

COMMUNICATION

Verbal and non-verbal requests in Spanish speaking children with Down syndrome

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Children with Down syndrome have been described to have language, social-communicative and intentional skills that lag behind age-matched peers, with frequent gesture use that is not accompanied by vocalisations or words. Early intentional communication, particularly requests, has been shown to be an important step in future language development. This is a preliminary study that explores the use of verbal and non-verbal requests in 4 Spanish-speaking children with Down syndrome from very low income families. Children were observed in an elicited request task and language level was evaluated using a parental report. Results showed that all participants were very delayed in their language production. Children used mostly combinations of non-verbal requests. Data support previous studies in that Spanish-speaking children also use non-verbal requests for a prolonged period of time as a strategy to compensate for their linguistic deficits. Findings differ from previous studies in that most combinations of gestures were complementary and not equivalent. Their language development was much more depressed than most data published to date. This lag could be explained because children were from very low income environments and they may lack stimulation because of family situations. It is suggested that data from a larger sample be collected and compared to typically developing children in order to make a stronger proposal about the use of non-verbal forms as a bridge to verbal productions.

Introduction

Children with Down syndrome have been reported to have delayed development in language production, and dissociations among linguistic domains^[1,2,3]. Chapman and colleagues^[4,5] have described a phenotype that is characterised by deficits in expressive language, mostly in morphosyntax and intelligibility. They have shown that vocabulary comprehension is stronger than production and there are deficits in phonological working memory. Further, this population has been described to have social-communicative and intentional skills that lag behind age-matched peers, with frequent gesture use that is not accompanied by vocalisations or words^[1,2,6,7,8].

The language delay in these children has been explained because there is a strong relation between distinctive pre-linguistic communication and later language and socio-emotional development^[9,10]. Early non-verbal interaction,

particularly declarative and imperative pointing, has been shown to be related to later vocabulary development because of an underlying cognitive mechanism^[8] or because they are supported by sociocognitive skills that lead them to an understanding that experiences can be shared^[11]. Several authors have proposed that the language delays may also be explained by problems in speech planning and motor control deficits, short term memory and phonological processing^[12]. Within the many areas of communication that are attenuated, the use of non-verbal requests has been of interest in the study of children with Down syndrome because of the apparent interrelationship between intellectual disability, delayed language production, and a prolonged use of gestural communication, particularly a relationship between non-verbal requests and language^[10,13,14,15]. Yoder and colleagues have suggested that language abilities in intervention may be strengthened by using the child's prelinguistic skills, such as non-verbal requests. Thus, studies about non-verbal

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communication and requests in particular, may be useful for clinical intervention and may aid in the understanding of language development.

Non-verbal communication and language development

It has been established that there is a relationship between early communicative intent, such as proto-declarative pointing and proto-imperative gesture requests, and the later development of language^[11,16]. Bates and colleagues^[11] described proto-forms as oral and gestural manifestations to express declarative and imperative functions. Proto-imperatives express the intention to obtain an object or attention from the adult. Proto-declaratives signal or show an object or event. Several studies have also demonstrated longitudinal associations between joint attention abilities such as proto-declarative pointing, following eye gaze and pointing, and later language ability^[11,17].

Language comprehension and gesture use have also been shown to be predictors of future language ability based on the continuity between pre-verbal forms and subsequent language comprehension and production in typically developing children and late talker^[11,18]. Deictic gestures and representational forms such as flying an airplane or combing a doll's hair were related to vocabulary comprehension whereas gestures that are routines, like patty cake or byebye, were associated with word production. In studies of children with Down syndrome similar relations have also been established^[6,7] and it has been suggested that the relationship between gesture production and vocabulary development is mediated by the influence of word comprehension^[7]. Further, gestures are seen as a 'bridge' between comprehension and production.

Although strong relations have been shown between language and gesture in the early stages of language development, the association does not remain constant in later years. Stefanini^[17] has shown that correlations are weaker or non-significant in children above 6 years of age. This is relevant to the present study as the participants are older children.

One specific type of gestures, non-verbal requests, are the focus of this study. It has been suggested that requests are a stepping stone in the linguistic process^[19] in children with Down syndrome. Several studies have illustrated that non-linguistic requests are attenuated in children with Down syndrome but that joint attention and declarative gestures are similar to those used by typically developing peers in children 3 years and younger. This has been found for English speaking children^[19], Norwegian chil-

dren^[20], Dutch-speaking children^[21], and Italian children^[1], as well. Further, when children with Down syndrome were compared to children with Williams syndrome the former had a request deficit while the latter have an impaired declarative function^[22].

Most studies of children with Down syndrome who are four years old or younger have found that there is a gesture advantage in children and that gestures are used for a longer period of time than they are in their typically developing peers^[1,13,19]. Most of this data has been obtained through parental report, but a naming confrontation task has recently shown similar results^[7]. However, although gestures were used more frequently and their repertoire was richer than their typically developing peers, most gestures were iconic and context dependent.

Iverson et al.^[3] have taken the study a step further by observing gesture-word combinations in a small group of children with Down syndrome with a mean age of 47 months and whose language was at the one word stage. They found no overall differences in gesture repertoires when compared to mental age controls, but did find differences in gesture-word combinations. When gestures were combined in children with Down syndrome they usually had the same referent (head shake "no" + word no) and did not include complementary (gesture + new referent) and supplementary (gesture + new information) forms. Mental age controls did use complementary and supplementary combinations. Volterra et al.^[13] have proposed that the lack of complementary or supplementary information could explain why there is a gap between language and cognition that, in turn, might partially explain the difficulty in achieving productive language. As Zampini^[6] has suggested what has been labeled a "gesture advantage" may actually be a "speech disadvantage" in the case of these children.

Although a large population of children with Down syndrome is from Spanish-speaking families, work based on this group is scarce. Most of the available systematic information available about Spanish-speaking children with Down syndrome is based on children in Spain and data is still unpublished. It is related to vocabulary development using parental report measures and does not address the question of non-verbal requesting. Galeote et al.^[23,24] and Soto et al.^[25] studied a sample of children (N= 66) using a parental report instrument developed for Spanish-speaking children with Down syndrome in Spain^[37,43]. They compared children with Down syndrome between 12 and 28 months to mental age controls. Similar to Iverson et al.^[3] children with Down syndrome had similar gestural rep-

ertoires and overall vocabulary when compared to mental age controls.

No published work is readily available for Mexican Spanish speaking children with Down syndrome. A large proportion of children with Down syndrome in Mexico are from economically deprived homes. Recent reports have shown that 47.4% of the Mexican population lives in poverty. Along with poverty come multiple language and developmental disorders^[26,27]. Unfortunately, all data about low income children is very scarce, much less of children with Down syndrome.

As stated above, the use of requests are a stepping stone in the linguistic process. There seems to be a deficit in this function in children with Down syndrome in most languages studied thus far. Information about requests from other cultures and socio-economic or socio-educational groups may aid in the understanding of why children with Down syndrome have language production deficits.

Goals of the study and research questions

This paper addresses 4 case studies of Spanish-speaking school age children with Down syndrome, in Mexico, who are from low income families. Results are compared to data from studies with typically developing children. The purpose of this study is to offer a description of uses of verbal or non-verbal requests for objects or events by means of an elicitation task. A second goal is to determine modality differences. That is, to observe preferences for verbal or non-verbal gestures or a combination of both. Finally, relations between language level and gestural or verbal forms are explored. Clinical implications are suggested.

The study answers several questions:

- 1) Do Spanish-speaking children with Down syndrome use non-verbal requests similar to data exposed in other languages and cultures?
- 2) Is there a modality difference: do children use more gestures, words or combinations of both?
- 3) Is there a relation between non-verbal gestures and language level?
- 4) Can differences between the Spanish-speaking population and previously cited research be a product of socio-demographic characteristics?

Method

This is a preliminary case study based on a low income group of children in Mexico. The group seen in this study is representative of the Down syndrome population in the country. In Mexico

children from lower income families, especially children with Down syndrome, lack adequate stimulation as many do not attend early intervention centres and when they do the services may be deficient. As also shown in the U.S. for typically developing children from lower income homes^[26], there is little home interaction and stimulation. In the clinics, intervention groups are frequently composed of children with multiple disorders and a variety of ages and levels of development. Further, many centres do not always have early intervention specialists, special education teachers or fully prepared clinicians to guide the language development process. The children in this study appear to be more delayed than would be expected of children their age. This is may be because they are from low income families and have few options of schools, clinics or rehabilitations centres that they may attend and they may also lack a stimulating home environment.

Participants

The participants of this study were four children (2 male, 2 female) between six and eight years of age with Down syndrome (see TABLE 1). The children attended two different State or Federal Special Education centres in a city in Central Mexico. One centre was the state-run Rehabilitation Centre and the other was a Special Education school. Most of the children who attend these schools are from lower income families.

All children in the study were monolingual speakers of Spanish and from lower socio-economic level families. In this study social economic status was determined by the mother's education rather than income. For the sake of anonymity, all children's names have been changed. One child, Emma, was an orphan, who was being brought up by a nun. Mothers or guardians (the nun) of three of the children had completed Middle School (Freddy, Marco and Emma) and Danielle's mother had not completed her Elementary School education.

Children with Down syndrome were compared to the norms of the MacArthur-Bates Inventario del Desarrollo de Habilidades Comunicativas (hereafter Inventario and also known as the Spanish SMBCDI)^[28] to further understand their linguistic and gesture profile. Vocabulary and gesture production scores were used to determine the language age of each child using the guidelines suggested in the Technical Manual^[28] for using the norms with older children. Scores were contrasted to the norms using the 50th percentile as the point of comparison. That is, the score that was closest to the 50th of a given age was determined to be the language equivalent.

For example, a score of 274 words, as reported for Danielle, would be equivalent to the mean word production for a child of 25 months based on the Inventario norms, where the 50th percentile for genders combined for that age is 250.

Participants were also compared to language matched controls who participated in a previous study. It is important to note, however, that as this group of children with Down syndrome was so severely delayed in their language production, the controls were several years younger and, therefore, were cognitively and developmentally quite dissimilar, making any comparison somewhat artificial, but illustrative of general developmental patterns. In TABLE 1, language controls are exhibited solely to illustrate how different these 4 children are from typically developing children from the same socio-demographic background. The children with Down syndrome are comparable to children between 12 and 25 months although their own chronological ages are between 6 and 8 years of age.

Further contrasts are made with a group of younger children with Down syndrome from a somewhat less impoverished environment to determine whether severe language delays may be more an artefact of environment or a characteristic of children with Down syndrome in Mexican public schools. Data for this group is illustrated in TABLE 2.

Instruments

Two instruments were used: a parental report, the MacArthur-Bates Inventario del Desarrollo de Habilidades Comunicativas or Inventario 47 to determine the linguistic level of the children, and an experimental measure to elicit requests. The experimental measure was created solely for the purpose of this study and thus can only be used as an exploratory measure to compare to the Inventario.

The Inventario is based on the English and Italian versions of the MacArthur-Bates Communicative Development Inventory (MBCDI)^[29,30] and has Mexican Spanish norms, validity, and reliability^[28,31,32]. It is an adaptation (not translation) that includes language specific and culturally relevant items. Work by several researchers has shown the validity of using the MBCDI in different languages, both for children with Down syndrome and for children with other disorders who are older than the ages for which it or related measures have been normed^[33-36]. An Iberian Spanish version of the MBCDI especially for children with Down syndrome has also been developed and is in the process of being normed^[37], but was not used in this study as it was not yet available.

The Inventario has two forms. Inventario 1 contains a section on vocabulary comprehension and production and another of gesture use. Norms for this form go up to 18 months, but may be used with other children following criteria established in Thal et al.^[31]. Only gesture data was used from this form as children had reached the ceiling for vocabulary comprehension and production. Further, late gestures and total number of gestures were also at ceiling, so only early gesture data is reported on. The second form, the Inventario 2 is normed on typically developing children between 16 and 30 months of age and measures vocabulary production and early grammar. Vocabulary production scores were obtained from this form for Danielle and Freddy, although gesture data was obtained from Inventario 1.

Participant	Age (mths)	Gender	Mother's education	Prod	Language age (mths)	Early gest	Gest age (mths)
Down syndrome							
Danielle	7;11 (95)	F	Elementary	274	25	15	13
Freddy	8;7 (103)	M	Middle school	247	25	15	14
Marco	8;2 (98)	M	Middle school	61	17	20	18
Emma	6;1 (73)	F	Middle school	9	12	17	16
Language control					Percentile	Percentile	
828SB	2;4 (28)	F	Elementary	281	35th	NA	NA
228SB	2;4 (28)	M	Middle school	506	75th	NA	NA
820SB	1;6 (20)	F	Middle school	191	70th	NA	NA
612SB	1 (12)	F	Middle school	7	55th	14	55th

Table 1 | **Down syndrome and language age control information: Age, vocabulary and gesture scores.** Vocabulary production and gestures scores for controls are given in percentiles because language age is not relevant. No data is given for gestures for controls over 18 months, as parents did not fill out the Inventario 1 because their child's age fell above the norms.

Age (mths)	Gender	Mother's education	Father's education	Prod	Language age (mths)	Early gest	Gest age (mths)
45	M	College	College	28	17	52	NA
47	M	High school	College	6	12	55	NA
47	M	Middle school	High school	5	11	34	14
47	M	Middle school	Middle school	9	13	39	15
51	F	Middle school	Elementary	0	9	15	9
52	F	Middle school	Middle school	215	24	59	NA
54	M	College	College	35	17	47	NA
56	F	Middle school	College	0	9	19	10

Table 2 | **Inventario data for children with Down syndrome from Mexican Public Schools.** Gesture age that is marked as NA is because score has reached ceiling.

Task	Object	Request expected
1	Pop-up with four buttons that are pressed, slid or turned to get an object to pop out	Ask for help in moving the buttons as they are difficult to manipulate
2	Lego box with small pieces to assemble	Elicit help in assembling the pieces
3	Farm house with insertable animals in spaces shaped like the animals. Animals fall onto a truck and a button needs to be pushed to get them out	Elicit help in putting the animals in place and getting the truck out of the farm
4	Big transparent container with objects inside and the cover is on tight	Elicit aid in opening the container
5	Insertable pyramid with plastic tubes that are ordered by size and out of reach of the child	Elicit help in placing the tubes in order and requesting each tube that the researcher has
6	Wooden puzzle with a few pieces that is assembled and then disassembled	Elicit aid in finding the place for each puzzle piece
7	Insertable necklace of wooden pieces and a thick cord. Pieces are out of reach of the child	Elicit help to insert the wooden pieces on the cord and ask for pieces

Table 3 | Request elicitation task

Because of their extremely low vocabulary production levels, Inventario 1 was used for Marco and Emma. As all the children fell above the maximum age of the norms of the Inventario, percentile scores are not reported and language equivalents were calculated as suggested by Thal et al.^[33], Fenson et al.^[29] and Jackson-Maldonado et al.^[28]. However, language equivalent scores must be taken with caution and only as developmental estimates, because of large age differences. Gestures were classified according to the Inventario Manual subcategories. Early gestures were the sum of sections A and B and were communicative (pointing, shaking head to say no, routine games).

The request elicitation task was created as part of a student Bachelor of Arts thesis (of the second and third authors) and, thus, is exploratory in nature and no conclusion as to its usefulness as a request tool is established. It consisted of a scripted interaction with several toys. Seven tasks included actions in which the child would have to request assistance using age-appropriate toys and activities. The goal was for the children to use either deictic (give the object), representational gestures (do a gesture of trying to open something) or, if they preferred, words. The children used very scarce productions of representational gestures thus, they will not be reported on. No verbal requests were solicited per se, but the children did use words and proto-forms. TABLE 3 describes the tasks, objects, and requests expected. All of the sessions were videotaped and double coded for reliability analysis. Actions were identified as being verbal or non-verbal. Types of gestures used were described. Productions were further classified as gesture only, verbal only, and/or combinations of both.

Procedure

Parents or caregivers were contacted through the Special Education centres and were invited to participate in the study. If they accepted, they were asked to fill out consent forms and the Inventario on the first visit. Children were seen in the university laboratory for approximately 40 minutes. The first part of the session consisted of a warm up in which the researcher showed the child some crayons and a drawing, a set of cards and animal picture books. The children were invited to draw a picture. The second part was the request task. The researcher showed the child a series of objects (see TABLE 3) in order to elicit requests. All of the items were shown one by one and were manipulated by the researcher, who set the objects out of reach of the child to elicit the child's requests. For instance, a big container with attractive objects inside was placed in front of the child. The researcher would say, "mira esto" (*look at this*) and move it around to attract the child's attention. The child was expected to request that the container be opened by a 'twisting' gesture, by handing it to the researcher, by taking the researcher's hand to try and open it or by some verbal means. Tasks were presented to each participant in random order.

Coding

Gesture coding followed the Thal and Tobias^[38] criteria to determine whether gestures and words were communicative. Iverson, Capirci and Caselli^[39] criteria were applied for gesture types. Thus, gestures (and words) were considered to be communicative if there was eye contact with the other person or a clear intent to direct the other person's attention to the object. Gestures could be both deictic and representational. In this project, most forms were deictic. That is, they designated an object or event by touching it or indicating it, with no specific semantic content. Although, by nature, not all deictic forms are requests, gestures that accompanied a proto-imperative type action 16 or verbal production (asking for help, giving something with a verbal request, pointing accompanied by giving or requesting) were counted as requests. Thus, although pointing usually designates existence or attention to an object when it accompanies giving or a verbal request, it is considered a request.

Five types of deictic gestures were established. Four of these have been previously described in the literature: *showing, pointing, giving, ritualised requests*, and a fifth form had not been previously mentioned, *take hand of other*. Following Iverson et al.^[39], 'showing' was when the child held an object up to the adult's level of vision. 'Point-

ing' was when the child extended the index finger towards an object or event or when the child tapped or touched the object or location with a finger. Although pointing usually depicts the object it may also be a request depending on the context. 'Giving' consisted of an extension with object in hand towards the other person. 'Ritualised requests' were hand or arm extensions with repeated opening and closing of the hand. 'Take hand of other' was when the child would take the hand of the other person to the object or the event the child wanted. Finally, there were also few occurrences of a type of representational gestures, the conventional *nodding* to say "yes", but they were so infrequent they will not be presented. Only gestures that were used as requests or as part of a request were analysed.

Productions were classified as non-verbal forms produced alone, verbal forms produced alone or *combinations* that could consist of a sequence of non-verbal forms only or verbal and non-verbal forms. Verbal combinations were further classified by the type of information conveyed^[41]: *equivalent, complementary or supplementary*. Most combinations were *crossmodal* (with gestures and verbal components), although *unimodal* (gesture-only) combinations were also classified. Equivalent Combinations consisted of a word and a gesture of the same referent. These did not occur in our corpus. Complementary forms also had the same referent, but one element provided non-redundant information by giving distinctive features (point + 'uno' *one*). In the Supplementary combinations one of the elements added information to the other (point + 'caliente' *hot*). Combinations of verbal forms did not occur either, so counts are not given.

Verbal utterances consisted of proto-forms or words and/or frozen phrases. All utterances that were similar to the target word were counted as words ("pelaqui" meaning 'ponlo aquí' *put it here*). As in Bates^[11] and Jackson^[40], for Spanish, verbal proto-forms were utterances similar to vocalisations (such as 'ah', 'eh' or 'ta'), but with clear communicative intent. Proto-imperatives were similar vocal productions to proto-declaratives accompanied by gestures, rising intonation and/or eye contact to achieve a goal or receive assistance from an adult.

For reliability, all samples were transcribed and double coded by the two last authors of the study until 100% agreement was reached. Before reliability disagreement was 88%. Disagreements were resolved by reviewing the rules for each type of gesture and reviewing the video tape.

Results

The purpose of this research was to describe the use of verbal or non-verbal requests in an elicitation task. These requests were further analysed to determine whether they were used in isolation or in combination. The relation between types of requests and language level was also analysed. First, a description of the participants by language level is given. Comparisons are made to two groups: a control language group and a small group of children with Down syndrome from a similar school environment. These comparisons were made to give a more concise picture of whether language delays were specific to children with Down syndrome and/or children with Down syndrome from lower income families who go to Mexican public schools. Then, results of the request task are shown, first by individual children and then demonstrating group profiles. As data are for only 4 children in a task with few productions, only general descriptive data will be presented.

The language level of each participant was calculated by counting the total number of words produced on the Inventario and calculating language equivalence according to the guidelines of the test manual (see TABLE 1). The Inventario 2 was used for Danielle and Freddy and Inventario 1 for Marco and Emma. As it has been shown in previous research in other languages^[4,34] scores were highly variable both for age equivalence and total number of words. Levels for word comprehension and late gestures and total number of gestures exceeded ceiling levels for the Inventario norms (of 18 months) and thus, are not presented here.

Vocabulary and gesture data was compared to a group of typically developing children from a similar socio-demographic background. These children were much younger than the Down syndrome group for reasons exposed above. Controls were selected according to the language age of each child with Down syndrome to the closest age possible. As can be seen in TABLE 1, vocabulary scores are also quite variable. However, all fell above the 35th percentile in vocabulary production.

The controls for Danielle and Freddy, the two oldest children, had vocabulary scores of 281 and 506 whereas their pairs had scores of 247 and 274 (considering that controls were almost 6 years younger). The language control for Marco had a vocabulary score of 191, compared to 61 words and for Emma who was reported to produce 9 words, the control produced of 7. Once again, note that the age differences were almost 7 years in the first case and 5 years in the second. Except for the youngest participant, who was 12

months old, all had reached ceiling in gesture use, whereas only Marco had reached ceiling in the experimental group.

These data illustrate that children from a similar socio-demographic environment do not lag far behind their middle class peers in vocabulary and gesture use. It could be that the schooling environment or parental attitude towards development in this socio-demographic group may explain the delay in this group of children. To answer this, a comparison was made to other children with Down syndrome from a similar school environment.

In TABLE 2 a summary of vocabulary production data for a group of children with Down syndrome who are somewhat younger is given. In this table it can be observed that children with Down syndrome who are between 4 and 5 years of age (a year above the limits of the norms of the Inventario 2) all have language ages that are 3 and 4 years below their chronological age. Thus, at a younger age than the children from the present study, this group still falls considerably behind their age in vocabulary and in most cases, in gesture use as well. It may be that this delay accumulates with age, as the data of the 4 children in this study fall 6 and 7 years behind in vocabulary production. However, it must be remembered that these are all estimates as all ages far exceed the norms of the instrument. They may only be taken as estimates of delay.

What can be observed is that although the children with Down syndrome have chronological ages between 6 and 8 years, vocabulary production language equivalent scores on the Inventario were very low, between 12 and 25 months, and total number of words varied between 9 and 274 words (out of a total of 428 on the Inventario 1 and 680 on the Inventario 2). Danielle and Freddy had language equivalent scores of 25 months (274 and 247 words). Language equivalent scores, from the Inventario 1 were 17 months for Marco and Emma, despite being 73 months old and 12 months (61 and 9 words) respectively. Thus, language equivalents for vocabulary production for all participants fell many years below their chronological age. Language delays oscillated between approximately 61 months, for the youngest participant, Emma, and approximately 70 and 81 months for the other three participants. Therefore, all 4 participants had language level equivalents similar to the one word stage or beginning word combinations despite their being school aged children.

Because of ceiling effects of other sections, only early gesture data could be analysed. Different measures that address gestures in older children would be required to describe later gesture use.

Marco was reported to use 20 early gestures, which is at ceiling (18 months). Danielle, Freddy and Emma had age equivalent scores of 13, 14 and 16 months, respectively. The fact that only early gestures had not reached ceiling effects could sound contradictory, but an explanation for this could be offered. It is possible that parents reported less early gestures because as vocabulary increases, gesture use decreases as Bates et al.^[11] and Inventario norms^[28] have suggested. Both words and more representational gestures could have taken their place. Thus, it may not be the case that they have a reduced repertory of early gestures, but that they no longer need to use them. Therefore, data from this section must be taken with caution. It may not be the case that children use less early than late gestures, but that the measure cannot give an adequate account of gesture productions at these ages. Thus, the gesture use in the elicitation task may be more representative of the child's gestural ability.

Requests by participant

Types and tokens of the different requests, types of combinations, and examples of the elicitation tasks are presented by participant in TABLE 4. All forms that were combinations were complementary (gesture + new referent), therefore, other types of combinations will not be described. Types of productions are marked as follows: non-verbal or gesture forms are "G", words are "W", proto-forms are "P". Combinations of these are coded with a plus sign, "G + G" (two gestures). In the second column non-verbal forms that appeared in isolation are given. In the third column verbal productions in isolation are presented. All types of combinations appear in the fourth column: gesture + gesture ("G + G"), gesture + verbal combinations of words or proto forms ("G + W or G + P"). Combinations consisted of two or more productions and, frequently, forms were repeated in a sequence. Not all examples are given. Instead a rule or formula for the types of utterances is exposed. Codes appearing in parenthesis mean that the sequence optionally could have these forms. Thus, W (W) +G means that there were both combinations of word + gesture and/or word + word + gesture.

As shown in TABLE 4, Danielle used the least number of requests of the 4 participants, only 2 types and tokens, and Emma appears to be the most productive, using 20 types and 43 tokens, but all combinations were merely repetitions of the same word, thus artificially inflating the count. Differences among participants were not only quantitative, but qualitative as well.

Danielle used 2 combinations and 1 isolated non-verbal form. The only gesture she used was

Participant	Non-verbal isolated Type(tok)	Verbal	Combinations	Examples
Danielle	Give	0	W + G	Yo no pedo 'I can't' (frozen phrase) + give
TOTAL:	1 (1)		2 (2)	
Freddy	Give	Más	W (W') + G W W + G W W (W') W + G W W (W') + G + G W (W') + G + G P (P') P + G	Uno 'one' + give, más más 'more'+ request Am 'yum' uno 'one' + request Eo 'want' más más 'more' dame 'give me'+ request No 'no' más más 'more' + give + request Pelaqui pela 'put it here' + give + point Ah ah leto + request
TOTAL:	1 (1)	1 (1)	14(18)	
Marco	Give Ritualised request	Ma (más)	W (W') + G P + G W P (P') + G W + G + G + G	Más más 'more'+ request, tú 'you'+ point Eh + point Más 'more' ah ah + point Tú 'you' + point + give + nod
TOTAL:	2 (2)	1 (2)	11 (16)	
Emma	Give Ritualised request	0	G + G P (P') + G P (P') + G + G P W (W') + G W (W') + G + G P + G + G + G	Give + point Ah + give, ta tapta + give Ta + give + point, ah ah + request + point Ah éte éte 'this' + request Éte éte 'this'+ point + request Ah + give + request + point
TOTAL:	2 (5)		20 (43)	

Table 4 | **Results: Types of verbal and non-verbal requests.** G= gesture, (G) second gesture optional and/or repetition of first gesture, G+G= two different gestures.

W = word, (W) second word optional and/or repetition of first word, W +W = two word utterance with different words.

P= verbal proto form (ah, eh, etc), (P) – second proto-form optional and/or repetition of first one, P+ P = two different proto-forms.

give, but her verbal productions included a frozen phrase, “yo no pedo (puedo)” *I can't do it*, that was counted as 1 word. Her longest ‘utterance’ included 2 elements: a word and a gesture

Freddy used the most sophisticated verbal forms and combinations in a total of 20 requests. His vocabulary level, according to the parental report, was also higher than both Marco and Emma. He used an isolated verbal form, “más” *more*. Most of his productions (90%) were combinations, and only 5% of the requests were verbal or isolated non-verbal forms. The variety of forms can be seen in TABLE 4. Most productions were recognisable words or phrases, such as “pelaqui (ponla aquí)” *put it here*, “yo no pelo (puedo)” *I can't do it*, “uno” *one*, “no” *no*, “más” *more*, “palela (ábrela)” *open it*. Only one proto-form, “ah” was used. Combinations consisted of isolated words, repeated words, combinations of words plus most kinds of gestures. He produced many different types and utterances were of different lengths. His longest utterance consisted of 4 words (one repeated) and a gesture or 3 words (1 repeated) and 2 gestures.

Marco also produced a total of 20 requests, but with less variety of verbal forms. Most were the same form: “ma (más)” *more*. He also used proto-forms “eh” and “ah” in his combinations. Again, most of his requests (80%) were combinations, with more isolated verbal and non-verbal forms (10% each) than Freddy. Marco’s longest utterance was with 4 forms: 1 word, 2 proto-forms and 1 gesture or 1 word and 3 gestures.

The youngest participant, Emma, produced

more requests than the others, but with less elaborate forms. She used a total of 48 requests, but most were deictic words, “éte (éste)” *this*, “te (ten)” *have this*, or protoforms “ta”, “ah”, “tapta”. Similar to all other participants, most of her requests (89.5%) were combinations. Emma’s combinations were of a maximum length of 4 elements: 1 proto-form, 2 words and a gesture, 2 words and 2 gestures or 1 proto-form and 3 gestures. Again, her word combinations were always repeating the same word.

No single activity out of the 7 that were presented to the participants appeared to be a more suitable means of eliciting requests than the others. Some participants used more requests in one task, while others used more in another task.

Summary of gestures of all participants

Although these are only case studies, patterns across the four children can be observed. Results may not be generalised because there are so few participants and normal controls were not included. FIGURE 1 depicts the use of different kinds of gestures across all participants. Pointing, giving and, ritualised requests appeared with similar frequencies, 31.19%, 33.9%, and 26.6% (or 34, 37 and 29 mean number tokens) respectively, out of a total of 109 (the figure does not include less frequent gestures, thus the sum does not equal 109). Showing was used only 1.83% (2 occurrences) of the time.

If taken together, all participants used more

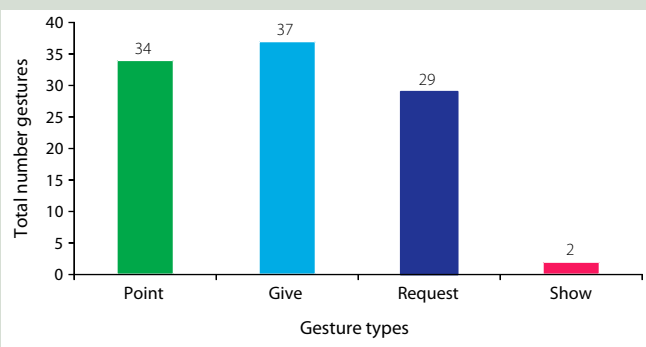
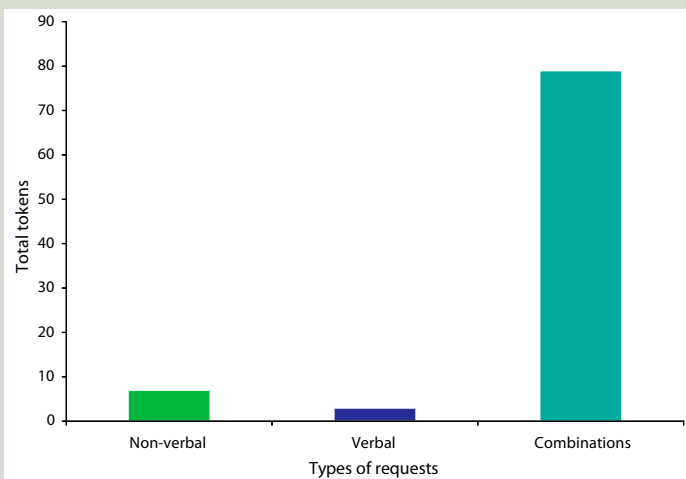


Figure 1 | Total number (occurrences) of types of gesture for all participants

Figure 2 | Total number of tokens verbal, non-verbal and combinations. Tokens refer to the total number of times each gesture was used, either in isolation or in combinations.



combinations than isolated non-verbal forms (see FIGURE 2) with different types of combinations that were between 2 and 5 elements long. Only the two boys used more isolated verbal forms: either 'más' more or 'tú' you.

FIGURE 2 depicts all (tokens) isolated non-verbal, verbal, and combinations. As can be seen, in isolation, participants used a similar number of non-verbal and verbal requests, but overall, most requests were used in combinations. As stated earlier, all combinations were complementary and only two participants used proto-forms.

Discussion

The goal of this paper was to determine whether children with Down syndrome use verbal, non-verbal or combinations of both to request objects or events in a controlled situation. All participants in this study were very delayed in their language production; they were all above 6 years of age yet their language equivalent scores were between 1 and 2 years of age. Children were from very low income families and attended Mexican public schools for children with developmental disabilities.

Results showed that non-verbal requests were principally of three types: pointing, ritualised requests and, to a lesser degree, giving. All forms were used in combinations and only ritualised requests and giving were used in isolation. Few verbal forms were observed. As expected, the participant with the lowest language level used more proto-forms than the others. She was 6;1 with a language-equivalent age score of 12 months. Thus, in the absence of words (as manifested by vocabulary level), this child uses proto-forms as has been shown in other populations and in typically developing children^[9,16].

The results of this research support Caselli and colleagues^[11] proposal, and extend it to Spanish-speaking children. Children with Down syn-

drome experience some delays in their language development and, as a result, tend to use non-verbal communication as a strategy to compensate for their linguistic deficits. Participants used many more gestures than verbal productions and the types of words used were very limited. This finding also supports Caselli et al.'s suggestion that gestures are used for a prolonged period of time, especially deictic gestures and more sophisticated combinations. As Zampini^[6] has proposed, a gesture advantage may be a speech disadvantage.

Despite low vocabulary levels in all participants, combinatorial forms were highly frequent and distinct from what has been reported in most typical language development studies^[3,39]. Combinations were longer and of different types than those reported on in previous studies. Participants used up to 5 elements in a given combination and combinations were not equivalent, but were complementary. Most typically developing children who are beginning to combine words at around 24 months use one word or phrase and one gesture per utterance. These children had longer 'phrases' than what has been reported both for oral language in typically developing^[41] and gestures in children with Down syndrome^[13]. The children appear to compensate for their low vocabulary levels by using longer combinations with several gestures or, moreover, have increased the length of their utterances by means of gestures rather than words. These combinations seem to have taken the place of utterance length in language production.

Further, the types of combinations were also different. Iverson and colleagues^[3,39] found that children with Down syndrome used equivalent forms and typically developing controls used complementary forms. In this study the 4 children used mostly complementary forms. Information was not repeated and new information

was added with each element.

Combinations were mostly with several gestures and words, but two participants used proto-forms. This high tendency to use long combinations follows the pattern of what typically developing children would do with words, but in this case it is with gestures that are mostly deictic. Thus, there is a tendency to combine forms and information, but these children with Down syndrome lack the ability to transform non-verbal forms into words in order to develop syntactic skills.

Previous research^[10,21,22] has suggested that the delay of requests in children with Down syndrome may explain why language production is also late. Data from this study do not support a request delay, but, rather suggest that requests are frequent and produced in a gestural modality rather than in the verbal modality. It may be the case, as suggested by these authors, that verbal requests may aid in the future language development. It is possible that gestural requests do not aid in the same way. This could explain why this group of children, despite having requests in their communication repertoire, has not developed oral language to a greater degree. Further, although they use long 'utterances' or combinations, their phrases are primarily gestural. Their language has not evolved, as typical language development does, into word combinations and instead has remained in a non-verbal format. So, although these children have basic communicative functions that have been shown to be important for language development, such as communicative intent and requests, the process to oral language has not been successful.

No clear pattern between vocabulary level, number and types of request and types of combinations was found. The oldest participant, Freddy, with a language-equivalent age of 25 months, used longer utterances with a larger variety of words or frozen phrases. Danielle, also with a language equivalent age of 25 months, used the most restricted variety of both unimodal and combinatorial forms. Thus, language equivalence did not explain all request productions. Emma, who was the youngest and had the lowest language-equivalent score, was highly creative in her request types. She used many forms and her combinations contained more than two elements as well. However, as stated above, her verbal forms were mostly proto-forms. Finally, Marco, who also had a low language level, used up to 4 forms in a given combination, but with a very restricted verbal vocabulary. Thus, no clear pattern was found for the types or forms of requests in relation to language level. What is outstanding is individual variability and that all participants

used non-verbal requests in combinations with a restricted variety of verbal forms.

This study does not address socio-cultural issues per se, but the low language levels could be explained by the fact that all four participants are from low socio-economic level groups and one is an orphan. Most of the reported literature on children with Down syndrome is from middle and upper middle class families. Many studies have shown that a low SES background may have a negative effect on language development in typically developing children^[26,27,42]. Thus, the issue of the impact of socio-economic status and, as a by-product, the type of school attended, needed to be explored. The participants were compared to a group of typically developing children from a similar SES background and to another group of children from a similar school setting. The group of children in this study, as many others in Mexico, are from low SES homes, live in an environment in which there is little development stimulation in general and less than adequate educational programmes. In most reported studies of children with Down syndrome, participants do not have such low vocabulary levels and extensive use of gesture combinations.

When the group was compared to children from a similar socio-economic background, who were language age controls, and thus many years younger, the controls were not below in vocabulary production and gesture use based on the Inventario norms. Thus, SES per se could not explain the extreme delay. Still, as Stefanini^[7] has shown, it is hard to compare children with Down syndrome to younger controls because the relation of gesture and vocabulary changes with age and the importance of vocabulary level also changes with age^[11]. Thus, vocabulary levels for an 8 year old are different than for a 36 month old.

In order to partial out whether this group of children is different to other Mexican children from similar backgrounds, data showed that all children with Down syndrome in a similar setting fall way below Inventario norms for younger children and usually are several years behind. Therefore, it seems to be the case that most children in Mexico with these characteristics may not be benefiting from the school intervention at optimal rates. This study contributes to our understanding of the effect of extreme socio-economic disadvantage on the development of children with Down syndrome.

Findings from this study lead to the conclusion that these participants, like similar children from other cultures and languages, use more non-verbal than verbal forms to request objects and events. Their verbal language has not emerged

despite their age; instead they compensate by using long combinations of multiple gestures with few words or proto-forms.

The results of this study, potentially, have strong clinical implications. As Yoder and colleagues have shown^[14,15,36] non-verbal forms may be an effective means to facilitate communicative development. Thus, requests in the non-verbal modality, could be used to stimulate language production. We have shown that children with Down syndrome, despite a lack of isolated verbal forms, have begun to make combinations of request forms that include verbal counterparts. It

is suggested that the non-verbal request base be used as a stepping stone towards verbal communication by stimulating first proto-type productions and then words to communicate signalling and requesting events and objects. These verbalisations should include both demand type word phrases such as “give me”, “don’t”, “open” and “I want” as well as the object requested: “toy”, “bike”, “ball”. This combination of verbal and non-verbal forms may be an efficient instrument to motivate vocabulary development and language production.

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