterances produced by adults at: 21 and 24 months ($t(15) = 1.528$, $p = .147$), 21 and 30 months ($t(16) = .653$, $p = .523$) and 24 and 30 months ($t(15) = -1.338$, $p = .185$). In what follows, we present results regarding each research question.

Frequency of spontaneous repetition

We formulated our first research question as *What is the frequency of spontaneous repeated utterances in adult-child interactions? How does it change from 21 to 30 months?*

Table 4 presents mean proportions of overlapped utterances (repetitions) over the total utterances produced by each speaker at each time of development. The Table also shows maximal and minimal proportions of repetitions at each time of development. Children's and adults' maximal proportion of repeated utterances was 0.20, whereas children's minimal proportion of repeated utterances was 0.12 and for adults it was 0.11.

Table 5 shows mean rates of repetition per minute at each point of development by each speaker. The Table also shows maximum and minimum proportions of repetitions at each time of development.

Regarding the proportion of repetitions, we found no age effect ($F(2,14) = 0.036$, $p = .965$) for children, and no age effect for adults ($F(2,14) = 2.035$, $p = .168$). Regarding the rate of repetition per minute we found no age effect for children ($F(2,14) = 2.626$, $p = .092$), and no age effect for adults ($F(2,14) = 0.890$ $p = .421$).

In order to test the relationship between the utterances produced by each speaker at each age and the number of repetitions, Pearson's correlations were calculated between

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Table 5. Mean Rates of Repetition per Minute

	21 Months				24 Months				30 Months			
	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max
Child	0.90	.56	0.60	1.20	1.20	.70	0.83	1.58	1.43	1.05	0.86	1.99
Adult	3.10	1.69	2.20	4.00	2.93	1.13	2.33	3.54	3.36	1.29	2.67	4.04

Table 6a. Mean Proportion of Type of Repetition and Standard Deviations at Each Time of Development by Each Speaker

		21 Months		24 Months		30 Months	
		M	SD	M	SD	M	SD
Exact	Child	.07	.05	.05	.03	.04	.02
	Adult	.05	.04	.03	.02	.03	.02
Expanded	Child	.04	.02	.05	.02	.05	.02
	Adult	.01	.02	.89	.40	.01	.01
Reduced	Child	.04	.01	.01	.01	.02	.03
	Adult	.06	.04	.06	.03	.04	.03

the number of utterances provided by each participant at each age and the number of repeated utterances (raw scores). We found positive and significant correlations between each speaker and the number of utterances produced, both for adults and children, at 21, 24 and 30 months. The results of these analyses are shown in Appendices C (for children) and D (for adults).

Type of repetition

With regard to our second research question: *Are there changes in the types of repetitions depending on the speaker and the age?*, Table 6a shows means of proportions of each type of repetition over the total number of utterances produced at each age by each participant. Table 6b shows means of rates of repetition per minute for each type of repetition for each group of participants at each age.

First, we will report results related to children. Then, we will report results related to adults.

Children

We found a main effect of type of repetition ($F(2,14) = 20.398$ $p < .001$, $\eta^2 = .593$), since, overall, children produced a larger proportion of reduced than exact repetitions (.075 vs. .048; $p < .001$), more reduced than expanded repetitions (.075 vs. .011; $p < .001$), and more exact than expanded repetitions ($p = .016$).

No age effect ($F(2,14) = .870$ $p = .430$) and no interaction between the type of repetition and age was found ($F(2,14) = .704$; $p = .480$).

A subsequent Bonferroni test revealed that, although at 21 months reduced repetitions were more frequent than exact and expanded repetitions, these differences

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Table 6b. Mean Rate of Each Type of Repetition and Standard Deviations at Each Time of Development by Each Speaker

		21 Months		24 Months		30 Months	
		M	SD	M	SD	M	SD
Exact	Child	.26	.22	.20	.18	.24	.22
	Adult	1.22	.85	.78	.38	.75	.45
Expanded	Child	.08	.09	.09	.13	.09	.12
	Adult	1.04	.52	.89	.40	.73	.40
Reduced	Child	.32	.18	.42	.23	.40	.51
	Adult	.14	.14	.17	.15	.29	.22

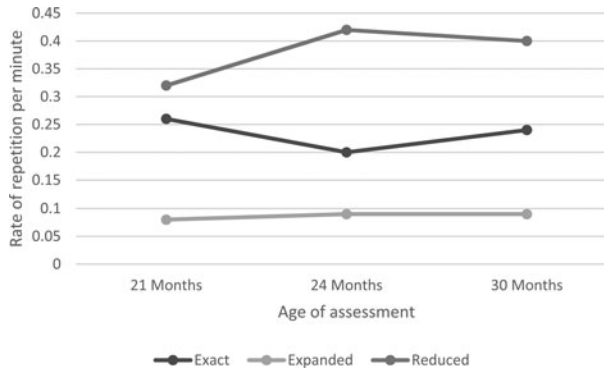

Figure 1. Children's rates of each type of repetition at each age

did not reach significance ($p = .087$). As shown in Table 6a, at 24 and 30 months we found that children produced more reduced than exact repetitions ($p = .006$; and $p = .008$ respectively). We also found that, at 24 months, the proportion of expanded repetitions was lower than the proportion of exact ($p = .019$), and reduced repetitions ($p = .014$). At 30 months we found that children produced more reduced repetitions than expanded repetitions ($p = .005$). However, the differences between reduced and exact repetitions were marginally significant ($p = .053$). The proportion of exact repetitions was higher than the proportion of expanded repetitions ($p = .029$).

Regarding rates of repetition per minute, results show a main effect of Type of repetition ($F(2,14) = 14.781$ $p = .014$, $\eta^2 = .881$), since children produced generally more reduced than expanded repetitions per minute (.389 vs. .093; $p < .001$), more reduced than exact (.389 vs. .239; $p = .001$), and more exact than expanded (.293 vs. .093; $p = .001$). No age effect and no interactions were found. Figure 1 shows the results of these analyses.

A subsequent Bonferroni test revealed a type of repetition effect at 21, 24 and 30 months. As shown in Table 6b, at 21 months children produced significantly fewer expanded than reduced repetitions ($p = .039$), and fewer expanded than exact repetitions ($p = .006$). We did not find significant differences between reduced and exact repetitions. At 24 months, children produced generally more reduced than

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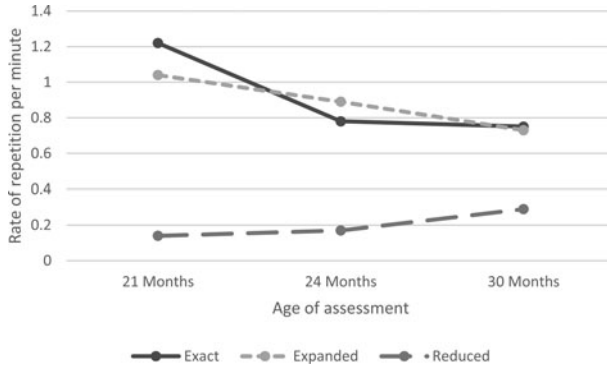

Figure 2. Adults' rates of each type of repetition at each age

expanded repetitions per minute ($p = .001$) and more reduced than exact repetitions ($p < .001$). Nevertheless, we did not find significant differences between expanded and exact repetitions. At 30 months we found the same pattern as at 24 months: children produced generally more reduced than expanded repetitions per minute ($p = .001$) and more reduced than exact repetitions per minute ($p < .001$). Differences between exact and expanded did not reach significance.

In sum, we found similar effects by taking the proportion of each type of utterance over the total number of utterances and the rate of repetition per minute and we found that children's proportions and rates of expanded repetitions remained stable across the study. In addition, children produced more reduced repetitions at the three developmental points, and fewer expanded repetitions.

Adults

Regarding the proportion of repetition, results show no type of repetition ($F(4,12) = .817$, $p = .504$) and no age effects ($F(4,12) = 1.202$, $p = .390$). No interactions were found ($F(4,12) = .904$, $p = .505$). Regarding the rate of repetitions per minute we found a Type of repetition per Age effect ($F(4,12) = 3.594$, $p < .05$, $\eta^2 = .193$). Figure 2 shows the results of this analysis.

At 21 months adults produced significantly more expanded than reduced repetitions ($p < .001$) and more exact than reduced repetitions ($p < .001$). There were no significant differences between exact and expanded repetitions. We found the same pattern at 24 months (that is, the adult rate of reduced repetitions was significantly lower than exact ($p < .001$) and expanded ($p < .001$) repetitions) and at 30 months. Again, the rate of reduced repetitions was significantly lower than the rate of exact ($p < .001$) and expanded ($p = .002$), and we did not find differences between exact and expanded repetitions.

The role of repetition and language development

In order to answer our third research question, that we formulated as "*What is the relationship between repetition rate and language development?*", we present two different sets of analyses: first, we present the results found in the correlations carried out between adults' and children's repetitions at each developmental point, and between repetitions at each age and children's linguistic achievements at the same age. The results of these analyses are shown in Appendix D. Second, we

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present the results found in the series of step-wise regression analyses that examine the predictive value of repetition at each developmental point of children's linguistic achievements at 30 months. The results of these analyses are shown in Appendix E.

Correlations at each developmental point

Adults' and children's rates of repetitions

We found no significant correlation between adults' and children's proportion of repeated utterances at any point of development. We found positive and significant correlations between adults' and children's rates of repetitions per minute at 21 months ($r(17) = .703$, $p = .002$), 24 months ($r(17) = .688$, $p = .003$) and at 30 months ($r(17) = .713$, $p = .001$).

Appendix A shows correlations between parents' and children's proportions of repeated utterances and rates of repetition per minute.

Children's repetitions and vocabulary and grammatical levels

We did not find any statistically significant relationship between children's overall proportions and rates of repetition per minute and any of the children's linguistic measures at the three ages. We also found no relation between any type of repetition in children and the linguistic measures at the three ages. Appendix B shows correlations between children's proportion of repetitions with MCDI raw scores (vocabulary and morpho-syntax) at 30 months, and children's rates of repetition with MCDI raw scores at 30 months. Additionally, Appendix C shows correlations between children's proportions and rates of repetition at each age with MCDI raw scores (vocabulary and morpho-syntax) at each age.

Adults' repetitions and vocabulary and grammatical level

We found that adults' repetitions at 21 months correlate with children's vocabulary level at 21 months, both with the proportion of repeated utterances ($r(17) = .730$, $p = .001$) and with the rate of repetition ($r(17) = .514$, $p = .035$). No significant correlation was found with morpho-syntax scores at 21 months. At 24 months, there are no significant correlations with adults' repetitions and children's vocabulary and morpho-syntax scores. At 30 months, no significant correlation was found between children's vocabulary level and adults' proportion and rate of repetition. The proportion of adults' repeated utterances correlates significantly with children's morpho-syntax scores ($r(17) = .801$, $p < .001$). Nevertheless, no significant correlation was found between adults' rate of repetition at 30 months and children's morpho-syntax scores.

Additionally, we found that adult's repetitions at one point of development correlate with their repetitions at the other points of development. Specifically, we found positive and significant correlations between adults' repetitions when children were 21 and when children were 24 months, both for proportions ($r(16) = .504$, $p = .046$) and rates of repetition ($r(17) = .601$, $p = .014$); and when children were 24 months and when children were 30 months for proportions ($r(17) = .519$, $p = .039$) and rates of repetition ($r(17) = .588$, $p = .016$).

Regression analyses.

First, we will report results regarding general repetition. Second, we will report results for each type of repetition.

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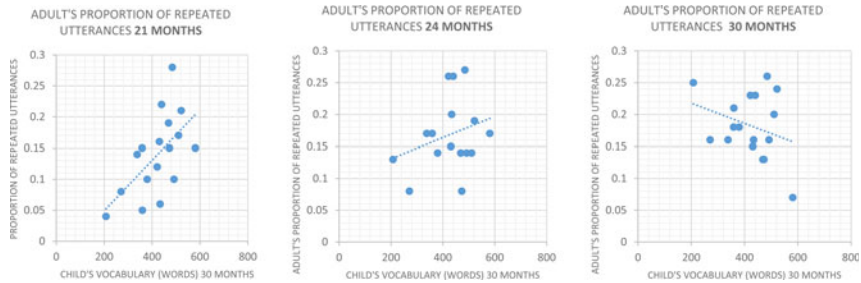

Figure 3. Relationship between adult's proportion of repeated utterances and children's vocabulary scores at 30 months.

Figure 4. Relationship between adult's rate of repetition per minute and children's vocabulary scores at 30 months.

General proportions and rates of repetition

We separate the information tested with proportions and rates per minute.

Proportions

There is a relation between adults' proportions of repetitions when children are 21 months old and children's vocabulary level at 30 months. Adults' repetitions (when children are 21 months old) explain a significant amount of variance in children's vocabulary level at 30 months ($\beta = .644$, $p < .05$). The proportion of repetitions at 21 months accounted for 37.3% of the variance in 30- months-olds' vocabularies ($F(1,15) = 9.940$, $p < .005$). Regarding grammatical level at 30 months, we found no relation with the proportion of adults' repetition at any point of development.

Table 1 in Appendix E shows the results of these analyses. Figure 3 shows the relationships between parental repetition at each point of development and children's vocabulary level at 30 months.

Rates of repetitions

There is a relation between adults' rate of repetition when children are 21 months old and children's vocabulary level at 30 months. Adults' repetitions (when children are 21 months old) explain a significant amount of variance in children's vocabulary level at 30 months ($\beta = .572$, $p < .05$). The rate of repetition per minute at 21 months accounted for 27.9% of the variance in 30- month-olds' vocabularies ($F(1,15) = 6.800$, $p < .005$). The inclusion of adults' repetition when children were 30 months produced a significant increment in the proportion of the explained variance ($\Delta R^2 = .233$). Note that the

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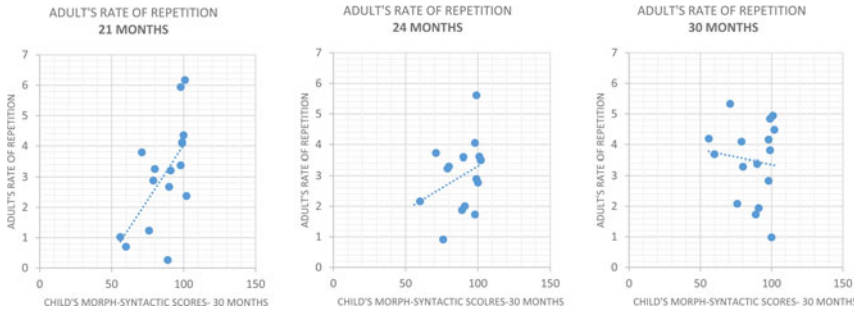

Figure 5. Relationship between adult's rate of repetition per minute and children's morph-syntax scores at 30 months.

correlation between adults' repetition at 30 months and vocabulary level is negative. Regarding grammatical level at 30 months, we also found a significant relation between adults' repetitions when children are 21 months old and morph-syntactic raw scores at 30 months ($\beta = .567$, $p < .05$). The rate of repetition per minute explains 26.9% of the variance in 30 months-olds' grammatical levels ($F(1,15) = 6.152$, $p < .005$).

Table 2 in Appendix E shows the results of these analyses. Figure 4 shows the relationship between parental rate of repetition at each age and children's vocabulary level at 30 months. Figure 5 shows the relationship between parental rate of repetition and children's grammatical level at 30 months.

Rates of exact, expanded and reduced repetitions

In order to test the relationship between the type of repetition and linguistic measures at 30 months, we ran a series of step-wise regressions only with the rate of repetition.

Exact repetitions

Regarding exact repetitions, Table 3 in Appendix E shows that the rate of adults' exact repetition per minute at 21 months explains a significant amount of the variance of children's vocabulary level at 30 months ($\beta = .516$, $p < .01$). The rate of exact repetition per minute at 21 months accounted for 21.4% of the variance in the vocabulary at 30 months ($F(1,15) = 5.075$, $p < .005$). Note that in this case, the correlation was positive. Figure 6 shows this relationship. Nevertheless, we found no relationship between the rate of adults' exact repetitions and children's grammatical level at 30 months.

Expanded repetitions

Regarding expanded repetitions, we found a negative and significant relationship between adults' expanded repetitions at 30 months and vocabulary level at 30 months ($\beta = -.608$, $p < .01$). The rate of repetition per minute at 30 months accounted for 37% of the variance in the vocabularies of 30- month-olds ($F(1,15) =$ 7,623 $p < .001$).

On the other hand, rate of expanded repetitions at 21 months explains a significant amount of the variance in the grammatical level at this age (55.1%). As shown in Table 3 in Appendix E, the inclusion of adults' repetitions at 21 months produces an increment in the variance explained by these variables ($\Delta R^2 = ,551$).

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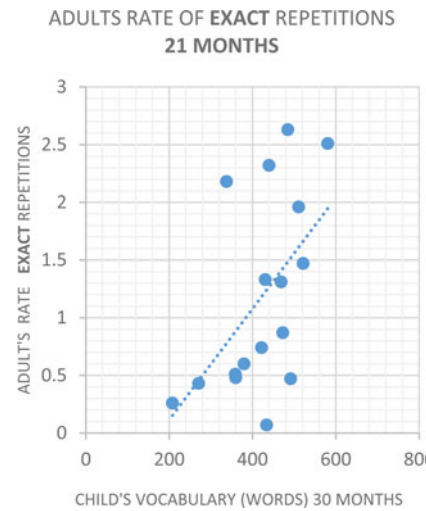

Figure 6. Relationship between adult's rate of exact repetition at 21 months and children's vocabulary scores at 30 months.

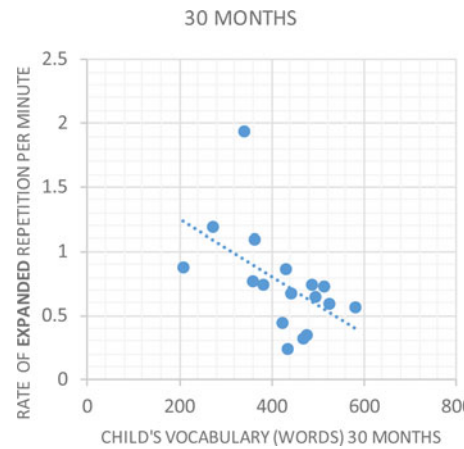

Figure 7. Relationship between adult's rate of expanded repetition and children's vocabulary scores at 30 months.

Figures 7 and 8 show relationships between adults' rate of expanded repetitions and vocabulary and morpho-syntax CDI scores.

Reduced repetitions

Finally, regarding reduced repetitions, we found that the rate of adults' reduced repetitions is not related to vocabulary and grammatical level at 30 months.

Discussion

The results of the present study show that repeated utterances ranged from 14% to 18% of the utterances produced by adults and 16% to 17% of the utterances produced by children. This result is in line with previous studies with younger English-speaking children, which found that repeated utterances are about 20% of the whole speech (Snow, 1981; Užgiris et al., 1989). Che et al. (2018) found similar rates of children's

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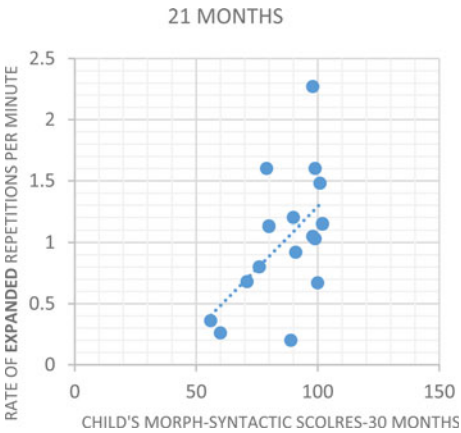

Figure 8. Relationship between adult's rate of expanded repetition at 21 months and children's morph-syntax scores at 30 months.

repetition at similar ages (ranging from 14% to 18%). Nevertheless, they found that the proportion of adults' repetitions increased from 16% at 14 months and reached 25% at 32 months. Although we cannot make direct comparisons, in our study, we found that adults' average of repeated utterances is 18% at 30 months. It is worth noting that the results are very similar even if the sample sizes of these studies vary. Snow (1981) reported data from a longitudinal case study, whereas Užgiris et al. (1989) studied 14 parent-child dyads, Masur (1995) studied 20 children and the final sample reported in Che et al. (2018) comprised 46 children. Thus, our results suggest that, between 21 and 30 months of age, repetition is a part of adult-child conversations that should be taken into account. As Clark and Bernicot (2008) pointed out, children and adults may not rely on repetition as much as in previous stages; even though they repeat each other more than 15% of the time. Therefore, these repetitions may serve different communicative functions.

Regarding our developmental hypothesis, we expected that the rate of repetition would decrease gradually as children reached their second birthday, especially adults' repetitions (Schwab et al., 2018). Nevertheless, we did not find age effects, since the proportion and the rates of children's and adults' repetition remained stable between 21 and 30 months. However, it is possible that the period of our study was not sensitive to the developmental changes that take place in spontaneous verbal repetition at about 18 months and after the third birthday. Previous research has reported single word repetitions around the first birthday (Masur & Eichorst, 2002). Thus, it is possible that when children are younger and learning their first words, children repeat adult utterances because they may need more linguistic feedback (see, for example, Hodges, Munro, Baker, McGregor, Docking & Arciuli, 2016 for a discussion in experimental settings). As children grow older (as with the children in our study) and as they improve their linguistic skills, repetition may serve conversational as well as linguistic functions.

Regarding the analyses that consider different types of repetition, the results of our study also show the need to go beyond general frequencies of repetition in order to understand the nature of spontaneous verbal repetition in adult-child conversations. Even if children reduced adults' utterances more frequently than expanded them, they produced the three types of repetition during the period analyzed, so each one may have different functions. Although at 30 months old children differ in their grammatical skills compared to at 21 months old, they may need exact repetitions

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that help them to build stable representations of new structures. Further research should examine whether the forms that are repeated differ from one type of repetition to the other. However, the fact that children still produce reduced repetitions, even when they are 30 months old, suggests that they may still repeat single words taken from the source utterance, given that adults' sentences could be too long for their working memory. Finally, the fact that children did not increase the proportion and the rate of expanded repetitions is in line with this hypothesis, since expanded repetitions are presumably more complex both in syntactic and cognitive terms. Further research should analyze the number and type of words that children are repeating, and test whether children are repeating new structures, as suggested by Olson and Masur (2012). Nevertheless, reduced repetitions may serve more for linguistic purposes than for conversational ones, since they provide immediate feedback that reinforces the representation of words and short utterances (Clark & Bernicot, 2008; Che et al., 2018).

The results found with the proportion of each type of utterance also suggest that there are individual differences related to the level of participation. This interpretation needs more investigation, since no correlation was found between the number of utterances and the number of expanded repetitions at any point of development. Moreover, we did not find correlations between each type of repetition (as rate of repetition or as proportion) with our measures of vocabulary and grammar at any point of development.

According to previous studies in the English language (Snow, 1981), we expected a general increment in children's expanded repetition at 24 months. Further research should analyze the length of each repeated utterance, as well as the type of structures repeated. It is possible that children with lower levels of grammatical development are using each type of repetition to practice different aspects of grammar. Exact and reduced repetitions at this age may serve to increase the frequency of each grammatical form (Che et al., 2018), whereas expanded repetitions may be used to practice new structures that are not produced spontaneously in other contexts (Stine & Bohannon, 1983).

Considering the results regarding adults' type of repetitions, we found that the rate of expanded repetitions was higher than the rate of reduced repetitions, which is the reverse pattern to the one found in children. These differences did not reach significance when we analyzed the proportion of each type of repetition. Since the mean number of utterances that the adults produced at the three points of development remained stable, and since the proportion of repeated utterances depends on the total number of utterances produced by each participant, this may explain, at least partially, why the proportion of repeated utterances was not so sensitive to differences between the types of repetition in adults. Moreover, the proportion of each type of repetition is very low (below 1% in all cases).

Adults' rate of expanded repetitions was significantly higher than reduced repetitions across the study and this is in line with previous studies on child directed speech – which show that adults extend children's utterances more than merely repeating them word for word; and that expansions are not only a characteristic of parental responsiveness but play an important role in grammatical development (Conway et al., 2018; Tamis-LeMonda et al., 2001). Repeating the conversational partner's utterances and extending them shows that adults are paying attention to children's speech and establishes a common ground to introduce new information. Clark and Bernicot (2008) put forward that this type of repetition is a characteristic of adult repetition of 3;1 to 4;2-year-olds in the French language. Exact repetitions are more immediate and more frequent with younger children in their sample and serve for

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different functions that are related to vocabulary growth. In any case, as Che et al. (2018; p. 92) point out, "by building on what the child has just said, within a span of one or two utterances, mothers are effectively following the child's lead, rather than redirecting their focus of attention".

Regarding the effects of children's general rates of repetition on their linguistic development, we found no significant correlation between children's repetitions and their vocabulary and grammatical level at each age tested. Our results are similar to the ones reported by Che et al. (2018), since we found that both the proportion and the rate of repetition per minute at 21, 24 and 30 months does not predict a child's grammatical and lexical levels at 30 months. Masur and Rodemaker (1999) as well as Olson and Masur (2012) reported positive and significant correlations between children's and adults' repetitions and with vocabulary levels. However, these studies were carried out with younger children and it is possible that, when children are younger, word repetition (and especially the repetition of new words) is related to their vocabulary level. Nevertheless, we cannot conclude that more repetitive children in our study show better linguistic skills than children with lower repetition rates.

Taken together, these results show that the role of children's repetition on linguistic development is indirect and complex. Although we did not find significant correlations between adults' and children's proportions of repeated utterances, we did find significant correlations between children's and adults' rates of repetitions per minute at the three points of development, and this is similar to what Masur (1995) found with younger children. Therefore, we cannot conclude that children's repetition is dependent on adults' repetitions. The question that remains is: what is the role of adults' repetition in children's verbal repetition and linguistic development?

The results related to the effect of adults' repeated utterances should be interpreted cautiously, given the sample size, and the differences between the results found with the two independent variables (proportion of repeated utterances and rate of repetition per minute). Nevertheless, we found that children whose parents were more repetitive when they were 21 months old showed larger vocabularies at 30 months. These results were found both with proportions of repeated utterances and the rates of repetition per minute. Adults' proportion and rate of repetition at 21 months is also correlated significantly with children's vocabulary level at 21 months. Interestingly, adults' rate of exact repetitions at 21 months is also related to children's vocabulary level at 30 months, and adults' rate of expanded repetitions at 21 months is related to children's vocabulary and grammatical level at 30 months. These results seem consistent enough to think that adults' repetition at 21 months has a positive effect on children's linguistic abilities. The fact that expanded repetitions are related to vocabulary and grammatical level provides new evidence that shows the importance of adults' scaffolding during the transition to each linguistic developmental stage (Bruner, 1978; Herr-Israel & McCune, 2011; Veneziano, 2013). Adults' repetitions and expansions of children's utterances show that they are being responsive and consistent in time and semantics (MacGillion et al., 2013).

Our results related to the influence of adults' repetitions at 30 months are not so consistent and should be taken with a degree of caution. On the one hand, results of the regression models carried out with the rate of repetition per minute show negative correlations between adults' general rates of repetitions and children's vocabulary and grammatical levels. These results are also found with expanded repetitions. At the same time, Figures 3 to 8 suggest a negative relationship between adults' repetition at 30 months and children's vocabulary and grammatical level. Schwab et al. (2018) also

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found no influence of repetitions of low-SES fathers in the vocabulary of two-year-olds and concluded that there are specific characteristics in the input that are more helpful at some points in development. Thus, it is possible that adults are reducing the frequency of their repetitions as children increase their linguistic abilities, given that adults adapt their speech to the linguistic abilities of their conversational partners (Conway et al., 2018; Kuchirko, Tafuro & Tamis-LeMonda, 2018).

On the other hand, we did not find the same results with the proportion of repeated utterances, and bivariate Pearson's correlations did not show significant relationships. Therefore, we cannot conclude that our data are fully interpretable in these terms. Our results suggest that it would be very interesting to continue exploring the influence of adults' spontaneous repetitions on language development and to consider it not only as indirect but also variable in terms of children's communicative skills.

It is possible that the feedback provided by parental repetition (both in an exact and extended manner) interacts somehow with vocabulary level, and probably with other variables related to multimodal communication and the way actions are integrated into child-directed speech (Suanda, Smith & Yu, 2016). Further research should investigate repetition from a multimodal point of view, analyzing, for example, whether children whose linguistic levels are higher at 30 months are more prone to repeat adults' utterances using verbal and gestural behaviors.

Taken together, the results of the present study are in line with previous research, which has shown that repetition is a characteristic of child directed speech. When adults repeat children's utterances, they are not only showing attention, but also increasing the opportunities to hear the same utterance in different syntactic frames, which increases the frequency of each structure (Schwab & Lew-Williams, 2016). Children's own repetitions are also increase the frequency of each structure in communicative contexts. The role of frequency on grammatical development has been widely discussed in the literature (see Ambridge et al., 2015, for a review). Thus, as children repeat adults' utterances, even in a reduced way, they may be practicing new structures in contexts that share a common ground with the adult.

The current study extends previous research by contributing crosslinguistic evidence at transitional stages and clarifies previous research. Our study highlights the need to take into account different types of repetition at different moments of development. It also shows that adult repetition is a characteristic of the quality of child-directed speech (Conway et al., 2018) and provides the first step towards a more detailed study of the variables related to spontaneous verbal repetition as a complex form of imitation that goes beyond mimicry (Bannard et al., 2013; Jones, 2007). Our study has some limitations that prevent us from concluding that both adults' and children's repetitions decrease with age and with linguistic level. Further research should attempt to overcome these limitations. In particular, we should increase the sample size to be able to generalize the results and to draw conclusions about the results found analyzing the proportion of repeated utterances and the rates of repetition. In addition, we did not analyze which were the linguistic forms that are repeated with greater frequency, nor the mean length of the repeated utterances.

Future research should also analyze specific trajectories of each dyad when reproducing each other's utterances. It might also take into consideration repetitions from the conversational point of view and link both speakers' utterances in unique repetitive events (Herr-Israel & McCune, 2011). Nonetheless, despite these limitations, we feel this study has been able to shed some light on the role of adults' repetitions and extensions of two-year-olds grammatical development.

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Appendix A:

Table A1. Mean Vocabulary raw scores (and percentlies) at each age.

VOCABULARY	21 Months	24 Months	30 Months
Mean	143,7 (p 55–60)	263.1 (p 60–65)	422,11 (p 55–60)
Min	92,35 (p 35–40)	207,87 (p 50–55)	373,57 (p 40–45)
Max *(out of 588)*	195,05 (p 70–75)	318, 36 (p 75–80)	470, 67 (p 60–65)

Table A2. Mean Vocabulary raw scores (and percentlies) at each age

MORPH-SYNTAX	21 Months	24 Months	30 Months
Mean	28,06 (p 55–55)	58,26 (p 70–75)	87,27 (p 75–80)
Min	19,25 (p 30–35)	41,66 (p 55)	78,79 (p 65–70)
Max *(out of 102)*	36,88 (p 65–70)	74,86 (p 85–90)	95,742 (p 90–95)

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Appendix B. Correlations Between Children's and Adult's Repetitions

Table B1. Pearson Correlations between Children's and Adult's Proportion of Repeated Utterances

		Child 21 Months	Adult 21 Months	Child 24 Months	Adult 24 Months	Child 30 Months	Adult 30 Months
Child 21 months	Pearson Correlation	_					
	N	17					
Adult 21 months	Pearson Correlation	,023	_				
	N	17	17				
Child 24 months	Pearson Correlation	,479	,354	_			
	N	16	16	16			
Adult 24 months	Pearson Correlation	,105	,504*	,345	_		
	N	16	16	16	16		
Child 30 months	Pearson Correlation	–,004	,197	,374	,245	_	
	N	17	17	16	16	17	
Adult 30 months	Pearson Correlation	,135	,171	,030	,519*	,345	_
	N	17	17	16	16	17	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table B2 Pearson Correlations between Children's and Adult's Rates of Repetition per Minute

		Child 21 Months	Adult 21 Months	Child 24 Months	Adult 24 Months	Child 30 Months	Adult 30 Months
Child 21 Months	Pearson Correlation	_					
	N	17					
Adult 21 Months	Pearson Correlation	,703**	_				
	N	17	17				
Child 24 Months	Pearson Correlation	,536*	,411	_			
	N	16	16	16			
Adult 24 Months	Pearson Correlation	,624**	,601*	,688**	_		
	N	16	16	16	16		
Child 30 Months	Pearson Correlation	,297	,149	,108	,372	_	
	N	17	17	16	16	17	
Adult 30 Months	Pearson Correlation	,511*	,370	,168	,588*	,713**	_
	N	17	17	16	16	17	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Appendix C. Correlations Between Children's Repetitions and CDI Scores

Table C1. Pearson correlations between children's proportion of repeated utterances and CDI raw scores (vocabulary and morph-syntax)- 21 months

		CDI vocabulary scores 21 months	CDI morph-syntax scores 21 months	Child 21 Months
CDI Vocabulary Scores 21 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 21 Months	Pearson Correlation	,154	_	
	N	17	17	
Child 21 Months	Pearson Correlation	–,008	,165	_
	N	17	17	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table C2. Pearson correlations between children's proportion of repeated utterances and CDI raw scores (vocabulary and morph-syntax)- 24 months

		CDI Vocabulary Scores 24 Months	CDI Morph-Syntax Scores 24 Months	Child 24 Months
CDI Vocabulary Scores 24 Months	Pearson Correlation			
	N	17		
CDI Morph-Syntax Scores 24 Months	Pearson Correlation	,025	_	
	N	17	17	
Child 24 Months	Pearson Correlation	,046	,167	_
	N	16	16	16

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table C3. Pearson correlations between children's proportion of repeated utterances and CDI raw scores (vocabulary and morph-syntax)- 30 months

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Child 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,241	_	
	N	17	17	
Child 30 Months	Pearson Correlation	–,265	–,291	_
	N	17	17	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

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Table C4. Pearson Correlations between Children's Proportion of Repeated Utterances and CDI Raw Scores (Vocabulary and Morph-Syntax)

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Child 21 Months	Child 24 Months	Child 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_				
	N	17				
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,241	_			
	N	17	17			
Child 21 Months	Pearson Correlation	−,050	,347	_		
	N	17	17	17		
Child 24 Months	Pearson Correlation	,088	−,198	,479	_	
	N	16	16	16	16	
Child 30 Months	Pearson Correlation	−,265	−,291	−,004	,374	_
	N	17	17	17	16	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table C5. Pearson Correlations between Children's Rate of Repetitions and CDI Raw Scores (Vocabulary and Morph-Syntax)- 21 Months

		CDI Vocabulary Scores 21 Months	CDI Morph-Syntax Scores 21 Months	Child 21 Months
CDI Vocabulary Scores 21 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 21 Months	Pearson Correlation	,734**	_	
	N	16	16	
Child 21 Months	Pearson Correlation	,490*	,589*	_
	N	17	16	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table C6. Pearson Correlations Between Children's Rate Of Repetitions And CDI Raw Scores (Vocabulary And Morph-Syntax)- 24 Months

		CDI Vocabulary Scores 24 Months	CDI Morph-Syntax Scores 24 Months	Child 24 Months
CDI Vocabulary Scores 24 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 24 Months	Pearson Correlation	,025	_	
	N	17	17	
Child 24 Months	Pearson Correlation	,095	,341	_
	N	16	16	16

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table C7. Pearson correlations between children's rate of repetitions and CDI raw scores (vocabulary and morph-syntax)- 30 months

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Child 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,801**	_	
	N	16	16	
Child 30 Months	Pearson Correlation	−,228	−,284	_
	N	17	16	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

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Table C8. Pearson correlations between Children's rate of repetition and CDI raw scores (vocabulary and morph-syntax)

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Child 21 Months	Child 24 Months	Child 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_				
	N	17				
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,801**	_			
	N	16	16			
Child 21 Months	Pearson Correlation	,300	,191	_		
	N	17	16	17		
Child 24 Months	Pearson Correlation	,121	,173	,536*	_	
	N	16	15	16	16	
Child 30 Months	Pearson Correlation	−,228	−,284	,297	,108	_
	N	17	16	17	16	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Appendix D. Correlations Between Adult's Repetitions and Children's CDI Scores

Table D1. Pearson correlations between adult's proportion of repeated utterances and children's CDI raw scores (vocabulary and morph-syntax)- 21 months

		CDI Vocabulary Scores 21 Months	CDI Morph-Syntax Scores 21 Months	Adult 21 Months
CDI Vocabulary Scores 21 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 21 Months	Pearson Correlation	,154	_	
	N	17	17	
Adult 21 Months	Pearson Correlation	,730**	,120	_
	N	17	17	17

**$p < .01$, two tailed.
*$p < .05$, two tailed.

Table D2. Pearson correlations between adult's proportion of repeated utterances and children's CDI raw scores (vocabulary and morph-syntax)- 24 months

		CDI Vocabulary Scores 24 Months	CDI Morph-Syntax Scores 24	Adult 24 Months
CDI Vocabulary Scores 24 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 24 Months	Pearson Correlation	,025	_	
	N	17	17	
Adult 24 Months	Pearson Correlation	,116	,385	_
	N	16	16	16

**$p < .01$, two tailed.
*$p < .05$, two tailed.

Table D3. Pearson correlations between adult's proportion of repeated utterances and children's CDI raw scores (vocabulary and morph-syntax)- 30 months

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Adult 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,801**	_	
	N	16	16	
Adult 30 Months	Pearson Correlation	−,298	−,081	_
	N	17	16	17

**$p < .01$, two tailed.
*$p < .05$, two tailed.

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Table D4. Pearson correlations between adult's proportion of repeated utterances and children's CDI raw scores at 30 months (vocabulary and morph-syntax)-30 months

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Adults 21 Months	Adults 24 Months	Adults 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_				
	N	17				
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,241	_			
	N	17	17			
Adults 21 Months	Pearson Correlation	,585*	−,109	_		
	N	17	17	17		
Adults 24 Months	Pearson Correlation	,295	−,109	,504*	_	
	N	16	16	16	16	
Adults 30 Months	Pearson Correlation	−,298	−,129	,171	,519*	_
	N	17	17	17	16	17

**$p < .01$, two tailed.
*$p < .05$, two tailed.

Table D5. Pearson correlations between adult's rate of repetition and children's CDI raw scores (vocabulary and morph-syntax)- 21 months

		CDI Vocabulary Scores 21 Months	CDI Morph-Syntax Scores 21 Months	Adults 21 months
CDI Vocabulary Scores 21 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 21 Months	Pearson Correlation	,734**	_	*
	N	16	16	
Adults 21 months	Pearson Correlation	,514*	,633**	_
	N	17	16	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table D6. Pearson correlations between adult's rate of repetition and children's CDI raw scores (vocabulary and morph-syntax)- 24 months

		CDI Vocabulary Scores 24 Months	CDI Morph-Syntax Scores 24 Months	Adults 24 months
CDI Vocabulary Scores 24 Months	Pearson Correlation	_		
	N	17		
CDI Morph-Syntax Scores 24 Months	Pearson Correlation	,025	_	
	N	17	17	
Adults 24 months	Pearson Correlation	,228	,419	_
	N	16	16	16

*$p < .01$, two tailed.
*$p < .05$, two tailed.

Table D7. Pearson correlations between adult's rate of repetition and children's CDI raw scores (vocabulary and morph-syntax)- 21 months

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Adults 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_	*	
	N	17		
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,801**	_	
	N	16	16	
Adults 30 Months	Pearson Correlation	−,202	−,111	_
	N	17	16	17

*$p < .01$, two tailed.
*$p < .05$, two tailed.

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Table D8. Pearson correlations between adult's rate of repetitions and children's CDI raw scores at 30 months (vocabulary and morph-syntax)

		CDI Vocabulary Scores 30 Months	CDI Morph-Syntax Scores 30 Months	Adults 21 Months	Adults 24 Months	Adults 30 Months
CDI Vocabulary Scores 30 Months	Pearson Correlation	_				
	N	17				
CDI Morph-Syntax Scores 30 Months	Pearson Correlation	,801**	_			
	N	16	16			
Adults 21 Months	Pearson Correlation	,588*	,625**	_		
	N	17	16	17		
Adults 24 Months	Pearson Correlation	,208	,320	,601*	_	
	N	16	15	16	16	
Adults 30 Months	Pearson Correlation	−,202	−,111	,370	,588*	_
	N	17	16	17	16	17

**$p < .01$, two tailed.
*$p < .05$, two tailed.

Appendix E: Results of the Regression Analyses

Table E1. Results of the Regression Analyses on Adults' Proportions of Repetition (Vocabulary Level at 30 Months)

	B	*β*	*95% CI*		R^2	*F*	$R^2_{adj.}$	ΔR^2
Step 1 21 Months	287.776	,644	92,005,	483.547	.415	9.940**	.373	.415

Note: The values are standard regression coefficients
*p < .05, **p < .01.

"Residual Statistics"

	Min	*Max*	*M*	*SD*
Predicted Value	290.2508	523.4459	418.9619	66.61637
Std. Predicted Value	−2.192	1.573	−.114	1.076
Residual	−97.03351	141.36430	3.15575	72.34398
Std. Residual	−1.275	1.858	.041	.951
Stud. Residual	−1.376	1.922	.024	1.022
Cook's Distance	.000	.587	.094	.55

Dependent Variable: CDI words 30 Months
Note: N = 17.

Table E2. Results of the Regression Analyses on Adults' Rate of Repetition per Minute (Vocabulary level at 30 months)

	B	*β*	*95% CI*		R^2	*F*	$R^2_{adj.}$	ΔR^2
Step 1 21 Months	32.517	.572	5.772,	59.261	.327	6.800**	.279	.327
Step 2 30 Months	−40.135	−.748	−73.158	−7.112	.493	8.278**	.560	.233

Note: The values are standard regression coefficients
*p < .05, **p < .01.

"Residual Statistics"

	Min	*Max*	*M*	*SD*
Predicted Value	296.19	578.77	418.36	76.435
Std. Predicted Value	−1.805	2.124	−.106	1.063
Residual	−119.954	110.107	3.754	63.627
Std. Residual	−1.752	1.608	.055	.929

(*Continued*)

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Table E2. (*Continued.*)

	Min	*Max*	*M*	*SD*
Stud. Residual	−1.918	1.745	.046	1.020
Cook's Distance	.000	.303	.079	.100

Dependent Variable: CDI words 30 months
Note: N = 17.

Table E3. Results of the Regression Analyses on Adults' Rate of Repetition per Minute (Morph-Syntax Level at 30 Months)

	B	*β*	*95% CI*		R^2	*F*	$R^2_{adj.}$	ΔR^2
Step 1: 21 Months	4.341	.567	.560,	8.123	.269	6.152**	.269	.321

Note: The values are standard regression coefficients
*p < .05, **p < .01.

"Residual Statistics"

	Min	Max	M	SD
Predicted Value	75.99	101.62	88.27	7.440
Std. Predicted Value	−1.767	1.750	−.082	1.021
Residual	−23.266	16.857	−1.454	11.774
Std. Residual	−2.116	1.533	−.132	1.071
Stud. Residual	−1.939	1.603	−.122	1.115
Cook's Distance	.001	.543	.118	.188

Dependent Variable: CDI grammar 30 months
Note: N = 16.

Table E4. Results of the Regression Analyses on Adults' Rate of Exact Repetitions per Minute *(Vocabulary Level at 30 Months)*.

	B	*β*	*95% CI*		R^2	*F*	$R^2_{adj.}$	ΔR^2
Step 1: 21 Months	57.699	.516	2.765,	112.633	.266	5.075**	.214	.266

Note: The values are standard regression coefficients.
*p < .05, **p < .01.

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"Residual Statistics"

	Min	*Max*	*M*	*SD*
Predicted Value	358.86	507.04	423.45	49.136
Std. Predicted Value	−1.354	1.635	−.051	.991
Residual	−162.326	110.026	−1.335	79.914
Std. Residual	−1.905	1.291	−.016	.938
Stud. Residual	−2.062	1.372	−.019	1.009
Cook's Distance	.000	.365	.077	.106

Dependent Variable: CDI words 30 months
Note: N = 17.

Table E5. Results of the Regression Analyses on Adults' Rate of Expanded Repetitions per Minute *(Vocabulary Level at 30 Months)*

	B	*β*	*95% CI*		R^2	F	$R^2_{adj.}$	ΔR^2
Step 1: 30 Months	−18.824	−.608	−33.554,	−4.095,	.370	7.623*	.321	.370
Step 2: 21 Months	10.248	.742	.087	20.409	.551	7.348*	.476	.181

Note: The values are standard regression coefficients.
*$p < .05$, **$p < .01$.

"Residual Statistics"

	Min	*Max*	*M*	*SD*
Predicted Value	63.33	101.40	88.01	9.837
Std. Predicted Value	−2.676	1.313	−.090	1.031
Residual	−19.143	12.160	−1.196	9.607
Std. Residual	−2.055	1.306	−.128	1.032
Stud. Residual	−2.211	1.471	−.096	1.124
Cook's Distance	.000	1.580	.182	.401

Dependent Variable: CDI grammar 30 months
Note: N = 16.

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