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INFORMATION FLOW IN BATTALION COMMAND GROUPS

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Information flow in battalion command groups was measured via a questionnaire based on information presented during the brigade briefing. Data from 13 groups showed that a substantial amount of information was lost in the processes of communication and remembering. Averaged over all command groups, there were consistent differences in the percentage of available required information communicated through particular channels, varying from 17% to 80%. Among battalion commanders, those who transmitted more information received less from their staffs. The fact that information loss was

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concentrated in specific, identifiable areas, indicates that efforts to improve communication can be focused where they are needed.

Technical Report 499

INFORMATION FLOW IN BATTALION COMMAND GROUPS

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Training Simulation

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FOREWORD

The Fort Leavenworth Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducts a research program in support of the Combined Arms Center (CAC), which includes the Combined Arms Training Developments Activity (CATRADA), the Combined Arms Combat Development Activity (CACDA), and the Command and General Staff College (CGSC).

The CATRADA-related efforts encompass the identification of critical command group performance requirements at battalion, brigade, and division levels, the development of procedures for measuring the training effectiveness of battle simulations, and the development of specifications for more effective command and control training systems through experimentation with current simulations.

The present investigation extended the development of performance measures and the identification of training requirements reported earlier. Previous reports have described an assessment methodology based on the Command Group/Staff Module of the Army Training and Evaluation Program (ARTEP) and the results of using that methodology to measure the performance of battalion command groups in the Combined Arms Tactical Training Simulator (CATTS). This paper describes the application of a procedure designed to measure the effectiveness of intragroup communication--an important facet of command group performance, which is not directly addressed by the ARTEP.

This investigation is responsive to the objectives of Army Project 2Q263744A795 and to the special requirements of CATRADA concerned with the development of procedures for measuring command group performance and the identification of critical command group performance requirements. These special requirements are expressed in Human Resources Need 80-94, Technical Assistance in the Evaluation of Training Effectiveness and Cost Analysis of the Army Training Battle Simulation System (ARTBASS).

LTC Frank McGurk and the staff of the Automated Command Training Division of the Battle Simulations Development Directorate, CATRADA, at Fort Leavenworth, provided invaluable aid in developing measures of command group performance and conducted the exercises on which this research is based.

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INFORMATION FLOW IN BATTALION COMMAND GROUPS

BRIEF

Requirement:

To develop meaningful measures and methods of measurement of command group performance that can be used (a) to diagnose deficiencies and provide feedback to participants in command group training exercises, (b) to identify training requirements common to incumbent command groups, and (c) to help evaluate the relative effectiveness of alternative command group training systems and strategies.

Procedure:

Thirteen U.S. Army battalion groups participated in simulated combat exercises generated by the Combined Arms Tactical Training Simulator (CATTS). At the beginning of each exercise, each principal member of the command group was briefed separately by his brigade counterpart, except for the commander and S3 who were briefed together. During these briefings, certain unique items of information were presented to each member. Then the members worked together for 3 to 4 hours to develop a plan which they presented to their company commanders. Subsequently, the group members and company commanders answered a multiple-choice test based on the unique information originally presented in the brigade briefing. By analyzing their responses, it was possible to trace the flow of information through the battalion command group.

Findings:

A substantial amount of information was lost in the processes of communication and remembering. The command group members recalled 81% of the information that was presented to them directly by their brigade counterparts. They recalled only 63% of the required information that was available to them from other members of the command group. Averaged over all groups, there was a distinctive pattern of strong and weak communication channels. The battalion commanders and S3's were relatively good transmitters and receivers. The FSO's and S4's were better receivers than transmitters, while the reverse was true for the S2's. The S1's usually had the lowest transmission and reception scores. Among battalion commanders, those who transmitted the most information, generally received the least information from their staffs. [The observation that information loss was concentrated in specific, identifiable channels allows efforts in improving communications to be focused where they are needed.]

Utilization of Findings:

The information-flow measurement methodology developed in this research has been incorporated into the CATTS training exercise. It is used, together with other performance measures, to provide feedback to the groups that are exercised, and to build up a data base on the common strengths and weaknesses of incumbent battalion command groups, which helps to specify the Army's command group training requirements. It also contributes to the development of a comprehensive assessment methodology for evaluating the effectiveness of future command group training systems.

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INTRODUCTION

Background

In the Fall of 1975, a concerted effort was begun to improve the effectiveness of command group training in the U.S. Army. The Combined Arms Center (CAC) at Fort Leavenworth, Kans., was charged with the responsibility of developing training programs for battalion and higher commanders and their staffs. At the same time, the continued development of battle simulations, which had been conducted at several different locations, was centralized under CAC at Fort Leavenworth. The Combined Arms Training Developments Activity (CATRADA) was subsequently established by CAC to carry out its command group training development effort. One product of this effort is the Command Group/Staff ARTEPs (Army Training and Evaluation Programs), which specify the tasks, conditions, and standards that command groups must accomplish in combat. A second major thrust is the evaluation and refinement of battle simulations, like the Computer Assisted Map Maneuver System (CAMMS) and the Combined Arms Tactical Training Simulator (CATTS), and the development of new systems, like the Army Training Battle Simulation System (ARTBASS), all of which are designed to provide realistic training experiences for commanders and their staffs (Battle Simulations and the ARTEP, 1977).

The development of performance measures is an essential step in the process of training development. Performance measures are necessary to diagnose deficiencies and to provide the trainees with feedback, to identify common training requirements, and to evaluate the effectiveness of alternative training systems. The ARI Field Unit at Fort Leavenworth has collaborated with the Automated Command Training Division (ACTD) of CATRADA to develop a methodology for measuring command group performance, based on the battalion Command Group/Staff ARTEP. This methodology was used to provide feedback to battalion command groups in CATTS exercises, and to determine which ARTEP subtasks were most commonly deficient and most highly correlated with overall performance measures; thereby to determine empirically which subtasks are most critical for training (Barber & Kaplan, 1979; Kaplan & Barber, 1979). More recently, ARI and ACTD have developed a way to measure intragroup communication, a potentially important facet of command group performance, which is not directly addressed by the ARTEP.

Intragroup communication makes the difference between a collection of individuals working independently and an organized group that functions as a team. Fisher (1974) contends that communication is the defining property of a group and the basis for its entire organization and functioning. Many experiments (Hare, 1976, Chap. 12) have shown that communication patterns influence group productivity and satisfaction.

Communication constitutes much of a command group's observable behavior. Olmstead, Christensen, and Lackey (1973) analyzed the performance of battalion command groups in simulated combat by recording all their communications (radio, written, and face-to-face) and categorizing them under seven processes, derived from Schein's adaptive coping cycle (1972). Ratings of command group

effectiveness were significantly correlated with performance measures for five of the seven processes: sensing, communicating information, decision making, communicating implementation, and coping. Multiple correlation showed that communicating information contributed more to effectiveness than did any of the other processes.

Henriksen et al. (1980) identified communication as one of five categories of leader skills and leader-group interaction processes that influenced unit performance in engagement simulations, i.e., battlefield exercises with realistically simulated weapons effects. The other categories were management, problem solving, tactical, and technical skills. Both the communication of planned information and the pursuit, reception, and transmission of new information were essential. The authors described several situations where failure to transmit information resulted in friendly losses and mission failure, and effective communication contributed to successful tactical operations.

Purpose

In view of the probable importance of communication for command group effectiveness, ACTD and ARI at Fort Leavenworth have undertaken the development of procedures to measure information flow during simulated combat exercises. The planning stage was chosen as the initial focus of our efforts, because information input to the battalion command group follows a script during the planning stage; whereas information generated during the battle is subject to considerable variation. Work is in progress, however, to extend the information measurement approach to the execution stage of the battle. This research is part of a larger effort to develop measures of command group performance that can be used to provide feedback to participants in training exercises and to guide the development of command group training systems.

The present investigation addressed the following questions:

1. How much information was lost during the planning stage?

2. Where was the information lost, i.e., in which communication channels?

3. How were various measures of communication performance correlated with one another as a function of individual differences?

METHOD

Participants

Thirteen U.S. Army battalion command groups each participated in a simulated combat exercise. Each group had seven principal members: the battalion commander, S1, S2, S3, S4, fire support officer (FSO), and air liaison officer (ALO); plus about ten other officers, NCO's, and enlisted men, who assisted the principal staff members and operated radio and telephone equipment. Two company commanders also came with the battalion command group to serve as player-controllers during the exercise. The roles of other company and brigade level personnel were played by CATTS controllers.

Battle Simulation

The Combined Arms Tactical Training Simulator (CATTS) is a computer-driven battle-simulation system that creates a realistic environment for training battalion commanders and their staffs. The computer simulates the actions of units in combat, calculating movement, visibility, and weapons effects in real time, so that events in the simulated battle are responsive to the command group's decisions and actions. Professional controllers mediate between the command group and the computer, playing the roles of higher- (brigade) and lower- (company) level personnel. Because of their experience conducting many similar exercises, the CATTS controllers were able to identify items of information that command groups needed to plan and prepare for the battle.

Procedure

The procedure developed to measure information flow is illustrated in Figure 1. At the beginning of the exercise, each principal member of the battalion command group was briefed individually by his brigade (controller) counterpart, except for the commander and S3 who were briefed together. Then the members of the battalion command group worked together for 3 to 4 hours to develop a plan and write the operations order, which they briefed to the company commanders. After about 2 hours of preparation for the simulated battle that was to be played the following day, the principal members of the battalion command group and their company commanders answered a multiple-choice questionnaire based on information presented in the brigade briefing.

Measures of information flow were derived from the responses to the questionnaire, on the assumption that correct recall--or, more precisely, recognition--indicated that the respondent had received the item. When an item was recalled by the person to whom it had been presented in the brigade briefing, it was assumed to be available for further communication within the battalion command group.

Questionnaire

The items of information on which the questionnaire was based were identified by a three-step procedure: First, each brigade controller listed the principal items that he presented to his battalion counterpart during the brigade briefing. Then, the controllers determined which of these items were unique, in the sense that no other controller presented the item to any other member of the command group. The third step was to decide who else, other than the direct receiver, needed to know each item. For example, during the briefing, the brigade S4 told the battalion S4 that the speed limit on the open highway was 40 mph. No one else received this information directly, but, in the opinion of the controllers, the battalion S4 should have shared it with his commander and the S1 during the planning process, and then passed it on to the company commanders in the operations order. The first two steps were completely objective, because the brigade briefing was given from a script. The distinction between required and nonrequired information was based on the controllers' expert judgement. As described below, the results supported the controllers' judgement.

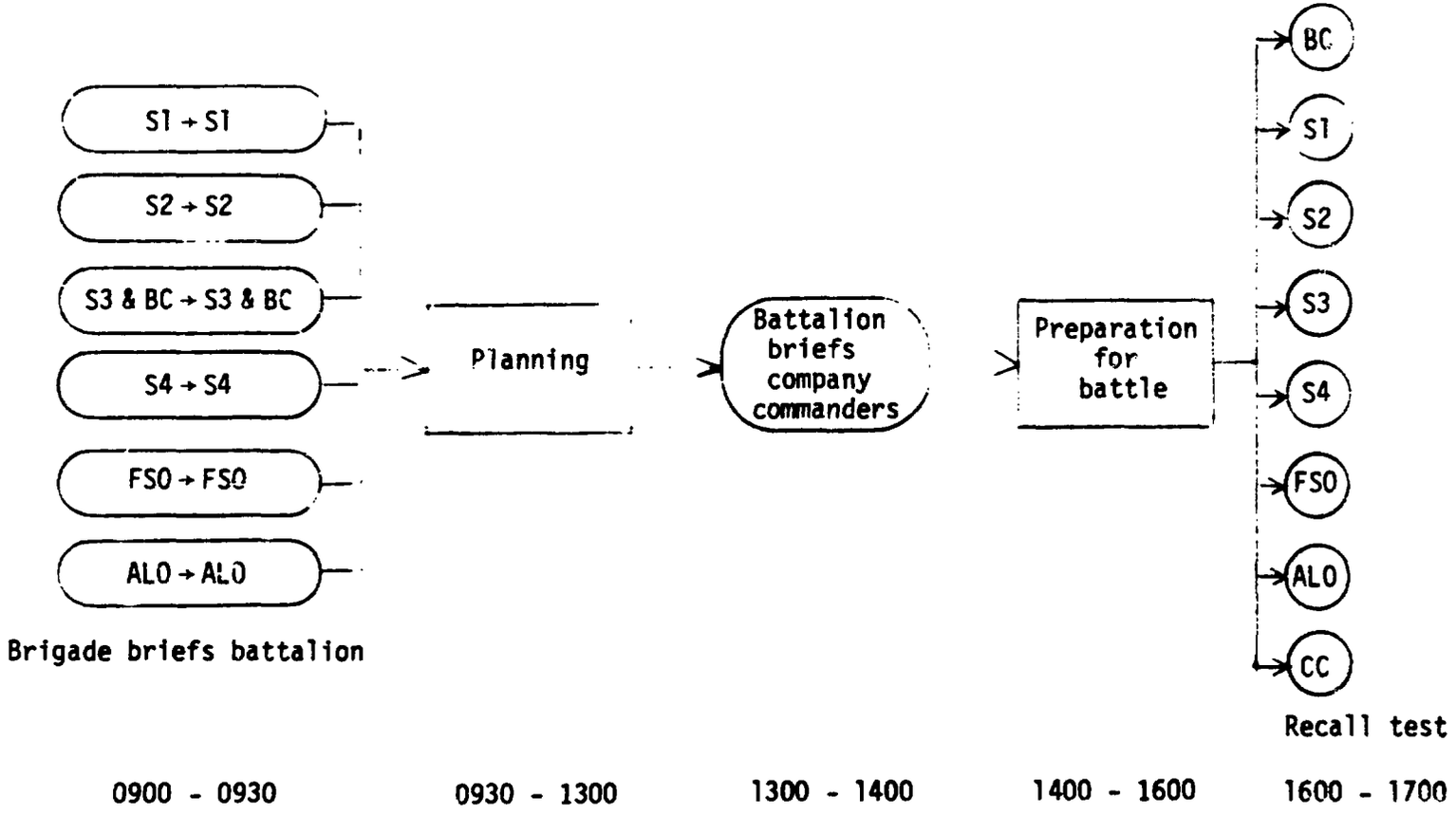

Figure 1. Flow of information from 0900 to 1700 Hours on the first day of a CATTS exercise. Controllers acting as brigade officers briefed their battalion counterparts, who shared the information as they developed a plan which they presented to their company commanders. Recall of information originally presented in the brigade briefing was tested by a multiple-choice test.

The questionnaire, reproduced in Appendix A, comprised 35 items. Each question had four alternative responses: one correct, two incorrect, and the fourth, "unknown." The instructions were to answer "unknown," rather than to guess. Each item of information addressed by the questionnaire was presented to a particular member of the command group during the brigade briefing. All the items presented in the brigade briefing were required by the persons who received them. Most of these items were also needed by persons who did not receive them directly, but who could receive them later through intragroup communication. The persons who required each item are identified in Appendix B.

Table 1 shows how many items were required by each person. The first row of numbers in the table indicates how many items were presented directly by the controllers in the brigade briefing, i.e., five to the battalion commander (BC) and the S3, four to the S1, etc. The lower part of the table shows how many items each person required from persons who received them directly, i.e., the battalion commander needed 3 items that were presented to the S1, 11 that were presented to the S2, etc. The battalion commander and S3 are listed together as transmitters of intragroup information, because they received the same information during the brigade briefing. The company commanders (CC) were not present during the brigade briefing, so they received all their information indirectly--through the battalion command group.

Table 1

Number of Required Items to be Transmitted to Each Receiver

	Receiver							
Transmitter	BC	S1	S2	S3	S4	FSO	ALO	CC
	Items Presented During The Brigade Briefing							
Controller	5[a]	4	15	5[a]	4	3	4	0
	Items to be Received via Intragroup Communication							
BC & S3	-	0	3	-	0	3	3	5
S1	3	-	1	2	2	1	1	2
S2	11	3	-	9	3	4	6	8
S4	2	2	2	1	-	0	0	3
FSO	2	0	1	2	0	-	1	1
ALO	4	0	1	4	0	2	-	0

[a]The same five items were presented to the battalion commander (BC) and the S3, who were briefed together.

RESULTS AND DISCUSSION

In describing the results, it is helpful to differentiate between direct and indirect, intergroup and intragroup communication. Direct communication occurs between two persons, without an intermediary, e.g., from the brigade S2 to the battalion S2. In the present situation, the intergroup communication, from brigade to battalion, was also direct communication. Indirect communication is transmitted through an intermediary, e.g., from the brigade S2 through the battalion S2 to the battalion commander. Thus, indirect communication consisted of intergroup communication followed by intragroup communication.

Communication for the Command Group as a Whole

Averaged over all 13 command groups, 81% of the information presented in the brigade briefing was recalled by the persons who received it directly. Of this 81%, 48% was recalled by persons who received it indirectly, through one or more intermediaries; so that 39% of the original information was received through indirect communication. In computational terms, intergroup communication multiplied by intragroup communication equals indirect communication.

The successive loss of information in intergroup and intragroup communication is illustrated by the "filter model" in Figure 2. This model compares the flow of information through the battalion command group to the passage of light through a series of filters, which represent the processes of transmission and reception. In the brigade briefing (Figure 2a), the controllers used a script and played the same roles repeatedly, so there was presumably no loss in transmission. The command group members required all the information they received directly, and they subsequently recalled 81% of it. During intragroup communication, however, the members may not have transmitted all the information they had received, so information may have been lost in transmission as well as in reception. In addition, the command group members and company commanders did not require all the information available to them indirectly. The end result was that only 39% of the information originally presented was ultimately recalled by persons who received it indirectly.

Like a color filter that selectively transmits certain wavelengths of light, intragroup communication selectively conveyed required information better than nonrequired information. Required and nonrequired information are shown separately in Figure 2b, to indicate that 63% of the required information available for intragroup communication was later recalled, compared to only 37% of the available information that was not required by the receiver. (It is just a coincidence that the two percentages sum to 100%.)

According to the preceding analysis, information passes through three filters in the course of indirect communication: direct reception followed by intragroup transmission and reception. It is interesting to note that the combined effect of the last two processes was very nearly twice that of the first. Consider that if each filter transmitted 80% of the information that it received, the last two filters together would transmit 64% (80% x 80% = 64%). These values are close to those actually obtained for the direct reception of required information (81%) and for intragroup communication of required information (63%). This equivalence does not prove that intragroup transmission and reception were necessarily equal, only that their combined effect was approximately twice that of direct reception alone.

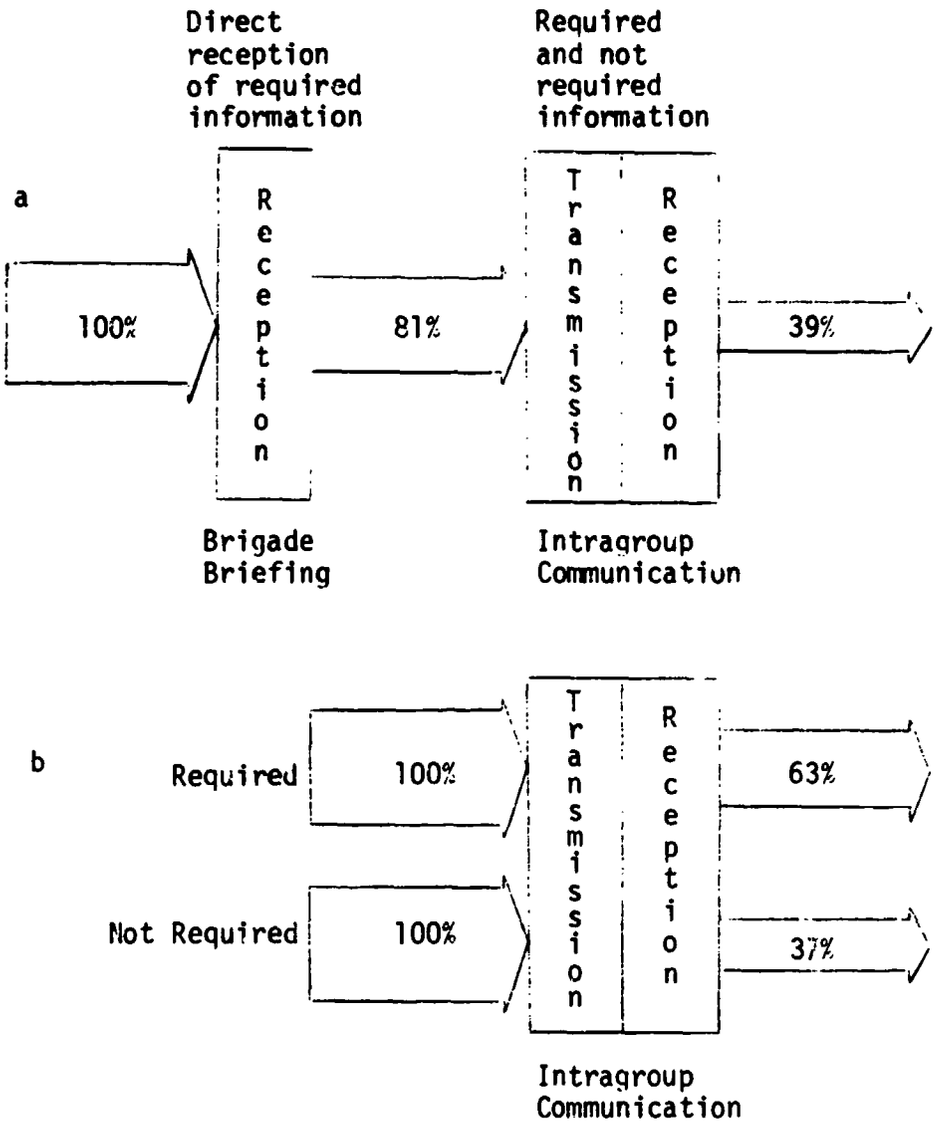

Figure 2. A filter model of communication. (a) Information loss in direct and intragroup communication. (b) Communication as a selective filter.

The classification of information as required or not required was based on the CATTS controllers' expert judgement of what each command group member needed to know. Their judgement was supported by the result that required information was recalled much better than information that was classified as not required. Further support for the controllers' judgement was provided by analysis of the errors for required and nonrequired items. Errors were either of omission ("unknown") or of commission (wrong answers). For required items, 35% of the errors were commission errors, compared to 23% for items that were not required. Apparently, when persons did not know the correct answers, they were more likely to guess at required items than at items that were not required.

Intragroup Communication Channels

During the brigade briefing, communication was largely one-to-one: the brigade officer spoke and his battalion counterpart listened. In intragroup communication, on the other hand, everyone spoke and listened to several persons in turn. The different intragroup communication channels varied widely with respect to the percentage of available required information that was recalled. An item was considered available for intragroup communication only when it was recalled by the person who received it directly. Table 2 shows how much available required information was received through each of the 32 channels for which intragroup communication was measured. Since the battalion commander and the S3 received the same information during the brigade briefing, they had common communication scores as transmitters of information, and there was no measure of communication between them. The company commanders did not receive any information during the brigade briefing, so there was no measure of communication from them. For the intragroup communication channels that were measured, recall varied from 17% for communication from the S4 to the S1 to 80% for communication from the S2 to the FSO. The analysis of variance summarized in Table 3 showed that the variation among communication channels was significant beyond the .01 level. Variation among groups was significant beyond the .05 level.

The differences among channels were larger than the differences among command groups. Averaged over each group, the recall of available required information varied from 44% to 76%, compared to the 17% to 80% range across channels. Examination of the data showed that the relative effectiveness of the various channels was fairly consistent across groups: the poorest channels had consistently low scores, while the most effective channels had relatively high scores in every command group.

Figure 3 illustrates the eight best and six worst intragroup communication channels. Each channel is represented by a vector, pointing from transmitter to receiver, whose length is proportional to the percentage of available required information recalled by the receiver. The battalion commander and S3 and the S2 were good transmitters, with good reciprocal communication between them. In contrast, the S1 and S4 were poor transmitters. Communication between the S2 and the FSO was asymmetrical: the FSO received 80% of the information he needed from the S2, but the S2 received only 25% of the information he needed from the FSO.

Table 2

Intragroup Communication
Percentage of Available Required Items Recalled by Each Receiver
Averaged over 13 Battalion Command Groups

Transmitter	Receiver								Mean[a] Transmission
	BC	S1	S2	S3	S4	FSO	ALO	CC	
BC & S3	-	-	69	-	-	79	75	78	76
S1	42	-	44	37	59	56	63	37	45
S2	78	58	-	71	72	80	57	66	69
S4	58	17	50	62	-	-	-	35	45
FSO	58	-	25	55	-	-	50	41	47
ALO	65	-	36	60	-	62	-	-	60
Mean[a] Reception	68	52	51	63	67	74	62	61	63

[a]The mean transmission and reception scores are weighted averages of the row and column recall scores, respectively; weighted according to the number of items on which each component score was based.

Table 3

Intragroup Communication
Analysis of Variance Summary

Source	MS	df	F
Communication Channels	3635.07	31	2.81**
Command Groups	2499.18	12	1.93*
Error (Interaction)	1292.59	324	

*$p < .05$ **$p < .01$

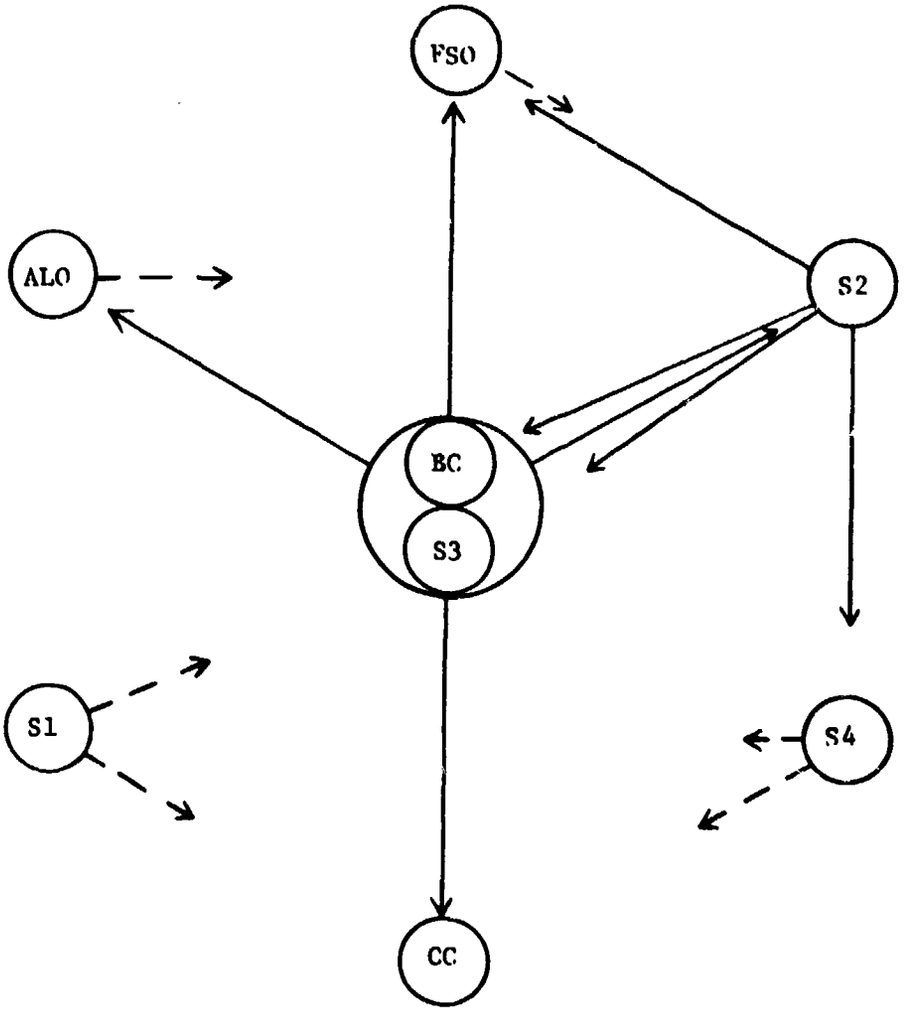

Figure 3. Best and worst intragroup communication channels. The length of each vector is proportional to the percentage of available required information communicated. The eight best channels (69 to 80%) are represented by solid lines; the six worst (17 to 37%), by broken lines.

The impression given by consideration of the best and worst intragroup communication channels, that the commander, S3 and S2 were better transmitters--or were more listened to--than the S1 and S4, is confirmed by the mean transmission scores in Table 2. These scores, in the rightmost column of Table 2, are intragroup communication scores averaged over all the receivers for a given transmitter. Since different numbers of required items were available for transmission to each receiver, the component scores were weighted according to the number of available required items on which they were based. Although it is convenient to call them transmission scores, these averages indicate how much the transmitters were listened to, as well as how effectively they presented their information. Similar considerations apply to the calculation and interpretation of the mean reception scores. The S1 and S2 may have been poor receivers because they were not listening or because they were not spoken to.

The mean intragroup communication score for available required information, averaged over all channels, was 63%. This percentage, which appears in the lower right corner of Table 2, occurs also in Figure 2b, as the required intragroup communication score for the command group as a whole.

The rank order of transmission scores for the members of the command group reflected the importance of their roles in the exercise. The battalion commander and the S3, who were the highest ranking members of the group (lieutenant colonel (O-5) and major (O-4), respectively), were the most listened to (76% transmission). This result agrees with reports that higher status individuals exert more influence (Torrance, 1954) and receive more attention (Wheeler, 1964; Butler & Miller, 1965) than other group members. The other command group members were usually captains (O-3s), but they differed with respect to the importance of their information for the exercise. The S2 (69% transmission) had the most relevant information (intelligence), while the S1 and S4 (both 45% transmission) had the least relevant information (personnel administration and logistics). The S4 might have been more important in a field exercise, when he would have been responsible for real food, supplies, and equipment. The FSO should have received more attention than he did, based on the importance of his information. The CATTS controllers commented that the FSO was seldom sufficiently involved in preparation of the operations order, perhaps because he was not a regular member of the command group. Like the ALO, he was assigned to the group just for the exercise.

Individual Differences

There were large individual differences in communication performance. Among S2's, for example, direct reception varied from 53% to 93%, while intragroup reception of available required information varied from 20% to 100%. To investigate how the more effective communicators differed from those who were less effective, several relationships between different measures of communication were calculated and tested for significance. In particular, correlations (Pearson r's) were calculated for the relationships between intragroup reception of available required information and three other measures of performance, to answer the following questions:

1. Direct versus intragroup reception of available required information. Did individuals who received more information in the brigade briefing also receive more information through intragroup communication? If recall scores were determined largely by a general ability to receive and remember information, then direct and intragroup recall scores would be positively correlated. If other factors were more important (e.g., performance of the transmitter, content of the items), then there would be little or no correlation.

2. Intragroup reception of available information: required versus not required. Did individuals who recalled more required information recall more, or less, nonrequired information, i.e., did they have a larger capacity for both types of information, or did they employ selective attention to receive more required information by receiving less information that was not required?

3. Transmission versus reception of intragroup required information. Were better receivers also better transmitters, or was there a trade-off between transmission and reception, so that one occurred at the expense of the other?

The answers to these questions can be found in Table 4. First, there was no consistent or significant relationship between direct and intragroup reception for any position in the command group. Second, there was usually a positive relationship between intragroup reception of required and nonrequired information, but the correlations were not statistically significant, except for the S3. This result clearly contradicts the hypothesis that greater recall of required information was accompanied by decreased recall of information that was not required. With regard to the third question, the only significant relationship was a negative correlation for the battalion commander. This relationship is sufficiently interesting to deserve further discussion.

Figure 4 shows a reciprocal relationship between transmission and reception. Battalion commanders who transmitted the most information, received the least information from their staffs; and those who received the most, transmitted the least. (Each transmission score represents the combined performance of a commander and his S3, because they were initially briefed together.) The slope of the fitted regression line is very nearly -1 ($b = -1.05$), which means that there was a literal trade-off between transmission and reception. A possible mechanism for this relationship was observed in the case of the occasional commander who dominated his staff to the extent of interrupting and correcting them while they were speaking, which may have discouraged them from transmitting information to him. At the other extreme was the commander who appeared to assume the attitude of an observer, while his staff did most of the planning. Bass, Klaus, and McGowan (1979) assert that a manager's leadership style is reflected in his pattern of communication. Specifically, the directive style of leadership is defined in terms of one-way communication from the leader to his subordinates. The directive leader tells his subordinates what to do and how to do it. On the other hand, attentive listening is characteristic of a good consulting style. The decisions of the consultative leader reflect the information he has acquired from his subordinates.

Table 4

Correlation of Intragroup Reception of Available Required Information with Other Measures of Communication

Position of Individual	Other Measures of Communication: Direct Reception of Available Required Information		Intragroup Reception of Available Not Required Information		Intragroup Transmission of Available Required Information	
BC	.44	(13)	-.01	(13)	-.68*	(13)
S1	-.40	(13)	.39	(13)	.20	(13)
S2	-.25	(13)	.23	(13)	.00	(13)
S3	-.30	(13)	.73**	(13)	-.29	(13)
S4	.22	(13)	.43	(13)	.43	(13)
FSO	.25	(13)	.05	(13)	.31	(12)
ALO	.11	(11)	.57	(11)	.40	(11)
CC	-	-	.03	(24)	-	-

Note: The numbers in parenthesis indicate the number of pairs on which each correlation is based.

*$p < .05$. **$p < .01$.

Whether there is an optimum balance between transmission and reception is a question for further research. Experiments have shown, however, that when a leader participates in discussion and encourages equal participation by all members, the result is greater group agreement, greater influence of the leader on the members, and more satisfaction in the task for both leader and followers (Hare, 1976, p. 274).

Future Research

Work is now in progress to determine the validity of the information flow methodology and to enlarge its area of application. One aspect of validity is the degree to which the method actually measures communication. This question is being addressed by gathering data on the correlations between the information flow measures and the players' own estimates of how much information they need to transmit and receive from every other member of the group, plus their own perceptions of the percentages of required information that they actually do transmit and receive. Another aspect of validity, the correlation of information measures with other measures of performance, is being investigated by obtaining the controllers' expert judgement of how well the players perform during the exercise. If the initial results on validity are encouraging, the methodology will be extended to the execution stage of the exercise.

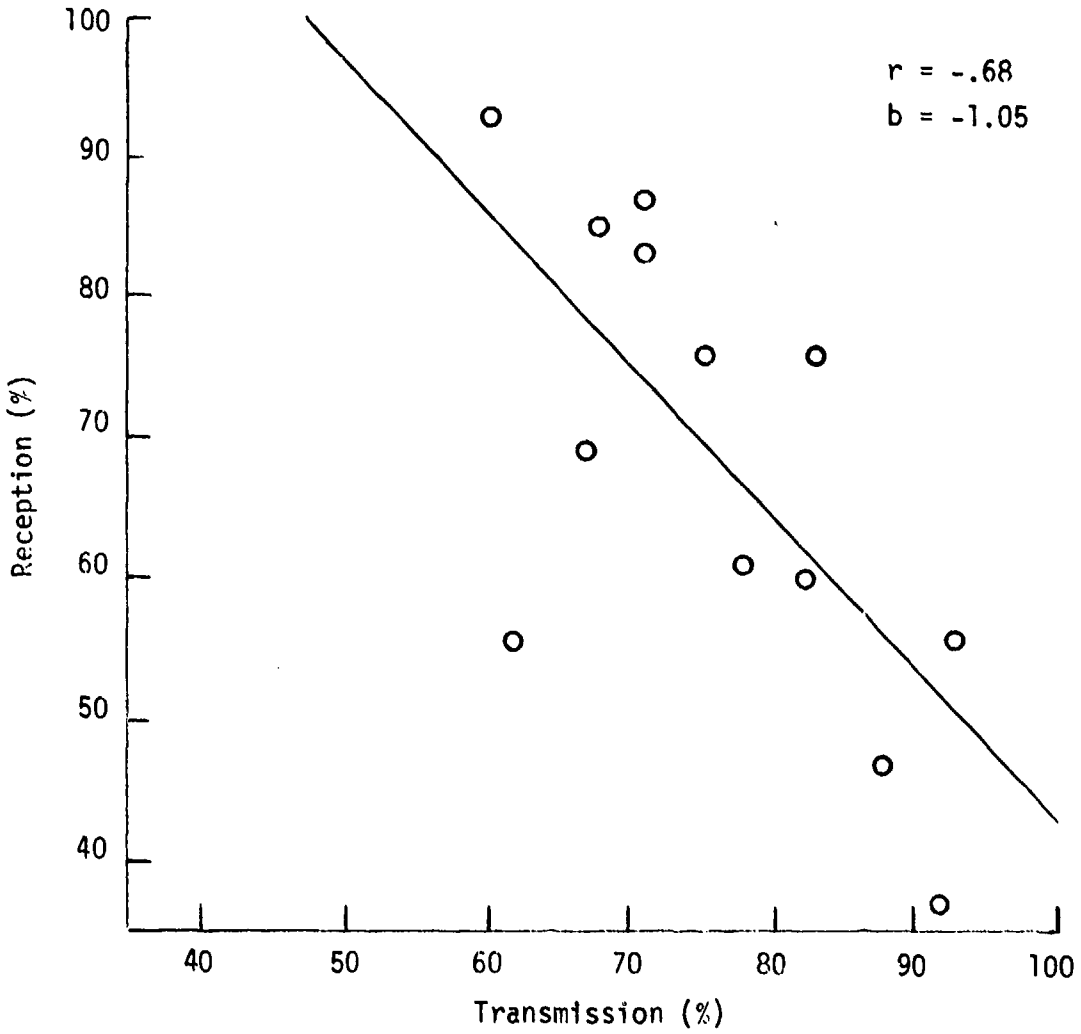

Figure 4. Intragroup communication of available required information: reception by battalion commanders (BC's) versus transmission by BC's and S3's.

At present, the measurement of information flow is limited to the planning and preparation stages of the battle. It is more difficult to measure information flow during the battle, because the events are less predictable. Whereas the content of the brigade briefing is fixed for a given scenario, the events of the computer-simulated battle vary in response to the command groups' decisions and actions. Nevertheless, efforts will be made to identify key events that can be expected to occur in every simulated battle, and to develop probes, i.e., prewritten messages that can be transmitted by the controllers to the players at appropriate times during any exercise. Corresponding questions will be written for each key event and probe message to determine whether each group member receives the information. In addition to having the players complete a questionnaire at the end of the day, the controllers will measure information flow during the exercise by asking questions in their roles as brigade officers and company commanders.

SUMMARY AND IMPLICATIONS

A substantial amount of information was lost in the process of communication. Battalion command group members recalled 81% of the information presented to them by their brigade counterparts, but only 63% of the required information available to them from the other members of their own group. Much of the information loss was concentrated in specific intragroup communication channels. In the six poorest channels, recall of available required information varied from 17% to 37%. It was also observed that the most important members of the group were listened to the most, and that battalion commanders who transmitted the most information, received the least information from their staffs.

Providing command groups with diagnostic feedback about their patterns of communication may enable them to take corrective actions to improve the transmission and reception of required information. Given the potential contribution of communication to group performance, it is possible that improving this component of their performance may increase the command group's overall effectiveness.

REFERENCES

Barber, H. F. and Kaplan, I. T. Battalion command group performance in simulated combat. ARI Technical Paper 353, March 1979.

Bass, B. M., Klaus, R., and McGowan, R. Communication, managerial style and success. Syracuse, New York: Maxwell School of Citizenship and Public Affairs, September, 1979.

Battle simulations and the ARTEP. Fort Leavenworth, Kansas: Combined Arms Training Developments Activity, 18-461, November 1977.

Butler, D. C. and Miller, N. Power to reward and punish in social interaction, Journal of Experimental Social Psychology, 1965, 1, 311-322.

Command group/staff module. Army training and evaluation program for mechanized infantry/tank task force, No. 71-2. Washington, D.C.: Headquarters, Department of the Army, 17 June 1977.

Hare, A. P. Handbook of small group research (2d ed.). New York: Free Press, 1976.

Henriksen, K. F., Jones, D. R., Jr., Hannaman, D. L., Wylie, P. B., Shriver, E. L., Hammill, B. W., and Sulzen, R. H. Identification of combat unit leader skills and leader-group interaction processes. ARI Technical Report 440, January 1980.

Kaplan, I. T. and Barber, H. F. Training battalion command groups in simulated combat: Identification and measurement of critical performances. ARI Technical Paper 376, June 1979.

Olmstead, J. A., Christensen, H. E., and Lackey, L. L. Components of organizational competence: Test of a conceptual framework. (HumRRO Technical Report 73-19). Alexandria, VA: Human Resources Research Organization, August 1973.

Schein, E. H. Organizational psychology (2d ed.). Englewood Cliffs, N. J.: Prentice-Hall, 1970.

Torrance, E. P. Some consequences of power differences on decision making in permanent and temporary three-man groups. Washington State College, Research Studies, 1954, 22, 130-140.

Wheeler, L. S. Information seeking as a power strategy. Journal of Social Psychology, 1964, 62, 125-130.

APPENDIX A

INFORMATION FLOW QUESTIONNAIRE

SELF-EVALUATION (PLANNING STAGE)

(Sinai)

Purpose: This questionnaire is designed to provide information to assist in the analysis of lessons learned during CATTS exercises.

Instructions: Answer all questions. If you did not receive the information asked for, answer unknown. DO NOT GUESS!! Parts of this questionnaire will cover material to which you did not have access.

1. REMS available for the operation are:
   A. Air droppable
   B. Artillery deliverable
   C. Hand emplaced
   D. Unknown

2. Air Recce assets will be controlled by:
   A. Bn
   B. Bde
   C. Div
   D. Unknown

3. The covering force is authorized to fire across the Suez Canal when:
   A. OPFOR are positively identified
   B. The OPFOR reach the west bank of the Canal
   C. Fired upon
   D. Unknown

4. ADA weapons control status at the beginning of the operation was: WEAPONS

A. Free
B. Tight
C. Hold
D. Unknown

5. OPFOR opposite of Division sector are believed to be units of the:

A. 77th CAA
B. 11th CAA
C. 46th Tank Div
D. Unknown

6. The primary avenue of approach into the Brigade sector is:

A. Hwy 11
B. Hwy 33
C. Hwy 44
D. Unknown

7. CAS should be reserved for lucrative targets. Groups of armor vehicles of less than ____ are not good CAS targets.

A. 2
B. 5
C. 10
D. Unknown

8. The initial FSCL is the:

A. West bank of the Suez Canal
B. East bank of the Suez Canal
C. FEBA
D. Unknown

9. The curfew in effect is:

A. Sundown to Sunrise
B. 2200 - 0300
C. 2000 - 0600
D. Unknown

10. The speed limit on the open highway is:
    A. 25 mph
    B. 40 mph
    C. 55 mph
    D. Unknown

11. A bath, clothing, and wash point is located with:
    A. Bn Field Trains
    B. Bde Trains
    C. DISCOM
    D. Unknown

12. The main attack for the opposing forces will be directed towards the:
    A. Mitla Pass
    B. Suez Canal
    C. Giddi Pass
    D. Unknown

13. During the first 12 hours of hostilities, air superiority will be held by:
    A. USAF
    B. Abar Forces
    C. Air parity will be maintained
    D. Unknown

14. The effect of the Sinai climate will _____ the number of non-combat casualties.
    A. Not change
    B. Double
    C. Triple
    D. Unknown

15. The current TF requirement is to:
    A. Defend the Suez Canal
    B. Delay the enemy forward of the MBA
    C. Retain the Mitla Pass
    D. Unknown

16. Guerrilla activities in the Brigade sector have _____ in the past few days.

A. Increased
B. Decreased
C. Not been reported
D. Unknown

17. The combat efficiency of the Abar forces is expected to be:

A. High
B. Low
C. Medium, because of equipment shortages
D. Unknown

18. Trafficability in the AO east of the canal is:

A. Generally poor
B. Good except for an area within 3 km of the canal
C. Poor because the wadies cannot be crossed
D. Unknown

19. Replacement availability status is:

A. Individual replacements are available at Division
B. Unit replacements with equipment are available as Division assets
C. Replacement channels have not been established
D. Unknown

20. The graves registration collection point is located:

A. With the 3d Field Hospital
B. Vicinity Battalion Combat Trains
C. Vicinity Brigade Trains
D. Unknown

21. Prior to initiation of hostilities, the OPFOR were estimated to be at _____% strength.

A. 100
B. 90
C. 65
D. Unknown

22. Within the past 24 hours, OPFOR air recce missions along the West bank have:

A. Not been reported
B. Increased
C. Decreased
D. Unknown

23. Abar forces have the capability to employ nuclear as well as chemical and biological weapons. Currently, indications are that:

A. Only chemical weapons will be employed
B. Nuclear weapons will be used
C. Abar forces do not plan to use these weapons
D. Unknown

24. RSF personnel in sector are located:

A. Along the berm east of the Canal
B. Only in the built up areas East of the Canal
C. All RSF personnel have been moved out of the AO
D. Unknown

25. The route to be used when moving from the Assembly Areas forward to the FEBA is:

A. Highway 52
B. Route Gold
C. Highway 33
D. Unknown

26. The number of air sorties allocated to the Division per day is:

A. 50
B. 135
C. 16
D. Unknown

27. The time required to change the ordnance on an aircraft in response to a special ordnance request is:

A. 30 minutes
B. 1 hour
C. 4 hours
D. Unknown

28. The response time for an air sortie for aircraft on strip alert is:

A. 30 minutes
B. 5 minutes
C. 1 hour
D. Unknown

29. An immediate smoke mission must be approved at _____ level.

A. Co/Tm
B. Bn/TF
C. Bde
D. Unknown

30. There is a shortage of artillery _____ rounds in the theater:

A. HE
B. WP
C. Illum
D. Unknown

31. "F" nets will be opened:

A. When the artillery battalion is in position
B. When the FIST team chief has positively identified a target as hostile
C. Upon contact with the enemy
D. Unknown

32. The Suez Canal:

A. Can be forded by T62 tanks
B. Can be crossed by T62 tanks using snorkeling equipment
C. Can be crossed by T62 tanks only with bridging assistance
D. Unknown

33. Brigade EEI will be distributed to battalions via:

A. RATT
B. OPORD
C. Messenger
D. Unknown

34. The CSR for TOW rounds is:

A. 9 rounds/wpn/day
B. 50 rounds/wpn/day
C. No CSR on TOW
D. Unknown

35. The division light line is located at:

A. The FEBA
B. The brigade rear boundary
C. The division rear boundary
D. Unknown

APPENDIX B

The following table indicates the letter of the correct response to each question, the position of the person to whom the information was presented directly in the brigade briefing, and the positions of persons who should have received that information indirectly via intragroup communication.

Table B-1

Scoring Key for Information Flow Questionnaire

Question Number	Correct Response	Position of Receiver							
		BC	S1	S2	S3	S4	FSO	ALO	CC
1	C			D					
2	C	I		D				I	
3	C	D		I	D		I	I	I
4	B	D		I	D		I	I	I
5	B			D					
6	B	I	I	D	I	I	I	I	I
7	C	I		I	I		I	D	
8	A	I		I	I		D	I	I
9	C	I	D	I	I	I	I	I	I
10	B	I	I			D			I
11	B					D			
12	C	I		D	I		I	I	I
13	B	I		D	I		I	I	
14	C	I	D		I				I
15	B	D		I	D				I
16	C	I		D	I				I
17	A	I	I	D	I	I	I	I	I
18	B	I	I	D	I	I			I
19	B	I	D		I			I	
20	C		D			I		I	
21	A			D				I	
22	B	I		D					
23	C	I		D	I				I
24	C	I		D	I				I
25	C	D			D		I	I	I
26	A	I			I		I	D	
27	C	I			I			D	
28	A	I			I			D	
29	A	D			D				I
30	C	I			I		D		
31	C						D		
32	C	I		D	I				I
33	A			D					
34	A	I		I	I	D			I
35	C		I	I		D			I

Abbreviations:
BC = battalion commander
FSO = fire support officer
ALO = air liaison officer
CC = company commander
D = direct receiver
I = indirect receiver

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