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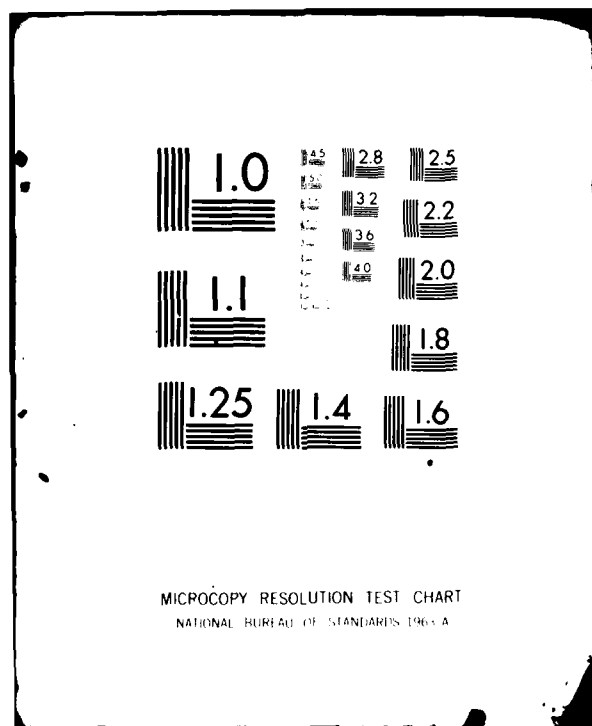
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Intrusive and Non-Intrusive Instruction

in Dynamic Skill Training

Allen Munro
Michael R. Fehling
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October 1981

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A distinction is drawn between computer based instruction of <u>knowledge systems</u> and computer based instruction of <u>dynamic skills</u>. There is reason to expect that the findings of research on knowledge system instruction will not apply universally to dynamic skill instruction. In particular, a theory of cognitive resource demand suggests that the principle of immediate instructional feedback may not apply in dynamic skill training. Because students in dynamic skill training are often heavily loaded with processing demands, instructional feedback must be postponed until the students have sufficient free resources to process it. This hypothesis was tested in

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an experiment in computer based instruction. One group of students received instructional feedback upon request, while a second group received feedback under program control. The group with control over feedback made significantly fewer errors in training than did the group that did not control timing of the instructional feedback messages.

ABSTRACT

A distinction is drawn between computer based instruction of knowledge systems and computer based instruction of dynamic skills. There is reason to expect that the findings of research on knowledge system instruction will not apply universally to dynamic skill instruction. In particular, a theory of cognitive resource demand suggests that the principle of immediate instructional feedback may not apply in dynamic skill training. Because students in dynamic skill training are often heavily loaded with processing demands, instructional feedback must be postponed until the students have sufficient free resources to process it. This hypothesis was tested in an experiment in computer based instruction. One group of students received instructional feedback upon request, while a second group received feedback under program control. The group with control over feedback made significantly fewer errors in training than did the group that did not control timing of the instructional feedback messages.

ACKNOWLEDGMENTS

INTRUSIVE AND NON-INTRUSIVE INSTRUCTION
IN DYNAMIC SKILL TRAINING

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INTRODUCTION

There has been little academic research on computer based dynmaic skill training (see Munro, Towne, & Fehling, 1981). Instead, the bulk of academic research on computer based learning systems has dealt with knowledge system teaching. By knowledge systems we mean coherent bodies of essentially propositional knowledge. By dynamic skills we mean bodies of knowledge that coordinate perception, motor skills, and decision making in real time driven environments. Existing computer based training devices for dynamic skills are typically vehicle simulation practice environments. Examples include aircraft and helicopter simulators for pilot training. Such training installations are typically very expensive (more than one million dollars per unit). They are typically fully utilized for training, with no available time for research. In addition, the demands of verisimilitude frequently result in simulator designs that cannot provide the flexibilty of programming required by computer based learning research.

Recent advances in the development of low cost microcomputer systems make possible research on computer based dynamic skill training using systems developed solely for that research purpose. Such a low cost computer based learning research tool has been developed in our laboratory (Munro, Towne, & Fehling, 1981). This experimental system for the study of dynamic skill training is being used to conduct a series of experiments on a number of issues. This technical report describes the first experiment in a planned series.

It may be dangerous to assume that the research findings on

computer based learning of traditional knowledge systems will apply to dynamic skill training. The present experiment was designed to explore certain contrasts between dynamic skill training and knowledge system teaching in computer based learning. Two principles of knowledge system training are challenged in the dynamic skill training environment. The first of these is that instructional feedback (knowledge of results) should be immediate. The second is that student control over instructional pacing or sequence does not ordinarily result in a large improvement in learning.

The Dynamic Skill Training Task

The training task is loosely based upon the task of Navy Air Intercept Controllers. In the laboratory task, there are two display screens, one representing a radar screen, the other the display console of a tracking computer. A keyboard with fifteen specially labeled command keys and a numeric keypad is used for student input to the simulated tracking computer. The students use a joystick and certain keyboard keys to place identifying symbols on the simulated radar screen. The task calls for close attention to the simulated radar screen, which is updated once every eight seconds. Students must quickly execute a series of key presses in response to certain events observed on the radar screen, such as the appearance of a new blip or the movement of simulated friendly and enemy aircraft into a particular proximity. In addition, the student must keep track of certain tasks that are periodically required, such as determining fuel and weapons status for the simulated aircraft.

There are many opportunities for errors in this task. When the

training system detects a student error, it can present information about the error in a reserved area of the simulated tracking computer console screen. In the first experiment, two different methods of determining when to present these messages were employed. For the intrusive feedback group, these error messages were automatically presented at the time that the system detected the errors. For the non-intrusive feedback group, an error message was shown only when requested.

A student's interaction with the Air Intercept Controller training system has parallels to a conversational interaction between two people. In normal conversation, the participants exchange indications of their readiness to accept input from each other: they signal turn-taking in the conversation. In conventional knowledge system teaching in CBI, each student response (such as typing in the answer to a question) can be thought of as a signal that the student has completed and surrendered a conversational turn. After making a response, the student expects a reply from the teaching system. In dynamic skill training, however, each student interaction with the simulation system is not a signal that the student is surrendering a turn. Instead, the student reamains actively engaged with the simulation, preparing a series of actions in response to observed and expected events. In this context, the interjection of an instructional feedback message is an intrusion. The system is, in some sense, breaking in on the student's turn.

This "conversational rules" hypothesis is just a special case of an attentional demand hypothesis. In a complex training session, most of a student's cognitive processing resources are likely to be

allocated to attending to and responding to the task itself. If the task is suddenly intruded upon by an instructional message, the intrusion will demand additional processing resources to perform the attentional shift. This surge in processing resource demand is likely to interfere with the normal learning and performance processes. If the disruption occurs at a point in the task when a large percentage of cognitive resources are already committed, then either attention to feedback or performance on the task is likely to suffer. The attentional demand hypothesis predicts that feedback given intrusively will be more disruptive of learning than will feedback provided non-intrusively.

Conversational cooperation can be viewed as an adaptation to information processing resource limitations. A dynamic skills training system that partially emulates some of the features of conversational turn-taking in instructional feedback should prove superior to a system that interrupts student task processing with instructional messages. In the experiment, cooperative turn-taking is emulated by signaling a readiness to provide feedback in a non-intrusive way, and then postponing the presentation of the message until the student explicitly surrenders a turn and requests presentation of feedback.

Argument can be found to predict that the non-intrusive feedback condition (student paced presentation of feedback) could present difficulties for representational (as opposed to attentional) processes. Students in the non-intrusive group frequently postpone viewing a feedback message until some time after the commission of the error. The results of studies on delay of reinforcement during learning can be interpreted to imply that such a delay will be

detrimental to learning. According to this argument, feedback serves
as a reinforcer, and, therefore, the delays which occur in the
non-intrusive condition should impair overall student performance. A
cognitive view of this line of reasoning is that when the feedback
message is delayed it is more likely that the content of such a message
will not be correctly related to the student's representation of the
task. The student may not understand to which context the feedback
message refers. On the other hand, a student whose feedback is
presented intrusively always receives the feedback message immediately
following the context for which it is generated and so should not
suffer this representational (or reinforcement) disadvantage.

We do not expect the potential representational disadvantage for
non-intrusive group students to be as important as the attentional
disadvantage for intrusive group students. We postulate that students
have an ability to remember the context to which a feedback message
refers from the content of that message. The research specifically
addressed to delay of knowledge of results can be interpreted to
support this point of view (Kling & Schrier, 1971). In these studies
it appeared that making students wait for feedback was not detrimental
if little or no responding was required during the wait interval. This
suggests that students were able to maintain a memory of the context
for the knowledge of results information. If students in our Air
Intercept Controller training task were similarly able to recall the
context of a feedback message, then it would follow that students
recieving feedback non-intrusively would not suffer a representational
or reinforcement disadvantage.

The Experiment

Method

Subjects. Subjects were paid volunteers who responded to posted notices and/or class announcements made at two colleges (El Camino College and California State University, Dominguez Hills) and one high school (Redondo Beach High School). Thirty-five subjects participated in the experiment. Of these, thirty completed the experimental training task. Three subjects were dropped from the experiment due to poor performances. Two of these failed to correctly follow directions in the preliminary training phase, before the practice training of interest. One was dropped because of failure on all 30 practice problems, including those that were performed successfully by all other students. Two of the thirty-five subjects chose to discontinue the experiment before completion. Subjects were assigned to one of the two experimental groups in alternating order as they arrived for the experiment. Each subject who completed the training received fifteen dollars. Students who chose to terminate their participation or who were dropped due to poor performance received either five or ten dollars, depending on the length of their participation.

Procedure. Subjects were run individually in the experiment. Completion of the training session required from three hours twenty minutes to four and one-half hours. All subjects first viewed a six minute videotaped explanation and demonstration of the Air Intercept Controller task. They then were instructed in the functions of each of the control devices used in the simulated task--thirteen specially labeled keyboard keys and a joystick--by a computer-based-training

program called Pre-AIC. The Pre-AIC program consisted of a series of text presentations describing the task in greater detail than had been presented in the videotaped introduction. It also presented simulation segments that the student was required to interact with by using the control keys and joystick. Students who failed to complete two or more of the twelve training modules were dropped from the experiment. Two of the thirty-five subjects were disqualified from the experiment by this criterion.

After completing the Pre-AIC computer-based instruction program, all students then viewed the same videotaped sequence reviewing the Air Intercept Controller task and stating the requirements of the task. This tape segment lasted eight minutes. At this point the treatment of students in the two groups diverged. Each group viewed a videotape segment describing the way in which instructional feedback would be presented and how they should respond. This tape segment lasted one minute and twenty seconds for the intrusive feedback group and three minutes and thirty seconds for the non-intrusive feedback group. Students were then given a five minute break from the training task. At the end of the break, students were given practice in the Air Intercept Controller task, using a simulator trainer program called AIC. The AIC program presented a series of 30 problems to the student, organized in four banks of five, ten, ten, and five problems. Difficulty was held roughly constant within each bank, but increased with the progression of problem banks. Students in both groups received the same problems, and the training program was the same for students in the two groups in every respect except instructional feedback.

Instructional Feedback Treatments. The AIC program continually
monitored student performance for a variety of errors. Examples
include inacurrately positioning a symbol on the simulated radar
screen, or failing to get a fuel status update from the pilots of the
simulated aircraft within the required time. The Appendix contains a
complete list of these errors. For both feedback conditions, when the
AIC program detected an error, a warning tone sounded and the word
"Advisory" appeared in an area of the computer console display reserved
for instructional messages.

At this point, those students in the intrusive feedback group
were presented with a one- to four-line instructional message related
to the error just detected. While the message was displayed, the
simulation was frozen. The radar screen did not change, and all the
normally active keys of the computer console were dead. Only one key,
the "Accept message" key could be pressed by the student with effect.
When this key was pressed, the instructional feedback message was
erased from the screen and the problem continued, resuming at the point
at which it had been frozen. If more than one error had been detected
at one time, they were presented in sequence, from most to least
recent, as the student pressed the "Accept message" key, until all were
seen by the student. After the last currently active message was seen,
the word "Advisory" was erased from the screen along with the last
message.

The students in the non-intrusive feedback group were not
immediately presented with the instructional message after the system
sounded the error tone and displayed "Advisory" in the reserved area.

Thus, unlike the students in the intrusive condition, the non-intrusive
Feedback Group members were able to choose the time of the appearance
of the error messages by depressing a special "Help" key. Depressing
this key caused the error message to appear and the simulation to
freeze until the student pressed the "Accept message" key. If more
than one error had been detected by the system before the feedback
message was requested, then the student was first presented with the
most recent error message. In each case, depressing the "Accept
feedback" key caused the error message to be erased and the simulation
to resume. When all pending feedback messages had been presented, the
word "Advisory" was removed. If, at the end of a problem, the student
had not reviewed messages for all the errors detected by the system,
then the student was given the option of seeing these messages before
beginning the next problem.

In summary, students in the intrusive feedback group were
presented with an error message for each detected new error at the time
that the AIC program recognized the error. Students in the
non-intrusive feedback group had the option of determining when and
whether they would view the error messages.

Data collection. The AIC simulation training program preserved
an exhaustive record of each student's interactions with the program.
These data sets were later processed by data extraction programs to
produce records of errors, time on problems, and other variables of
interest.

Results

Errors. Number of errors per problem was used as one measure of learning. Table 1 presents an analysis of variance of the error data. The mean number of errors for the students in the non-intrusive group was 9.17, and for the intrusive treatment group, the mean number of errors per problem was 15.67. This difference was highly significant, suggesting that students in the non-intrusive group learned more than those in the intrusive group.

Errors, last ten problems. A second analysis was performed, using only the error data from the last one-third of the thirty practice problems. These problems, which were longer and more difficult than most of the previous problems, were treated as a measure of final training performance in this analysis. Students in the non-intrusive feedback group made a mean of 14.74 errors per problem in these ten problems. In the intrusive group, the mean was 22.82 errors per problem.

It is possible that the comparison of total errors made in practice training, given in Table 1, is not the best measure of learning. If students learn from making errors, then fewer errors in training might not portend better performance on the final task. After twenty problems, however, some training has taken place. Yet the data of Table 2 reveal that the students in the non-intrusive group made fewer errors in the last ten problems than those in the intrusive group. This result suggests that non-intrusive feedback promotes learning in dynamic skill training.

Time per problem. The time spent on each problem by each student was recorded. Table 3 presents the analysis of the time on problem data, where time is expressed in tenths of seconds. Intrusive group students spent a mean of 264.7 seconds per problem, and non-intrusive group students took 274.3 seconds. This difference was not significant.

It had been predicted that students in the non-intrusive group would require significantly less time per problem than those in the intrusive group. In retrospect, it can be seen that this prediction is in partial conflict with the prediction of fewer errors for the non-intrusive group. Some errors, such as allowing one's fighters to be shot down by the enemy, resulted in premature termination of problems. Because intrusive group students are more likely to make such errors, a prediction of shorter time per problem for intrusive group students would have been appropriate. In any case, the experimental results do not permit the rejection of the null hypothesis that there is no difference in time to complete problems for the two groups.

Crucial and non-crucial errors. Student errors are classified by the AIC program into thirty-six types. Of these, twenty-three may be termed "crucial" errors, in that they are likely to materially affect the student's chances of "winning" an exercise by shooting down the enemy aircraft. The other thirteen types of errors are non-crucial in that they reflect errors of form that will not immediately decrease the chances of winning the problem. Table 4 presents the analysis of crucial errors for all thirty problems. It shows a small but significant difference in number of crucial errors per problem between

the two groups. The non-intrusive feedback group made an average 5.36
crucial errors per problem, while the intrusive group made 6.14. Table
5 shows a significant and much larger difference in non-crucial errors.
The mean number of non-crucial errors per problem for the non-intrusive
training group was 3.18. For the intrusive feedback group, the mean
was 9.53 errors per problem. These results suggest that, even though
overloaded by the intrusive instructional messages, the intrusive group
students are still able to decide which performance factors to attend
to. They choose to permit greater deterioration of their non-crucial
performance rather than their crucial performance.

Joystick errors. In an attempt to determine what kind of
performance is affected by the intrusiveness of instructional feedback,
a separate analysis of joystick errors was performed. Most of the AIC
task requires the fusion of skills of planning, time or distance
estimation, and decision making, as well as some motor coordination.
One essential skill, however, is primarily one of motor coordination .
This is the task of using the joystick and keyboard to "hook" a symbol
on a simulated radar screen blip. Table 6 shows that there was no
significant difference in the total number of joystick errors made by
students in the two instructional treatment groups over the course of
the thirty practice problems. This implies that the deleterious effect
of intrusive feedback may not equally degrade all types of skills. The
motor skill of using the joystick appears not to be harmed by the
processing loads imposed by intrusive feedback.

Discussion

The results support our hypothesis that the processing demands of dynamic skill simulation training require non-intrusive rather than intrusive feedback. Students trained with the intrusive feedback method committed significantely more errors, both in the last set of problems and throughout the practice training, than did those trained by the non-intrusive method. Intrusive group students made significantly more errors of both crucial and non-crucial types. This higher incidence of errors is evidence that, in this dynamic skill training system, students who receive intrusive instructional feedback learn less well than those who have control over when the feedback will be presented.

A conversational analogy to computer based training is presented above. In normal conversation, the participants take turns talking, exchanging special signals to indicate a willingness to surrender a turn or to request a turn as soon as possible. The non-intrusive feedback condition simulates this aspect of conversation. The training system signals that it has a feedback message by sounding a tone. The student surrenders a turn by depressing a special key. These features allow the student to control the system's instructional input.

The fact that our results indicate a superiority for a treatment condition that gives the students control over instructional presentation contrasts markedly with the results of studies of student control of conventional knowledge system instruction in CBI. For example, studies by Judd, O'Neil, & Spelt (1974); Lahey, Hurlock, & McGrain (1973); and White & Smith (1974) all find no performance improvement due to student control of instruction in computer based

instruction. It is not surprising that the effect is not found in these cases, but is found in dynamic skill simulation training. In conventional computer based instruction, students consciously surrender a turn in the "conversational" interaction every time they depress the Return key.

The conversational analogy is just one way of viewing the difference between student control or lack of control of attentional demands. If the student can control the cognitive processing load by postponing instructional feedback until the processing required by the task is at a low level, then more resources will be available to process the instructional message. Furthermore, the resources devoted to the dynaic task during a demanding portion of the episode will not be diverted to processing feedback messages. Further research is called for to determine which of these effects is primarily responsible for improved learning in a non-intrusive feedback environment. It is possible that improved attention to instruction and to the task both have beneficial consequences for learning dynamic skills.

One type of error, joystick manipulation errors, required only perceptual and motor skills, rather than planning or decision making skills. Students in the two treatment groups did not differ significantly in the number of this type of error. This result implies that this perceptual-motor skill complex was less sensitive to the processing load imposed by the dynaic task together with instructional feedback processing than were the decison-making and planning skills called for by the task. Further research is called for to determine the detailed consequences of processing load on performance in dynamic skill training tasks such as the simulated Air Intercept Controller

Task used in this experiment.

More research is also called for to determine other means of improving dynamic skill instruction by reducing or by more effectively distributing processing loads during training. Experiments have not yet been performed to explore the consequences of manipulating the continuity of the simulation in training. (See Munro, et al., 1981, for a plan of research in this area.) In addition, the use of alternate presentation modes for instruction and simulation should be explored. Research on selective attention has shown that simultaneous attention is facilitated by distinguishing the channels of information as much as possible. This suggests the need to experiment with different modalities for task performance and for feedback. In the case of a system such as ours, the dynamic task is largely visual (textual) and tactile (key presses and joystick manipulation). If feedback presentations were by means of computer-generated voice output, rather than text, then the discriminability between the task and instruction would be improved. It is possible that such enhanced discriminability would reduce processing demands and thereby improve learning.

Summary

The resuls of the intrusive feedback experiment with the AIC simulation training system do not accord with two commonly accepted precepts of computer based learning. The first of these is that instructional feedback should be as prompt as possible. In this experiment, the group that received immediate feedback performed significantly less well than the group that had the delayed feedback option. The second expectation was that student control over the instructional process would have little, if any, effect. In this experiment, the group that chose the timing of instructional feedback presentations made significantly fewer errors than the group that did not have this control. This finding is not anomalous in view of the differences in processing demand between conventional computer based instruction and dynamic skill training. The transient processing demand fluctuations of dynamic skill training can be exploited by giving students control over the timing of some aspect of instruction.

The most important conclusion to be drawn from this study is that the findings of computer based learning research on knowledge system training may not be applicable to dynamic skill training. Further research is called for to determine the characteristics of an appropriate training methodology for computer based simulation training.

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Intrusive Feedback Group	Non-intrusive Feedback Group
15.67	9.17

2-WAY ANOVA

Source of Variation	Sum of Squares	DF	Mean Square	F	
Group	9423.297	1	9423.297	74.721	**
Problem	37947.422	29	1308.532	10.376	*
Group x Problem	3618.318	29	124.770	0.989	n.s.
Residual	100511.750	797	126.113		

Table 1

Total Errors. Analysis of Variance

*   P < .01

**   P < .001

Intrusive Feedback Group	Non-intrusive Feedback Group
22.82	14.74

2-WAY ANOVA (Last 10 Problems)

Source of Variation	Sum of Squares	DF	Mean Square	F	
Group	4941.145	1	4941.145	75.168	**
Problem	14059.820	9	1562.202	23.765	**
Group x Problem	736.404	9	81.823	1.245	n.s.
Residual	17091.066	260	65.735		

Table 2

Errors, Last 10 Problems

Analysis of Variance

** P < .001

Intrusive Feeeback Group	Non-intrusive Feedback Group
2647	2743

2-WAY ANOVA

Source of Variation	Sum of Squares	DF	Mean Square	F	
Group	1531126.000	1	1531126.000	3.117	n.s.
Problem	430203136.000	29	14834590.000	30.201	*
Group x Problem	13610033.000	29	469311.438	0.955	n.s.
Residual	391969024.000	798	491189.250		

Table 3

Time per Problem. Analysis of Variance.

* $P < .01$

Intrusive Feedback Group	Non-intrusive Feeeback Group
6.14	5.36

2-WAY ANOVA FOR CRUCIAL ERRORS

Source of Variation	Sum of Squares	DF	Mean Square	F	
Group	151.928	1	151.928	17.947	**
Problem	12426.016	29	428.483	50.616	*
Group x Problem	197.630	29	6.815	0.805	n.s.
Residual	6746.871	797	8.465		

Table 4

Crucial Errors. Analysis of Variance.

* $P < .01$

** $P < .001$

Intrusive Feedback Group	Non-intrusive Feedback Group
9.53	3.81

A 2-WAY ANOVA FOR NON-CRUCIAL ERRORS

Source of Variation	Sum of Squares	DF	Mean Square	F	
Group	7120.387	1	7120.387	67.743	**
Problem	9352.324	29	322.494	3.068	**
Group x Problem	2967.144	29	102.315	0.973	n.s.
Residual	83772.313	797	105.110		

Table 5

Non-Crucial Errors. Analysis of Variance

** P <.001

Mean Joystick Errors per Student

Intrusive Feedback Group	Non-intrusive Feedback Group
31.0	26.6

T-TEST FOR JOYSTICK ERRORS

T (pooled)   1.03   DF   28

T (not pooled)   1.03   DF   29.96

F ratio=   0.93   DF   14, 14

Not Significant

Table 6

Joystick Errors.   T-Test .

APPENDIX

Types of Student Errors Detected

Crucial Errors

1 Mishook. To depress a reserved Symbol key when the joystick cursor is not centered (within the error margin) on a blip.

2 Fail to hook CAP after appear. To fail to label a CAP within 60 seconds of its first appearance.

3 Fail to rehook CAP after first hook. To fail to relabel a CAP within 30 seconds of first labeling it. The blip labeled by the CAP symbol must have moved since the first hook.

4 Fail to hook Bogey after appear. To fail to label a Bogey within 24 seconds of its first appearance.

5 Fail to rehook Bogey after first hook. To fail to relabel a Bogey within 18 seconds of first labeling it. The blip labeled by the Bogey symbol must have moved since the first hook.

6 Fail to rehook Bogey after a heading jink. To fail to rehook a Bogey blip within 36 seconds after it makes a change of course.

7 Fail to rehook Bogey after a speed jink. To fail to rehook a Bogey blip within 36 seconds of its change of speed.

8 Incorrect pairing for intercept heading. To choose to assign a CAP to an intercept when there is a closer, unassigned CAP to the target Bogey.

9 Fail to elicit intercept heading. To fail to elicit an intercept heading to a Bogey within 18 seconds of rehooking the Bogey blip, when there is a free CAP available for the assignment.

10 Incorrect pairing for attack heading. To choose to assign a

CAP to attack a Bogey when there is a closer, unassigned CAP to the target Bogey.

11 Fail to elicit an attack heading. To fail to elicit an attack heading to a Bogey within 18 seconds of a CAP entering attack range, if the CAP is free or assigned to the Bogey.

12 Fail to elicit an attack heading. To fail to elicit an attack heading to a Bogey within 18 seconds of rehooking the Bogey while it is in attack range of the CAP assigned to it.

13 Send wrong intercept heading. After eliciting an intercept heading, to send a different intercept than that recommended.

14 Fail to send intercept heading. To fail to send an intercept heading for more than 12 seconds after eliciting the intercept heading. Applies only if both CAP and Bogey are still alive at time of error.

15 Fail to reassign CAP after splashing Bogey. To fail to either elicit a new intercept or attack heading or to abort the CAP flight for more than 18 seconds after shooting down its Bogey.

16 Send wrong attack heading. After eliciting an attack heading, to send a different attack heading than recommended.

17 Fail to send attack heading. To fail to send the attack heading for more than 12 seconds after eliciting it. Applies only if both Bogey and CAP are still up.

18 Get shot down. Fail to fire when in firing range. When range is very close, Bogey shoots down CAP.

19 Fire when not on attack heading.

20 Fail to fire in firing range. More than 12 seconds pass without firing since CAP enters firing range.

Non-Crucial Errors

1 Fail to rehook CAP after turn to intercept. To fail to rehook CAP for more than 36 seconds after it turns to a new intercept heading.

2 Fail to rehook CAP after turn to attack. To fail to rehook CAP for more than 36 seconds after it turns to a new attack heading.

3 Send attack heading when CAP not in attack range of Bogey.

4 Fire when CAP out of firing range.

5 Fire when CAP out of weapons.

6 Abort CAP flight prematurely. To send CAP back toward home base while there is still a Bogey on the screen and the CAP has enough fuel.

7 Fail to get first fuel update. To fail to elicit information on fuel supply within 60 seconds of first rehook of CAP.

8 Fail to get subsequent fuel update. To fail to elicit fuel supply information within 60 seconds of previous fuel update.

9 Fail to get first weapons update. To fail to elicit information on weapons quantity within 60 seconds of first rehook of CAP.

10 Fail to get subsequent weapons update. To fail to elicit weapons information within 60 seconds of previous weapons update.

11 Send intercept heading before eliciting intercept heading for CAP.

12 Send attack heading before eliciting attack heading for CAP.

Navy

Navy

1   Dr. Ed Aiken
    Navy Personnel R&D Center
    San Diego, CA 92152

1   Dr. Arthur Bachrach
    Environmental Stress Program Center
    Naval Medical Research Institute
    Bethesda, MD 20014

1   Meryl S. Baker
    NPRDC
    Code P309
    San Diego, CA 92152

1   CDR Thomas Berghage
    Naval Health Research Center
    San Diego, CA 92152

1   Dr. Alvah Bittner
    Naval Biodynamics Laboratory
    New Orleans, Lousiana 70189

1   Dr. Robert Breaux
    Code N-711
    NAVTRAEQUIPCEN
    Orlando, FL 32813

1   Chief of Naval Education and Training
         Liason Office
    Air Force Human Resource Laboratory
    Flying Training Division
    WILLIAMS AFB, AZ 85224

1   CDR Mike Curran
    Office of Naval Research
    800 N. Quincy St.
    Code 270
    Arlington, VA 22217

1   DR. PAT FEDERICO
    NAVY PERSONNEL R&D CENTER
    SAN DIEGO, CA 92152

1   Dr. John Ford
    Navy Personnel R&D Center
    San Diego, CA 92152

1   LT Steven D. Harris, MSC, USN
    Code 6021
    Naval Air Development Center
    Warminster, Pennsylvania 18974

1   Dr. Lloyd Hitchcock
    Human Factors Engineering
         Division (6022)
    Naval Air Development Center
    Warminster, PA 18974

1   Dr. Jim Hollan
    Code 304
    Navy Personnel R & D Center
    San Diego, CA 92152

1   CDR Charles W. Hutchins
    Naval Air Systems Command Hq
    AIR-340F
    Navy Department
    Washington, DC 20361

1   Dr. Norman J. Kerr
    Chief of Naval Technical Training
    Naval Air Station Memphis (75)
    Millington, TN 38054

1   Dr. William L. Maloy
    Principal Civilian Advisor for
         Education and Training
    Naval Training Command, Code 00A
    Pensacola, FL 32508

1   CAPT Richard L. Martin, USN
    Prospective Commanding Officer
    USS Carl Vinson (CVN-70)
    Newport News Shipbuilding and Drydock Co
    Newport News, VA 23607

1   Dr. George Moeller
    Head, Human Factors Dept.
    Naval Submarine Medical Research Lab
    Groton, CN 06340

1   Dr William Montague
    Navy Personnel R&D Center
    San Diego, CA 92152

Navy

1   Commanding Officer
    U.S. Naval Amphibious School
    Coronado, CA   92155

1   Ted M. I. Yellen
    Technical Information Office, Code 201
    NAVY PERSONNEL R&D CENTER
    SAN DIEGO, CA   92152

1   Library, Code P201L
    Navy Personnel R&D Center
    San Diego, CA   92152

1   Technical Director
    Navy Personnel R&D Center
    San Diego, CA 92152

6   Commanding Officer
    Naval Research Laboratory
    Code 2627
    Washington, DC 20390

1   Psychologist
    ONR Branch Office
    Bldg 114, Section D
    666 Summer Street
    Boston, MA   02210

1   Psychologist
    ONR Branch Office
    536 S. Clark Street
    Chicago, IL   60605

1   Office of Naval Research
    Code 437
    800 N. Quincy SStreet
    Arlington, VA   22217

1   Office of Naval Research
    Code 441
    800 N. Quincy Street
    Arlington, VA   22217

5   Personnel & Training Research Programs
       (Code 458)
    Office of Naval Research
    Arlington, VA   22217

Navy

1   Psychologist
    ONR Branch Office
    1030 East Green Street
    Pasadena, CA   91101

1   Office of the Chief of Naval Operations
    Research Development & Studies Branch
       (OP-115)
    Washington, DC 20350

1   LT Frank C. Petho, MSC, USN (Ph.D)
    Selection and Training Research Division
    Human Performance Sciences Dept.
    Naval Aerospace Medical Research Laborat
    Pensacola, FL   32508

1   Dr. Gary Poock
    Operations Research Department
    Code 55PK
    Naval Postgraduate School
    Monterey, CA 93940

1   Roger W. Remington, Ph.D
    Code L52
    NAMRL
    Pensacola, FL 32508

1   Dr. Worth Scanland, Director
    Research, Development, Test & Evaluation
    N-5
    Naval Education and Training Command
    NAS, Pensacola, FL   32508

1   Dr. Sam Schiflett, SY 721
    Systems Engineering Test Directorate
    U.S. Naval Air Test Center
    Patuxent River, MD 20670

1   Dr. Robert G. Smith
    Office of Chief of Naval Operations
    OP-987H
    Washington, DC 20350

1   Dr. Alfred F. Smode
    Training Analysis & Evaluation Group
       (TAEG)
    Dept. of the Navy
    Orlando, FL   32813

Navy

1   Dr. Richard Sorensen
Navy Personnel R&D Center
San Diego, CA 92152

1   Roger Weissinger-Baylon
Department of Administrative Sciences
Naval Postgraduate School
Monterey, CA 93940

1   Dr. Robert Wherry
562 Mallard Drive
Chalfont, PA 18914

1   Dr. Robert Wisher
Code 309
Navy Personnel R&D Center
San Diego, CA 92152

1   Mr John H. Wolfe
Code P310
U. S. Navy Personnel Research and
     Development Center
San Diego, CA 92152

Army

1   Technical Director
U. S. Army Research Institute for the
     Behavioral and Social Sciences
5001 Eisenhower Avenue
Alexandria, VA 22333

1   Mr. James Baker
Systems Manning Technical Area
Army Research Institute
5001 Eisenhower Ave.
Alexandria, VA 22333

1   Mr. J. Barber
HQS, Department of the Army
DAPE-ZBR
Washington, DC 20310

1   Dr. Beatrice J. Farr
U. S. Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

1   Dr. Michael Kaplan
U.S. ARMY RESEARCH INSTITUTE
5001 EISENHOWER AVENUE
ALEXANDRIA, VA 22333

1   Dr. Harold F. O'Neil, Jr.
Attn: PERI-OK
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

1   LTC Michael Plummer
Chief, Leadership & Organizational
     Effectiveness Division
Office of the Deputy Chief of Staff
     for Personnel
Dept. of the Army
Pentagon, Washington DC 20301

1   Dr. Robert Sasmor
U. S. Army Research Institute for the
     Behavioral and Social Sciences
5001 Eisenhower Avenue
Alexandria, VA 22333

Air Force   Marines

1   U.S. Air Force Office of Scientific   1   H. William Greenup
        Research   Education Advisor (E031)
     Life Sciences Directorate, NL   Education Center, MCDEC
     Bolling Air Force Base   Quantico, VA 22134
     Washington, DC 20332
                                                 1   Special Assistant for Marine
1   Air University Library   Corps Matters
     AUL/LSE 76/443   Code 100M
     Maxwell AFB, AL 36112   Office of Naval Research
                                                      800 N. Quincy St.
1   Dr. Alfred R. Fregly   Arlington, VA 22217
     AFOSR/NL, Bldg. 410]
     Bolling AFB   1   DR. A.L. SLAFKOSKY
     Washington, DC 20332   SCIENTIFIC ADVISOR (CODE RD-1)
                                                      HQ, U.S. MARINE CORPS
1   Dr. Genevieve Haddad   WASHINGTON, DC 20380
     Program Manager
     Life Sciences Directorate
     AFOSR
     Bolling AFB, DC 20332

1   Dr. Frank Schufletowski
     U.S. Air Force
     ATC/XPTD
     Randolph AFB, TX 78148

2   3700 TCHTW/TTGH Stop 32
     Sheppard AFB, TX 76311

CoastGuard   Other DoD

1   Chief, Psychological Reserch Branch   12   Defense Technical Information Center
    U. S. Coast Guard (G-P-1/2/TP42)   Cameron Station, Bldg 5
    Washington, DC 20593   Alexandria, VA 22314
                                                     Attn: TC

                                                1   Military Assistant for Training and
                                                        Personnel Technology
                                                    Office of the Under Secretary of Defense
                                                        for Research & Engineering
                                                    Room 3D129, The Pentagon
                                                    Washington, DC 20301

                                                1   DARPA
                                                    1400 Wilson Blvd.
                                                    Arlington, VA 22209

CoastGuard   Other DoD

Civil Govt   Civil Govt

1   Dr. Paul G. Chapin   1   Dr. Joseph L. Young, Director
     Linguistics Program   Memory & Cognitive Processes
     National Science Foundation   National Science Foundation
     Washington, DC 20550   Washington, DC 20550

1   Dr. Susan Chipman
     Learning and Development
     National Institute of Education
     1200 19th Street NW
     Washington, DC 20208

1   Dr. John Mays
     National Institute of Education
     1200 19th Street NW
     Washington, DC 20208

1   William J. McLaurin
     66610 Howie Court
     Camp Springs, MD   20031

1   Dr. Arthur Melmed
     National Intitute of Education
     1200 19th Street NW
     Washington, DC 20208

1   Dr. Andrew R. Molnar
     Science Education Dev.
         and Research
     National Science Foundation
     Washington, DC 20550

1   Dr. Joseph Psotka
     National Institute of Education
     1200 19th St. NW
     Washington,DC 20208

1   Dr. H. Wallace Sinaiko
     Program Director
     Manpower Research and Advisory Services
     Smithsonian Institution
     801 North Pitt Street
     Alexandria, VA 22314

1   Dr. Frank Withrow
     U. S. Office of Education
     400 Maryland Ave. SW
     Washington, DC 20202

Non Govt

1   Dr. John R. Anderson
    Department of Psychology
    Carnegie Mellon University
    Pittsburgh, PA 15213

1   Anderson, Thomas H., Ph.D.
    Center for the Study of Reading
    174 Children's Research Center
    51 Gerty Drive
    Champiagn, IL 61820

1   Dr. John Annett
    Department of Psychology
    University of Warwick
    Coventry CV4 7AL
    ENGLAND

1   DR. MICHAEL ATWOOD
    SCIENCE APPLICATIONS INSTITUTE
    40 DENVER TECH. CENTER WEST
    7935 E. PRENTICE AVENUE
    ENGLEWOOD, CO   80110

1   1 psychological research unit
    Dept. of Defense (Army Office)
    Campbell Park Offices
    Canberra   ACT 2600, Australia

1   Dr. Alan Baddeley
    Medical Research Council
         Applied Psychology Unit
    15 Chaucer Road
    Cambridge CB2 2EF
    ENGLAND

1   Dr. Patricia Baggett
    Department of Psychology
    University of Colorado
    Boulder, CO   80309

1   CDR Robert J. Biersner
    Program Manager
    Human Performance
    Navy Medical R&D Command
    Bethesda, MD   20014

1   Liaison Scientists
    Office of Naval Research,
    Branch Office , London
    Box 39 FPO New York   09510

1   Dr. Lyle Bourne
    Department of Psychology
    University of Colorado
    Boulder, CO 80309

1   Dr. John S. Brown
    XEROX Palo Alto Research Center
    3333 Coyote Road
    Palo Alto, CA 94304

1   Dr. Bruce Buchanan
    Department of Computer Science
    Stanford University
    Stanford, CA 94305

1   DR. C. VICTOR BUNDERSON
    WICAT INC.
    UNIVERSITY PLAZA, SUITE 10
    1160 SO. STATE ST.
    OREM, UT 84057

1   Dr. Pat Carpenter
    Department of Psychology
    Carnegie-Mellon University
    Pittsburgh, PA 15213

1   Dr. William Chase
    Department of Psychology
    Carnegie Mellon University
    Pittsburgh, PA 15213

1   Dr. Micheline Chi
    Learning R & D Center
    University of Pittsburgh
    3939 O'Hara Street
    Pittsburgh, PA 15213

1   Dr. William Clancey
    Department of Computer Science
    Stanford University .
    Stanford, CA 94305

Non Govt   Non Govt

1   Dr. Allan M. Collins   1   Dr. Ed Feigenbaum
    Bolt Beranek & Newman, Inc.   Department of Computer Science
    50 Moulton Street   Stanford University
    Cambridge, Ma 02138   Stanford, CA 94305

1   Dr. Lynn A. Cooper   1   Mr. Wallace Feurzeig
    LRDC   Bolt Beranek & Newman, Inc.
    University of Pittsburgh   50 Moulton St.
    3939 O'Hara Street   Cambridge, MA 02138
    Pittsburgh, PA 15213
                                      1   Dr. Edwin A. Fleishman
1   Thomas L. Crandell   Advanced Research Resources Organ.
    35 Leslie Avenue   Suite 900
    Conklin, NY 13748   4330 East West Highway
                                          Washington, DC 20014
1   Dr. Meredith P. Crawford
    American Psychological Association 1 DR. JOHN D. FOLLEY JR.
    1200 17th Street, N.W.   APPLIED SCIENCES ASSOCIATES INC
    Washington, DC 20036   VALENCIA, PA   16059

1   Dr. Kenneth B. Cross   1   Dr. John R. Frederiksen
    Anacapa Sciences, Inc.   Bolt Beranek & Newman
    P.O. Drawer Q   50 Moulton Street
    Santa Barbara, CA 93102   Cambridge, MA 02138

1   Dr. Diane Damos   1   Dr. Alinda Friedman
    Arizona State University   Department of Psychology
    Tempe, AZ 85281   University of Alberta
                                          Edmonton, Alberta
1   Dr. Emmanuel Donchin   CANADA T6G 2E9
    Department of Psychology
    University of Illinois   1   Dr. R. Edward Geiselman
    Champaign, IL 61820   Department of Psychology
                                          University of California
1   LCOL J. C. Eggenberger   Los Angeles, CA 90024
    DIRECTORATE OF PERSONNEL APPLIED RESEARC
    NATIONAL DEFENCE HQ   1   DR. ROBERT GLASER
    101 COLONEL BY DRIVE   LRDC
    OTTAWA, CANADA K1A OK2   UNIVERSITY OF PITTSBURGH
                                          3939 O'HARA STREET
1   ERIC Facility-Acquisitions   PITTSBURGH, PA   15213
    4833 Rugby Avenue
    Bethesda, MD 20014   1   Dr. Marvin D. Glock
                                          217 Stone Hall
1   Dr. A. J. Eschenbrenner   Cornell University
    Dept. E422, Bldg. 81   Ithaca, NY 14853
    McDonnell Douglas Astronautics Co.
    P.O.Box 516
    St. Louis, MO 63166

Non Govt   Non Govt

1   Dr. Frank E. Gomer   1   Dr. Earl Hunt
    McDonnell Douglas Astronautics Co.   Dept. of Psychology
    P. O. Box 516   University of Washington
    St. Louis, MO 63166   Seattle, WA 98105

1   Dr. Daniel Gopher   1   Dr. Ed Hutchins
    Industrial & Management Engineering   Navy Personnel R&D Center
    Technion-Israel Institute of Technology   San Diego, CA 92152
    Haifa
    ISRAEL   1   Dr. Steven W. Keele
                                                    Dept. of Psychology
1   DR. JAMES G. GREENO   University of Oregon
    LRDC   Eugene, OR 97403
    UNIVERSITY OF PITTSBURGH
    3939 O'HARA STREET   1   Dr. Walter Kintsch
    PITTSBURGH, PA   15213   Department of Psychology
                                                    University of Colorado
1   Dr. Harold Hawkins   Boulder, CO 80302
    Department of Psychology
    University of Oregon   1   Dr. David Kieras
    Eugene OR 97403   Department of Psychology
                                                    University of Arizona
1   Dr. Barbara Hayes-Roth   Tuscon, AZ 85721
    The Rand Corporation
    1700 Main Street   1   Dr. Robert Kinkade
    Santa Monica, CA 90406   Essex Corporation
                                                    3211 Jefferson Street
1   Dr. Frederick Hayes-Roth   San Diego, CA 92110
    The Rand Corporation
    1700 Main Street   1   Dr. Kenneth A. Klivington
    Santa Monica, CA 90406   Program Officer
                                                    Alfred P. Sloan Foundation
1   Dr. James R. Hoffman   630 Fifth Avenue
    Department of Psychology   New York, NY 10111
    University of Delaware
    Newark, DE 19711   1   Dr. Stephen Kosslyn
                                                    Harvard University
1   Dr. Kristina Hooper   Department of Psychology
    Clark Kerr Hall   33 Kirkland Street
    University of California   Cambridge, MA 02138
    Santa Cruz, CA 95060
                                                1   Dr. Jill Larkin
1   Glenda Greenwald, Ed.   Department of Psychology
    "Human Intelligence Newsletter"   Carnegie Mellon University
    P. O. Box 1163   Pittsburgh, PA 15213
    Birmingham, MI 48012

Non Govt

Non Govt

1   Dr. Alan Lesgold
     Learning R&D Center
     University of Pittsburgh
     Pittsburgh, PA 15260

1   Dr. Michael Levine
     Department of Educational Psychology
     210 Education Bldg.
     University of Illinois
     Champaign, IL 61801

1   Mr. Merl Malehorn
     Dept. of Navy
     Chief of Naval Operations
     OP-113
     Washington, DC 20350

1   Dr. Erik McWilliams
     Science Education Dev. and Research
     National Science Foundation
     Washington, DC 20550

1   Dr. Mark Miller
     TI Computer Science Lab
     C/O 2824 Winterplace Circle
     Plano, TX 75075

1   Dr. Donald A Norman
     Dept. of Psychology C-009
     Univ. of California, San Diego
     La Jolla, CA 92093

1   Committee on Human Factors
     JH 811
     2101 Constitution Ave. NW
     Washington, DC 20418

1   Dr. James A. Paulson
     Portland State University
     P.O. Box 751
     Portland, OR 97207

1   Dr. James W. Pellegrino
     University of California,
        Santa Barbara
     Dept. of Psychology
     Santa Barabara, CA 93106

1   MR. LUIGI PETRULLO
     2431 N. EDGEWOOD STREET
     ARLINGTON, VA 22207

1   Dr. Martha Polson
     Department of Psychology
     Campus Box 346
     University of Colorado
     Boulder, CO 80309

1   DR. PETER POLSON
     DEPT. OF PSYCHOLOGY
     UNIVERSITY OF COLORADO
     BOULDER, CO 80309

1   Dr. Steven E. Poltrock
     Department of Psychology
     University of Denver
     Denver,CO 80208

1   Dr. Mike Posner
     Department of Psychology
     University of Oregon
     Eugene OR 97403

1   DR. DIANE M. RAMSEY-KLEE
     R-K RESEARCH & SYSTEM DESIGN
     3947 RIDGEMONT DRIVE
     MALIBU, CA 90265

1   Dr. Fred Reif
     SESAME
     c/o Physics Department
     University of California
     Berkely, CA 94720

1   Dr. Lauren Resnick
     LRDC
     University of Pittsburgh
     3939 O'Hara Street
     Pittsburgh, PA 15213

1   Mary Riley
     LRDC
     University of Pittsburgh
     3939 O'Hara Street
     Pittsburgh, PA 15213

Non Govt   Non Govt

1   Dr. Andrew M. Rose   1   Dr. Richard Snow
    American Institutes for Research   School of Education
    1055 Thomas Jefferson St. NW   Stanford University
    Washington, DC 20007   Stanford, CA 94305

1   Dr. Ernst Z. Rothkopf   1   Dr. Robert Sternberg
    Bell Laboratories   Dept. of Psychology
    600 Mountain Avenue   Yale University
    Murray Hill, NJ 07974   Box 11A, Yale Station
                                                 New Haven, CT 06520

1   Dr. David Rumelhart
    Center for Human Information Processing 1   DR. ALBERT STEVENS
    Univ. of California, San Diego   BOLT BERANEK & NEWMAN, INC.
    La Jolla, CA 92093   50 MOULTON STREET
                                                 CAMBRIDGE, MA 02138

1   DR. WALTER SCHNEIDER
    DEPT. OF PSYCHOLOGY   1   Dr. Thomas G. Sticht
    UNIVERSITY OF ILLINOIS   Director, Basic Skills Division
    CHAMPAIGN, IL 61820   HUMRRO
                                                 300 N. Washington Street
1   Dr. Alan Schoenfeld   Alexandria,VA 22314
    Department of Mathematics
    Hamilton College   1   David E. Stone, Ph.D.
    Clinton, NY 13323   Hazeltine Corporation
                                                 7680 Old Springhouse Road
1   DR. ROBERT J. SEIDEL   McLean, VA 22102
    INSTRUCTIONAL TECHNOLOGY GROUP
        HUMRRO   1   DR. PATRICK SUPPES
    300 N. WASHINGTON ST.   INSTITUTE FOR MATHEMATICAL STUDIES IN
    ALEXANDRIA, VA 22314   THE SOCIAL SCIENCES
                                                 STANFORD UNIVERSITY
1   Committee on Cognitive Research   STANFORD, CA 94305
    % Dr. Lonnie R. Sherrod
    Social Science Research Council   1   Dr. Kikumi Tatsuoka
    605 Third Avenue   Computer Based Education Research
    New York, NY 10016   Laboratory
                                                 252 Engineering Research Laboratory
1   Robert S. Siegler   University of Illinois
    Associate Professor   Urbana, IL 61801
    Carnegie-Mellon University
    Department of Psychology   1   DR. PERRY THORNDYKE
    Schenley Park   THE RAND CORPORATION
    Pittsburgh, PA 15213   1700 MAIN STREET
                                                 SANTA MONICA, CA 90406
1   Dr. Edward E. Smith
    Bolt Beranek & Newman, Inc.
    50 Moulton Street
    Cambridge, MA 02138

Non Govt

1   Dr. David J. Weiss
    N660 Elliott Hall
    University of Minnesota
    75 E. River Road
    Minneapolis, MN 55455

1   DR. GERSHON WELTMAN
    PERCEPTRONICS INC.
    6271 VARIEL AVE.
    WOODLAND HILLS, CA 91367

1   Dr. Keith T. Wescourt
    Information Sciences Dept.
    The Rand Corporation
    1700 Main St.
    Santa Monica, CA 90406

1   DR. SUSAN E. WHITELY
    PSYCHOLOGY DEPARTMENT
    UNIVERSITY OF KANSAS
    LAWRENCE, KANSAS 66044

1   Dr. Christopher Wickens
    Department of Psychology
    University of Illinois
    Champaign, IL 61820

1   Dr. J. Arthur Woodward
    Department of Psychology
    University of California