1999

Subjective impressions of child cochlear-implant users: effects of conversational fluency, intelligibility, speech perception, and communication mode

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"Subjective Impressions of Child Cochlear-Implant Users: Effects of Conversational Fluency, Intelligibility, Speech Perception, and Communication Mode."

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Independent Study

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Spring 1999

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INTRODUCTION

This investigation concerned the conversational fluency of young cochlear-implant users who communicate with either an oral or a total communication (TC) approach. According to Tye-Murray (1998) conversational fluency relates to how smoothly conversation unfolds. Conversational fluency is affected by factors such as: the amount of time spent in repairing communication breakdowns, the amount of time spent in silence, the ease and success of exchanging information and ideas, and the amount of time each person is given to speak (Tye-Murray, 1998). It requires a combination of speech production, speech perception, social and language skills. In the absence of conversational fluency the interaction becomes difficult and uncomfortable. Once we have taken notice of these difficulties we in turn form subjective impressions and opinions about this individual.

Tye-Murray (1998) considers a communication breakdown as "an instance in which one person says something and another person does not recognize the message". If a breakdown in communication does occur strategies to repair it must be made. Both specific and nonspecific strategies can be used to rectify the breakdown in interactions with the hearing-impaired. Specific strategies provide explicit instruction to the communication partner about how to repair the breakdown whereas a non-specific strategy only indicates a lack of understanding (i.e., what-huh-pardon) (Tye-Murray, 1998)

Unfortunately devices such as hearing aids and cochlear-implants do not solve all of the communication difficulties experienced by the hearing-impaired. Erber suggests that conversations with a hearing-impaired individual may consist of the following

characteristics: disrupted taking of turns, modified speaking style, superficial content, frequent clarification, and inappropriate topic shifts (Erber, 1996). All of these characteristics described by Erber can in turn influence how others perceive these individuals.

"Self perception is influenced by the attitudes and levels of acceptance of significant individuals in one's immediate environment and in society as a whole" (Cambra, 1996). Perceptions of hearing-impaired subjects have been studied for years. In 1978, Blood, Blood, and Danhauer conducted a study on listener's impressions of normal-hearing and hearing-impaired children. The study investigated the relationship between speech of hearing-impaired children and the listener's ratings of the speakers' intelligence, personality, appearance, and achievement as a function of whether or not the speakers wore hearing aids. According to the authors this study indicated that a hearing-impaired child's speech may trigger more negative emotions than previous research had shown.

Research has also shown that frequent requests for clarification lead others to perceive the hard-of-hearing individual less favorably (Tye-Murray,1998). In 1991 Gagne, Stelmacovich, and Yovetich conducted a study to examine the reactions of subjects to both the type of requests for clarification used by hearing-impaired adults and the proportion of communication breakdowns that occurred during a conversation. After the subjects viewed skits between a normal-hearing and hearing-impaired actor they were asked to complete a rating scale to assess their perceptions and reactions to the interaction. Results showed that hard-of-hearing persons who participated in conversations with fewer breakdowns were perceived more favorably.

In 1994 Tye-Murray, Witt, and Schum assessed how conversational partners react to breakdowns in communication and the repair strategies that follow them. Subjects viewed videotapes of adult cochlear-implant users interacting with familiar and unfamiliar conversational partners. Results showed that subjects were more likely to use non-specific repair strategies (what-huh-pardon) than specific repair strategies. Subjects who used specific repair strategies more often and who spoke more words were also perceived more favorably. Overall, this research suggests that conversational fluency influences subjective impressions of cochlear-implant users.

Hearing aids and cochlear-implants help hearing-impaired individuals receive and perceive speech. Research has shown that speech production and perception skills improve with increased experience using a cochlear implant (Vieu et al, 1998). A study conducted by Meyer et al in 1998 showed that in general, speech perception scores for children using cochlear implants were higher than those of children with a 101-110 dB HL loss using hearing aids.

Production and perception skills can also differ among auditory-oral and total communication children. According to Geers and Moog, (1992) "in the past twenty years total communication (TC) has replaced oralism as the mode of choice in most educational programs for hearing-impaired children". In oral programs speech and auditory skills are emphasized. On the other hand, TC programs emphasis both sign and speech. In the past many educators were concerned about the possibility of sign inhibiting the development of speech and auditory skills. Therefore a study was conducted by Geers and Moog (1992) to determine the degree to which profoundly hearing-impaired students who had been educated in oral and total communication surroundings developed speech and

auditory skills. The study examined a total of 227 students in the 16 to 17 year old age range: 100 from oral programs and 127 from TC programs. Results showed that students from oral programs had better speech production, speech perception, and oral communication skills.

PURPOSE OF STUDY

The purpose of this investigation was three-fold. First, although investigators have speculated that objective measures, such as time spent in communication breakdown or time spent in silence, may index the fluency of a conversation, little work has been conducted to determine whether these kinds of measures correspond with subjective impressions. This dearth of information is particularly true with respect to children (as opposed to adults). The second purpose was to relate how children's communication skills influence both objective and subjective measures of conversational fluency. For example, it is likely that children who have better speech perception and speech intelligibility scores probably spend less time in communication breakdowns. The final purpose was to compare the performance of children who use an oral mode of communication to children who use a total communication mode in an everyday conversational setting. In the following discussion research pertaining to each purpose will be reviewed.

HYPOTHESIS

The three purposes were accomplished by addressing the following hypotheses. Previous research has shown that conversational fluency influences subjective

impressions of adult cochlear-implant users when interacting with an unfamiliar partner (Tye-Murray et al., 1994). Therefore, it is anticipated that conversational fluency will influence subjective impressions of child cochlear-implant users when interacting with an unfamiliar partner.

Secondly it is expected that children with better overall communication skills will yield higher speech intelligibility and speech perception skills. In turn it is anticipated that speech perception and intelligibility skills will influence subjective impressions. In general it is expected that children with good speech and language will be perceived more favorably than those with poor speech, and language.

Thirdly, it is anticipated that conversational performance will also be influenced by the mode of communication in which the child was instructed. Two main types of communication modes will be considered: oral and total communication. It is possible that children who have abundant practice in verbal conversational exchanges may better maintain high levels of fluency than children who converse less often with partners who do not know sign language. Therefore, it is anticipated that oral children will in general perform better than TC children.

SUBJECTS

Forty adults with normal hearing served as judges. Judges ranged in age from 18 to 30 years old. Forty-seven prelingually deafened children ranging from 8;0 years to 9;11 years of age were previously selected from the 1997 cochlear-implant summer camp held at The Central Institute for the Deaf. Over a two to three day period the children were given a variety of tests to determine each child's speech perception and

intelligibility skills. The children used in this study were implanted with the Nucleus 22 cochlear-implant. Subjects received an implant at an average age of 3½ years and have used an implant for an average of 5½ years. The communication mode of each child was determined by a questionnaire completed by each child's parent or guardian. The adult was asked to categorize their child's mode of communication using a six-point scale described below.

1. Sign Emphasis: The class primarily used a form of manually coded English, but rarely signed word endings such as s and ing, or function words such as a and the. Sign-only was often used for communication during each day.

2. Equal Emphasis: the class used manually coded English, and sometimes signed word endings and function words. Sign-only or speech-only were rarely used.

3. Speech emphasis: The class used manually coded English and consistently signed word endings such as s and ing, and function words such as a and the. Speech almost always occurred simultaneously with each signed word. Speech-only was used for communication occasionally during each day.

4. Cued Speech: A system of manual cues was used, along with speech when communicating with the child.

5. Auditory-Visual: the child was encouraged throughout the day, and on a daily basis, to both lipread and listen to the talker. No formal sign language was used. Although the lipreading might have been eliminated for short periods of auditory and/or speech training, the child both watched and listened for most of the day.

6. Auditory Verbal: Lipreading was discouraged and the child was taught to rely on listening alone to understand speech

Parents were asked to check the category corresponding to the child's communication mode at hook-up, during the first year, second year, third year, and currently. Scores were then averaged across these five years to determine a composite

score. The highest score possible was a score of thirty which indicated that the child's educational mode was consistently auditory-verbal across this five year span. A score of twenty or greater was considered oral and a score of nineteen or less was considered total communication. The average mode of communication score for the forty-seven children was 18.8. Twenty-one used a communication mode that was considered oral and twenty-six used a communication mode that was considered TC.

MATERIALS

A 12-item scale adapted from Tye-Murray et al. (1994) was used to assess the judges' reactions to the videotaped interactions between a child cochlear-implant user and an unfamiliar partner. Each test item consisted of a five-point differential scale, with one being the most favorable on all scales except the fluency scale (Scale 3) in which a score of five was considered most favorable. The rating scale was separated into three main sections to evaluate various aspects of subjective impressions (see Table 1).

The first section of the scale measured the subjective impressions of the personalities of the cochlear-implant subjects and will be referred to as the personality scale (persn). The second part measured how the judges felt emotionally toward the subject. For example judges will indicate how relaxed or anxious they would feel if they were having a similar conversation with this child. This scale will be referred to as the emotional scale (emot).

Finally, the third part measured how the judges would assess the overall structure of the conversation. For example, the judges would respond with how strongly they agree or disagree with the statement "The child understood what the adult said". The

third section was subdivided into Scale 3 and Scale 4 for analysis purposes. Scale three included questions 1,2, and 3 in the third section of the rating form which assessed perceived talk time of the child and adult, as well as whether or not there were awkward pauses. Scale 3 will be referred to as the fluency scale (flncy). Unlike the other scales when rating the fluency scale a higher number denotes a more favorable rating. Scale 4 consisted of questions 4 –7 which assessed how much of the conversation was understood by both the child and adult, whether problems in communication were fixed quickly, and whether there was a meaningful exchange of information. Scale 4 will be referred to as the exchange of information scale (exch info).

PROCEDURES

Subjective Impressions

Forty-six videotaped segments of an interaction between a child cochlear-implant user and an unfamiliar adult were used as stimuli. Each interaction lasted 3 minutes in duration and included a question similar or identical to "What do you like to do in the summer?" or "What do you like to do in the winter?".

Each judge viewed and rated twelve (12) children using the scale previously described. There was a total of forty judges used in the study. Each group of ten judges rated twelve children. Judges saw an equal or near equal representation of oral and total communication children. The first group of judges rated the same group of twelve children a second time in order to assess intra-judge reliability. It is assumed that if scores collected from the first and second scoring are similar then data collected from the other three groups is also reliable.

Judges were given a consent form to read and sign after the experiment and its purpose had been explained. The subsequent instructions were also given: "In the following videotapes you will see and hear several children conversing with an adult. Each child has a hearing loss. The adult is a speech and hearing professional. After each conversation, please complete the three scales below for each child." Between each child the judges were given ample time to complete the rating scale before viewing the next child.

Table 1
Conversational Rating Form

Your impression of the child
Personality Scale
Sociable-Unsociable
Self-sufficient-Helpless
Cooperative-Uncooperative

Your reaction to the child
Emotional Scale
If I were having a similar conversation with this child, I would feel:
Successful-Unsuccessful
Relaxed-Anxious
Motivated to continue the conversation-Unmotivated to continue the conversation

Your assessment of the conversation:
(respond with strongly agree, agree, neutral, disagree, or strongly disagree)
Fluency Scale
The child talked too much. (Scale 3#1)
The adult talked too much. (Scale 3#2)
There were no awkward pauses. (Scale 3#3)

Exchange of Information Scale
The child understood what the adult said. (Scale 4#4)
The adult understood what the child said. (Scale 4#5)
Problems in communication were fixed quickly. (Scale 4#6)
There was a meaningful exchange of information. (Scale 4#7)

Expressive Language

A twenty-minute videotaped language sample was used to determine the child's expressive language and conversational fluency. In this sample a speech and hearing professional conversed with the child on controlled topics. The children were not

allowed to sign during this time. After the sample was collected a three-minute segment was extracted that included the question "What do you like to do in the summer?" or "What do you like to do in the winter?". This segment was then used to calculate communication breakdowns and conversational fluency utilizing the DYLOG software developed by Norm Erber (1997). Dyalog communication analysis is a computer program that allows a speech and hearing professionals to quantify a specific communication behavior of a client. When a communication breakdown occurs the space bar of a computer is pressed until the breakdown ends. Using this program the percentage of time that the child spoke (%CH), time spent in communication breakdown (%Bkdn), and time spent in silence (%Sil) were all calculated. These measures were then related to subjective impressions, speech perception, and intelligibility data.

Speech Perception

Speech perception ability was first determined using the Word Intelligibility by Picture Identification test (WIPI) (Ross and Lerman, 1970). The WIPI is a closed set test that uses six pictures depicting words that contain the same vowel. The child is asked to point to the picture of the word that is said. Subjects sat one meter from the loudspeaker which presented words at 70 dB SPL. A percent correct score was obtained after twenty-five words were presented.

Secondly, an open set speech perception test was administered. The Lexical Neighborhood test (LNT) consists of two "easy" and two "hard" lists that each include twenty-five words. "Easy" words are words with few lexical neighbors while "hard" words have many lexical neighbors. Research has shown that cochlear-implant users perform better on this test as compared to the PB-K. In fact research has shown that the

PB-K list underestimates a cochlear-implant child's ability to recognize words by failing to show that these children observe acoustic-phonetic details (Kirk, Pisoni, & Osberger, 1995). Words were presented again at 70 dB SPL and a percentage score was obtained. LNT scores were then related to subjective impressions, intelligibility scores, and conversational fluency data.

Speech Intelligibility

Using the McGarr sentences the percent of keywords correct were calculated to determine intelligibility (McGarr, 1983). The children read sentences out loud which were recorded and presented to normal hearing listeners. An intelligibility score is then computed by the percentage of key words that are identified by a total of three listeners. Intelligibility scores were then correlated with subjective impressions and conversational fluency data.

RESULTS

The overall mean scores from each rating scale are shown in Table 2. Results revealed a range of scores within each measure as shown by the standard deviations included in the table. The mean personality rating score was 2.1, the mean emotional rating scale score was 2.3, the mean fluency rating scale score was 3.8, and the mean exchange of information rating scale score was 2.4. Mean intelligibility, speech perception and conversational fluency data are shown in Table 3. The mean WIPI score was 46.7, the mean LNT score was 39.7, and the mean intelligibility score was 63%.

Table 2

	Persn	Emot	Flncy	Exch Info
Mean	2.1	2.3	3.8	2.4
SD	0.79	0.96	0.38	0.77

Table 3

	%CH	%SIL	%Bkdn	WIPI	LNT	intell
Mean	41%	22%	18%	46.7	39.7	63%
SD	0.13	0.12	0.20	22.94	25.93	0.32

Table 4 shows the relationships between the rating scales. When correlating the individual scales with each other there was not a significant correlation between the fluency scale (Scale 3) and the emotional scale (Scale 2), or between the exchange of information scale (Scale 4) and the fluency scale (Scale 3) (P>.6). However there was a statistically significant correlation between all other scales.

Table 4

Individual Scales: * = P >0.6	***Persn Scale***	***Emot Scale***	***Flncy Scale***	***Exch of Info Scale***
Persn Scale	*1.00*			
Emot Scale	*.93**	*1.00*		
Flncy Scale	*-.60**	*-.57*	*1.00*	
Exch of Info Scale	*.91**	*.95**	*-.59*	*1.00*

Intrajudge reliability data is shown in Table 5. The fluency rating scale was added to the questionnaire after the data from the first group was obtained, therefore it is not included in the reliability data. Results showed that strong correlations were found

between the first and second ratings within the reliability group. Stronger correlations occurred among the average scale data than among the individual questions.

Table 5

Intrajudge Reliability Correlations
*= P>0.6

Average Persn	Average Emot	Average Exch of info
0.88*	0.891*	0.893*

Purpose 1: *To correlate conversational fluency with subjective impressions.*

Correlations between conversational fluency data and subjective impressions are shown in Table 6. Results showed that the personality rating scale highly correlated with the percentage of communication breakdowns occurring during the conversation (r=.81, P>0.6). In other words the lower the percentage of breakdowns occurring during the conversation the more favorable the child's personality was rated. The relationship between the personality rating scale and communication breakdowns is illustrated in Figure 4. The second conversational rating scale looked at emotional reactions to the child. This scale also was highly correlated with percentage of breakdowns (r=.84, P>0.6). Once again the lower the percentage of breakdowns occurring the better the emotional reaction was to the child (Figure 5).

The last rating scale consisted of questions to assess the overall structure of the conversation. The average exchange of information rating scale highly correlated with percentage of time spent in communication breakdowns (r=.85, P>0.6). Subjective ratings on whether there was a meaningful exchange highly correlated with the amount of

time spent in communication breakdowns (r=.88, P>0.6) (Figure 6). Therefore, as less time was spent in communication breakdowns subjective impressions became more favorable when considering whether or not there was a meaningful exchange.

Table 6

Comm. Breakdown: * = P>0.6	Persn Scale	Emot Scale	Fincy Scale	Exch of Info Scale
%EX	.29	.17	.10	.18
%CH	-.59	-.44	.21	-.39
EX:CH	-.42	-.29	-.05	-.26
%SIL	.40	.35	-.14	.27
%Bkdn	.81*	.84*	-.51	.85*
n	47	47	35	47

Purpose 2: *To relate how children's communication skills influence both objective and subjective measures of conversational fluency.*

Correlations between subjective impressions and speech perception, intelligibility and mode of communication are shown in Table 7. Results showed that the personality scale was highly correlated with LNT, WIPI, and intelligibility scores (r= -0.6, -0.7, -0.8, P>0.6). Average Scale 2 scores, or emotional feelings toward the subject, were also highly correlated with LNT, WIPI, and intelligibility scores (-0.7, -0.7, -0.8, P>0.6). Average fluency rating scale scores did not significantly correlate with mode of communication, intelligibility, or speech perception scores. Average exchange of information rating scale scores were strongly correlated with LNT, WIPI, and intelligibility data (-0.7,-0.7,-0.8, P>0.6). In fact Scale 4 #7, which assessed whether or not there was a meaningful exchange of information, also highly correlated with LNT, WIPI, and intelligibility scores (-0.6,-0.7,-0.8, P>0.6).

Table 7
*= P>0.6

Speech	LNT	WIPI	Intell	Mode
Mode	0.35	0.36	0.44	1
Persn Scale	-0.6	-0.7*	-0.8*	-0.2
Emot Scale	-0.7*	-0.7*	-0.8*	-0.2
Average Fincy Scale	0.17	0.25	0.36	0.32
Fincy Scale #1	0.13	0.16	0.36	0.16
Fincy Scale #2	-0.2	-0.1	-0.3	0.13
Fincy Scale #3	0.42	0.4	0.6	0.29
Exch of Info Scale	-0.7*	-0.7*	-0.8*	-0.2
Exch of Info Scale#7	-0.6	-0.7*	-0.8*	-0.2

Correlations between conversational fluency data and speech perception and intelligibility scores are shown in Table 8. Results showed that the percentage of time spent in communication breakdowns highly correlated with LNT, WIPI, and intelligibility scores (-.63,-.70,-.79, P>0.6). No other significant correlations were found.

Table 8
*= P>0.6

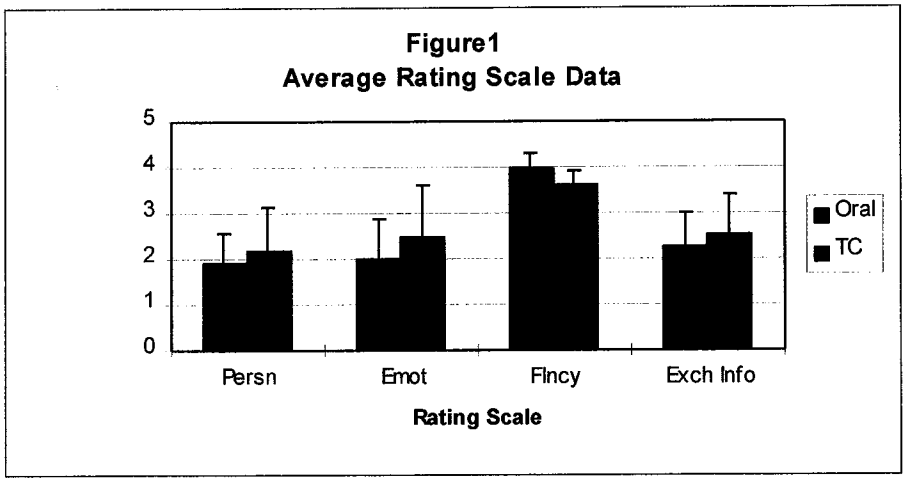
	LNT	WIPI	Intellig
%Sil	-0.28	-0.15	-0.28
%Bkdn	-0.63*	-0.70*	-0.79*
%Ch	0.40	0.35	.46

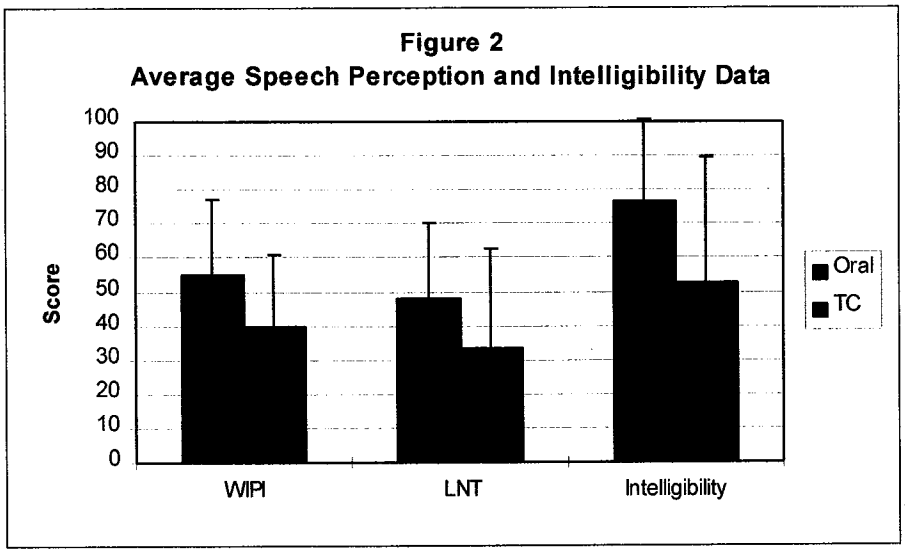
Purpose 3: *To compare the performance of children who use an oral mode of communication to children who use a total communication mode in an everyday conversational setting.*

When looking at results considering mode of communication (oral vs. TC) there does not seem to be a correlation between subjective impressions and the continuum of communication mode that the child uses. Therefore as the score for communication mode

increased (more auditory-oral based) the subjective impressions did not directly become more favorable. The mode of communication scale was not highly related to any of the subjective impression scales, LNT, WIPI, or intelligibility scores.

Results were then separated by mode of communication to show the differences in rating scale, speech perception, and intelligibility scores. Figures 1 and 2 graphically represent these differences in scores between oral and TC children. As indicated by Figure 1, oral children were rated more favorably on the personality, emotional, fluency, and exchange of information rating scales.

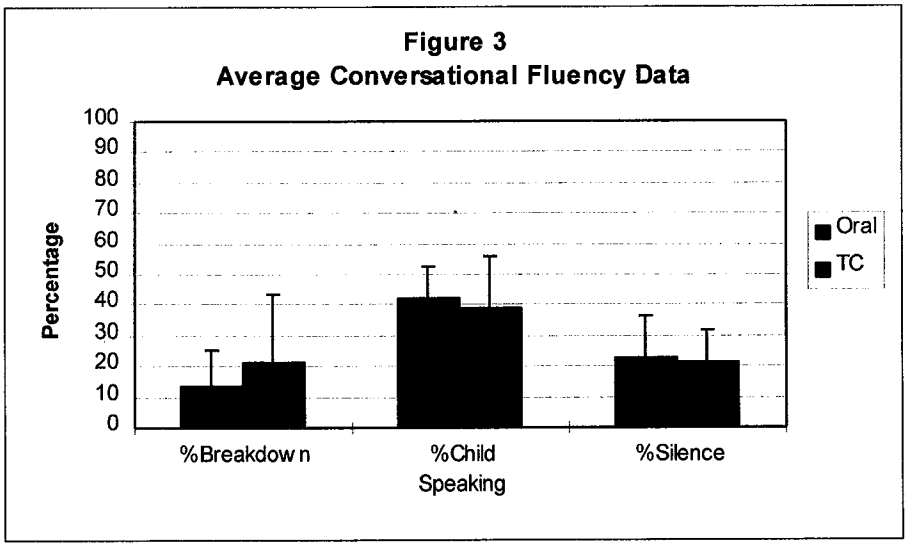




Two-sample T-Tests assuming equal variances were completed to determine if differences between oral and TC scores were statistically significant (P< .05). Results show that the average oral score was higher on all measures. Results show that there was a statistically significant difference between oral and TC children when analyzing WIPI (t=.021), intelligibility (t=0.1), and fluency rating scale scores (t=.012) Utilizing T-tests all other measures did not show a significant difference between oral and TC scores.

Average oral and TC conversational fluency data is shown in Figure 3. Results showed that in general the amount of time that the child spoke was essentially the same for the oral and total communication children (t=.412, P< .05). The two groups also did not significantly differ in the amount of time spent in silence (t=.831). Children who use oral communication spent 13% of their time in communication breakdowns while total communication children spent 22% of their time in communication breakdowns which also did not prove to be statistically significant (t=.168).

Figure 3
Average Conversational Fluency Data



DISCUSSION

Results in general show that subjective impressions of children are in fact affected by communication breakdowns. As less time was spent in communication breakdowns subjective impressions became more favorable. Even though oral children spent less time in communication breakdowns this did not appear to be enough of a difference to show a distinction between the two groups when subjective impressions are determined.

Results also showed that as LNT, WIPI, and intelligibility scores increase the child is perceived more favorably in regard to personality, emotional feelings toward the child, and whether or not there was a meaningful exchange of information (Scale 4 #7). This study also showed that the percentage of time spent in communication breakdowns is highly correlated with speech perception and intelligibility scores. Therefore children who spent less time in communication breakdowns also had higher LNT, WIPI, and intelligibility scores.

Overall, oral children performed better on all measures of speech perception, intelligibility, and subjective impressions as shown by the average scores. Only the WIPI, intelligibility, and fluency rating scale scores showed statistically significant differences between the two modes of communication. Yet as the children's mode of communication became "more oral" subjective impressions did not become more favorable. Even though there was not a direct relationship between the mode of communication scale and subjective impressions there does seem to be a difference in speech perception and intelligibility scores between oral and TC children. In accordance with previous studies oral children do appear to have an advantage over total communication children in these areas

In conclusion it appears from this study that cochlear-implant children with higher conversational fluency, better speech perception and production, and oral instruction are more likely to be perceived favorably. These results imply that audiologic rehabilitation programs should include communicational fluency training and focus on speech perception and intelligibility skills. More research needs to be done to determine if the type of repairs that cochlear-implant children use affect conversational fluency and subjective impressions.

Figure 4

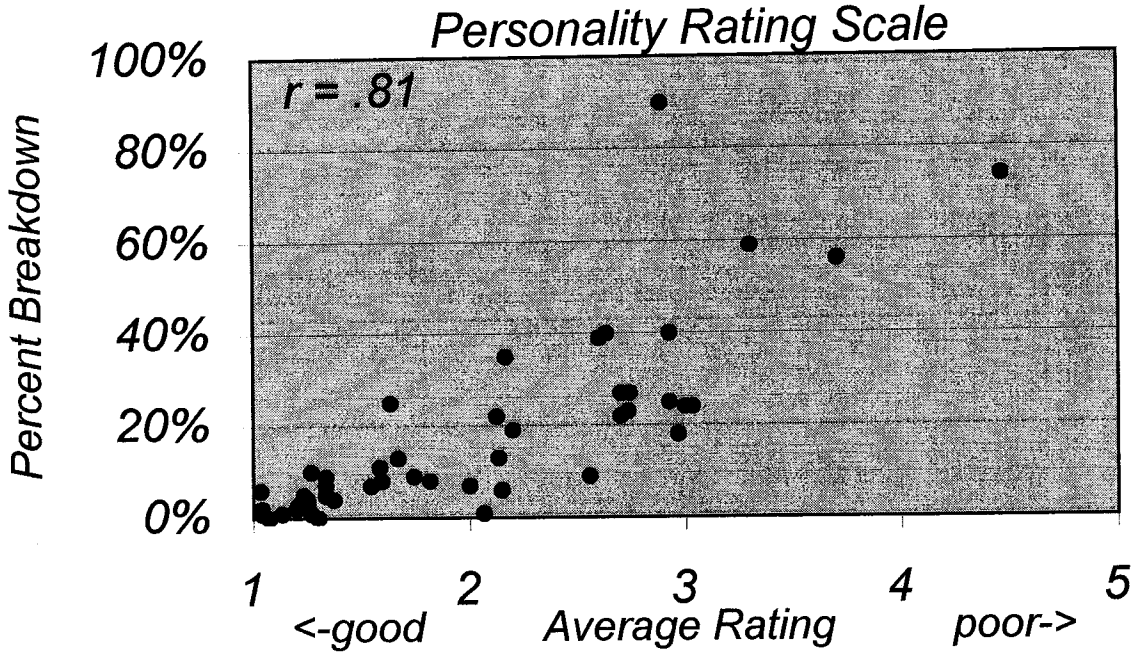


Figure 5

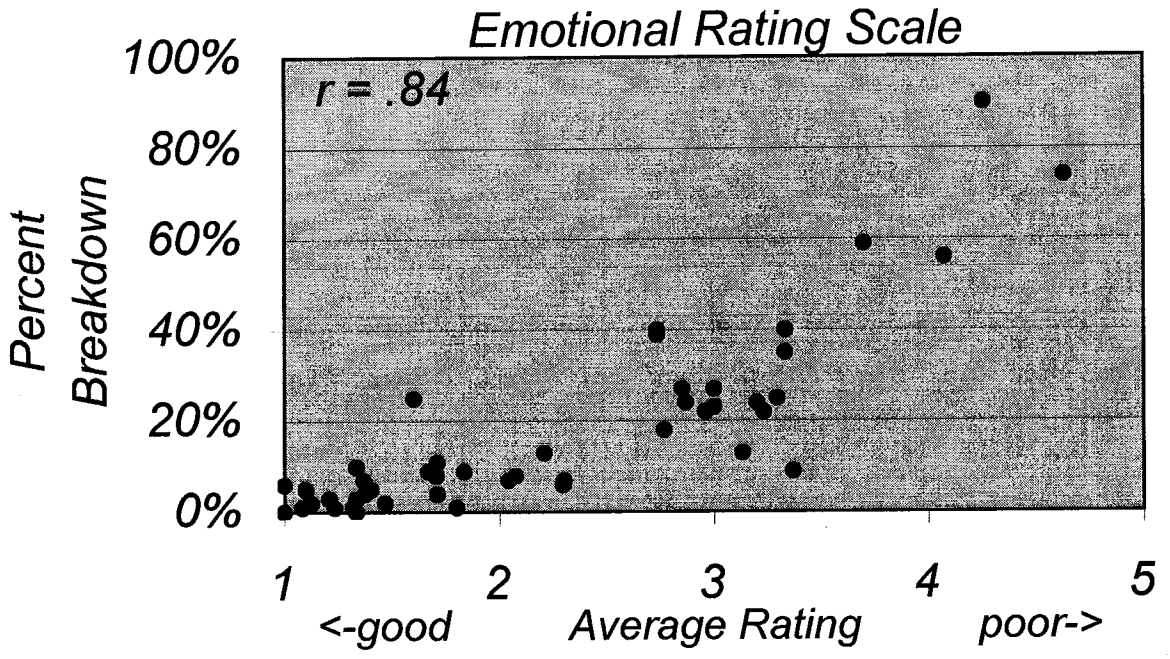
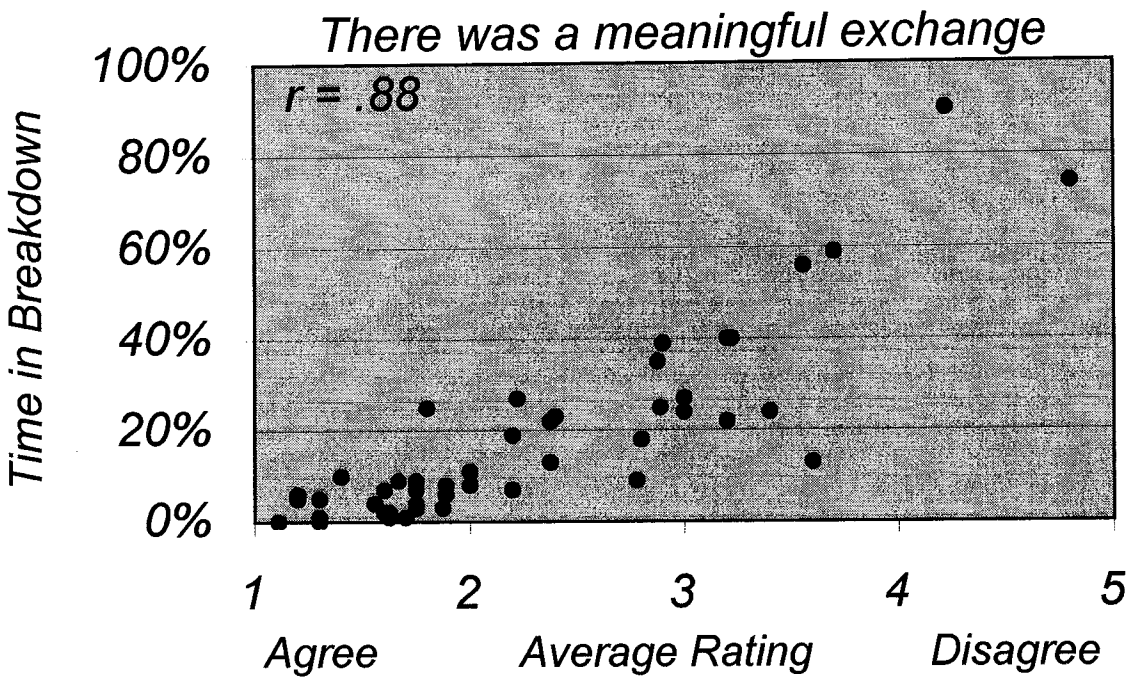


Figure 6


There was a meaningful exchange
r = .88
Time in Breakdown
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Agree
Average Rating
Disagree

BIBLIOGRAPHY

Blood, G.W., Blood, I.M., and Danhauer, J.L. (1978). Listener's Impressions of Normal-Hearing and Hearing-Impaired Children. Journal of Communication Disorders, 513-519.

Cambra, C. (1996). A Comparative Study of Personality Descriptors Attributed to the Deaf, the Blind, and Individuals with No Sensory Disability. American Annals of the Deaf, 141: 24-28.

Dyalog Communication Analysis Software. (1997). Parrot Software, P.O. Box 250755, West Bloomfield, MI, 48322.

Erber, N. (1996). *Communication Therapy for Adults with Sensory Loss, 2nd ed.* Melbourne: Clavis Publishing.

Geers, A., and Moog, J. (1992). Speech Perception and Production Skills of Students With Impaired Hearing from Oral and total Communication Education Settings. Journal of Speech and Hearing Research, 35: 1384-1393.

Gagne, J.P., Stelmacovich, P., and Yovetich, W. (1991). Reactions to Requests for Clarification Used by Hearing-Impaired Individuals. The Volta Review, 129-143.

Kirk, K., Pisoni, D., and Osberger, M. (1995). Lexical Effects on Spoken Word Recognition by Pediatric Cochlear Implant Users. Ear and Hearing, 16: 470-481.

McGarr, (1983). The Intelligibility of Deaf Speech to Experienced and Inexperienced Listeners. Journal of Speech and Hearing Research, 451-458.

Meyer, T., Svirsky, M., Kirk, K., and Miyamoto, R. (1998). Improvements in Speech Perception by Children with Profound Prelingual Hearing Loss: Effects of Device, Communication Mode, and Chronological Age. Journal of Speech, Language, and Hearing Research, 846-58.

Robinson, L., and Reis, H. (1989). The Effects of Interruption, Gender, and Status on Interpersonal Perceptions. Journal of Nonverbal Behavior, 13: 141-151.

Ross, M., and Lerman, J. (1970). A Picture Identification Test for Hearing Impaired Children. Journal of Speech and Hearing Research, 13: 44-53.

Tye-Murray, N. (1998). *Foundations of Aural Rehabilitation.* San Diego: Singular Publishing Group.

Tye-Murray, N., Witt, S., and Schum, L. (1994). Communication Breakdowns: Partner Contingencies and Partner Reactions. JARA, 106-133.

Vieu, A., Mondain, M., Blanchard, K., Sillon, M., Reuillard-Artieres, F., Tobey, E., Uziel, A., and Piron, J. (1998). Influence of Communication Mode on Speech Intelligibility and Syntactic Structure of Sentences in Profoundly Hearing Impaired French Children Implanted Between 5 and 9 Years of Age. International Journal of Pediatric Otorhinolaryngology, 15-22.

APPENDIX A

Average Data

Average Data

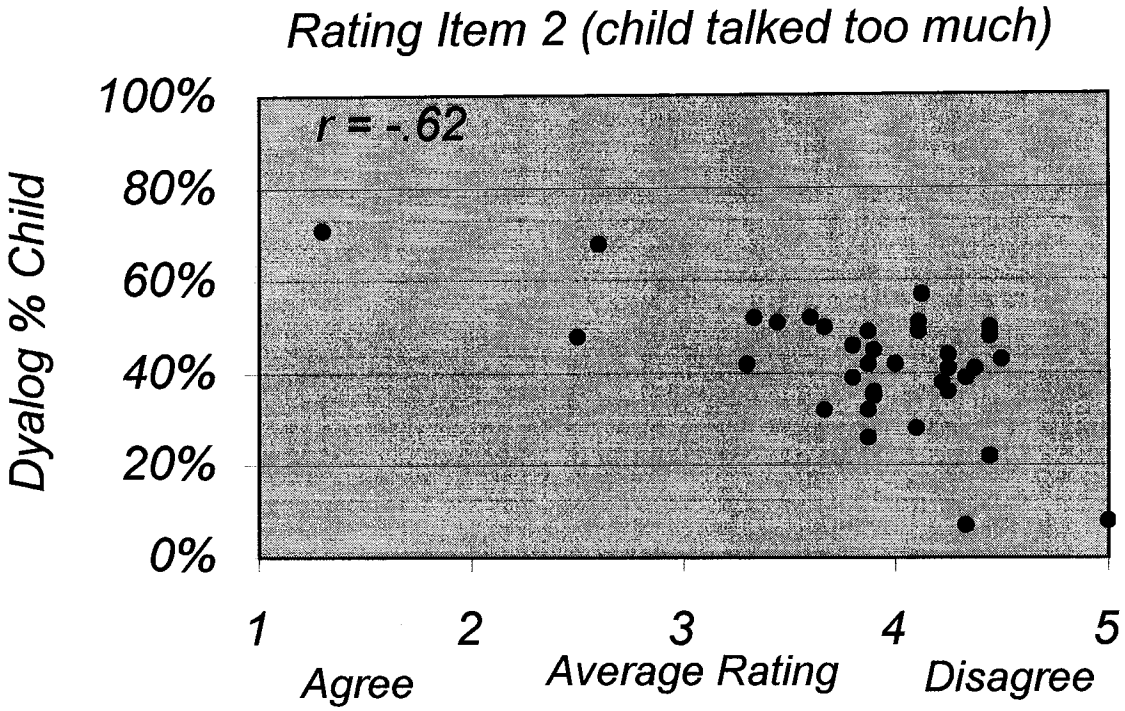
subject	raters	Scale1	Scale2	Scale3	S3#1	S3#2	S3#3	Scale4	S4#7	ModeSum	%EX	%CH	EX:CH	%SIL	%Bkdn	WIPI	LNT	Intell
97101	10	2.2	2.0					2.2	2.2	24.0	45%	29%	0.64	26%	19%	44	46	89.8%
97102	10	2.7	3.0					3.5	3.0	23.0	37%	44%	1.2	19%	27%	20	6	26.9%
97103	10	1.1	1.3					1.8	1.3	17.0	35%	47%	1.3	18%	1%	72	76	95.4%
97104	10	1.2	1.1					1.5	1.3	15.0	42%	39%	0.93	19%	5%	68	70	92.6%
97105	10	1.0	1.0					1.5	1.2	30.0	33%	53%	1.6	14%	6%	76	64	94.4%
97106	10	2.6	2.7					3.4	2.9	26.0	40%	38%	0.95	22%	39%	24	12	22.2%
97107	10	3.0	2.9					3.4	3.0	29.0	60%	17%	0.28	23%	24%	28	34	61.1%
97108	10	1.6	1.6					2.3	1.8	15.0	39%	45%	1.15	16%	25%	24	6	34.3%
97109	10	1.2	1.5					1.9	1.6	15.0	27%	54%	2	19%	2%	68	64	98.1%
97110	10	2.6	2.7					3.5	3.2	12.0	50%	29%	0.58	21%	40%	12	6	25.9%
97111	10	2.8	4.3	3.5	3.4	3.7	3.5	4.0	4.3	10.0	34%	50%	1.5	16%	90%	0	0	0.0%
97112	10	1.9	2.4	3.3	3.1	3.9	2.8	2.4	2.3	14.0	54%	26%	0.48	20%	13%	20	8	42.6%
97113	10	1.2	1.1	4.1	4.1	4.2	3.9	1.7	1.5	11.0	44%	41%	0.93	15%	1%	44	68	91.7%
97114	10	1.3	1.3					1.9	1.4	10.0	44%	33%	0.75	23%	10%	76	24	75.0%
97115	10	3.0	2.8					2.8	2.8	14.0	51%	22%	0.43	27%	18%	40	32	23.1%
97201	10	1.1	1.3	4.0	4.0	3.9	4.1	1.7	1.5	23.0	43%	42%	0.98	15%	2%	68	60	96.3%
97202	10	1.8	2.0	3.7	3.7	4.0	3.3	1.9	2.0	26.0	37%	32%	0.86	31%	11%	72	46	96.3%
97203	10	1.4	1.3	4.1	4.0	4.2	4.0	1.8	1.7	25.0	27%	57%	2.1	16%	3%	84	84	89.8%
97204	10	1.4	2.0	4.0	4.1	3.9	4.1	2.1	1.8	25.0	37%	49%	1.3	14%	9%	80	78	92.6%
97205	10	1.3	1.4	4.1	4.0	4.4	4.0	1.9	1.6	26.0	36%	43%	1.2	21%	3%	92	70	86.1%
97206	10	2.3	3.2	4.1	4.1	4.2	4.1	2.7	2.5	24.0	40%	44%	1.1	22%	22%	24	16	48.1%
97207	10	1.6	2.0	4.1	4.2	4.3	3.8	2.1	1.8	27.0	45%	36%	0.8	79%	4%	56	30	77.8%
97208	10	2.4	3.4	4.0	4.2	4.0	3.8	3.2	3.0	27.0	43%	42%	0.98	15%	35%	20	30	34.3%
97209	10	2.7	3.0	3.3	3.0	3.9	3.1	2.7	2.4	10.0	40%	35%	0.87	25%	23%	56	36	25.0%
97210	10	1.8	2.4	4.2	4.3	4.3	4.0	2.1	1.8	10.0	39%	41%	1.05	20%	7%	44	18	64.8%
97211	10	4.5	4.6	3.1	2.1	5.0	2.2	4.0	4.8	19.0	47%	8%	0.17	45%	74%	20	20	8.3%
97212	10	2.0	2.3	3.8	3.9	3.3	4.2	2.3	2.2	12.0	41%	42%	1	17%	7%	36	54	88.0%
97213	10	1.3	1.4	4.0	3.9	3.6	4.4	1.5	1.2	11.0	32%	52%	1.6	18%	5%	48	40	67.6%
97214	10	3.3	3.7	3.2	3.2	3.9	2.5	3.8	3.7	10.0	37%	45%	1.2	18%	59%	20	0	7.4%
97215	10	1.3	1.2	3.9	3.3	3.9	4.1	1.4	1.3	17.0	46%	36%	0.78	18%	1%	68	70	98.1%
97301	10	2.1	3.1	3.2	4.3	1.3	4.1	3.2	3.6	16.0	23%	71%	3.1	6%	13%	48	38	66.7%
97302	10	3.0	3.2	3.1	3.2	3.8	2.3	3.4	3.4	26.0	27%	46%	1.7	27%	24%	64	58	75.9%
97303	10	2.1	1.8	3.2	2.4	4.1	3.2	1.8	1.7	27.0	40%	28%	0.7	32%	1%	72	78	96.3%
97304	9	1.6	1.7	4.0	4.3	3.4	4.2	2.2	1.9	30.0	32%	51%	1.6	17%	8%	56	46	96.3%
97305	9	2.7	2.9	3.7	3.8	4.4	2.9	2.9	2.2	25.0	29%	50%	1.7	21%	27%	64	64	78.7%

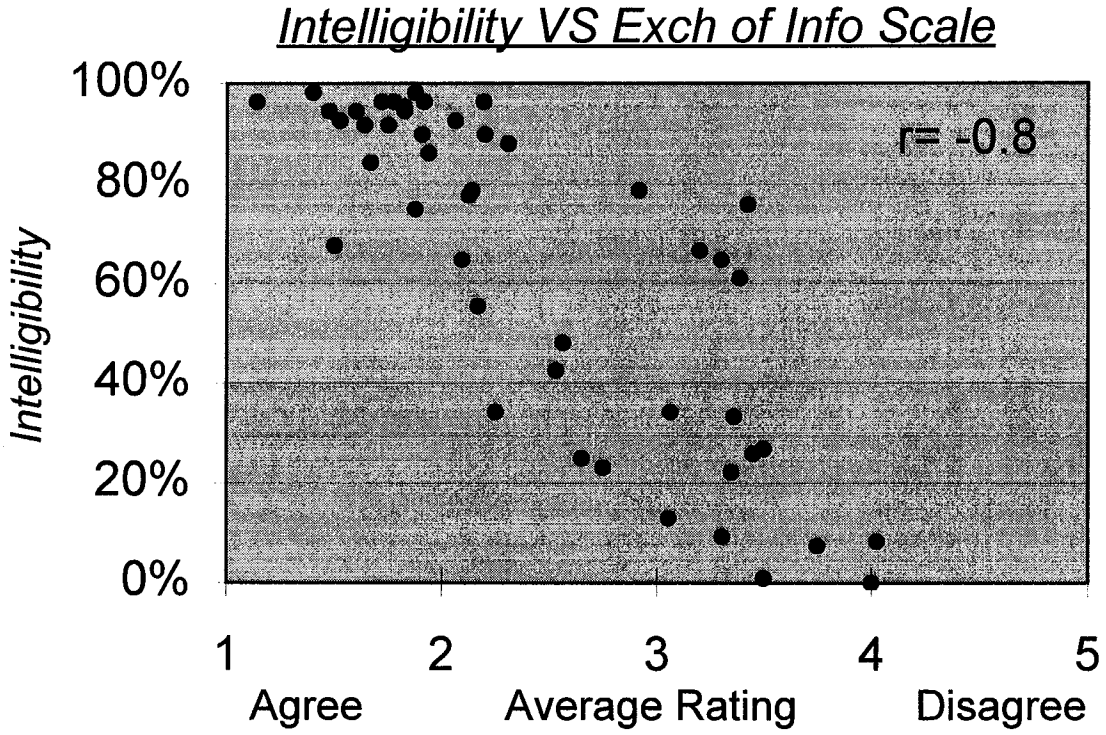
Average Data

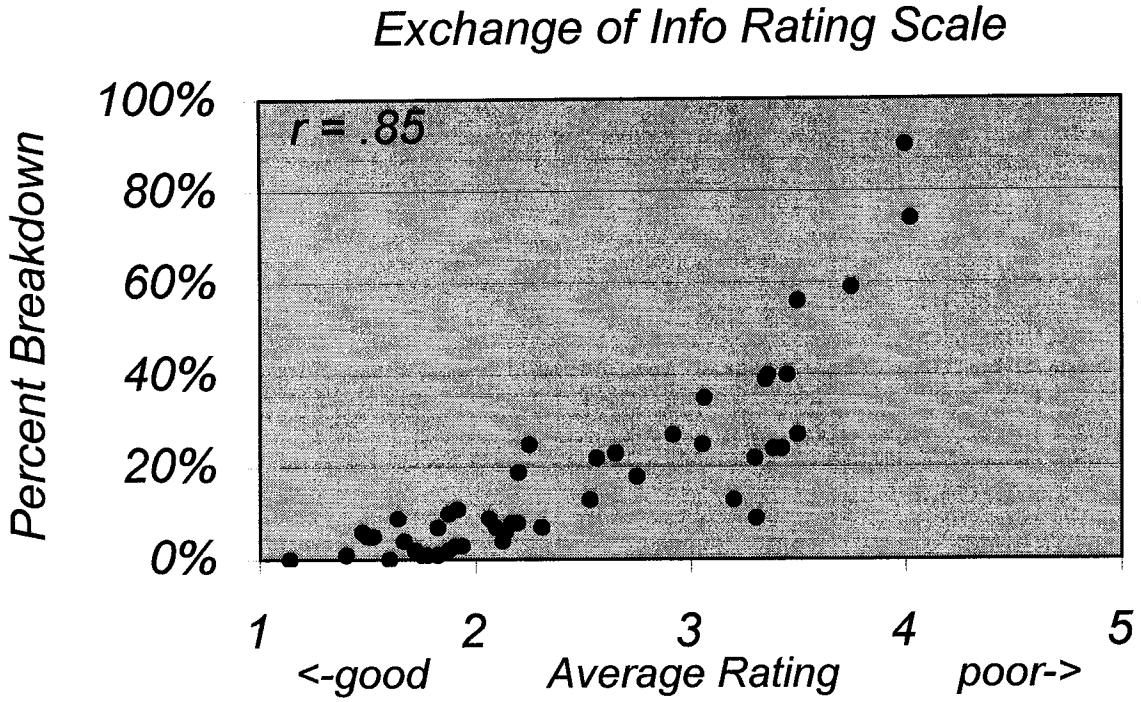
subject	raters	Scale1	Scale2	Scale3	S3#1	S3#2	S3#3	Scale4	S4#7	ModeSum	%EX	%CH	EX:CH	%SIL	%Bkdn	WIPI	LNT	intell
97306	9	2.1	2.3	4.0	3.7	4.2	4.0	2.1	1.9	26.0	44%	38%	0.9	18%	6%	64	38	78.7%
97307	9	1.1	1.0	4.5	4.7	4.1	4.7	1.1	1.1	28.0	36%	51%	1.4	13%	0%	60	62	96.3%
97308	9	1.7	1.7	4.0	4.3	3.3	4.3	1.6	1.7	29.0	32%	52%	1.6	16%	9%	48	54	91.7%
97309	10	1.3	1.3	3.4	4.0	2.6	3.6	1.6	1.3	14.0	20%	68%	3.4	12%	0%	40	58	94.4%
97310	9	2.6	3.4	3.9	4.1	4.4	3.0	3.3	2.8	10.0	36%	22%	0.6	42%	9%	28	0	9.3%
97311	9	1.8	2.1	4.0	4.1	4.1	3.8	2.2	2.0	8.0	37%	49%	1.3	14%	8%	44	42	55.6%
97312	9	2.9	3.3	3.9	3.8	4.3	3.4	3.4	3.2	14.0	39%	39%	1	22%	40%	32	16	33.3%
97313	10	1.3	1.4	3.5	4.1	2.5	4.0	1.8	1.6	12.0	38%	48%	1.3	14%	7%	76	88	94.4%
97314	9	2.9	3.3	3.5	3.8	3.7	3.0	3.1	2.9	10.0	42%	32%	0.8	26%	25%	28	4	13.0%
97315	4	3.7	4.4	3.8	3.8	5.0	2.8	2.9	3.3	10.0	43%	7%	0.2	50%	56%	4	0	0.9%
97316	10	2.7	3.2	3.4	3.6	3.8	2.7	3.3	3.2	14.0	36%	39%	1.1	25%	22%	20	28	64.8%
97401	9	1.4	1.4	4.5	4.6	4.4	4.4	1.7	1.6	26.0	40%	48%	1.2	12%	4%	44	26	84.3%
Mean		2.1	2.3	3.8	3.8	3.9	3.6	2.4	2.3	18.8	39%	41%	1.2	22%	18%	46.7	39.7	63%
SD		0.79	0.96	0.38	0.55	0.68	0.65	0.77	0.87	7.19	0.08	0.13	0.62	0.12	0.20	22.94	25.93	0.32

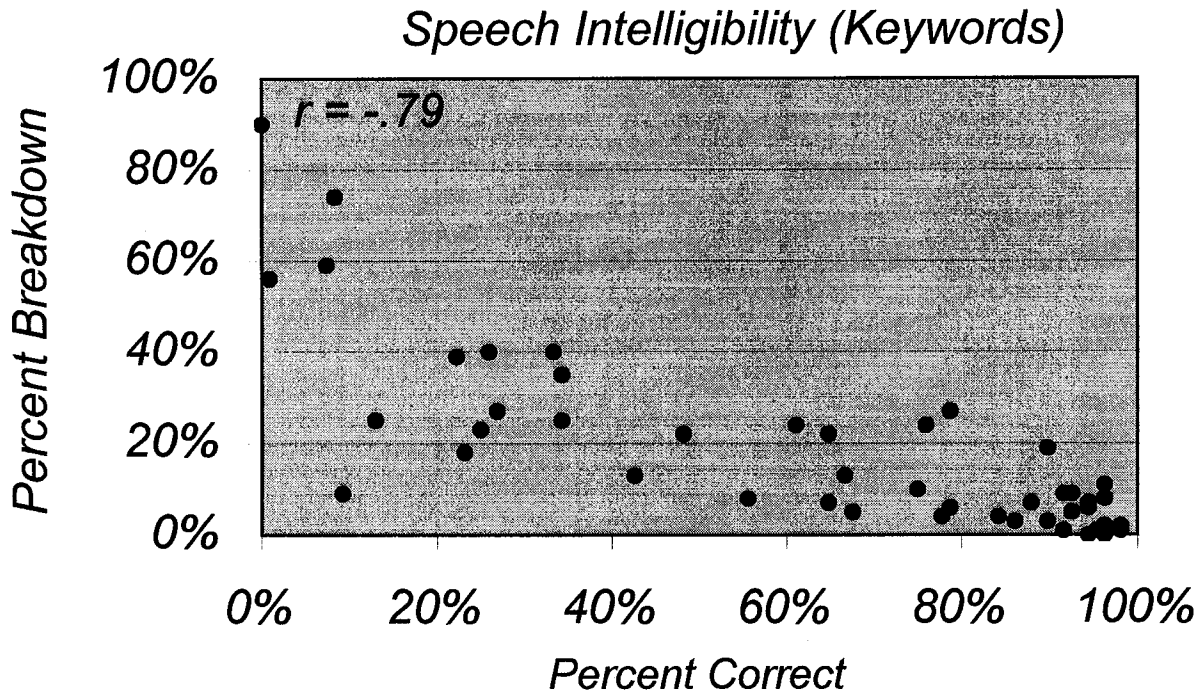
APPENDIX B

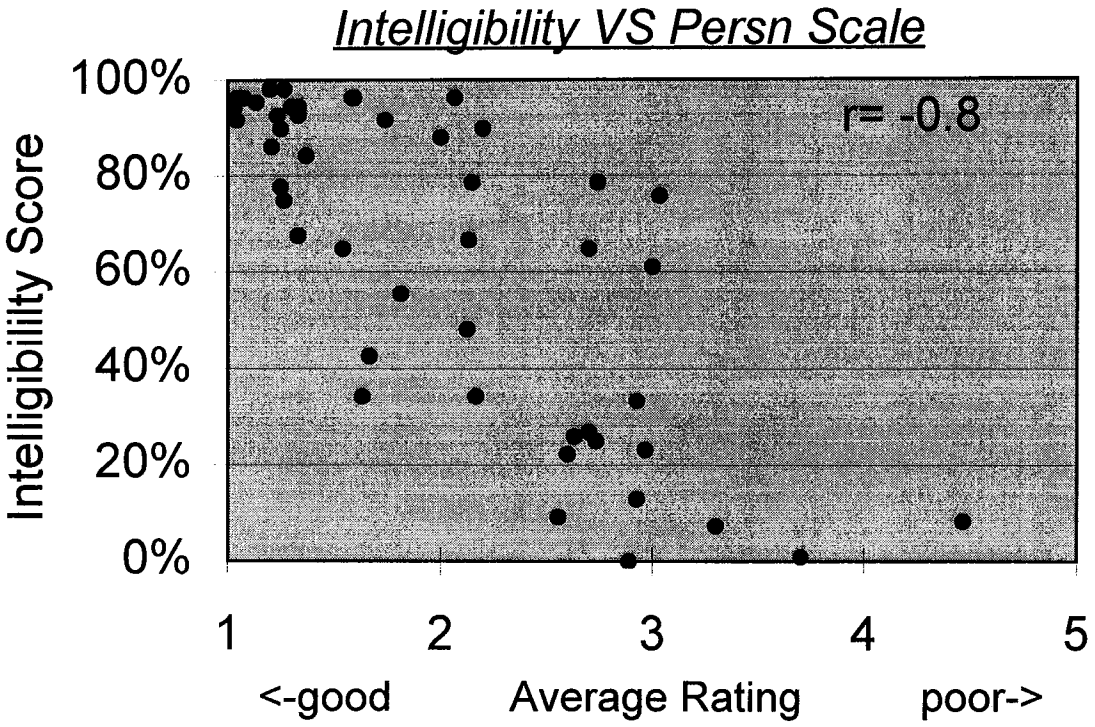
Correlation Scatter Plots

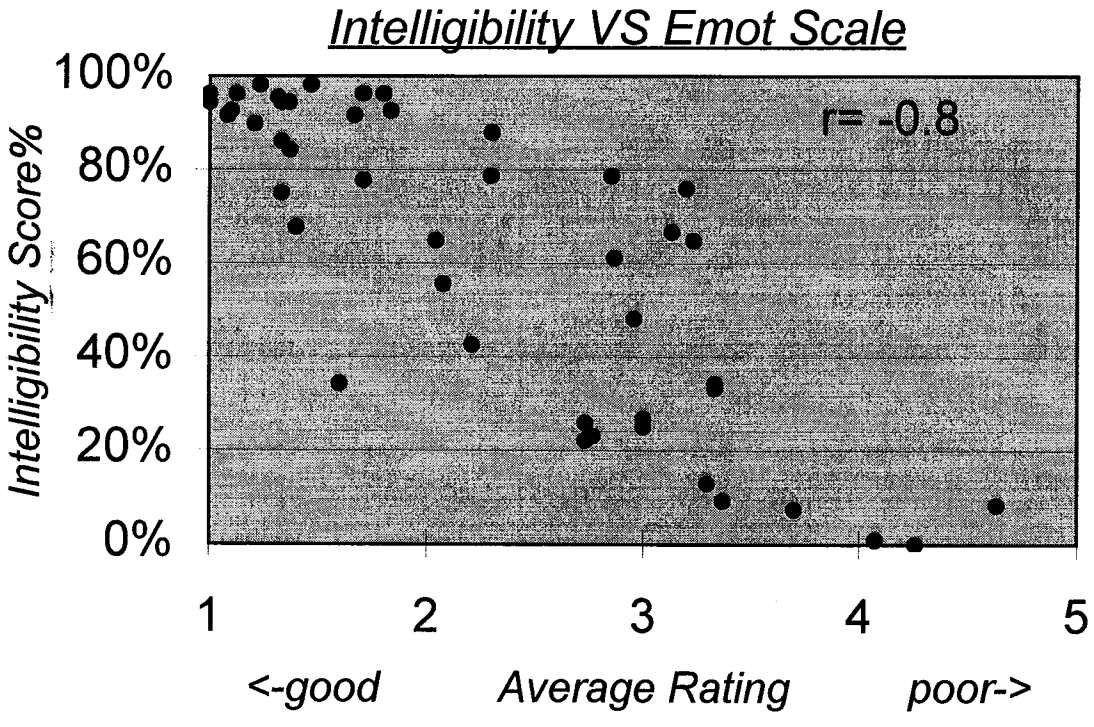

Rating Item 2 (child talked too much)
r = -.62
Dyalog % Child
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Agree
Average Rating
Disagree


Intelligibility VS Exch of Info Scale
r= -0.8
Intelligibility
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Agree
Average Rating
Disagree

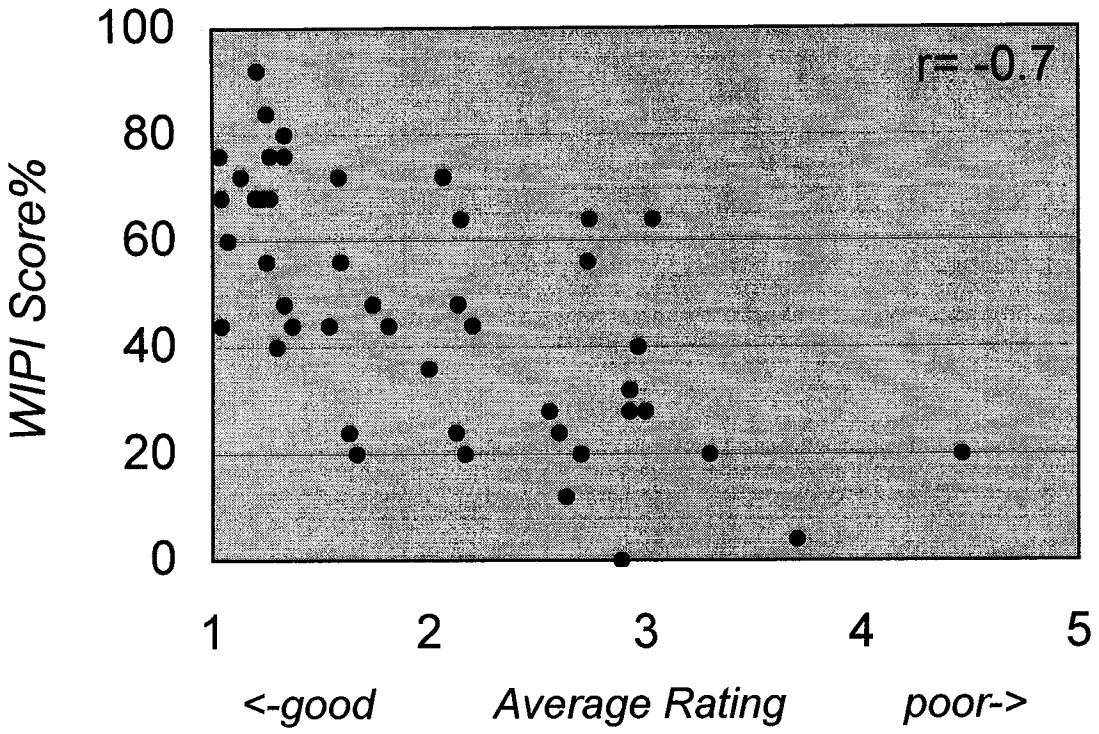

Exchange of Info Rating Scale
r = .85
Percent Breakdown
100%
80%
60%
40%
20%
0%
1
2
3
4
5
<-good
Average Rating
poor->


Speech Intelligibility (Keywords)
r = -.79
Percent Breakdown
100%
80%
60%
40%
20%
0%
0%
20%
40%
60%
80%
100%
Percent Correct

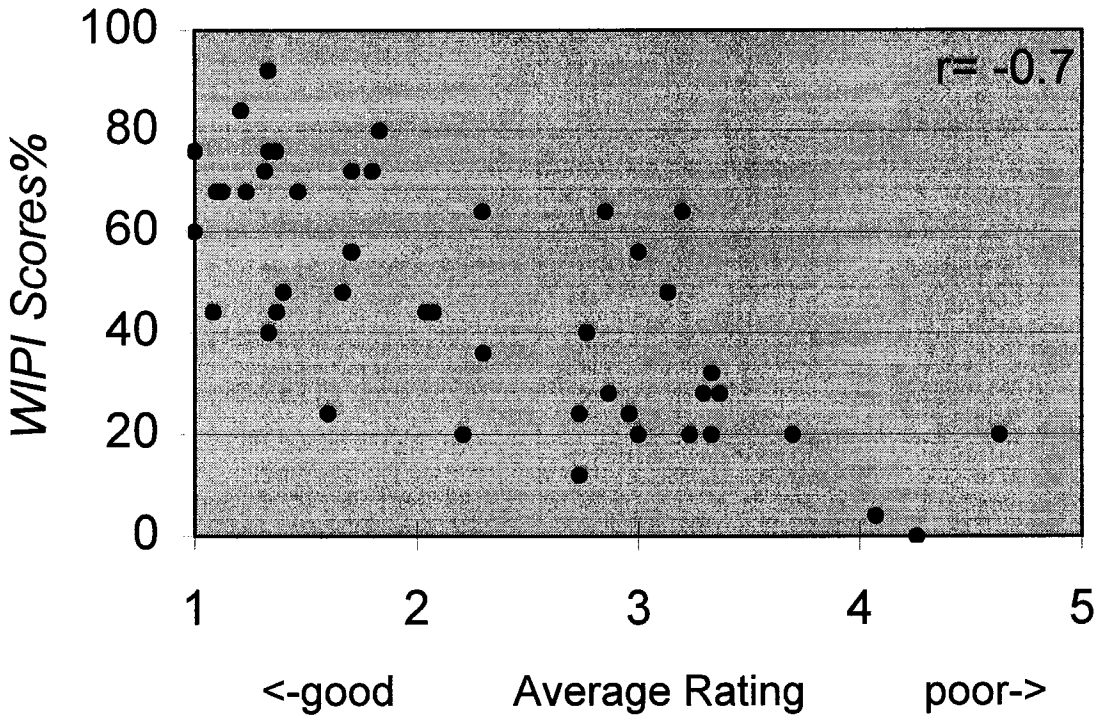

Intelligibility VS Persn Scale
Intelligibility Score
100%
80%
60%
40%
20%
0%
r= -0.8
1
2
3
4
5
<-good
Average Rating
poor->


Intelligibility VS Emot Scale
Intelligibility Score%
100%
80%
60%
40%
20%
0%
r= -0.8
1
2
3
4
5
<-good
Average Rating
poor->

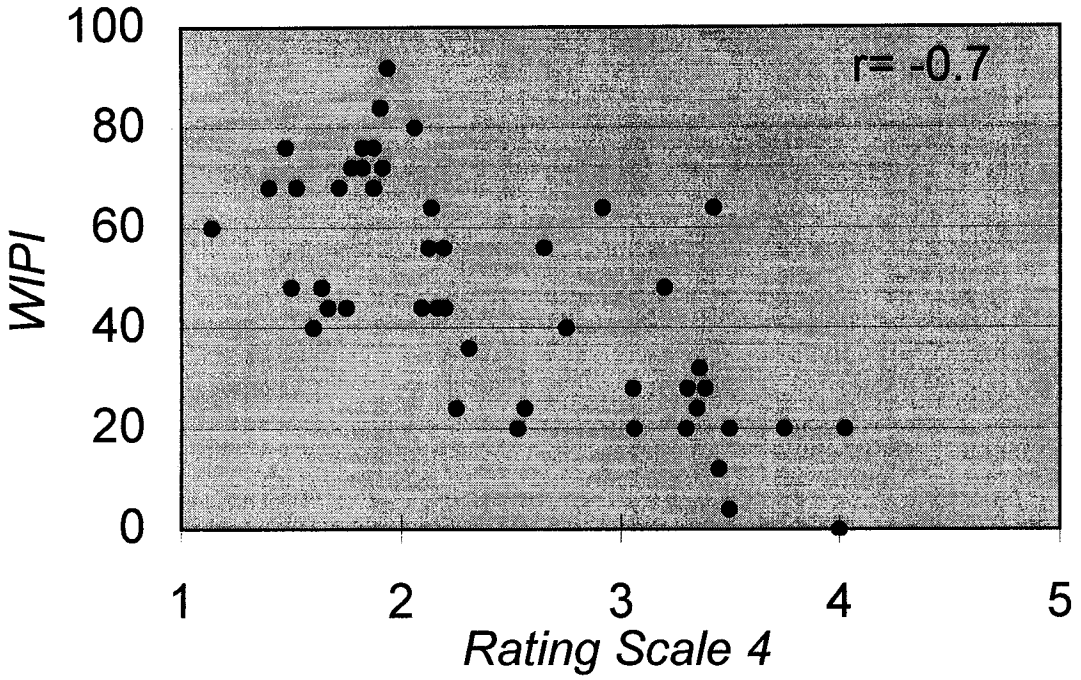
WIPI VS Persn Scale



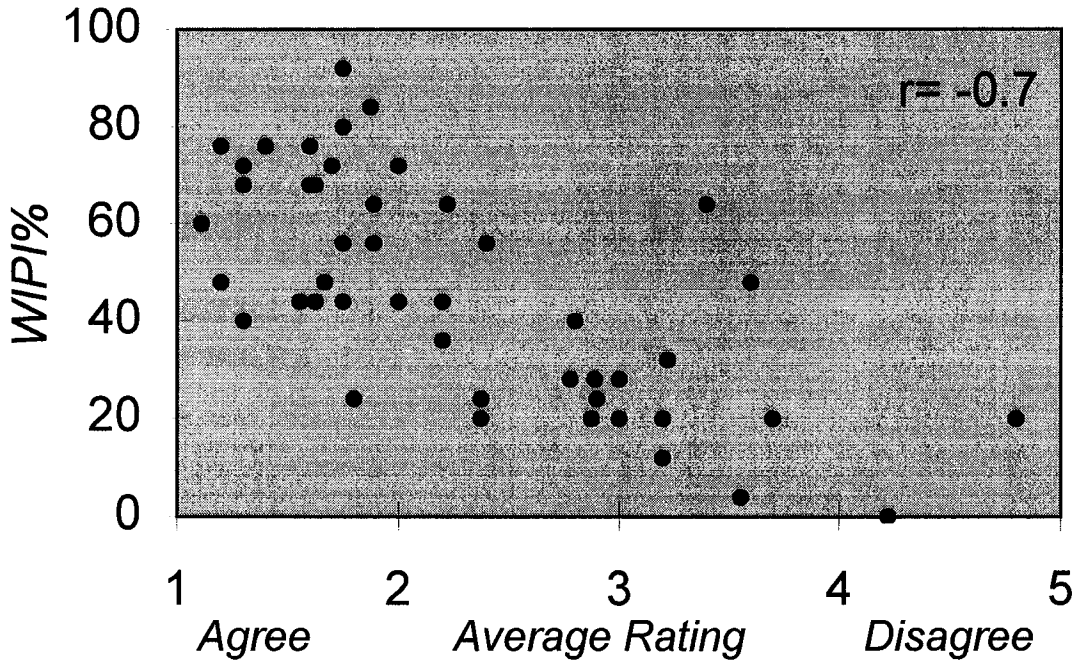
WIPI VS Emot Scale



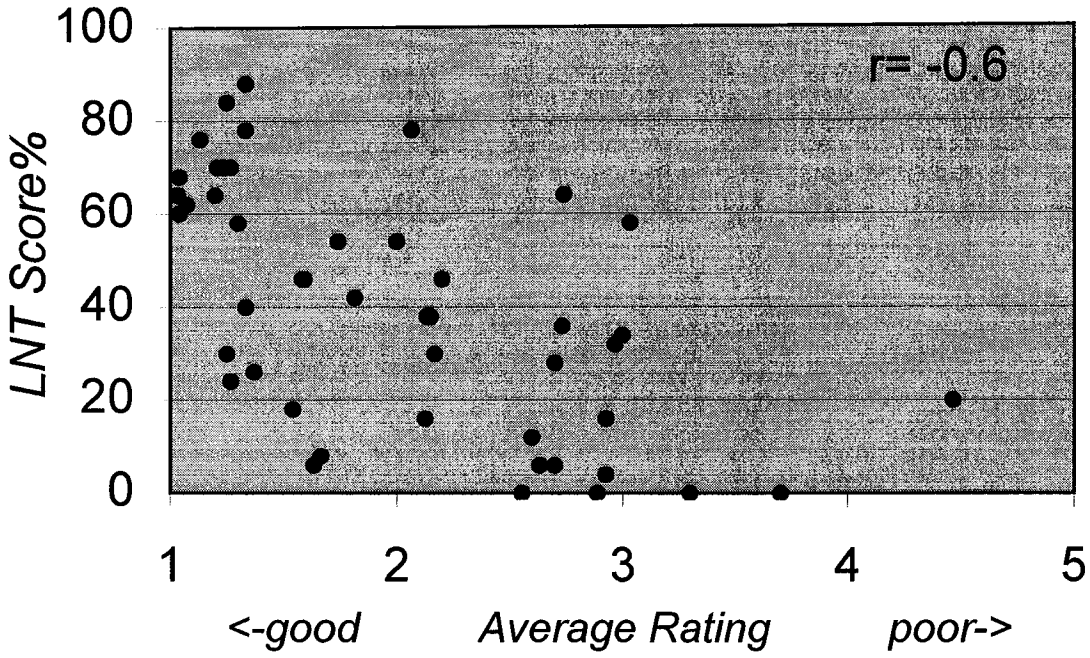
WIPI VS Exch of Info Scale



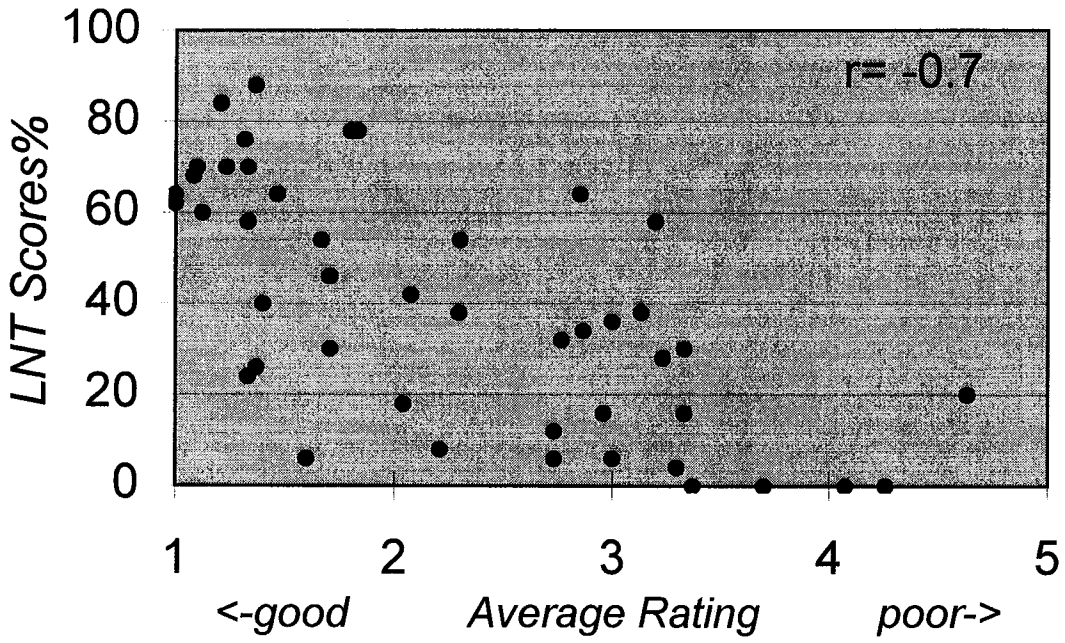
WIPI VS Meaningful Exchange(4#7)



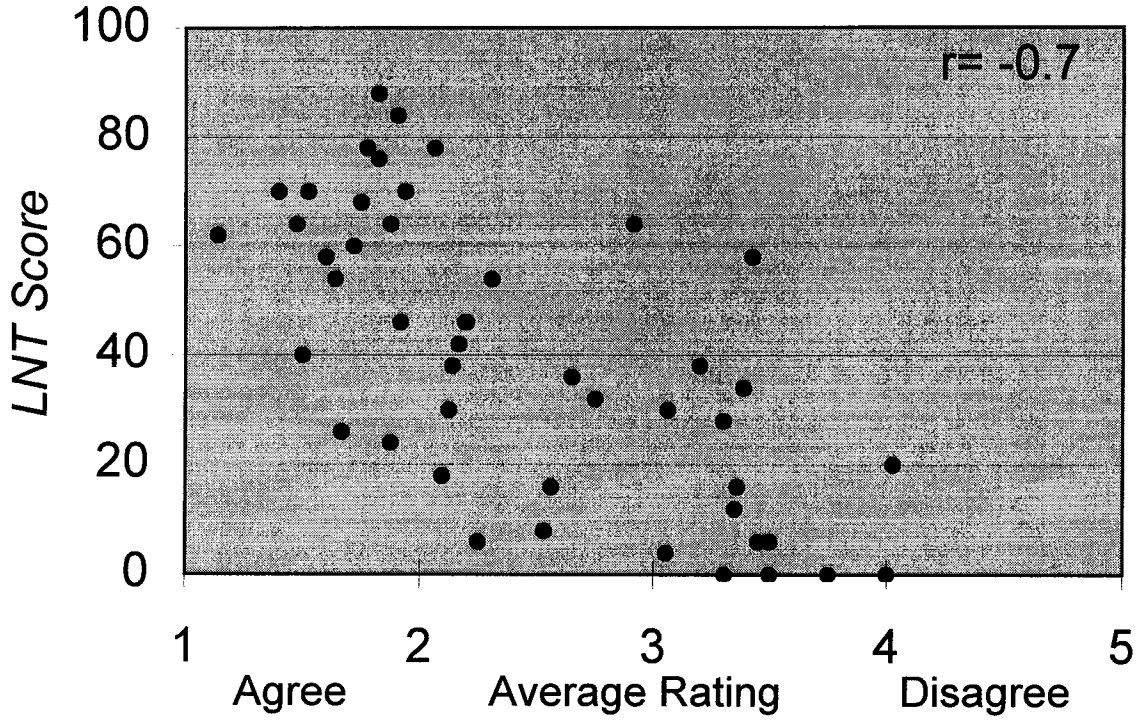
LNT VS Persn Scale



LNT VS Emot Scale



LNT Score VS Exch of Info Scale



LNT Score VS Meaningful Exchange