

*FACILITATING GENERALIZED REQUESTING BEHAVIOR IN
BROCA'S APHASIA: AN EXPERIMENTAL ANALYSIS OF A
GENERALIZATION TRAINING PROCEDURE*

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The effects of a generalization training procedure on requesting by 4 subjects with chronic Broca's aphasia were examined using a multiple baseline design across behaviors and subjects. Subjects were trained to request information on three topics sequentially. Generalization across topics and persons was assessed in weekly probe sessions consisting of 5-min conversational interactions with trainers and unfamiliar volunteers in a nontreatment setting. Results revealed generalization effects were greatest when trainers, as opposed to unfamiliar volunteers, served as conversational participants. Nevertheless, subjects' requests increased with all conversational participants to a level comparable to a normal comparison group assessed under conditions identical to the experimental probes. Social validation of treatment effects using a subjective evaluation procedure revealed significant improvement on the parameters of talkativeness, inquisitiveness, and conversational success.

DESCRIPTORS: aphasia, generalization, social validity, language, speech acts

The spontaneous speech of individuals with Broca's aphasia has been described as "telegraphic" or "agrammatic" (Goodglass, 1968) and is characterized by effortful production of short utterances in which functors, prepositions, auxiliary verbs, and grammatical morphemes marking tense and plurality are conspicuously absent. For decades, clinical aphasiologists have addressed the verbal production deficits associated with Broca's aphasia by training subjects to produce specific morpho-syntactic forms. That is, intervention efforts were directed at facil-

itating verbal production of frequently omitted structural elements within sentence contexts.

Early investigations reported consistent and rapid acquisition effects using a variety of treatment approaches replicated across a number of syntactic forms (Crystal, Fletcher, & Garman, 1975; Holland & Levy, 1971; Naeser, 1975; Shewan, 1976; Wiegel-Crump, 1976), but more recent investigations have found that subjects failed to use morpho-syntactic forms in the absence of training stimuli (Doyle, Goldstein, & Bourgeois, 1987; Kearns & Salmon, 1984; Thompson & McReynolds, 1986; Thompson, McReynolds, & Vance, 1982). As a result, recent aphasia intervention studies have attempted to facilitate transfer of treatment effects by employing various generalization-promoting techniques proposed by Stokes and Baer (1977), including loose training (Kearns, 1985; Kearns & Potechin, 1988; Thompson & Byrne, 1984), sequential modification (Wambaugh & Thompson,

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in press), and training common stimuli and sufficient stimulus exemplars (Thompson & Warner, in press).

In spite of generalization programming and measurement conditions that provided ample opportunities for subjects to use trained wh— interrogative constructions, generalization of these forms to novel settings has not been demonstrated consistently among subjects (Thompson & Byrne, 1984; Wambaugh & Thompson, in press). In contrast, studies in which Broca's aphasic subjects have been trained to produce functionally significant responses without regard to structural form have yielded more positive results (Kearns, 1985; Thompson & Warner, in press).

In the present investigation, a training procedure was used in which both stimulus dimensions and response criteria were loosened in an attempt to facilitate the functional use of requests for information in Broca's aphasic subjects. Requests were specifically targeted because previous research has found this behavior to be frequently omitted in the conversational discourse of Broca's aphasic subjects (Holland, 1982; Wilcox & Davis, 1977). The training procedure employed multiple trainers, used functional rather than structural response criteria, reinforced various topographies of the target behavior, and encouraged subject-initiated responses.

Our primary experimental question was whether the training procedure would increase subjects' use of requests for information about trained and non-trained topics in conversations with trainers and unfamiliar partners. Second, we were interested in the effect of treatment on the relative use of other classes of responses within conversational interactions. Third, we were interested in describing subjects' requests with regard to grammatical completeness and type of request (i.e., yes/no type or wh— type).

METHOD

Participants

Subjects. Three men and 1 woman, ranging from 46 to 63 years of age, participated in the study. All subjects were right-handed native speak-

ers of English, high-school educated, and lived independently or with family. They ranged from 29 to 195 months post onset of a single thromboembolic stroke within the distribution of the left middle cerebral artery. All subjects passed a pure-tone audiometric screening at 30 dB HL bilaterally at 500 and 1000 Hz and at 40 dB HL bilaterally at 2000 Hz. All subjects had negative histories for psychiatric illness and alcoholism.

All subjects were administered the Western Aphasia Battery (Kertesz, 1982) within 2 weeks prior to their participation in the study. This measure yielded speech and language profiles consistent with the diagnosis of Broca's aphasia and severity quotients of 64.4 for Subjects 1, 2, and 3 and 74.4 for Subject 4. All subjects had received previous speech and language therapy, but no treatment was received concurrent with their participation in this study. Detailed subject data are available from the authors upon request.

Volunteers. One hundred thirty-two hospital volunteers served as conversational participants. The volunteer group consisted of 66 men and 66 women ranging from 18 to 87 years of age ($M = 59.7$ years, $SD = 14.1$). None of the volunteers were familiar with the experimental subjects or the purposes of the study, nor did they receive any special training prior to their participation in the study.

Settings

Baseline/generalization setting. All baseline and probe sessions were conducted at a round table (0.91 m diameter) in a nontreatment room. All baseline and probe sessions were videorecorded through a two-way mirror using an Hitachi VM 2000A camera/recorder and audiorecorded using a Sony TCM 5000EV cassette recorder with Realistic lapel microphones. These sessions were timed using a Markson digital countdown timer with electronic alarm. During probes, all recording equipment and timers were placed out of view of the conversational participants, and a less clinical atmosphere was created by providing beverages and allowing participants to smoke.

Treatment setting. All treatment sessions were conducted at a rectangular table (0.91 by 1.82 m)

in a quiet room and were audiorecorded using a Sony TCM 5000EV cassette recorder. Time intervals used during training were determined by a stopwatch. During training, recording equipment, data sheets, stopwatch, and experimental prompt cards were all in view on the table.

Response Definitions and Scoring

Utterances were coded according to their communicative function. Although only the conversational act of requesting information was targeted for intervention, all utterances of both subjects and conversational participants were coded during baseline and probe sessions for descriptive purposes. The response definitions that follow were adapted from Dore (1977).

Requests. A word or utterance was considered a request when it solicited the hearer to affirm, negate, or confirm the proposition of the speaker's utterance or solicited information about the identity, location, or property of an object, event, or situation, based upon the following criteria: the utterance was (a) intelligible, (b) on a topic specified by the investigator, and (c) contained a question morpheme and a content word (e.g., "where home," "pills, what kind") or (d) ended with rising inflection (e.g., "you work^," "children^," "finished^"). Only unprompted requests were scored as correct. Under training conditions, requests were scored only if they occurred within the specified 20-s interval and communicated an unambiguous message as determined by the trainer. Under baseline, generalization, and maintenance conditions, an unambiguous request was determined by the conversational participants' provision of information that satisfied the request. Perseverative requests (i.e., requests that solicited information already provided within the probe interaction) were not included in the data analysis. All scoring for conversational interactions was done by the primary investigator (P.D.) from audiorecordings of the probes supplemented by typewritten transcriptions.

Responses. Utterances that provided information directly complementing prior requests were scored as responses. For example, the utterance "Yes, one boy and two girls" directly complements the re-

quest "you children^" by (a) affirming the proposition of the subject's utterance and (b) providing information about the identity of the children. Responses had to be intelligible, but structural criteria for scoring responses were not used.

Statements. Utterances that expressed facts, rules, attitudes, feelings, or beliefs were scored as statements. For example, a subject's utterance "me stroke" expresses a fact about the speaker. The utterance "you look like you're doing well" expresses a belief. Statements were intelligible utterances that contained a subject and a verb, object, or modifier.

Other. Conversational acts that did not meet the definitional criteria for requests, responses, or statements were coded as "other." These included organizational devices that served to regulate the conversation, such as topic initiations, commands, acknowledgments, and social conventions.

Unintelligible/uninterpretable. Utterances that could not be interpreted by the conversational participants as evidenced by requests for repetition or clarification or statements communicating misunderstanding were scored unintelligible. In the absence of such markers, utterances were also coded unintelligible when transcribers could not determine the content of the utterance.

Experimental Design and Procedures

A multiple baseline design across behaviors and subjects was used to assess the effects of treatment. The primary dependent variable was the number of subject-initiated, on-topic requests within a 5-min conversational interaction. The multiple baseline design across behaviors was used to assess both response generalization (i.e., the use of requests about untrained topics) and stimulus generalization (i.e., the use of requests about trained topics under nontraining conditions). The multiple baseline across subjects was used prospectively for control purposes in the event that subjects' requesting behavior generalized across topics.

Baseline. Subjects' ability to request information about an identified topic was assessed in 5-min timed conversations with trainers and unfamiliar peer volunteers. Each baseline session consisted of

six separate 5-min interactions; one with each of the three trainers (P.D., M.B., and K.N.) and one each with three different unfamiliar volunteers. The ordering of topics and conversational participants was counterbalanced across sessions throughout all phases of the study.

Prior to each interaction, volunteers were informed that the purpose of their visit was to give a language-impaired stroke patient practice at conversing with unfamiliar people. They were instructed to stay on one of the three identified topics, to give the subject an opportunity to talk as much as they did, and within these constraints, to try to have as natural a conversation as possible. When trainers served as conversational participants, they behaved in a manner consistent with the instructions given to volunteers. Subjects were instructed to ask the conversational participant as many questions as possible about the specified topic (e.g., personal information, leisure activities, or health). However, the specific *content* of probes was not controlled for and varied considerably across conversational interactions. For example, during personal information probes, specific content included discussion about family, careers, pets, military service, politics, neighborhoods, education, growing up, and so on. Baseline sessions were conducted three times weekly until stable levels of requesting were demonstrated for each subject.

Training. Subjects received treatment individually three times a week for a total of 36 to 40 treatment sessions (approximately 3 months). Subject 2 received six treatment sessions each week because he lived outside of commuting distance and voluntarily admitted himself to the medical center for the duration of the study (approximately 2 weeks). Each successive treatment session was conducted by one of three ASHA certified speech/language pathologists (P.D., M.B., K.N.) counterbalanced within each week. The order in which the three main topics were trained was counterbalanced across subjects.

Each session began with the initial prompt to ask questions about the training topic. Following the topic prompt and all subsequent levels of prompts, a 20-s interval in which the trainer re-

mained silent and maintained eye contact with the subject served as a stimulus for responding. If within the 20-s interval the subject responded in a manner that met the criteria established for requests, and the request was "adequate" (i.e., communicated an unambiguous message), the trainer praised the subject and provided the solicited information. The next trial then began with another 20-s interval in which the trainer remained silent while maintaining eye contact with the subject.

When inadequate (i.e., ambiguous) requests were produced, the trainer praised and acknowledged the subject's attempt and allowed another 20-s interval for the subject to produce an adequate request. If the subject did not respond adequately within the second 20-s interval the trainer provided a specific content prompt. If the subject responded adequately following the specific content prompt, the trainer praised the subject and provided the solicited information. If following the specific content prompt, the subject's response was still not adequate, the trainer modeled an adequate request for the subject to imitate. Following the subject's repetition of the modeled request, the trainer provided the solicited information and the next trial began.

When subjects produced speech acts other than requests, off-topic requests, and perseverative or unintelligible utterances, response-specific feedback was provided. When a subject failed to respond within the 20-s interval, the trainer provided a general content prompt (e.g., "you could ask a person about their family") selected from a prepared list of topic-specific prompts.

Twenty such trials were conducted each session. Subjects were not trained to a specific criterion level. Rather, as a result of the practical considerations of scheduling probes with volunteers, subjects received three to four treatment sessions followed by a probe each week until four probes were conducted for each topic.

Supplemental topic cue treatment. Subject 4 received five sessions of a supplemental treatment due to weak generalization effects on the last trained topic. This consisted of providing cue cards upon which the 20 general content items for each main

topic were listed. For example, the cue card for the main topic "Personal Information" had listed (a) home, (b) family, (c) career, (d) neighborhood, and so on. The subject was instructed to refer to the card whenever necessary during the probe.

Generalization probes. Generalization probes were identical to baseline probes. Following four probes on a given topic, training was initiated on the next topic.

Maintenance. Following the termination of treatment on a particular topic, probes continued to be administered on a weekly basis. Follow-up probes were conducted 6 weeks after the termination of treatment for all subjects and again at 12 weeks for those subjects still available.

Descriptive Analyses

Proportion of speech act use. Changes in the relative use of all coded speech acts were investigated by sampling the first four volunteer baseline probes, all volunteer probes conducted during the treatment phase, and the last four volunteer maintenance probes across all topics. The percentages of utterance types were calculated for each phase for both subjects and volunteers.

Qualitative analysis of subjects' requests. All subjects' requests were scored with regard to (a) whether they solicited the conversational partner to affirm or negate the proposition of the subject's utterance (i.e., a yes/no request) or solicited information about the identity, location, or property of an object, event, or situation (i.e., a wh— request), (b) question morpheme usage (i.e., who, what, where, when, why, how, are, do), and (c) grammatical completeness of the utterance (i.e., included all structural elements of standard English interrogative forms).

Reliability

Transcription. Audiorecordings of all conversational interactions were transcribed using a Craig 2706A cassette transcription unit with earphones. A second observer (K.N.), who was familiar with the experimental questions, was provided with all original transcripts and corresponding audiorecordings and was instructed to indicate any errors of

transcription on the original transcript. Utterances on which there were disagreements with regard to content were not scored. This represented less than 1% of all utterances transcribed throughout the study.

Dependent variables. Interobserver reliability was determined in two ways for the dependent variables. First, point-to-point reliability was determined by having the primary investigator (P.D.) and an additional investigator (K.N.) independently score all utterances within a sample (i.e., requests, statements, responses, others, and unintelligible responses of both the subject and conversational participant). Second, point-to-point reliability was determined for only the subjects' requests within samples. Percentage of agreement was determined by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. These procedures were conducted on a random sample of 33% of trainer and volunteer probe conversations for each subject across all phases of the study.

The mean (range) interobserver agreement for all utterances coded within a conversational interaction was 90.3% (81.6%–97.5%), 90.1% (76.2%–98%), 91.6% (73.3%–100%), and 91.8% (79.7%–100%) for Subjects 1, 2, 3, and 4, respectively. The mean (range) interobserver agreement when considering only subjects' requests was 87.4% (0%–100%), 83.7% (0%–100%), 89.6% (0%–100%), and 93.9% (0%–100%) for Subjects 1, 2, 3, and 4, respectively. The wide range of variability in agreement for coding subjects' requests was a function of baseline sessions in which judges had to agree on the occurrence or nonoccurrence of a single request. The modal interobserver reliability score for these data was 100% across all subjects.

Independent variable. Interobserver reliability for the independent variable was determined by scoring training behaviors on a trial-by-trial basis from audiorecordings of the treatment sessions. This was done for six randomly selected treatment sessions (two from each topic trained) for each subject. Each trial was scored (+) if the trainer accurately carried out all steps of the treatment procedures

and (–) if the trainer failed to follow the specified procedures. The mean (range) percentage of agreement across all treatment sessions scored was 88% (80%–90%), 93% (90%–100%), 94% (90%–100%), and 93% (80%–100%) for Subjects 1, 2, 3, and 4, respectively. The bases for disagreement were inappropriate use of response-specific feedback and the premature use of specific content prompts (i.e., prior to a general content prompt).

Social Validation

A social comparison procedure (Kazdin, 1982) was used to obtain data on nonlanguage impaired adults' use of requests for information on the same topics (personal information, leisure activities, health) used in the experimental investigation. The social comparison group consisted of 38 men and 34 women ranging from 24 to 82 years of age ($M = 64$, $SD = 9.4$). Volunteers were separated into dyads in which neither member was familiar with the other. One member of the pair was given the instructions given to the experimental subjects, and the other member received the instructions given to volunteers who participated in the experimental investigation. Sixteen separate interactions were conducted for each topic. The audiotaped samples were transcribed, scored for the number of on-topic adequate requests, and checked for reliability of transcription and scoring in a manner identical to those used for the experimental procedures. The mean (range) reliability score obtained for these data was 91% (78.5%–100%). The number of on-topic requests used by the conversational participants who had received subject instructions were tallied, and means and standard deviations were computed for each topic.

A subjective evaluation procedure (Kazdin, 1982) was also used to determine whether persons unfamiliar with the subjects and the experimental procedures could detect changes over time on a number of conversational dimensions. In this procedure, a group of 12 masters-level speech pathology students rated a sample of 16 videotaped conversational interactions from the experimental study. The videotaped samples consisted of four volunteer probes for each subject (the last two probes conducted during the baseline and treatment phases

for the topic of personal information). The interactions were dubbed onto a master tape in random order across phases and subjects. Judges viewed the master tape in one session, pausing between each 5-min interaction to rate the conversations on the dimensions of subject talkativeness, subject inquisitiveness, volunteer comprehension, success, naturalness, and comfortableness. Each dimension was rated on a 7-point Likert-type scale. These data were collapsed across judges and subjects ($N = 96$) and the mean ratings obtained for each dimension were compared for baseline and treatment phase samples using a two-tailed Student's t test (Fisher, 1973).

RESULTS

The acquisition, generalization, and maintenance effects of treatment are shown in Figures 1 through 4 for Subjects 1 through 4, respectively. Three types of subject data are included in these figures: training data and two types of generalization data. Training data consist of the number of unprompted adequate requests for information out of 20 training trials per session. These data should not be compared to subjects' performance during baseline or social comparison data because they do not represent requests for information during 5-min conversational interactions. They are included to demonstrate that subjects were able to provide up to 20 different, unprompted, content-specific requests under training conditions. Trainer/volunteer probe data consist of the number of subject-initiated, on-topic requests that occurred within a 5-min conversational interaction with trainers or volunteers in a nontreatment setting. The horizontal lines running through each leg of the multiple baselines represent the means and (± 1) standard deviations of on-topic requests produced by the social comparison group during 5-min conversational interactions on each topic.

Baseline Data

Examination of subjects' performances during baselines reveals stable rates of requesting across all topics at levels below the normal range, as determined by the comparison group data. Conversa-

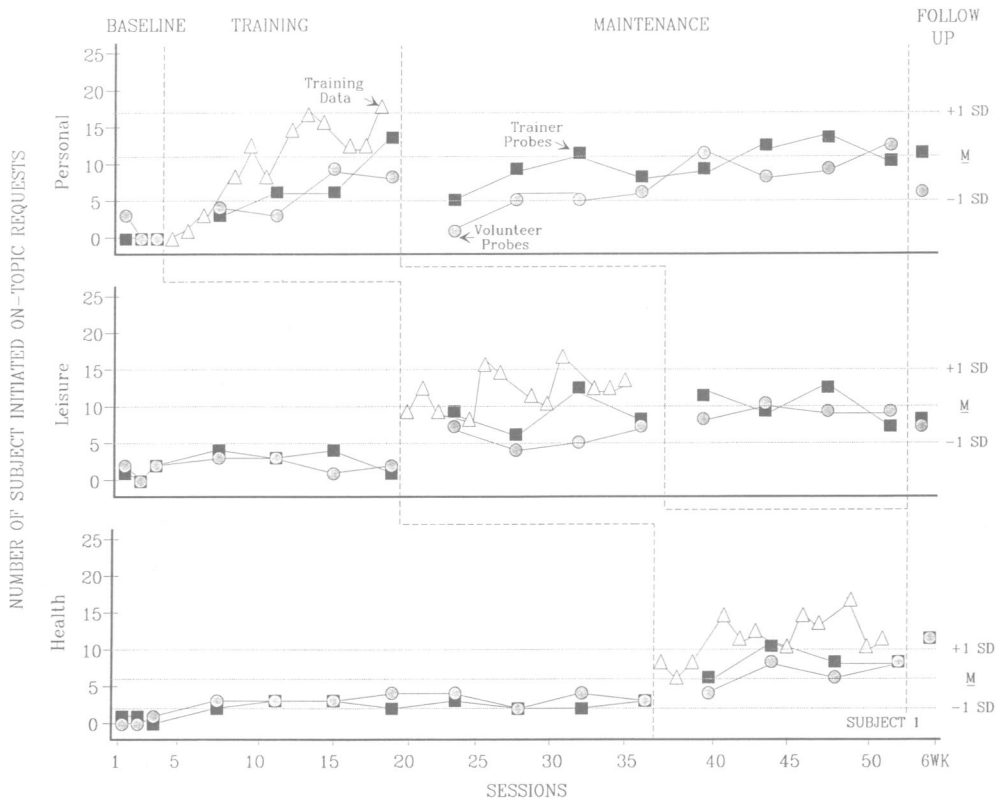


Figure 1. Frequency of self-initiated on-topic requests by Subject 1 across topics and experimental phases.

tional participants (i.e., trainers and volunteers) carried most of the communicative burden. Only rarely did subjects use a marker (i.e., question morpheme or rising inflection) that communicated an intent to request information.

Training Data

Subjects' performance under training conditions are shown in the treatment phases of Figures 1 through 4. Subjects provided increasing numbers of unprompted requests over time during training. Levels of performance on subjects' first trained topic ranged from 0 to 13 during the first week of treatment and 9 to 19 during the last week of treatment.

Response Generalization Effects of Treatment

The response generalization effects of treatment can be evaluated by comparing subjects' use of requests on trained topics during generalization probes to their performance on nontrained topics

under baseline conditions. Inspection of these data reveals that Subjects 1, 2, and 3 showed no evidence of response generalization. That is, their baseline performance remained stable and at low levels until training was initiated on each topic. Subject 4's data reveal that once training had been initiated on the topic of health, there was an overall increasing trend and greater variability under baseline conditions on the topic of personal information.

Stimulus Generalization Effects of Treatment

The stimulus generalization effects of treatment can be evaluated by comparing subjects' baseline performance to their performance on generalization probes for each topic. These data represent the effect of treatment on subjects' use of requests on trained topics in conversational interactions with trainers and unfamiliar volunteers in a nontreatment setting.

Performance with trainers. Inspection of these

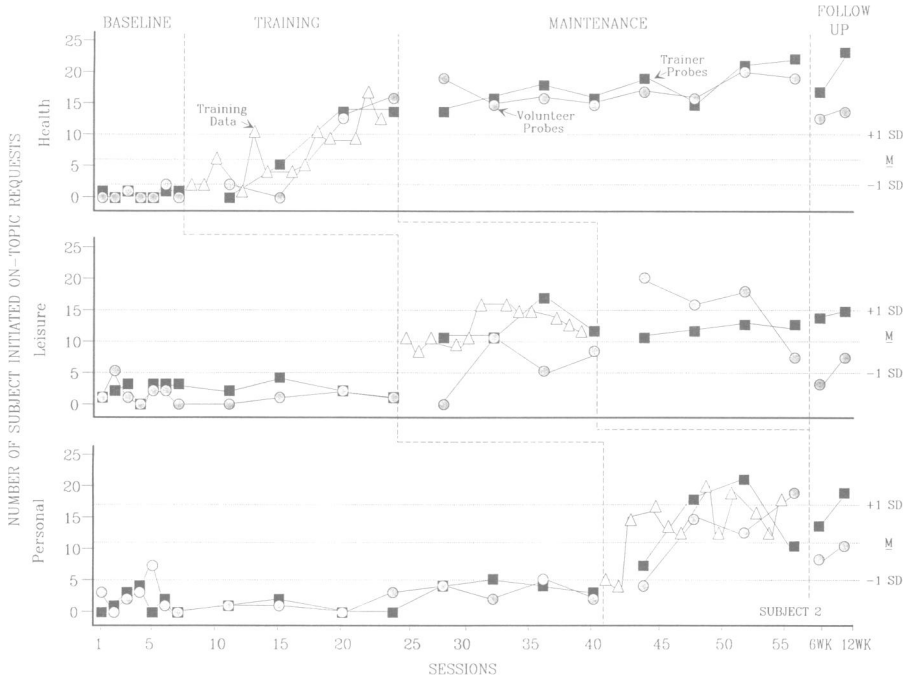


Figure 2. Frequency of self-initiated on-topic requests by Subject 2 across topics and experimental phases.

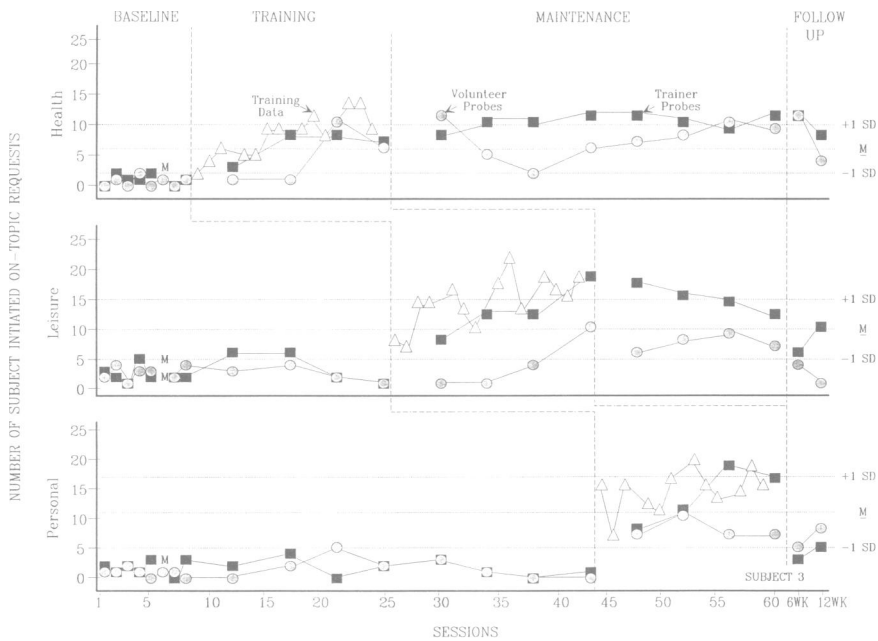


Figure 3. Frequency of self-initiated on-topic requests by Subject 3 across topics and experimental phases.

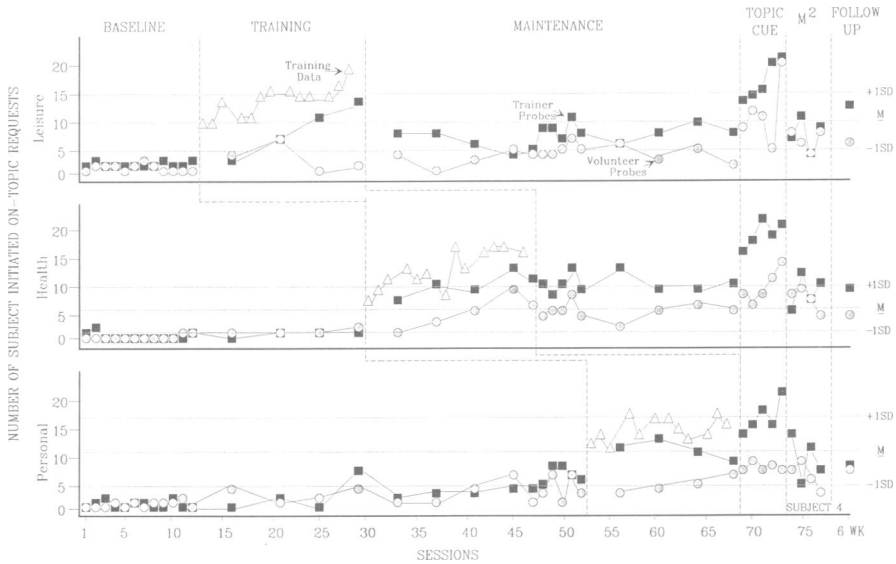


Figure 4. Frequency of self-initiated on-topic requests by Subject 4 across topics and experimental phases.

data reveals that the baselines of all subjects were at low and stable levels with the exception of Subject 4's final baseline (personal information) in which a gradual positive trend was noted between Sessions 35 and 55. Following the initiation of treatment, all subjects demonstrated a rapid and marked increase in the use of requests during trainer probes. Subjects' use of requests during trainer probes paralleled unprompted requests during training at comparable or slightly lower levels of performance across all subjects.

Performance with unfamiliar volunteers. Inspection of these data reveals low and stable levels of performance during baseline for Subjects 1, 2, and 3. Subject 4's baseline performance remained stable and at low levels until training was initiated on the second topic (health), at which time a positive trend with some variability was noted in the final baseline (personal information).

The effects of treatment were replicated with some variability across subjects. For Subject 1, the number of requests in volunteer probes increased gradually as each week of training was completed. Volunteer probe data paralleled the trainer probe data but at a slightly lower level.

For Subject 2, the effect of treatment was delayed

for all topics. During the first two volunteer probes on the topic of health and during the initial probes on the remaining two topics, there was little effect. However, by the third probe, effects were strong and remained at levels well above baseline throughout the maintenance phase of the study. These data again paralleled trends in the data obtained during trainer probes, but at an overall lower level.

Subject 3's data are similar to those of Subject 2 in that the effect of treatment was delayed for the first two topics trained. On the final topic trained (personal information), the effects were immediate, and remained relatively stable across all four probe sessions at levels well above baseline. As with Subjects 1 and 2, this subject's use of requests with unfamiliar volunteers was at an overall lower level than those obtained during trainer probes.

Subject 4's use of requests varied across topics. When the initial topic, leisure, was to be discussed, base rates were low with essentially no variability. Following the initiation of treatment there was a gradual increase in the number of requests produced in the first two volunteer probes, but the effect was not stable. In the third and fourth probes on this topic, subject-initiated requests returned to levels comparable to those obtained during baseline. Fol-

Table 1
Percentage of Speech Acts per Phase

	Subject			Volunteer		
	Base- line	Train- ing	Main- tenance	Base- line	Train- ing	Main- tenance
Requests						
1	4	23	37	51	41	38
2	5	26	37	40	41	33
3	4	22	30	51	43	46
4	3	19	23	55	43	42
Responses						
1	47	41	37	3	19	32
2	40	41	33	4	23	30
3	47	41	45	3	18	25
4	56	41	37	2	18	20
Statements						
1	4	6	4	38	32	21
2	15	5	3	42	25	26
3	2	5	2	36	23	21
4	10	10	15	28	24	23
Other						
1	41	26	16	8	7	8
2	35	25	24	14	11	11
3	37	17	10	10	16	8
4	20	19	13	15	14	15
Unintelligible						
1	4	4	6	0	1	1
2	5	3	3	0	0	0
3	10	15	13	0	0	0
4	11	11	12	0	1	0

lowing the initiation of treatment on the second topic (health), a gradual, positive trend was observed across the first four volunteer probes. Inspection of baseline data for the third topic (personal information), reveals that this subject was producing low and stable levels of requests until training was initiated on the second topic. At this point, the subject gradually increased his use of requests during probes on the topic of personal information as indicated by the positively sloped trend and variability in performance for Sessions 35 through 55. Once treatment was initiated on the topic of personal information, the subject's performance became more stable, yet considerable overlap in the data between baseline and treatment phases suggests a weak treatment effect. Following the fourth probe on this topic (Session 70), the supplemental topic cue treatment was implemented

for all topics. There was a rapid and marked increase in the subject's use of requests for all topics during trainer probes and for the topics of leisure and health during volunteer probes. During personal information probes with volunteers, the treatment effect was not as strong, although there were no overlapping data points between the previous experimental phases and the supplemental treatment phase. When the supplemental topic cue treatment was withdrawn the number of subject-initiated requests decreased for all topics to levels comparable to those in the training phase.

Maintenance Effects of Treatment

Subjects' performance during probes following the termination of training for each topic remained at levels comparable to those obtained during the training phase of the study, indicating good maintenance effects of treatment. For those topics on which several maintenance probes were conducted (i.e., the first and second topics trained for each subject), the effects were stable for all subjects.

Proportion of Speech Act Use

Table 1 shows the relative proportion of speech acts used in conversational interactions by subjects and unfamiliar volunteers across experimental phases. These data reveal increased levels across experimental phases in the use of requests by all subjects with corresponding increases in the proportion of volunteer responses. The proportion of requests used by subjects and volunteers approached equality by the maintenance phase of the study, with subject proportions ranging from 23% to 37% and volunteer proportions ranging from 33% to 46% of the total number of utterances within the phase.

Other consistent trends in the data include a decline in volunteers' use of statements from a range of 28% to 42% during baseline to a range of 21% to 26% during the maintenance phase of the study. Similarly, the utterances coded as "other" decreased across experimental phases for all subjects.

Qualitative Analysis of Requests: Form and Function

The mean number of requests per interaction, the percentage that functioned as yes/no and wh—

Table 2
Summary of Qualitative Analysis of Subjects' Requests

	Mean requests per interaction (total requests/ total interactions)	% wh—	% y/n	% + morpheme	% + grammatical
Subject 1					
Baseline	2.0 (42/21)	2	98	0	0
Treatment	6.08 (73/12)	5	95	1	0
Maintenance	7.8 (117/15)	6	94	0	0
Subject 2					
Baseline	1.7 (57/33)	61	39	65	7
Treatment	8.5 (102/12)	41	59	34	1
Maintenance	12.7 (229/18)	22	78	20	0
Subject 3					
Baseline	13 (46/35)	76	24	76	54
Treatment	5.08 (61/12)	31	69	23	13
Maintenance	6.3 (114/18)	31	69	23	13
Subject 4					
Baseline	1.2 (66/54)	48	52	52	32
Treatment	4.0 (52/13)	37	63	42	25
Maintenance	3.8 (88/23)	43	57	45	34
Topic cues	9.5 (143/15)	31	69	32	24
Baseline 2	6.4 (77/12)	30	70	35	27
Follow-up	5.7 (17/3)	18	82	18	12

requests, and the percentage that were grammatically complete and used question morphemes are presented in Table 2. These data reveal that the mean requests per session increased from a range of 1.2 to 2.0 in baseline to a range of 3.8 to 12.7 during the maintenance phase of the study. The percentage of wh— requests decreased and the percentage of yes/no requests increased across experimental phases for Subjects 2, 3, and 4, whereas the reverse was observed for Subject 1. Similarly, the percentage of requests that were grammatically complete and the percentage that contained question morphemes decreased across experimental phases for Subjects 2, 3, and 4. Subject 1 never produced grammatically complete requests and used question morphemes in only 1% of his requests during the treatment phase.

Social Validation

Social comparison. Figures 1 through 4 show that the mean values (and standard deviations) for personal information, leisure, and health were 10.8

(6.4), 9.9 (5.4), and 5.9 (3.8), respectively. Comparing subjects' volunteer probe data to these values, it can be seen that overall baseline levels were below the normal range, with the exception of Subject 1's final topic (health). Following the initiation of treatment, subjects' level of requesting increased to within the normal range for all topics, with the exception of Subject 4's first topic (leisure), where negligible effects were demonstrated. Otherwise, the level of performance remained within the normal range throughout the maintenance phase of the study.

Subjective evaluation. The results of the subjective evaluation procedure reveal that subjects were rated significantly more talkative, $t(190) = 6.13$, $p < .01$, and requested significantly more information from their conversational partners, $t(190) = 10.96$, $p < .01$, following the initiation of treatment. The conversations were also rated as being significantly more successful, $t(190) = 2.05$, $p < .01$, following training. Nonsignificant differences were obtained for the dimensions of vol-

unteer comprehension, $t(190) = .339, p > .01$, naturalness, $t(190) = .139, p > .01$, and comfortableness, $t(190) = .395, p > .01$.

DISCUSSION

The purpose of this investigation was to evaluate the effects of a generalization training program on Broca's aphasic subjects' use of requests for information. Stimulus generalization was measured continuously under conditions approximating a natural conversational context with both familiar (trainers) and unfamiliar (volunteers) conversational participants. The results indicated that, for all subjects, the target behavior generalized to conversations with familiar partners. These effects were strong and were replicated on each of 11 opportunities across the 4 subjects.

More frequent requests for information also were noted when unfamiliar volunteers served as conversational participants, although these effects were less robust. Generalization to conversations with unfamiliar conversational partners was replicated on each of eight opportunities for Subjects 1, 2, and 3. For Subject 4, generalization to the volunteer probe condition was clear for one of the topics trained (health) but less consistent for the other two topics. Subject 4 differed from Subjects 1 through 3 in terms of the severity of his motor speech impairment, but demonstrated an adequate repertoire of content-specific requests during training. It was hypothesized that the motor speech impairment (i.e., difficulty initiating speech, decreased speech rate, and impaired fluency) may have been a contributory variable inhibiting generalization to conditions in which responding was often required in less than 20 s (i.e., the interval allowed during training). Subject 4's positive response to the topic cue treatment and the subsequent reversal following withdrawal of this intervention suggest that initiation difficulties and decreased rate and fluency may have been controlling variables. These results are consistent with those of Thompson and Warner (in press) who reported limited generalization effects in 3 of 6 Broca's aphasic subjects who presented with co-occurring apraxia of speech.

The otherwise extensive stimulus generalization

effects found in the present study stand in contrast to those of most investigations in the aphasia treatment literature (Doyle *et al.*, 1987; Kearns & Salmon, 1984; Thompson & Byrne, 1984; Thompson & McReynolds, 1986; Wambaugh & Thompson, in press). Methodological differences such as the behaviors targeted for intervention, the sampling procedures used, and the generalization programming employed make comparisons across studies difficult. However, the training procedure used in the present investigation differed significantly from others that have been reported, was designed specifically to facilitate generalization, and was demonstrated to be functionally related to the observed effects across all subjects. The facilitative tactics included (a) using multiple trainers, (b) employing functional rather than structural response criteria, (c) reinforcing various topographies of the target behavior, (d) encouraging subject-initiated requests, and (e) using natural reinforcers. The design of this investigation does not permit inferences with regard to the separate contributions each variable may have made to the observed changes in behavior. Therefore, future research is needed to isolate variables that are necessary and sufficient for stimulus generalization to occur.

The generality of these findings must be considered as yet untested. Generalization data were gathered in highly analogue conditions in which there was considerable overlap of setting events (i.e., trainers and other artificial stimuli) with the training environment. Therefore, further research in which the effects of treatment are measured across a variety of settings is necessary to establish the extent to which the observed effects are externally valid.

Another aspect of this study addressed the response generalization effects of treatment; that is, the effect of training subjects to request information about a particular topic on their ability to request information about novel (untrained) topics. Response generalization was measured by introducing training across topics sequentially and probing the remaining topics during the extended baseline conditions. The results indicated that treatment did not result in generalization of the target behavior across topics.

These findings may also be explained by the

training procedure. Training was conducted sequentially across topics. When one topic was being trained, requests for information about other topics resulted in the trainer withholding the solicited information and indicating to the subject that his or her request was off-topic. This aspect of the treatment protocol may have inhibited generalization across topics by selectively reinforcing specific content. However, type or token analyses of all requests trained and all requests used during generalization probes revealed that as many as 11% of subjects' requests *within* topics were novel.

Kearns (1985) and Kearns and Potechin (1988) were able to facilitate generative responding in several aphasic subjects by reinforcing and shaping any subject-initiated utterance that was appropriate for a given stimulus regardless of its form or content. These findings suggest that generative responding may be obtained by using training procedures that not only sample and reinforce a variety of forms of the target behavior but, in addition, allow for variation with regard to content as well.

The data describing the form and function of subjects' requests reveal that subjects used more yes/no than wh— requests, and that improved efficiency of requesting occurred within the context of negative effects with regard to grammatical completeness and question morpheme usage. Because structurally deficient subject requests such as “you children”, “you golf”, and “pills, what kind” functioned adequately during conversational interactions, the desired natural maintaining contingencies (Stokes & Baer, 1977) of obtaining solicited information and maintaining social interaction operated. These results support the use of functional rather than structural response criteria when treating aphasic individuals, who characteristically present with propositional aspects of language disproportionately impaired relative to language pragmatics (Guilford & O'Connor, 1982; Holland, 1977; Prinz, 1980).

Analysis of conversational interaction patterns between subjects and unfamiliar volunteers revealed changes across experimental phases in the proportionate use of speech acts such that the percentage of subjects' and volunteers' use of requests approached equality. Because subjects successfully re-

quested information from volunteers more frequently, the opportunities for volunteers to communicate information in the form of self-disclosures (i.e., statements) were necessarily decreased. Essentially, subjects were able to exert more control over the conversational interaction by actively shifting the speaker role to the conversational partner through the use of requests. These findings are inconsistent with previous descriptive studies in which aphasic subjects were reported to assume a passive communicative role, use a limited variety of speech acts, and rarely solicit information from conversational partners (Gurland, Chwat, & Wollner, 1982; Holland, 1982; Kimbarow, 1982; Prutting & Kirchner, 1987; Wilcox & Davis, 1977).

Finally, the results of the subjective evaluation procedure indicated that the changes in subjects' communicative functioning were socially apparent and desirable.

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