

**Using an observational framework to investigate adult language input to young children in
a naturalistic environment.**

Running Title: Investigating adult language input to young children.

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Abstract

The correlation between the communicative intent of parents, in terms of their expectation of a response and the response patterns of young children aged 23-25 months during parent-child interactions was investigated. An Observational Framework was used to code these parameters in interactions between 36 children and their mothers. The children were assigned by cluster analysis to 'advanced', 'typical' and 'delayed' language groups and their responses were coded with respect to the degree of correctness or appropriateness within the interaction. Differences in both the parental response expectations and the children's response patterns across the three clusters are discussed.

Introduction

Communication is an interactive process. Therefore, in investigating the communication skills of young children, it seems logical that developmental studies of such an interactive process should themselves be interactive in nature. Where previously the nature-nurture debate has dominated the relevant literature, increasingly the importance of interaction in language development is being recognized (see for example, Baron, 1990; Pine, 1994). Furthermore, the concept of responsiveness of carers to children is now recognised as one of the most important factors in facilitating language development. This implies that where previous study has focused on the internal semantic and syntactic structure of parent language input or child-directed speech (CDS), it may also be valuable to investigate the overall intent of this input based on the pragmatic context in which it is produced.

Due to the foci of previous work, there is a large body of literature that describes the characteristics of parent language input, in particular, the phenomenon of CDS or ‘motherese’ (see McLaughlin, 1998; Rondal, 1981; Wells and Robinson, 1982 for reviews). Similarly, there is a weight of evidence supporting the innate language acquisition device described by Chomsky (1965). It appears however, that the process of language development is less straightforward than these reports would suggest (Pine, 1994), with contingent reciprocal interaction now being described as integral to the process of language development.

Furthermore, parent language input has typically been investigated by comparing the mother-child interactions of children with ‘normal’ language development and those described as ‘late talkers’ (i.e. children with delayed language development). Although such research contributes

greatly to the knowledge base regarding both typical and delayed language development, the subgroup of children who display 'advanced' language skills has not usually been included. The present study therefore investigated how parent language input influences, and is influenced by, language development along a continuum including this third group – 'advanced talkers'.

As previously stated, children with advanced language development are a subgroup on a continuum which largely remains unstudied. As yet there are no prescribed definitions for 'advanced talkers' in the developmental language literature. Therefore no specific linguistic markers have been described to distinguish 'advanced talkers' from children whose language is typically developing. This paucity of information is surprising, given the established knowledge that parental input is frequently determined by the child's linguistic development.

Researchers have, however, attempted to identify the specific characteristics of maternal speech that appear to promote language development most significantly (i.e. that may lead to an 'advanced talker'). The general consensus is that engagement in conversation with an interested adult is more important than any specific style or technique employed by the parent (Snow, 1977; Howe, 1981; Pine, 1994; Rescorla and Fechnay, 1996;). Therefore, parental responsiveness would seem to be a crucial factor for beneficial conversational interaction to occur. Such responsiveness is described as 'the rate at which carers respond to a child's gestures, vocalisations or other communicative acts' (Yoder and Warren, 2001, cited in Bochner and Jones, 2003: 41). These and other similar reports have informed many of the indirect language therapy programmes now used by speech pathologists. Under those models the aim is to teach parents to facilitate language development through enhancing the quality of the communicative interaction in naturally occurring contexts (Baxendale and Hesketh, 2003). These authors also

reported that there is considerable evidence to suggest that particular parental input styles may be associated with more advanced syntactic and vocabulary development. What remains unknown, however, is the type of responsiveness most facilitative of 'advanced' language development, and whether parents' response requirements are related to more rapid language development in their children.

It is now widely accepted that at two years, children with typically developing language display the following characteristics: an average vocabulary of 200 to 300 words; the understanding and use of two-word utterances; the ability to request information, answer questions and to acknowledge the communication of others around them (Paul, 2001). Late talkers are generally defined as children who are producing fewer than fifty words and/or limited word combinations by 24 months of age. As a definitive description of 'advanced' language development is not yet held, it is typically determined by intuitive and/or individually and arbitrarily set criteria.

These difficulties in describing children's language abilities are also pertinent to another well researched aspect of the interactional process – how the majority of mothers communicate with their children. 'Motherese' or CDS is characterized by slower, clearer, shorter, simpler and more fluent utterances with fewer false starts and hesitations and with frequent repetitions of words, phrases and whole utterances. Research has revealed that it also tends to be higher in pitch with more exaggerated rising tones and intonation patterns. To date, however, there has been limited reporting of the overall *intention* of the utterances produced by parents, except that it is generally accepted, as Snow (1977) reported, that the content is restricted to the immediate context of the interaction. The information available is further restricted as such investigations have focused only on children's responses to parents' utterances or communicative acts for which a response

was required (Girolametto *et al.*, 1999; Girolametto, 1997, cited in Paul, 2001). Responses offered by children when the parent's utterance did not require a response, such as in the case of commenting, have only rarely been considered.

Marinac (2000) provides an example of an Observational Framework to permit objective, quantitative data collection for the response expectation of adult input during adult-child interactions. In that framework, the intention underlying adult input is categorised according to the adult expectation of a response. Therefore, adult utterances can be classified as either requiring a response or as not requiring a response (rhetorical questions, statements, comments, etc.). See Appendix. This initial work revealed, to some extent, the natural response intent patterns of the adult input addressed to children aged three through to four years. As far as is known, no similar instrument has been described in the literature for investigating the communicative intent of adult input in terms of response expectation. In contrast, the *response* patterns of parents have been described and categorised, for example, as 'compliance' with the communicative act of the child; 'linguistic mapping' of the child's utterance; 'seeking clarification' or 'imitation'. Once again, however, children's ability to *respond appropriately* to their parents' *communicative intentions*, and whether these vary depending on the language skills held by the child, still remain unexplored.

Due to the interactive nature of adult-child communication, the response expectation of the adult, as communicative intent, has traditionally been placed in the area of pragmatics (as the study of language use) in the language acquisition literature. This 'use' is frequently described in terms of speech acts and, in the area of developmental language, primarily describes the child's communicative intent (McLaughlin, 1998). Where previously, speech acts have formed an

indication of the communicative abilities of children developing language, it is now of interest to examine how parents contribute to this process through their response expectations as part of their communicative intent in talking to children.

There is some debate in the literature on whether differences exist between the speech parents address to their children that are dependent on the child displaying typical or delayed language development. Some authors have suggested that parents of late talkers use a more directive communication style in an effort to elicit language, whereas others indicate no significant differences between parents' styles of input (Baxendale and Hesketh, 2003). Of particular relevance in discussing the language input of parents to their children with delayed language development however, is the notion that language influences are bi-directional (Baxendale and Hesketh, 2003). This infers that while parental language may influence their child's language development, the rate at which a child is developing language may in turn exert some influence over the style of input the parent provides. Much of the current knowledge base about parent-child language interaction therefore focuses on how parents influence their child's language. Very little definitive investigation has been conducted to describe the aspect/s of the child's degree of language development that impacts on the parent's language input during conversation.

The present study investigated the effects of communicative expectation in parent-child interactions with regard to: the impact of the child's language development (i.e. advanced, typical or delayed); differences in the response expectation of parents' utterances; children's response patterns in terms of the degree of correctness/appropriateness or the level of the child's ability to respond.

Hypotheses

The following hypotheses were investigated:

- clear differences in the response expectation of the parent's utterances would be evident between the parents of children with delayed and typical language development;
- more pronounced differences in the response expectation of the parent's utterances would be evident between parents of children with delayed and 'advanced' language development;
- differences would be evident in the child's responses that would reflect their current language status (i.e. advanced, typical, delayed).

Method

The study received ethical clearance from the Behavioural and Social Science Ethics Review Committee at the University of Queensland.

Participants

Thirty-six (36) children and their mothers participated in the study. Recruitment of the participants was through local childcare and playgroup centres, with consent from the centre owner or director being obtained. All parents of children attending the centre, who were within the specified age range and who met the inclusionary criteria were invited to participate. The criteria were that the children: must not have had any previous speech therapy/pathology input;

have no known medical or neurological deficits; have normal hearing. The children were all aged between 23 and 25 months of age.

From the parents who agreed to their child's participation in the study, three groups of children were identified. Given that that no gold standard exists for such group memberships, the children were initially assigned to either the delayed cohort on the basis of having a vocabulary of less than 50 words and/or producing limited word combinations. The 'typical' cohort was defined on the basis of both vocabulary and Mean Length of Utterance data with greater than 50 words and MLU +/- 1.0 SD for age (i.e., 1.47-2.37, Miller, 1981) being required. For the advanced cohort, group membership was defined on the basis of the MLU score alone with a score that was greater than + 1.5 SD for age (i.e., >= 2.6) being required. These preliminary groupings were based on the number of words reported by parents on the MacArthur Communication Development Inventories (MCDI) (Fenson *et al.*, 1993), and confirmed by word counts and MLU ratios calculated from language samples taken from video recordings of each child in conversation with their mother. Extensive language assessment as detailed below revealed that no child in this part of the study had a receptive language difficulty.

Measures

The observations of interactions between the children and their mothers were analysed and the child's language and play abilities were determined by: the MCDI; analysis of a video-recording of the child in a free-play interaction with their mother using the Computerized Profiling system (CP., Long, S. H., Fey, M. E. and Channell, R. W., version 9-5-0, 1 December 2003); the Symbolic Play Test (Lowe and Costello, 1988); the Reynell Developmental Language Scales-III

(RDLS-III) (Edwards *et al.*, 1997); the Rosetti Infant-Toddler Language Scale (Rosetti, 1990), completed by parent report; an Observational Framework (Marinac, 2000).

(Insert Table 1 here)

The psychometric details of the assessment instruments are presented in Table 1. The MCDI, RDLS-III and the Symbolic Play Test are formal standardised assessments. The Rosetti Infant-Toddler Language Scale provides no information on its reliability and validity and thus is not a standardised assessment. These measures were chosen since they are widely used clinically and allow for a variety of methods of assessment (i.e. direct, observed/elicited, parental report). The Symbolic Play Test was chosen as play gives an indication of normal global development.

Procedures

Assessments and video recordings were carried out with the children in their own homes between the hours of 9.00am and 12.00noon where possible, with the MCDI being completed by parents prior to the visit. Before the formal assessments were administered, video recordings were made of the children in naturally occurring free play with their mothers using a set range of toys provided by the researchers. For the video recording, a Panasonic NV-VX 7/SA (VHS-C) video camera with Fuji SHG VHS.C film was used. Recordings were for fifteen minutes with an additional five minutes of pseudo-recording where no actual footage was taken to allow participants to become accustomed to the presence of the researcher and the video-recording conditions.

This paper describes the mother-child interactions recorded in the videos, as analysed according to the Observational Framework developed by Marinac (2000). This includes an adult utterance taxonomy to code utterances directed to the child and a child response taxonomy to reveal the nature of the linguistic responses that the child makes to those utterances (Marinac, 2000) (see Appendix). Adult utterances were coded as one of:

Response Required (RR) where the adult clearly demonstrated that a verbal or non-verbal response was expected, marked by either a rising final intonation pattern or by the linguistic content/structure of the utterance.

Response Not Required (RNR) where the adult input was a comment, statement, or rhetorical question marked by a falling intonation pattern or through the linguistic content of the utterance.

Child responses were coded as one of:

Compliance if the child's response met the adult's response expectation and was appropriate in the situation.

Valid if the child's response met the adult's response expectation but was not appropriate in the situation (e.g., if an adult asked "Can you open the door?" , intending that the child should actually open the door, but the child responded "Yes" rather than performing the action).

Acknowledgement if the child verbally or non-verbally indicated that they had been spoken to but without attempting a response (e.g., if the child made eye contact with the adult).

Inappropriate if the child responded but the response was not appropriate under any circumstances and/or did not meet the adult's response expectation (e.g., if asked to "Open the door" the child responded by sitting on the floor).

Ambiguous if the child's response could not reliably be assigned to any other category, or

No response if the child gave no indication that they had been spoken to by the adult.

The children's responses were recorded according to the type of adult utterance that initiated the response (e.g. compliance in the RR condition, or valid in the RNR condition). Although additional specific response categories are given in the framework, in the present work any utterances or responses which may have belonged in the other categories (e.g. *other directed*, *non-specific eye gaze*) were coded as 'other' (this due to the very small number of such occurrences). No further analysis or reporting was undertaken with these data.

Cluster analysis was used to confirm the participant groups as 'advanced', 'typical' or 'delayed'. This analysis was based on percentile rank scores on the MCDI; the expressive language percentile rank scores on the RDLS-III, and the expressive language ages from the Rosetti Infant-Toddler Language Scale. The study cohort was then assigned to groups according to the cluster analysis and the characteristics of the mother-child interactions were compared across these clusters.

Reliability study

Following the initial administration of the framework, the videos of three participants were rated by a trained examiner for inter-rater reliability. Agreement percentages were calculated in terms of 'agreement over agreement plus disagreement x 100'. Agreement between the trained examiner and the original examiner was 60.38%. Similarly, three of the videos were re-rated by the original examiner at an interval of two months for intra-judge reliability purposes. Agreement between the two ratings by the original examiner was 70.22%. These reliability figures are acknowledged as being low but appear to reflect the practicality of using the on-line Observation

Framework with video-taped data wherein details were not always clearly available. In her doctoral study, Marinac reports interjudge reliability for the coding of 122 child responses as 91%, and for the response expectation in parental input as 96%. It is recommended, therefore, that the use of the Observation Framework with video-taped data be undertaken only with extensive practice being completed prior to analysis and that on-line data be gathered whenever possible.

Results

All statistical analysis was undertaken using the Statistics Package for the Social Sciences (SPSS Student Version for Windows, Release 11.0, 2003).

Cluster analysis, as previously discussed, was used to group the children by language development. This analysis clearly distinguished the following groups: cluster 1 as the 'delayed' group ($n = 12$); cluster 2, the 'typical' group ($n = 13$); cluster 3, the 'advanced' group ($n = 11$).

The transcript data for the parental language input were analysed by MLU and number of sentences per turn using the Computerized Profiling system. The means, standard deviations and median scores for the parent data were obtained for each cluster and are recorded in Table 2.

(Insert Table 2 here)

Raw score child data using the Observational Framework were converted to percentages of utterances in which each response type occurred. The RNR inappropriate response type was eliminated from the data analysis, as only one child in the study was observed to demonstrate this

behaviour, and this may have affected the results of the data analysis. The means, standard deviations and median scores for the converted data were obtained for each cluster and are recorded in Table 3.

(Insert Table 3 here)

The effects of language development on the mother-child interactions across the three clusters were investigated using the Kruskal-Wallis test. According to this analysis, there were no differences in the parents' language during the interactions across the three groups on the measures of MLU and sentences per turn (see Table 2).

The results of the child analysis showed significant differences across all three clusters for the *RR compliance* and *RNR valid* response categories. This suggests that the percentage of compliant responses when a response was required was lower for children in the 'delayed' group than the other two groups studied. In addition, the evidence suggests that children in the 'delayed' group provided valid responses when a response was not required less frequently than children in the 'typical' and 'advanced' groups (see Table 3).

A series of Mann-Whitney U analyses further investigated between-group effects, which may have been masked when comparing all three clusters simultaneously (see Tables 4 and 5). For the parent measures, a significant difference was observed between clusters 1 ('delayed') and 2 ('typical') for the number of sentences per turn. The mothers' number of sentences per turn was significantly higher in cluster 1, however this relationship was not strong. No other significant differences were observed between the clusters on the parent data.

(Insert Table 4 here)

In the child data, significant differences were observed between clusters 1 ('delayed') and 2 ('typical') for the RR compliance, RR acknowledgement and RNR valid response categories. Cluster 2 demonstrated a higher score for compliant responses in the RR condition and for valid responses in the RNR condition. In contrast, the children's rates for acknowledgement in the RR condition were higher in cluster 1 than in cluster 2. In comparing clusters 1 and 3, significant differences were observed with the percentages of compliant responses in the RR condition and valid responses in the RNR condition being higher for cluster 3, and the percentages of inappropriate and ambiguous responses in the RNR condition being lower. No significant differences were observed between clusters 2 and 3 (see Table 5).

(Insert Table 5 here)

Reasonably strong differences in RR compliance, inappropriate, and acknowledgement, and RNR valid and ambiguous response types in the child data were demonstrated, with less marked variation being noted in the parent data. Given the strength of the cluster analysis, these results were not as anticipated.

Discussion

The purpose of this study was to investigate the influence of the child's language development on parental communicative intention during conversations. Based on current knowledge that parents alter their speech style to facilitate their child's individual language skills, it was expected that clear differences in the response expectation of the parents' utterances would be evident between parents of children with 'delayed' and 'typical' language. Furthermore, if this were the case, even

greater differences should have been seen between the 'delayed' group and the children described as 'advanced'. Similarly, at different levels of development, the degree of correctness or appropriateness in the children's responses should have been markedly different between each of the groups, reflecting their current language status. These hypotheses, however, were not evidenced in the results.

In terms of the parent data, no variation was noted in the mothers' language across the three groups of children on the measures used. Furthermore, the only difference found in the mothers' language was for the number of sentences per turn, and then only between two of the groups ('delayed' and 'typical'). It had been anticipated that a more pronounced effect would be seen between the parents' language to children in the 'delayed' and 'advanced' groups, yet this difference was less than that between the 'delayed' and 'typical'. On the measures of the parents' communicative intention, calculated from the total number of RR and RNR utterances recorded on the Observational Framework, no differences were evident across the clusters. It would appear therefore, that the parental response expectation in interacting with their children was not influenced by the language development of the child. This finding parallels that of previous research which suggested that the child factors to which the mother responds remain unclear (Pine, 1994).

In contrast, there is strong evidence in the literature suggesting that parents respond to their children's receptive language and speak at a level commensurate with these skills, rather than their expressive language skills (Girolametto *et al.*, 2002; Paul and Elwood, 1991; Rescorla and Fechnay, 1996). The children in the present study were clustered primarily on their expressive language abilities, as is the accepted standard, and their receptive language skills were uniform

and within expected ranges across the three groups. Thus, it may be that the similar styles of parental language reflected the uniformity in the children's receptive language skills across the three clusters. 'Delayed' and 'typical' as clinical subgroups, however, are routinely informed by expressive language skills, a practice that may warrant careful consideration.

In the child data, the stronger difference noted across the clusters on the RR compliance response type was expected, and is in agreement with previous child language research. As children's receptive and expressive language skills develop, it is reasonable to expect the child to begin to understand when a response is required by the utterance that is addressed to them, and that they should increasingly be able to respond appropriately to that utterance (Shatz, 1978). This was reflected in the results, as a significant increase between the 'delayed' and 'typical' groups was noted on the RR compliance category. Additionally, in comparing the 'delayed' and 'advanced' groups, this relationship was stronger than between the 'delayed' and 'typical'.

The differences across the three groups on the RNR valid response type are of particular interest given that this category of input is not usually described. RNR valid responses were significantly more frequent in the 'delayed' group than in the other two groups studied. In comparing between-group effects, this difference however, was less pronounced between the 'delayed' and 'advanced' groups than between the 'delayed' and 'typical', an unexpected finding. According to previous research and the expectations of the researchers, the difference between the 'delayed' and 'advanced' groups should have been stronger than that between 'delayed' and 'typical'. This would reflect a progression in language competence commensurate with an increase in receptive and expressive language skills, however this was not evidenced in the results.

These results may in fact reflect a developmental hierarchy of comprehension strategies, similar to that proposed by Marinac and Ozanne (1999) and others (e.g. Chapman, 1978; Huttenlocher, 1974). These researchers described a hierarchy of compensatory strategies based on age-related variables that may also be applied to a hierarchy of language development. One such strategy occurs when children respond to the language directed to them by their parents and use their knowledge of familiar events to assist in structuring their responses (Paul, 1990). This may be influencing the children's understanding of their mothers' communicative intention. If parents typically initiate interaction with their child with an utterance that requires a response (i.e. RR), young children may then interpret the majority of their mother's utterances, regardless of intent, as requiring a response, and respond accordingly (as per Paul, 1990). In the present study, if no response had been required, they would then score a valid response under the RNR condition – correct if required.

The decrease in RNR valid responses in the 'typical' group may indicate that, as the children's language ability increased, they learned to read the underlying intent of utterances which they heard. As this understanding developed, the children were able to more accurately identify when an utterance required a response and when it did not, and inhibited their responses accordingly. This accords with information reported by Shatz (1978). It would seem to be unclear then, why the children with 'advanced' language development did not use a similar strategy to inhibit responses when they were not required. One explanation may be that, as these children become more competent language users, their desire to use their new skills similarly increases. Thus, a child whose language is more advanced may make greater use of all communication directed to them and act upon it more frequently, if not always appropriately.

It is also possible that children in the 'advanced' group were beginning to use a more advanced comprehension strategy, 'semantic probability'. This has been described as a strategy where the child, having misunderstood only one element in a complex sentence, responds based on the rest of the utterance (Marinac and Ozanne, 1999). This strategy is seen to be more advanced than other comprehension strategies (i.e. evident in 4 - 4;6 year old children) and, if used, would result in a valid, but not correct, response. For example, if the parent said, 'Let's go outside later' and the child went outside immediately. The semantic probability lies in not understanding the term 'later' and applying a best guess. The parental communicative intent, although not requiring a response or action, was accorded a 'valid' response by the child.

The other response types showed differences between the groups as expected. The 'advanced' group used significantly less inappropriate responses than the 'delayed', accurately reflecting their increased competence as language users. Similarly, the greater number of RR acknowledgement responses in the 'delayed' group than in the 'typical' may reveal less well developed language skills. The 'advanced' group also showed a higher rate of acknowledgement responses than the 'typical'. This result may be attributed to the children with 'advanced' language skills more frequently identifying that a response was required, but repressing an inappropriate response (i.e. recognizing that a response was needed and, as they did not have the correct one available, simply acknowledging the input). In the RNR category, the ambiguous response type was noted to be significantly higher in the 'delayed' group than the 'advanced'. This may reflect the difficulties of children who are delayed in developing language skills.

A secondary aim of this study was to determine if the Observational Framework is a suitable tool to assist in the evaluation of language skills in parent-child interactions. The data presented

demonstrate that it is a useful and effective tool for describing the parental intention and children's ability to respond in such interactions. Furthermore, following training and some in-depth practice, it is possible for the Observational Framework to be used for online recording.

The Framework was also investigated for its ability to distinguish the three groups of children described in this study, 'delayed', 'typical' and 'advanced'. The results suggest that it is possible to categorize the children's reading of intent into 'delayed' and 'typical'. On the current findings however, this measure of communicative intention did not distinguish children with 'advanced' language development from children who would be placed in the 'typical' group.

The major limitations of the study were the relatively small sample size and the reliability results. The latter suggests that detailed online training is required prior to the use of the Observational Framework. The results per se, however, warrant a similar investigation with a larger cohort to determine whether more pronounced differences in parental language style are present in children with differing *receptive* language skills. This is because the somewhat inconclusive results presented here may be linked to the accepted practice of assigning children to 'typical' and 'delayed' language groups based on their expressive language abilities.

Conclusion

This study has demonstrated that the Observational Framework can be used effectively online in clinical settings and, with detailed examiner training, would be a useful tool in evaluating parental interaction styles and the conversational skills of young children. No definitive conclusion could be made regarding the ability to distinguish language learners in the three

groups studied, advanced, typical and delayed, based on their reading of intent and responsivity as revealed during the parent-child interactions. The results however suggest two areas of child language development that warrant further investigation: parental input when a response is not required; the definitional basis for advanced, typical and delayed language development.

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Appendix: The Observational Framework (Marinac, 2000)

Child Details:		
Response Required	Response Not Required	Other Directed
Compliance:		
Dyadic compliance:		
Imitative compliance:		
Passive compliance:		
Valid:	Valid:	Valid:
Inappropriate:	Inappropriate:	Inappropriate:
Ambiguous:	Ambiguous:	Ambiguous:
Acknowledgment:	Acknowledgment:	
Non-specific eye-gaze:	Non-specific eye-gaze:	
No Response:	No Response:	

Table 1 Psychometric details for the instruments used.

Name	Authors	Area Investigated	Age Range	Validity	Reliability
MCDI	Fenson <i>et al.</i> , 1993	Expressive vocabulary	8-30 months	Content: 'high' Concurrent: 'high' Predictive: 0.6-0.8	Internal: 0.95-0.96 Test-retest: 0.9
RDLS-III	Edwards <i>et al.</i> , 1997	Receptive and expressive language	1;6-7;0 years	Concurrent: Receptive 0.62-0.70 Expressive 0.67-0.75	Split-half: Receptive 0.97 Expressive 0.96
Symbolic Play Test	Lowe and Costello, 1988	Cognitive – Play development	1-3 years	Construct: 0.28-0.31 Predictive: 0.40-0.76	Split-half: 0.81 Test-retest: 0.71-0.81
Rosetti Infant- Toddler Language Scale	Rosetti, 1990	Interaction-attachment, pragmatics, gesture, play, language comprehension and expression	0-36 months	Nil	Nil

Table 2 Parent data, and the effect of language development across all clusters.

Variable	Cluster 1		Cluster 2		Cluster 3		Sig.
	Mean	SD	Mean	SD	Mean	SD	
MLU	3.69	0.70	4.23	0.99	4.42	0.53	0.208
Number of Sentences per Turn	5.45	4.34	2.33	0.76	2.36	1.24	0.072

Note: Significance level $p \leq 0.05$, indicated by *.

Table 3 Descriptive statistics of child data by cluster, and the effects of language development across all clusters.

Variable	Cluster 1		Cluster 2		Cluster 3		Sig.
	Mean	SD	Mean	SD	Mean	SD	
Response Required (RR)							
Total	64.77	9.06	65.10	7.72	58.95	10.80	0.303
Compliance	40.29	11.94	53.59	10.89	54.56	6.90	0.005*
Valid	8.31	3.91	7.17	4.55	10.54	3.51	0.166
Inappropriate	7.73	4.46	7.22	4.96	4.11	3.98	0.059
Ambiguous	7.65	5.35	8.18	7.05	5.34	5.29	0.357
Acknowledgement	6.75	6.22	2.62	2.42	3.55	2.45	0.065
No response	24.57	12.04	17.89	9.99	18.44	7.92	0.336
Other	4.71	1.79	3.40	2.52	3.47	1.93	0.124
Response Not Required (RNR)							
Total	35.23	9.06	34.90	7.72	41.15	9.44	0.181
Valid	10.52	9.60	21.40	10.13	20.07	9.59	0.030*
Ambiguous	5.35	6.14	4.55	7.70	0.95	2.17	0.357
Acknowledgement	10.85	9.35	7.82	8.79	8.41	8.13	0.548
No response	70.90	17.85	64.25	11.67	70.02	16.34	0.375
Other	2.38	2.68	1.48	2.55	0.55	0.84	0.170

Note: Significance level $p \leq 0.05$, indicated by *; means and SDs given as percentages.

Table 4 Results of the comparison between clusters on parent measures.

Variable	Cluster 1 v 2			Cluster 1 v 3			Cluster 2 v 3		
	Mean (1)	Mean (2)	Sig.	Mean (1)	Mean (3)	Sig.	Mean (2)	Mean (3)	Sig.
MLU	3.69	4.23	0.442	3.69	4.42	0.068	4.23	4.42	0.573
Number of Sentences per Turn	5.45	2.33	0.050*	5.45	2.36	0.055	2.33	2.36	0.696

Note: Significance level $p \leq 0.05$, indicated by *.

Table 5 Results of the comparison between clusters on child measures.

Variable	Cluster 1 v 2			Cluster 1 v 3			Cluster 2 v 3		
	Mean	Mean	Sig.	Mean	Mean	Sig.	Mean	Mean	Sig.
	(1)	(2)		(1)	(3)		(2)	(3)	
Response Required (RR)									
Total	64.77	65.10	1.000	64.77	58.95	0.235	65.10	58.95	0.168
Compliance	40.29	53.59	0.007*	40.29	54.56	0.002*	53.59	54.56	1.000
Valid	8.31	7.17	0.320	8.31	10.54	0.288	7.17	10.54	0.082
Inappropriate	7.73	7.22	0.852	7.73	4.11	0.011*	7.22	4.11	0.119
Ambiguous	7.65	8.18	0.728	7.65	5.34	0.235	8.18	5.34	0.228
Acknowledgement	6.75	2.62	0.035*	6.75	3.55	0.134	2.62	3.55	0.303
No response	24.57	17.89	0.152	24.57	18.44	0.347	17.89	18.44	0.820
Other	4.71	3.40	0.068	4.71	3.47	0.118	3.40	3.47	0.691
Response Not Required (RNR)									
Total	35.23	34.90	1.000	35.23	41.15	0.169	34.90	41.15	0.087
Valid	10.52	21.40	0.019*	10.52	20.07	0.027*	21.40	20.07	0.776
Ambiguous	5.35	4.55	0.406	5.35	0.95	0.023*	4.55	0.95	0.277
Acknowledgement	10.85	7.82	0.320	10.85	8.41	0.487	7.82	8.41	0.733
No response	70.90	64.25	0.247	70.90	70.02	0.976	64.25	70.02	0.252
Other	2.38	1.48	0.270	2.38	0.55	0.079	1.48	0.55	0.691

Note: Significance level $p \leq 0.05$, indicated by *; means given as percentages.