Greater intelligibility in verbal routines with young children with developmental delays

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ABSTRACT
The unintelligible speech of many developmentally delayed children poses problems for language intervention and language assessment efforts. Eighteen developmentally delayed children in Brown's (1973) stage I and their parents participated in two studies of the relationship between verbal routines and the intelligibility of developmentally delayed children's speech. The first study demonstrated that more intelligible child speech was found in routines than in nonroutines. To determine if routine utterances were articulated more accurately than nonroutine utterances, the second study extracted a representative sample of routine and nonroutine utterances from their visual and discourse contexts and asked two naive observers to transcribe them. To investigate the possible effect of contextual information, the naive observers transcribed the extracted utterances under context-information-present and context-information-absent conditions. The results indicated that extracted utterances were more intelligible under context-information-present conditions. The results were interpreted as indicating that child speech was more intelligible in routines than nonroutines because routines provide adults with more context information for interpreting ambiguous child utterances.

Many developmentally delayed children do not talk as intelligibly as other children of the same linguistic level (Rosenberg, 1982). Unintelligible speakers present problems for language intervention and assessment efforts. Many early language intervention methods use techniques that expand on (Manolson, 1985), provide corrective feedback to (Chapman, Leonard, & Mervis, 1986), or query (Schwartz, Chapman, Prelock, Terrell, & Rowan, 1985) immediately preceding child utterances. If children speak unintelligibly, adults may not be able to accurately identify the child's intended message, thus reducing the efficacy of expansions, feedback, and contingent queries in facilitating language development.

Children who speak unintelligibly present the language examiner with a challenge, too. Language samples have become one of the most valuable assessment contexts for children in the first stage of language learning (Miller, 1981). The major alternative, elicited production protocols, often fails to elicit the target language behaviors found in speech samples (Lahey,

Launer, & Schiff-Myers, 1983; Prutting, Gallagher, & Mulac, 1975). Unintelligible conversationalists provide little analyzable language in language samples. One solution to this problem is to obtain longer or more frequent language samples (Miller, 1981). This solution will be impractical for many diagnosticians and clinicians. Methods for eliciting intelligible speech in the context of a single conversational sample may provide an alternative, more practical solution to the problem.

Verbal routines may elicit particularly intelligible speech. The term "verbal routines," as used in this study, refers to conversations that (a) recur frequently, (b) have a predictable and recognizable sequence, (c) have at least one spoken turn for each interlocutor, and (d) have content that is limited to a small set of variations (Conti-Ramsden & Friel-Patti, 1987; Peters, 1983; Snow, Perlmann, & Nathan, 1987; Snyder-McLean, Solomonson, McLean, & Sack, 1984). In addition, we require the child to fulfill his or her role in the routine consistently as evidence of child knowledge of the routine "script." A script is knowledge of the typical sequence of events in a particular context (Schank & Abelson, 1977). Examples of common verbal routines include common question–answer exchanges (e.g., "What is this?"), play scripts based around familiar toys (e.g., talking about what to eat and drink while playing with a tea set), tutorial exchanges (e.g., counting together), and culturally defined early games (e.g., nursery rhymes). More intelligible speech may be seen in routines because (a) parents may have more contextual and historical support for interpreting the child's probable message, and/or (b) children's utterances may be better articulated in routines than in nonroutines.

The predictability of routines provides much contextual support for forming a limited set of hypotheses about the child's probable message. With a limited set of hypotheses of probable child meanings, ambiguous child utterances may be easier to interpret. The effect of various aspects of contextual support on speech intelligibility of hearing impaired people is well established (Osberger, in press). Particularly relevant to the types of contextual support that routines provide, McGarr (1983) found that intelligibility of test words was greater when the test word was placed in highly predictable sentences than when placed in sentences with low predictability.

More accurate articulation of routine utterances than nonroutine utterances may occur for two reasons. First, repeated practice articulating various words in routines may improve articulation of these words. The repetitive, predictable, and frequently occurring nature of routines may aid in acquisition and fluency of speech motor control and linguistic rules that probably underlie normal phonological use (Bernthal & Bankson, 1988). Second, more accurate articulation of routine utterances than nonroutine utterances may occur because the lower information-processing load of routines (Shatz, 1983) may leave more cognitive resources available for speech production.

A third possibility is that both better contextual support and better articulation account for superior intelligibility in routines than in nonroutines. Sitler, Schiavetti, and Metz (1983) found that context affected the intelligi-

bility of target words only in the most intelligible subjects, not in the least intelligible subjects. Applying the notion of an interaction between context and articulation to the question of why intelligibility may be greater in routines, one may posit that routines provide the basis for a smaller set of working hypotheses about the child's message, but that the children's better articulation of words from routines is necessary for the adult to select among the hypothesized meanings.

This article presents two studies. The purpose of Experiment 1 was to test whether the routineness of parent–child conversations covaried with the intelligibility of child speech. The purpose of Experiment 2 was to determine why routineness is associated with intelligibility. Specifically, we investigated whether greater intelligibility in interactions that were identified as routines was due to (a) better articulation, (b) better contextual support, or (c) a combination of the two.

EXPERIMENT 1

METHODS

Subjects

To recruit subjects, administrators of local educational intervention programs for developmentally delayed children sent home consent letters to parents of the children who seemed to meet our selection criteria. We screened children of parents who signed and returned the consent letters. The selection criteria for the children were (a) mean length of utterance (MLU) between 1.01 and 2.00, (b) at least 50 intelligible utterances per 30-minute sample, (c) evidence of cognitive delay as indicated on school records, (d) no noticeable sensory impairments, (e) no diagnosis of autism, and (f) no severe oral muscular impairment. Fifty is the minimum number of child utterances that Miller (1981) suggested using when MLU is to be computed from the sample as a measure of grammatical development. Additionally, the present studies were part of a series of studies on Brown's (1973) stage I children with developmental disabilities. The criterion of 50 intelligible utterances allowed us to select children who would provide a sufficient number of at least partially intelligible utterances to test the research questions in several studies.

Eighteen developmentally delayed children and the parent who reportedly spent the most time with each child participated in the study. Seventeen mothers and one father participated. The *International Standard Classification of Occupations* (1968) indicated that the occupational status of the mothers and fathers was at about the population mean (international mean = 43.3; mother's mean = 40.89, $SD = 13.12$; father's mean = 44.57, $SD = 14.6$). The average number of years in school for the parents who participated in the procedures was 13 ($SD = 2.8$; range = 8–17). On the average, the children were 50 months old ($SD = 12.7$ months; range = 36–76 months). However, their average expressive level was at the 25-month level ($SD = 3$ months; range = 20–32 months), and their average receptive

level was at the 27-month level (SD = 4.6 months; range = 16–36 months), as indicated by the Sequenced Inventory of Communication Development-Revised (Hedrick, Prather, & Tobin, 1984) and the Receptive-Expressive Emergent Language Scale (Bzoch & League, 1971). The average MLU in morphemes was 1.50 (SD = .25; range = 1.2–2.01), thereby placing the children's language in Brown's (1973) stage I. The percentage of total child utterances in which at least one word was intelligible averaged 84% (SD = 11%; range = 64–100%). As estimated by the Merrill-Palmer (Stutsman, 1948) and the Bayley Mental Development Index (MDI) (Bayley, 1969), the average mental age was 29 months (SD = 6 months; range = 18–42 months), and the average cognitive developmental quotient was .63 (SD = .14; range = .40–.88). Therefore, these children's cognitive delays ranged from dull–normal to moderately retarded (American Psychiatric Association, 1987). Table 1 summarizes these subject description data.

Procedures

The parent and child engaged in a typical freeplay interaction session for 30 minutes with toys that we provided. We asked the parents to play with their children as they normally would at home, without doing anything special or trying to meet any goal. The play area was a carpeted rectangle, 8′ × 9½′. Age-appropriate toys (e.g., a small playhouse; toy phones; a toy car; truck; school bus; dress-up hats; a pop-up toy; a baby doll with blanket, bottle, etc.; a toy cash register and groceries; and a toy medical kit) lined three sides of the play area. We videotaped the sessions through a one-way mirror and audiotaped them by means of a wireless microphone worn by the child and a microphone suspended from the ceiling.

Parent identification of routines. By definition, routines are idiosyncratic to individual parent–child pairs. Alone, we could not identify routines from ongoing freeplay because we could not know which exchanges children have engaged in frequently at home or if what we saw in the laboratory was similar to what the parent and child usually did in their routines. Other researchers have used familiar picture books (Snow et al., 1987) or familiar toys (Conti-Ramsden & Friel-Patti, 1987) to elicit routines from children. Our pilot data indicated that many of the low SES families we tested had no routines centering around picture books and small toys that they could bring to our lab. It seemed unlikely that using picture books and child-selected toys would elicit routines with developmentally delayed children because many of these children are born into low SES families (Baumeister & Kupstas, 1987).

Therefore, we chose to use a team approach with parents to identify routines that may occur in the freeplay session. We purposefully used toys that we thought would elicit routines during the freeplay. After the freeplay session, we taught the parent our five defining characteristics of routines. These were (a) child and adult have at least one spoken turn in the exchange, (b) exchange occurs at least once per week, (c) exchange has a

Table 1. *Means, standard deviations, and ranges for subject descriptor variables*

Subject descriptor	Mean	Standard deviation	Range
Parent			
Participating parents' years of education	13.4	2.85	8–17
Mother's occupational status[a]	40.9	13.1	16–69
Father's occupational status[a]	44.57	14.6	22–78
Child			
Chronological age	50 mos.	12.7 mos.	36–76 mos.
Productive age[b]	25 mos.	3 mos.	16–36 mos.
MLU	1.50	.25	1.2–2.01
Receptive age[b]	27 mos.	4.6 mos.	16–36 mos.
Mental age[c]	28.7 mos.	6 mos.	18–42 mos.
Productive developmental quotient[b]	.55	.13	.31–.76
Receptive developmental quotient[b]	.60	.19	.31–1.01
Cognitive developmental quotient[c]	.63	.14	.40–.88
Total utterances	307	86	162–470
Total unintelligible utterances	49	38	0–141
Percentage of utterances that were partially or completely intelligible	.83	.11	.64–1.0

[a]Occupational status scores derived from the *International Standard of Classification of Occupations* (1968). Mean = 43.3; *SD* = 16.9; range = −2–90. Data reported for parent(s) with whom the child lived.
[b]Productive and receptive age equivalency scores from the Sequenced Inventory of Communication Development–Revised (Hedrick et al., 1984) and the Receptive-Expressive Emergent Language Scale (Bzoch & League, 1971). Developmental quotients are calculated by dividing age equivalency by chronological age at time of test. They index degree of delay with respect to chronological age.
[c]Mental ages from the Bayley MDI (Bayley, 1969) and the Merrill-Palmer (Stutsman, 1948).

predictable and recognizable sequence, (d) exchange has a limited set of options for appropriate role fulfillment, and (e) the child fulfills her or his role consistently. After several examples and feedback to the parent's examples, we asked the parent to view the middle 20 minutes of the freeplay session, telling us when to stop the tape to discuss a possible routine. At every potential routine, we determined whether the specific exchange fit the criteria, and whether the child was participating in the routine as he or she

usually did at home. If so, the beginning and ending times and utterances were recorded for later coding of routine boundaries. Two weeks later, we had the parent return to repeat the procedure. The average percentage agreement between sessions was 72% (SD = 25%). After the second session, we reviewed the criteria to help the parent make a final decision about any exchanges that were identified in one session but not in the other. Therefore, the average reliability of final·routine identification exceeded 72%. The beginning of the routine was the first partially or completely intelligible utterance that the parent identified as beginning the routine. The definition of the "end of the routine" was the last partially or completely intelligible utterance that the coder judged to be in the parent-identified routine. "Routines" were defined as those exchanges that (a) fit the five defining characteristics, and (b) the parent identified twice or, in the case of a discrepancy between identification sessions, decided was a routine after discussion with the examiner. "Nonroutine" utterances were those that were not included within the boundaries of routines that occurred during the 20-minute segment that the parents viewed to identify routines. The validity of this method of defining routines and nonroutines is supported by its relation to superior child verbal participation and more diverse vocabulary use in these interactions (Yoder & Davies, 1991).

Some may be concerned that some utterances were incorrectly labeled as routine or nonroutine. This concern may arise from the large standard deviation of percentage agreement between the first and second identification sessions or about the labeling of utterances as nonroutine that were part of interactions identified only once as routine. It should be noted that the consequence of low reliability of variables is attenuated differences (Pedhazur, 1982); therefore, any obtained routine–nonroutine differences would occur despite the possible misclassification of some utterances.

Transcription. Trained transcribers recorded the content and sequence of spoken utterances and pauses that were 2 seconds long from the audio- and videotaped sessions. Transcriptions followed the Systematic Analysis of Transcripts (SALT) (Miller & Chapman, 1983) format. During the transcription phase, the observer indicated whether an utterance was completely unintelligible. An unintelligible child utterance was one in which the transcriber understood no words. We used parents' verbal interpretations following the target child utterance to transcribe an utterance if at least one phoneme matched the adult's gloss and the adult's gloss logically encoded some aspect of the child's focus of attention. All transcripts were verified by viewing the videotaped session while checking the veracity of the transcript before analysis.

Interobserver agreement on transcription and variables. An independent observer transcribed the middle 20 minutes (i.e., the portion used for routine identification session) of three randomly selected transcripts (17% of the data) to estimate the reliability of selected aspects of the transcript. Point-by-point percentage agreement was used to estimate interobserver agree-

Table 2. *Types of routines parents identified*

	Number of Ss with this type of routine	Percentage of Ss with this type of routine	Percentage of total number that were this type of routine[a]
What/who is this or what does x say/do?	14	78	39
Idiosyncratic	12	67	21
Telephone dialogue	11	61	13
Eating/drinking dialogue	6	33	8
Counting	5	28	6
Doll-care dialogue	4	22	6
Imitation only	3	17	5

[a]Total number of routines = 119.

ment for the following variables: (a) presence of event (.93), (b) identification of major event type (i.e., pause, child utterance, or parental utterance; .997), (c) segmentation of utterances (.98), (d) transcription of adult utterances (.99), (e) transcription of at least partially intelligible child utterances (.95), and (f) judgment that a present child utterance was completely unintelligible (.78).

Additionally, we computed summary level percentage agreement on the dependent variable for the routine versus nonroutine comparison. Mean summary level agreement on the percentage of partially or completely intelligible child utterances was .99.

Data transformation and summary. Custom-designed computer software marked the utterances between routine beginning and routine ending codes. The same software separated the utterances from the middle 20 minutes of the sessions into separate files for routine versus nonroutine utterances. SALT (Miller & Chapman, 1983) was used to calculate the variable scores.

RESULTS

Table 2 provides a description of what the parents and children were doing and talking about during the routine interactions. All 18 parent–child pairs identified at least one routine during the 20-minute freeplay session. On the average, 30% of the 20-minute freeplay segment was called "routine" (*SD* = 19%). As indicated in Table 3, the most frequent routine the parents identified was a question/answer sequence involving asking what something is or who someone is and what they do and say. This and several other routines were initiated by both children and adults. However, the adult

Table 3. *Means and standard deviations of intelli-
gibility scores by observer, context condition, and
routineness condition*[a]

| | Percentage agreement with original transcription | |
	Mean	Standard deviation
Observer 1		
Context present	.31	.10
Routine	.31	.16
Nonroutine	.30	.12
Context absent	.21	.12
Routine	.24	.15
Nonroutine	.18	.17
Observer 2		
Context present	.31	.10
Routine	.33	.19
Nonroutine	.28	.15
Context absent	.16	.10
Routine	.16	.12
Nonroutine	.16	.14

Note: $N = 18$.
[a]Only context main effects are shown; all other effects
were nonsignificant.

initiated the routines more often. The second most frequent type of routine
was idiosyncratic (i.e., occurred in less than 3 dyads). These idiosyncratic
routines were personal data question/answers, acting out Santa Claus's
visit, saying goodbye, pushing or riding in a vehicle, dress-up, spelling
name with letter blocks, pretending to read to a play character, talking to a
play character, playing doctor, buying/selling things, singing in turns, and
questions about past activities.

Paired *t* tests were used to compare the intelligibility of child talk within
routine versus nonroutine interactions. Children generally spoke more intel-
ligibly, paired $t(17) = 6.14$; $p < .001$, in routines (mean = 90%; $SD =$
8%) than in nonroutines (mean = 77%; $SD = 10\%$).

DISCUSSION

There are three possible explanations for why children's speech may be
more intelligible in routines than in nonroutines. First, children's ambigu-
ous utterances may be easier to interpret in routines because routine inter-
actions generally provide the adult with greater contextual support for in-
terpreting the child's probable message. Second, children's utterances may
actually be more accurately articulated in routines than in nonroutines.

Third, a combination of more accurate articulation and greater contextual support could explain the finding that children's speech is more intelligible in routines than in nonroutines.

Experiment 2 was conducted to determine which of these explanations best explain the findings of Experiment 1. To test the articulation hypothesis separately from the contextual support hypothesis, randomly selected routine and nonroutine utterances were removed from their discourse and visual context and the intelligibility of selected routine and nonroutine utterances was compared. To do this, two naive observers listened to an audio presentation of the selected, isolated utterances. Intelligibility in Experiment 2 was defined as a naive transcriber's agreement with our best guess at the child's intended meaning (i.e., the original transcription). Most studies of speech intelligibility use agreement with a known text as their index of intelligibility (Osberger, in press). In Experiment 2, we cannot be certain of the child's intended message in the interactions in Experiment 1. The routines were identified from naturally occurring conversations. Our best guess at the child's intended message is our original transcription from videotapes and audiotapes in which the transcriber could interpret the child's utterance from visual, discourse, and sentential information. If the results of Experiment 2 indicate that naive transcribers match the original transcription to a higher degree within the routine condition, then more accurate articulation would best account for the results in Experiment 1.

To test the contextual support hypothesis, contextual support was independently manipulated to provide an analogue to the type of contextual support that routines may have provided in Experiment 1. By definition, routines provide more contextual support for interpreting child utterances than do nonroutines. To manipulate contextual support in Experiment 2, naive observers listened to the selected utterances in two conditions: context-information-present and context-information-absent. In Experiment 2's context-information-present condition, we provided information about the object(s) the child was playing with while saying the target utterance. In the context-information-absent condition, only the audio presentation of the utterances was available to interpret the selected utterance. Therefore, if the naive transcribers match the original transcription to a higher degree within the context-information-present condition than in the context-information-absent condition, regardless of the routineness of the utterances, this would suggest that the greater intelligibility in routines in Experiment 1 was due to the greater contextual support rather than more accurate articulation in routines.

Finally, manipulating context also allowed us to test whether degree of routineness interacted with context to affect speech intelligibility. If there is greater intelligibility under context-present conditions than under context-absent conditions only when transcribing utterances that were sampled from routines, then both the articulation and contextual support explanations would be supported. This might occur because the contextual support provided by our manipulation of context information may provide the basis for formulating a limited set of hypotheses. However, the naive transcriber

may be able to successfully select among this limited set of hypotheses only when the child's articulation is sufficiently accurate to guide the transcriber in selecting one hypothesized meaning over another.

EXPERIMENT 2

METHODS

Subjects

The same 18 subjects were used for Experiment 2 that were used for Experiment 1.

Procedures

Preparation of experimental stimuli. To test whether more accurate articulation accounted for the finding in Experiment 1, we presented representative routine and nonroutine utterances that had been extracted from their visual and linguistic contexts to two transcribers who were not familiar with the subjects and had not seen the videotaped parent–child sessions. To create the representative samples of routine and nonroutine utterances, we randomly selected 10 utterances from routines and 10 utterances from nonroutines for each of the 18 subjects (i.e., 360 utterances). To extract the utterances from their visual and linguistic contexts, we segmented and digitized the selected utterances using an analog-to-digital converter at a 20 Khz sampling rate. Digitization is a process by which the acoustic signal of the selected utterances is converted to a digital representation that could be stored on computer disks. This process records a digital (i.e., 1s and 0s) representation of the voltage for the sound wave at regular time intervals (i.e., every 20-thousandth of a second, in this case). Because the segmenting method allowed us to define the beginning and ending of the utterance within 20-thousandths of a second, we were able to extract the utterance from the videotape without including preceding or following utterances.

So that the sequence of utterances would not reveal to the transcribers whether the utterances came from routines or nonroutines, the extracted utterances were randomly sequenced (without replacement) using a randomization computer program. Once the sequence of utterances had been determined, it remained constant for both transcribers and conditions. This was necessary so that context information could be manipulated easily.

To test whether greater intelligibility was due to context, the 360 utterances were presented to the transcribers under two conditions: (a) context-present and (b) context-absent. Context was manipulated by providing information about the child's selected utterance. This contextual information took the form of an orthographic transcription of a short phrase or word next to the space provided for the transcription of the target utterance. This general logic was used effectively by Monsen (1983) and adapted to our particular stimuli and situation. We provided less information about

the utterances than Monsen because we wanted to prevent the transcribers from guessing whether the utterance to be transcribed was selected from a routine.

The principles for selecting the contextual information were as follows. When the selected utterance referred to an object, the context information was the object label. If the selected utterance was originally transcribed as unintelligible, the context information was the label for the object the child was attending to or holding. When the selected utterance was just a locative or exclamation and was spoken while attending to an object, the context information was "general conversation about [object label]." When the selected utterance did not contain a referent, the context information was simply "general conversation." The order of context conditions was counterbalanced across subjects and reversed between naive transcribers.

Transcription procedure. Two observers transcribed the extracted child utterances. Both transcribers were speech/language master's students with at least 1 year's experience transcribing young children's language. However, neither knew any of the children, nor had they seen any of the videotaped sessions.

With regard to the transcription procedures, it is important to note that when the dependent variable is agreement itself, as in the present study, applying the traditional 80% point-by-point agreement between pairs of observers is unrealistic. For example, the literature indicates that typical agreement with a known text in the hearing impaired is 15% for out-of-context targets and 30–50% for in-context targets (Brannon, 1964; McGarr, 1983; Sitler et al., 1983; Thomas, 1963). This is not to say that the general issue of reliability is not an important consideration. However, there are other ways to establish reliability of relations between variables that are more appropriate to the present study's dependent variable. As Yarrow and Waxler (1979) put it:

> [T]he issue of observer correspondence might profitably be considered as an
> issue of replication of research findings. One could thus assess to what degree
> the findings and research conclusions from one data gathering source are
> reproduced in the findings of a second source. (p. 42)

Therefore, in this experiment, two transcribers were used to afford a replication of the effect of routineness and/or context on intelligibility.

The actual transcription procedure was as follows. Before listening to the extracted utterances, transcribers were given a list of the toys and room furnishings available to the children during the parent–child session from which the target utterances were extracted. Without such information, pilot work indicated that agreement with the original transcription was virtually impossible. The transcribers heard the extracted utterances in a sound-isolated chamber through a TDK-49 headphone with a circumaural cushion. The utterances were played back using a 12 bit digital-to-analog converter at the rate of 20 Khz, low pass filtered at 8 Khz. Because presentations were controlled by the transcribers, there was no time limit on the transcription of each utterance. The transcribers independently listened to

the stimuli exactly five times before progressing to the next utterance. This number was determined through pilot testing and represents the mean number of times pilot transcribers requested to hear an utterance before they were sure they had recorded their best gloss of it. At the end of the five trials, the transcriber recorded the word(s) she thought the child was trying to say. English orthography was used to transcribe words. If the transcriber could not gloss a meaning from the child's utterance, an "x" was recorded for every unintelligible word in the target utterance.

Measure of intelligibility.   Percentage agreement of the audio-only transcription with the original transcription was our measure of intelligibility for the second study. As mentioned earlier, the best guess at the child's intended message was the original transcription. The original transcriber had the advantage of discourse and visual context to interpret the utterances. Note that the average point-by-point interobserver agreement of the original transcription was very high (average across assessed aspects of the transcription = .94; SD = .08). The numerator to Experiment 2's measure of intelligibility was the number of utterances that were agreed on between the audio-only and the original transcriptions. If one utterance was transcribed as completely intelligible, all word roots in the comparison utterance had to have the same meaning to be counted as an agreement (e.g., "I" was not a match with "eye," but "hi" was scored as a match with "hey"). This decision was made because intelligibility is important due to its effect on interpreting the child's meaning. Exact agreement was considered unnecessarily stringent for testing the research question. If one of the utterances was transcribed as partially intelligible (i.e., containing at least one unintelligible word or a false start), the comparison transcription needed to agree that at least one word was unintelligible or that the utterance contained a false start and to concur on the meaning of every glossed word to be scored as an agreement. If one transcriber recorded an utterance as completely unintelligible, the other transcriber must also have recorded it as completely unintelligible for it to be counted as an agreement. Our decision to require agreement for the entire utterance resulted in a more conservative estimate of transcription agreement than would agreement of particular words. The dependent variable for Experiment 2, then, was the number of utterances agreed on divided by the total number of utterances for each subject within context conditions (20 in each) and routineness conditions (20 in each). These scores were derived for each observer.

RESULTS

The results for both naive observers were equivalent and are summarized in Table 3. A context condition (context vs. no context) by routineness condition (routine vs. nonroutine) repeated measures ANOVA indicated a main effect for context: for observer 1, F = 16.21, p < .001; for observer 2, F = 26.18, p < .001. Specifically, audio-only transcribers agreed with the original transcription more often when context information was pro-

vided (for observer 1, mean = .31, *SD* = .10; for observer 2, mean = .31, *SD* = .10) than when no context information was provided (for observer 1, mean = .21, *SD* = .12; for observer 2, mean = .16, *SD* = .10). No other effects were significant.

GENERAL DISCUSSION

As predicted, the developmentally delayed children in this study used more intelligible speech in the routines than in the nonroutines. The experimental design of Experiment 2 and its corresponding finding that context affected intelligibility increases the basis for inferring with confidence that context affects intelligibility of developmentally delayed children's speech. This corresponds to similar findings in the hearing impaired literature (Osberger, in press). The level of intelligibility in Experiment 2 fell into the range found in other studies of the effect of context on intelligibility. Past studies have found that intelligibility under context-absent conditions ranges from 17 to 31%, while intelligibility under context-present conditions ranges from 30 to 50% (Brannon, 1964; McGarr, 1983; Sitler et al., 1983; Thomas, 1963). By definition, routines provide more context to adults' interpretation of child messages. By inference, we conclude that the greater intelligibility in routines was due to the greater contextual support, not to more accurate articulation in routines.

These results contribute to the growing body of literature that routines may provide a useful context for language intervention (Constable, 1986; Snyder-McLean et al., 1984; Yoder & Davies, 1991). The effectiveness of expansions (Manolson, 1985), feedback (Chapman et al., 1986), and vertical scaffolding (Schwartz et al., 1985) as language facilitation techniques are partly dependent on accurately interpreting the child's message. Therefore, intelligible speech provides an opportunity for more effective expansions of, feedback to, and contingent queries of child utterances.

This study does not provide support to the notion that child speech in routines is more accurately articulated than that in nonroutines. However, it would be erroneous to use the present study's lack of effect of routineness on articulation to refute whole language approaches to articulation remediation (Hoffman, Norris, & Monjure, 1990). We did not assess the effect of intentional use of routines that were designed to improve articulation. Perhaps, intentional use of routines as a generalization context (Swift & Rosin, 1990) or concurrent intervention context with traditional drill and practice methods could improve the probability that results of traditional remediation methods would generalize to conversational speech. The effectiveness of routines as articulation remediation contexts has not been adequately tested.

Routines may also be a useful context for assessing developmentally delayed children's productive language. Developmentally delayed children in Brown's (1973) first stage of language learning may not speak intelligibly enough to record sufficiently large language samples in the typical 30-minute sampling period (Miller, 1981). In addition to the more intelligible

speech reported in this study, other studies have found that routines contain more frequent (Conti-Ramsden & Friel-Patti, 1987; Snow et al., 1987; Yoder & Davies, 1991) and more diverse language (Yoder & Davies, 1991) than do nonroutines. For assessment purposes, routines could be used to elicit particular language targets or to assess more general aspects of language (e.g., rate of different words) when the child is reticent to speak with strangers or is particularly unintelligible.

Finally, the team approach used in the present study may be used to identify routines that are specific to a particular dyad. Using parents' expertise to design intervention and assessment contexts may increase the effectiveness of these contexts and convey the message that the parents' input is valued. In summary, the present study provides evidence that naturally occurring routines covary with more intelligible child speech. Appropriate experimental studies that consciously manipulate routineness would increase our confidence that routines are useful for intervention, generalization, and assessment contexts.

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