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CENTER FOR COMPUTER-BASED BEHAVIORAL
STUDIES (CCBS)

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California University

Prepared for:

Rome Air Development Center

31 January 1973

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RADC-TR-73-106
Technical Report
31 January 1973



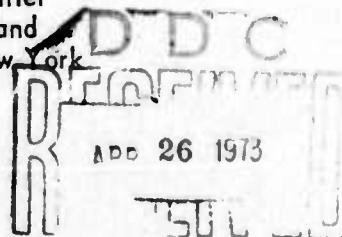
CENTER FOR COMPUTER-BASED BEHAVIORAL STUDIES
The Regents of the University of California

Sponsored by
Defense Advanced Research Projects Agency
ARPA Order No. 1488

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Rome Air Development Center
Air Force Systems Command
Griffiss Air Force Base, New York



46 R

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)		2a. REPORT SECURITY CLASSIFICATION	
The Regents of the University of California Department of Psychology 405 Hilgard, Los Angeles, CA 90024		Unclassified	
3. REPORT TITLE		2b. GROUP	
CENTER FOR COMPUTER BASED BEHAVIORAL STUDIES (CCBS)			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
CONFIDENTIAL			
5. AUTHOR(S) (First name, middle initial, last name)			
Gerald H. Shure Robert J. Meeker Alvin S. Cooperband			
6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS	
31 January 1973	41	28	
9a. CONTRACT OR GRANT NO.	9b. ORIGINATOR'S REPORT NUMBER(S)		
F30602-70-C-0016			
b. ARPA Order No. 1483			
c. Program Code No. 9D20	9d. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)		
d.	RADC-TR-73-106		
10. DISTRIBUTION STATEMENT			
Approved for public release; distribution Unlimited.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
Monitored by Al Delucia RADC (IRDA), GAPB, NY 13441 AC 315 330-3221		Advanced Research Project Agency 1400 Wilson Blvd. Arlington VA 22209	
13. ABSTRACT			
The Center for Computer-Based Behavioral Studies (CCBS) on the UCLA Campus is designed and is being developed to overcome a number of the methodological limitations blocking significant research advances in, and behavioral sciences' contributions to, the study of national policies and problems. The Center is designed around a time shared computer system that will make its informational and technological resources available to behavioral scientists and policy analysts located at widely dispersed university and government research centers, offering them new and powerful research, policy planning, and educational tools. A number of these tools for studying and analyzing the behavior of individuals, groups, and social-political units are specifically capable of narrowing the enormous gap that continues to exist between the policy analyst and the behavioral scientist. Essential to the development of these broad methodological and technological areas is an ongoing program of substantive research on bargaining and conflict resolution behavior relevant to political crisis management. As the three areas of development (laboratory gaming and simulation research, inductive data analysis, and data resources management) share a systematic base of operation, the potentials for mutual support among them will be substantially enhanced. Central to all of these activities are plans based on a number of highly integrated software system, hardware configurations, and laboratory design and equipment requirements, stemming from ARPA- supported research and development projects conducted over the past seven years. This document describes project developments covering the first three and one half years, placing particular emphasis on progress covering the last six month period and on plans for project developments for the balance of the contract (Over)			

DD FORM 1 NOV 63 1473

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UNCLASSIFIED

Security Classification

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Computer Simulation Gaming, Model Simulation Systems Analysis War Games Management Games						
<u>Abstract Continued</u>						
period. As an aid to the reader who may not have past documentation close at hand, the document as a whole, and many of the internal sections, are prefaced by an overview statement which reflects the general background and rationale developed in the original proposal.						
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CENTER FOR COMPUTER-BASED BEHAVIORAL STUDIES

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Contractor: The Regents of the University of California
Contract Number: F30602-70-C-0016
Effective Date of Contract: 1 July 1969
Contract Expiration Date: 30 June 1973
Amount of Contract: \$4,706,799.00
Program Code Number: 9D20

Principal Investigator: Gerald H. Shure PhD
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Project Engineer: Al DeLucia
Phone: 315 330-3221

Approved for public release;
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This research was supported by the
Advanced Research Projects Agency
of the Department of Defense and
was monitored by Al DeLucia, RADC
(IRDA), GAFB, NY 13441 under con-
tract F30602-70-C-0016.

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PUBLICATION REVIEW

This technical report has been reviewed and is approved.

Al. De Luca

RADC Project Engineer

Background and Summary

Progress during the first year of the project was severely curtailed by protracted contractual negotiations; a definitive contract was not implemented and finalized until the last week of June 1970. In sum, the project operated during the entire period without the enablement of a finalized contract and without authorization to acquire the central computing system and its major components of hardware and software support. In the absence of enabling conditions--without definite selection of the central processing system and without contractual authority to purchase major equipment, to subcontract for software development, or to develop project staff--the proposed schedule of development for the first year was critically compromised.

In contrast, the project progressed at an accelerated rate in the next two years; as a result, we have been able to recoup a significant portion of the schedule slippage due to first-year delays. Phase I of the computing system is complete, both with respect to hardware configuration and operating system software. Phase II hardware and software design has been developed through a detailed design stage and is being implemented. Two higher-order programming languages--JOVIAL and META--have been developed; both META and JOVIAL are now being used for applications programming. Interactive debuggers are available for both these languages. We have developed a programming system that provides rapid and easy laboratory implementation of experimental research designs. In data management and analysis, we have implemented TRACE, a system that provides implicit programming capabilities for data analysis, handling complex data structures, both hierarchical as well as rectangular; and we have implemented a fully interactive and augmented version of IDEA, a program that provides computer assistance in the task of inductive data analysis. The construction of permanent laboratory facilities is complete. CCBS is being interfaced with the ARPA network as a means of offering

our capabilities to a wider community of users. In sum, the overall project development is still behind the schedule originally proposed, but considerably less so than might be expected with the first-year delays.

Computer Laboratory Developments

The principal goal of the project is to broaden and expand the capabilities of behavioral research, particularly in areas of potential policy relevance. The principal means of accomplishing this goal is to develop new behavioral research methodologies through the use of on-line, data acquisition tools, particularly for computer-administered experiments and simulations and for interactive forms of data and text analysis. The goals of the project, then, are predicated on developments critically linked to a large-scale time-sharing computing system.

Computer Hardware

The hardware configuration of the CCBS central system computer is designed to support high-speed interaction with many concurrent users who, in the three primary applications of the system, may be any mix of experimental subjects, data analysts, and development programmers. The different applications (and associated different types of users) require different interactive service needs, which, in sum, present a need for greater than normal communications processing. The basic hardware configuration is especially designed to meet these requirements.

Beyond the basic configuration, the major extension of computer hardware is to meet extended data management requirements, especially as these relate to the management of data bases of archive proportions. (This aspect of the project is identified in the original proposal as Phase II development.) There are two major facets in extended data management capabilities: first, a need to provide greater data storage

capacity in the system, and, second, a need to provide improved means of accessing data when it resides outside the normal bounds of direct addressability (i.e. core memory). The first of these requirements is being met with the acquisition of additional standard disc storage. There is, by contrast, no standard hardware available for meeting the second requirement; we have therefore undertaken the development of hardware and associated software necessary to support virtual memory programming. A further extension is required to meet increased use of the central processor as the number of concurrent users increases; this will be achieved through an increase in the amount of swapping storage.

A summary of the computer system hardware is given below:

CCBS computer system hardware, basic configuration:

Processor: DEC PDP-10/PDP-15 dual processor--both processors interface to PDP-10 core (262,144 words of 36-bit, 1.5 μ sec. memory) with 4192 words of 18-bit, 0.8 μ sec. memory on the PDP-15; interprocessor memory interface, DA15-C, developed by DEC (detailed description in Appendix B, Technical Report 12/31/70); and high speed communications interface, developed by DEC (detailed description in Appendix C, Technical Report 12/31/70). An additional 8192 words of memory has been ordered for the PDP-15 to support ARPA Network operations. Virtual memory hardware is under development that will permit most of the instructions on the PDP-10 to reference directly over 8 billion words of storage.

Auxiliary storage devices on the PDP-10:

- Drum: 2 swapping drums. DEC RM10B (storage capacity of 345,600 words each, mean access time of 8.3 msec., and transfer rate of 4.1 μ sec. per word). An RFQ is out for an increase in swapping storage to at least one million words.
- Disc: 5 disc-pack drives. Four DEC RP02s (storage capacity of 5.2 million words per pack, mean access time of 62.5 msec., and transfer rate of 15 μ sec. per word) and one DEC RP02 drives with equivalent performance). The need for additional disc storage is under study.

- DECTAPE: 6 drives, DEC TU56 (storage capacity of 367 thousand characters per tape, mean access time of 10 seconds, and transfer rate of 15,000 characters per second).
- Tape: 3 drives--one 7-track industry standard, DEC TU20B (45 in./sec., density to 800 bpi.); one 9-track USASI standard, DEC TU20A (45 in./sec., density at 800 bpi.); and one 9-track TU10 (performance is equivalent to TU20A).
- Card: card punch, DEC CP10A (200 cards per minute) card reader DEC CR10A (1,000 cards per minute).

Auxiliary storage devices on the PDP-15:

- Disc: 1 fixed head track. DEC RS09 (storage capacity of 262,144 18-bit words, mean access time of 16.7 μ sec., and transfer rate of 16 μ sec. per word). Additional disc storage will be acquired during the last half of the year.

Printer Plotter: Gould, model 55-5032-100--text and graphics; 96 printable characters; print rate: up to 1000 lines per minute for a 132-character line access on 11-inch. page, processor-limited.

Plot rate: up to 8 inches per second for 11-inch wide plots, processor-limited.

Communication terminals:

- High-speed terminals: 24, Computek Model 400/15; storage tube; text/graphics display, keyboard and light-pen input; 96 printable characters; transmission rate: 7200/300 baud.
- Hard copy terminals: 5, Texas Instrument Model 720; 95 printable characters; transmission rate: 300/150/110 baud.

The system described above is essentially complete--except for the items indicated as being on order or under development, all components have been acquired and are operational.

Two major modifications to the hardware system are underway in the areas of data storage and data management:

Extended data storage capacity--disc storage has been augmented in two ways: by the addition of another disc drive (DEC RP03 which offers double the storage capacity of the RP02) and additional 9-track tape drive.

Extended data management--the hardware necessary to support virtual memory programming is being developed by CCBS; the design concept has been implemented by software simulation (the SMART system described below); a design study of the virtual memory hardware has been completed, and detailed documentation and logic design are nearing completion; hardware fabrication should start in the third quarter.

Accomplishments during the current reporting period relating to system modifications:

- Installation of additional storage (disc drive and tape drive).
- Design of virtual memory hardware.

Computer Software

Software developments are oriented toward on-line data acquisition techniques (computer-administered experiments and simulation) and interactive forms of data analysis. There are two major lines of development: General support and applications support--general support programming provides the software environment for application support programming which, in turn, provides the software-implemented methodology for the end-users in the system. Within the general support effort there are two areas of concentration: Operating system and higher-order languages. Within the applications support effort there are also two areas of concentration: Laboratory research and data analysis.

Operating System Improvements

CCBS requirements for a time-sharing system are somewhat atypical--in particular CCBS users are typically not all one class, are not usually programmers, and are often not independently related to a given object program. In some respect each of the differences are at variance with assumptions that are built into standard time-sharing system supplied with the DEC PDP-10 computer. It has been necessary, then, to modify the operating system to CCBS needs. While none of these modifications are in the class of major technical innovations, and while none by itself constitutes a major revision,

they are, on the other hand, non-trivial changes and represent, in sum, a significant programming effort. The major modifications are listed and briefly described below:

Interrupt-level communications support--because of the high data rates used by CCBS local terminals, the organization of the interrupt-level communications handlers has been revised to permit most of the interrupt-level processing to be performed by the PDP-15 rather than by the PDP-10. The benefits of this reorganization will become apparent only with the completion of a new PDP-15 operating system that is currently under development, partly in support of this contract and partly in support of the ARPA Network contract, F30602-72-C-0299. One of the consequences of the new PDP-15 system will be the capability to offer greatly expanded support for display terminals without burdening the main processor.

Terminal interactions--all terminal interactions in the delivered DEC system assume continuous-scroll output; to match the display characteristics of the Computek terminals, terminal output had to be "paged". Additional changes were required to permit several terminals to be controlled by one program and to provide software control over the way the system supports the terminals.

Disc and tape access--access to peripheral storage in the delivered DEC system is assumed to be a user responsibility with only minimal provision for system protection and assistance. To accommodate naive users, peripheral storage access procedures have been modified.

Device assignment--in the delivered DEC system, the assignment of access devices for private data storage are assumed to be a user responsibility; again, to accommodate naive users the operating system has been modified to provide new procedures, better protection, and greater assistance in device assignment. These improvements are generally applicable to all PDP-10 systems; documentation is contained in TM-13.

(In addition to modifications of the operating system monitor, the manufacturer-supplied general utility programs also required extensive modification and augmentation.)

Disc file backup--as the disc storage system nears saturation, the performance of the over-all system degrades (because of the need to fragment files) and there is a sharp increase in the likelihood that jobs that create or expand files will not run successfully. To overcome these problems, a disc file backup utility has been developed that automatically removes long-unused files from disc onto magnetic tape whenever disc availability drops too low; files

with the oldest access dates are removed first. A complementary utility has been developed to permit users to recover files from the backup. A corresponding modification was made to the disc directory utility to prevent modification of a file's access date in a manner that would subvert the purpose of the disc file backup utility.

Loader modification--to permit a user to call on the JOVIAL Debugger by means of similar protocols to those used for conventional debugging, and to permit both debuggers to be used on the same job, the DEC-supplied loader had to be modified.

Terminal support--the Computek terminals which serve as the primary interactive devices for the system are considerably more versatile than the normal devices upon which DEC utility programs are predicated; to fully utilize the versatility of the Computek terminals, the DEC utility programs had to be revised.

Text Editor--two editors were delivered with the hardware; neither was considered adequate for the broad class of users in CCBS; a new text editor has been implemented; this editor is generally applicable for all PDP-10 systems; documentation is contained in TM-10, TXTED: A Simple Content Editor.

Beyond these modifications, a major revision of the operating system is planned. This revision is required for the development of an extended data management capability (i.e. the software side of developing virtual memory capability). As mentioned previously, the virtual memory design has already been simulated in a software version. The emulation of virtual memory hardware is part of the SMART system, but, in addition to emulating the virtual memory hardware, SMART also performs elaborate core management services; it is these core management services that constitute the planned operating system revisions. They will be incorporated into the time-sharing monitor after the virtual memory hardware is acquired. The core management concepts of the SMART system are described in P-4 SMART: A Multiple High Segment Executive System.

Accomplishments during the reporting period that relate to operating system improvements are the following:

- Development of an interim interrupt-level communications processing capability in the PDP-15.
- Development of a disc file backup utility.
- Modifications to the loader to support the JOVIAL Debugger.

Higher-order Language Developments

The CCBS research program imposes requirements on the type of higher-order programming languages that are needed to support the development of application system. In particular, the computer-administered experimentation implies a need for programming forms that facilitate real-time process control, and interactive data analysis implies a need for programming forms that facilitate general data manipulation and management. When the PDP-10 computer was acquired, the higher-order languages available on the machine were evaluated for CCBS applications and were judged to be inadequate; a higher-order language development was required. A modified JOVIAL and META were selected for implementation--JOVIAL because it had a history of performance in both command-and-control systems and data management, and META because it had proven utility both as an interface between JOVIAL and intermediate language forms (of the type contemplated in CCBS applications), and as a powerful, character-string manipulator (to aid in restructuring data bases)..

Both JOVIAL and META are now operational in the CCBS system. Since both are programs of general utility for all PDP-10 systems, general releases are planned when the compilers have been shaken down and thoroughly documented. Experience with using both of these compilers in an interactive environment has demonstrated the need for improved on-line debugging aids that permit the user to communicate in the notation of the higher-order language source program. Such interactive debuggers have been defined both for JOVIAL and for META. A partial implementation of a META debugger has been developed and is now in use, resulting in a great reduction in time required to check out META programs. A contract has been let with Abacus Programming Co. for the incorporation of an interactive debugger into the JOVIAL system, a developmental version of the JOVIAL debugger has been released to CCBS, with final delivery expected early in the third quarter.

During the past winter quarter, an operational version of UCI-LISP has been implemented in the CCBS system. Developed by the Department

of Information and Computer Science at the University of California at Irvine, UCI-LISP is a compatible extension of the earlier Stanford LISP 1.6 for the DEC PDP-10. The extensions, which are very considerable in their scope and impact, make UCI-LISP a powerful and convenient interactive programming environment for research, teaching, and systems development in artificial intelligence and advanced list processing applications. Most of UCI-LISP's extensions to Stanford LISP were suggested by the novel features of BBN-LISP (a language available only on TENEX systems), including: uniquely sophisticated breakpoint, tracing, and function editing capabilities; interpreter context manipulating functions; more powerful and convenient I/O facilities; a variety of useful new functions and predicates; greatly improved error protection facilities; a re-entrant sharable high segment, which accommodates compiled code. In addition, UCI-LISP offers a more efficient compiler than BBN-LISP, and requires an order of magnitude less core storage to operate. CCBS is the first institution outside of Irvine to implement the UCI-LISP package.

Laboratory Software

On-line, computer-administered experimentation is, for many behavioral researchers, a relatively unfamiliar method of investigation. They have had little or no experience with the process control programming even if they have used computers extensively for data reduction and analysis. They would, then, have difficulty using the laboratory without a considerable degree of assistance; the problem is analogous to using a computer without the assistance of high-order languages; the analogous need is to provide a "research-design compiler". CCBS has developed this sort of software support in the form of a system of programs called LIS: Laboratory Implementation System. A more extended description of the general rationale of LIS is contained in P-1, LIS: An Implementation System for Computer-based Experiments. The total Laboratory Implementation System is composed of four programs described below:

- LIS--The central and major program in the system. The program handles all routing of information, evaluation of responses, presentation of displays, recording of data, and logic contingencies necessary for implementation of experiments. The program is operational; shake-down experience has substantiated the design concepts--for a broad set of applications we can produce a meaningful implementation in a matter of days. In the design and implementation of LIS we have adopted a strategy of incremental development; improvements to LIS are made in response to need; when a user has a need beyond the current general capabilities of the system, the need is satisfied, directly, with the development of a special processor; if the special processing capability is judged to be general in character it is then incorporated into the system. Experience thus far has revealed the need for more versatile display control than was originally implemented; general controls are being implemented.
- LSPEC--Laboratory Specifications Program. This program presents an interactive questionnaire to the user; responses to the questionnaire are the basis for generating formal specifications for a "first-cut" version of an experiment. The response-to-specifications is automated. The resulting specifications are sufficient to check-out the logic of the experiment; if modifications are required, the system offers an easy transfer to the LISED program (to make the necessary changes) and an easy transfer from LISED to LIS (to reflect the changes made). Iterations on this process permit the user to successively approximate his final research design. Elaboration of the display content is handled through DGP with comparably easy transfers between LIS and DGP.
- DGP--Display Generation Program. This program is used for preparing displays composed of straight-line graphics and alphanumeric information for use in experiments or for educational purposes. The procedures for preparing displays are conversational; the user language has been designed for a non-programmer, with operating instructions incorporated directly into the program. This program is operational. Further developments in the area of display generation are being concentrated on improved graphics capability, so the system will be better able to handle situational displays. Preliminary work on this improved capability has been completed; the improved graphics package will be completed in the third quarter.

.LISED--Table Editing Program. LIS operates interpretively on a set of tables whose entries contain values defining a given experiment. The initial setting of these values into the tables is the most exacting and time-consuming procedure in the process of implementing an experiment; for any given experiment, this is a one-time task almost exclusively clerical in character. As a practical expedient we have committed this task to a stand-alone program that can be used by a clerk-typist; this frees professional personnel from the most time-consuming aspect of the implementation process. This program is operational.

Accomplishments during the reporting period which relate to laboratory support software development:

- Improved display control on the LIS system.
- Improved graphics capability in the display generation program.

Management and Analysis of Data and Text

CCBS efforts in data management and analysis are focused on forms of interactive data analysis that will allow a substantive expert (the researcher, the policy-maker, the policy-analyst, the decision-maker, etc.) to exercise his judgment in the course of the analytic process. The principal efforts in this direction are the TRACE III and IDEA II developments. In addition to the data analysis systems that we are developing we are also concerned with interface to statistical programs that have been developed elsewhere and with the interface between these systems and our own. To facilitate this interface problem we have developed PREP I, a data base preparation system that interfaces to all analysis programs on our system.

In the area of text analysis, we are modifying an interactive recursive transition-network sentence analyzer for thematic analysis. The latter is designed to augment standard content analysis of text with thematic or sentence-analysis components. The resulting Theme Encoding System (TES) is intended to provide a considerably more sensitive and less ambiguous analysis of verbal text materials.

TRACE III--This is a highly general system of programs that produce the equivalent of an implicit programming system. Implicit programming is tantamount to "natural-interaction"--the user does not need to be explicitly concerned with data management; all data management is accomplished without direct specification. Functionally, this transforms the user into a data analyst technician without having to know or exercise data analysis computing techniques. The support that enables this sort of functional transformation is extensive and complex. TRACE is composed of three major components: a compiler that interacts with the user, a data-base management component that builds and updates the primary data structures; and a manipulative component that acts on the data structure to produce the desired results. (A description of the TRACE system is contained in P-2, TRACE: An Implicit Programming System for Inductive Data Analysis.)

The CCBS virtual memory developments afford a direct extension of the TRACE concepts; virtual memory extends the implicit programming capabilities to large data systems that exceed core memory limitations.

IDEA--The IDEA program offers an inductive aid to a researcher for discovering and summarizing potentially interesting data models in the form of restricted tree structures for a multi-variate data base. It permits the investigator to collaborate with an open-ended library of programmed heuristics in the process of uncovering and representing the structure of his data.

The interactive aspect of IDEA is essential since the number of potential decision trees for any interesting set of data is too large to permit exhaustive search for the best partitions, and the character of the data may be inconsistent with exhaustive search even if it were computationally possible. The program is thus designed to employ heuristics and to permit the investigator to monitor the process and to intercede when slavish application would produce artifactual results.

A fully interactive version of IDEA II is available on the CCBS system. It is continually being modified with user experience and additional capabilities. A revised version of "A Users Guide to IDEA in the CCBS System" has been completed. (CCBS-TM-24).

PREP I--Before a statistical analysis program may be applied to a data base, the data must be prepared. This usually involves a number of activities that may include ordering of the data, checking it for accuracy, and correcting and modifying values; and revision of distribution parameters and recording or transgeneration of values if desired or necessary.

PREP I is a system of computer programs providing a common data base interface to data analysis programs and packages. The PREP system provides a high degree of user support that minimizes user knowledge about programming conventions and operating system functions. The user need enter and edit his data only one time to use any of the data analysis programs that interface with the PREP system. The necessary, but usually troublesome and error-latent, process of data preparation (entry, verification, and pre-statistical manipulation) is concentrated and standardized for all application programs supported by the PREP system. The distinguishing feature of PREP is that it concentrates analysis preparation functions and yet remains an open-ended system in terms of the analysis programs that it supports. This contrasts on the one hand, with "integrated" systems like SPSS and DATATEXT which also provide data preparation capability but are essentially limited to those analysis programs included in the "integration package"--i.e., it is very difficult to add new statistical programs to these packages. Furthermore, PREP provides considerably more (user-oriented and interactive) support in analysis preparation than either of these "integrated" packages, and it does so in a manner that makes it possible to apply these capabilities to an easily expandable set of data analysis and statistical programs. In this respect PREP is best viewed as an "interfacing system" rather than as an integrated package. PREP contrasts, on the other hand, with a large set of "stand alone" analysis programs in statistical library packages (e.g., BMD) in which each program provides its own unique set of data preprocessing and preparation functions required for its own use. As a consequence, these capabilities are typically limited in scope, and not standardized from one program to the next. From the standpoint of the user, this means 1) he must learn to use each program on its own terms, and 2) the results of the data preparation for one program cannot be transferred directly to another. In summary, PREP 1) concentrates this learning process (one set of procedures for all applications), 2) reduces it in the sense of giving the user considerably greater assistance in the analysis preparation tasks and 3) makes the results available to all interfacing analysis programs.

The PREP system incorporates four major processing functions--input, verification check, editing, and interface. The input function accepts data from the conventional sorts of machine-readable storage mediums, producing a transposed data structure for the greatest efficiency of selected data retrieval. The verification check offers a variety of "quick-look" data summaries as a means of verifying the accuracy of the original and stored data. The editing function provides a number of procedures for error correction, data recoding, and data transformation. The interface function

is, of course, different for each of the programs being interfaced to the PREP system (and each must be separately produced), but since they all relate to a standard data structure, there is, even among the variety of interface requirements, enough commonality to make it a clean and practical programming task to bring most standard existing or new data analysis programs into the system.

The PREP system, implemented in standard FORTRAN IV, has a high degree of transferability to other computing installations; particularly important in this regard is the fact that PREP requires no special operating system support, and that it is not preemptive (i.e. it permits the analysis programs that it supports to be used in the conventional manner, thus making the same analysis programs accessible to expert users and naive users as well). All SPSS statistical programs and IDEA currently interface with PREP.

TES--Interactive Automatic Theme Encoding of Messages and Documents for Content Analysis. In recent years, natural language data processing research and development has turned away from its earlier goals of fully-automatic high-quality translation, and similarly unmanageable tasks, toward the construction of computational tools for application to a variety of practical applications. Within CCBS, these tools are being employed in the analysis of message sets originating in experimental gaming situations, studies of social interaction, and group simulations, as well as for the analysis of outside documents of interest.

The main tool employed in such studies is the Stanford Inquirer, a more sophisticated version of the earlier General Inquirer. The use of the Stanford Inquirer on a large scale has heretofore involved considerable costs and a great deal of time for the object texts to be pre-coded manually to isolate the themes of interest in the text. Moreover, manual text encoding has been subject to inconsistency and bias. Through automated interactive theme encoding, CCBS is working to overcome these hindrances to large-scale text analysis. In addition, these text-processing tools are being shaped for other applications within the spectrum of CCBS research, such as survey question design, evaluation, and interpretation.

Two approaches to automated interactive theme encoding are being pursued. The first approach, called "sequential coding", is based upon some novel hypotheses concerning the natural logic of textual communications¹. From the

¹ Tripodes, Peter. Note on a Method of Sequential Coding of Content, CCBS, UCLA, May 1971.

Tripodes, Peter. An Automatic Coder Utilizing Sequential Codes, CCBS, UCLA, CCBS-TM-26, December, 1971.

Tripodes, Peter. A Refinement of Sequential Coding Methods: Applications to Question Design and Automated Inference, CCBS, UCLA July 1972.

point of view of the implementation, its most striking advantage is the relative simplicity of the program and dictionary structure. Within a period of four months, a running version of the sequential coder has been implemented, tested, and demonstrated on texts of a political nature. Revisions of the sequential coding program are now in progress, with the aims of: (1) improving its running efficiency, (2) refining its encoding rules, (3) improving and broadening the scope of its interactive facilities, and (4) enlarging its dictionary.

The second approach is more comprehensive and aims at a more flexible product with maximal operational reliability. It is based solidly upon modern grammatical theory and software components of proven utility. The heart of this system is an adaptation of the successful Woods-Kaplan sentence analyzer², a transition-network parser developed originally for a NASA question-answering system. The output of this parser is transformed in simple ways to reflect the embeddings of content-analytic themes in English sentences³. A distinctive advantage of this approach is the versatility that can be obtained through (1) modifications to the system's grammar, and (2) alternative transformations of parser output.

The Woods-Kaplan system was originally written in BBN-LISP⁴, a powerfully user-oriented LISP dialect. This programming language has two important weaknesses: (1) dependency upon the TENEX operating system, and (2) extravagant demands for core storage. To overcome these problems, CCBS has recently obtained a new version of LISP from U.C. Irvine⁵ which offers most of the power of BBN-LISP, makes only modest demands for core storage, and can be run locally. The sentence analyzer is now being converted to UCI-LISP, while the development of other theme-encoding system components in UCI-LISP (including an experimental political science dictionary) continues. Working with a LISP-based system enables CCBS to share in a variety of language data processing software developments produced elsewhere (and vice versa), and promises to speed future progress in this

²Woods, W. A., Kaplan, R. M., and Nash-Webber B. The Lunar Sciences Natural Language Information System: Final Report, Bolt, Beranek, and Newman, BBN Report No. 2378, Cambridge, Mass., June 1972.

³Martins, Gary R. An Experimental Theme-Encoding System for Content Analysis, CCBS, UCLA, CCBS-TM-18, August 1971.

⁴Bobrow, D. G., Murphy, D., Teitelman, W., Hartley, A., The BBN-LISP System, Bolt, Beranek, and Newman, BBN Report No. 1677, Cambridge, Mass., April 1968.

⁵Bobrow, R., Barton, R. R., Lewis, D., UCI LISP Manual, Information and Computer Sciences Department, University of California, Irvine. (Draft version September 1972)

area.

Accomplishments during this reporting period in the area of interactive data analysis:

- Completion of subsystem checkout of all components of the TRACE system.
- Development of the PREP I system.
- A running version of the sequential coder has been implemented and a document describing the problems of automatic coding and the solution provided by the sequential coder has been written (CCBS-TM-36).
- A paper on the "Dimensions of Text Processing was delivered at the Fall Joint Computer Conference, 1972 (CCBS-P-9).

Laboratory Facilities

Housing for the CCBS computer-based laboratory has been developed on the U.C.L.A. campus. A facility of approximately 6,000 square feet provides space for the computer, laboratory, and staff offices. The laboratory is being outfitted for operations. In addition to the computer and interaction terminals, the laboratory requires other equipment (for monitoring, recording, stimulus presentation, and information exchange) in order to provide adequate facilities for a wide range of behavioral investigation. A closed-circuit T.V. system, an audio monitoring/recording system, and a general control system have been acquired and are being integrated into the computer-based laboratory.

Laboratory simulation exercises are being conducted at a number of centers for the study of international relations, for evaluation of political-military strategy for crises and long range planning, and for study of other allied topics. One of two divergent approaches are characteristically used in these gaming efforts. In policy-oriented gaming, where credibility and realism are emphasized, data are not systematically recorded and analyzed, methodologies employed are typically unevaluated, and experimental control is deemed unnecessary except for constraining player departures from realism or the gamer's intended focus. In research-oriented gaming, where theoretical and methodological issues are of primary concern, superficial representation of reality and the use of unskilled players have led to extensive criticism and charges of triviality. In either case, because these games are administered, played, and observed manually, they are severely limited in the amount and subtlety of monitoring and control, in the level of detail and volume of data that can be gathered, and in the role played by the analysis of these data. Furthermore, where the complexity of situations being studied does not readily yield to the control sought in the standard application of the laboratory experiment--a situation characteristic of almost all laboratory gaming--these limitations in control or data gathering greatly curtail the value of these exercises for evaluation or research purposes. Consequently, whether policy- or research-oriented, such games are unable to deal with a number of important questions, some of which are so fundamental as to bear on the validity of the games themselves.

Our research plan attempts to join the assets in both approaches and to reduce a number of the limitations associated with each. In particular, an attempt is being made to realize jointly the objectives of the theory-oriented researcher, and the more stringent demands for credibility and relevance of the policy-oriented practitioner, through our newly-developed on-line capabilities.

Furthermore, through a strategy that links the data collected in laboratory exercises with that collected in non-simulation approaches, we hope to increase the generalizability and utility of simulation studies and data.

Project activities during the past six months are described below:

Scenario Topics, Conceptual Issues, and Scenario Developments

Proposed and developed simulation scenarios will continue to focus on some of the central issues of American foreign policy today--the factors influencing the degree, form and effectiveness of U.S.-U.S.S.R. involvement in local conflict.

A key problem of United States foreign policy in the next decade will be the extent to which the United States can, in future crises, take actions that are commensurate with its conventional and nuclear power, its economic strength, its scientific and technological status, and its interests in the outcome of the crisis. We are concerned with studying the factors which permit or constrain the United States and the Soviet Union from taking action in a set of representative crisis situations.

Conceptual Framework for Simulation Scenarios

While pursuing the detailed development of particular scenarios we are attempting to set forth conceptual frameworks that raise questions about the dynamics of great power involvement. Most particularly we are concerned with the dynamics of confrontation and commitment processes in these circumstances. The evolving framework and hypotheses of interest are being used to shape scenarios and the simulation format as much as possible without compromising their policy-validity and their utility for policy analysis. Two areas have been singled out for attention:

Confrontation Theory: A Theoretical Framework. In exploring the field of deterrence theory as it relates to U.S.-involved crises in

the third-world area, we began by reviewing case studies of what has happened in earlier crises (Korea, Quemoy, Vietnam). This led us to a formulation designed to help us explore the conditions of successful and unsuccessful deterrence.

Deterrence is an attempt to avoid confrontation. Confrontation occurs when deterrence fails (or partly fails). Three aspects of confrontation are of special interest: the violation of deterrence by the initiator (Act), the reply by the responder (Counteract), and the gain and loss to each party (Outcome). It is these three aspects that a theory of confrontation must seek to understand, explain and show how to control.

Confrontation is a process that may contain many interactions, in which each actor is alternately initiator and responder: this process may be regarded as a series of rounds, and each round studied in itself; or a process may be regarded as a single round, and studied as such. Real confrontations often enlist many actors; two usually predominate, however, whether these be two major powers or two blocs. It is therefore a reasonable simplification to study "two-person confrontation".

In an "Outline of Confrontation Theory" (CCBS-TM-38) a new start toward confrontation theory is attempted including initiation theory (accounting for an Act--or its omission), response theory (explaining a Counteract--or a failure to Counteract), and outcome theory (explaining the result of a confrontation). Since initiation of an Act represents a deterrence failure, initiation theory is a theory of deterrence success and failure, and response theory is a theory of deterrence failure, "compellence", and the restoration of deterrence.

This paper starts from the assumption that the hypothesis-building stage of theoretical work requires the collection of a comprehensive set of variables. In this paper, a total set of some 117 variables (plus their perceptual variants, numbering about 120) is employed to account for Act, Counteract and Outcome.

At this stage, the variable-lists and schemata constitute a bare theoretical framework to help structure thinking and shape planning for policy games, laboratory experiments and simulations, by showing the variables from among which choices should be made when one zeros in on a particular investigation.

In a closely related paper, "Toward Confrontation Theory" (CCBS-P-8), "Confrontation" is defined and distinguished from the related phenomena of "crisis", "war", and "deterrence". The objectives of the study of confrontation are outlined, and a case is made for the construction of a framework for a set of propositions as a separate step in the study of confrontation. A quasi-canon of 72 propositions on origins, actions, and outcomes of confrontation is collected. A provisional set of confrontations (1898-1972), candidates for systematic study, is listed.

The Role of Commitment Processes in Defining Foreign Policy. The current phase of this effort is concerned primarily with testing a set of hypotheses on military commitments.

A paper prepared for presentation at the International Studies Association Convention, 14-17 March 1973, New York City, reports on an empirical study of deterrence in "third area" conflicts below the strategic level: a client state, more or less under the protection of a great power, is faced with a military threat from another state.

The relative importance of a number of relevant contextual factors affecting the operation of "third area" deterrence are explored: the probable consequences of defeat for the client; the strategic nuclear balance between defender and challenger; the regional military balance; the defender's past verbal commitment to defend the client; the defender's ideological value at stake in defending the client; the defender's military, economic, domestic, and future credibility values at stake; the potential negative economic, diplomatic, and domestic consequences if the defender does intervene; the

degree of public unity in the client state; the defender's record in meeting past commitment challenges; and, finally, the role of defender, client and challenger.

In the study initiated during the last reporting period, the first four and the last factors have been systematically manipulated and their effects on four interrelated dependent variables are examined: the perception of the defender's credibility, the defender's willingness to increase his credibility by strengthening his commitment, the challenger's willingness to attack the client based on his evaluation of the defender's credibility, and the defender's willingness to intervene if deterrence fails.

This large number of factors and associated consequences cannot be explored systematically in real world contexts or laboratory simulation. Instead, we have used a systematically designed and modified, individually administered, paper-and-pencil stimulation exercise. Each of the relevant contextual factors is described as one of two or more descriptions represented in the form of interchangeable paragraphs of a scenario. Sixty-four unique scenario combinations are prepared in this fashion. Each of the scenarios incorporating these variables describes a Middle East crisis in 1975. Respondents assumed the perspective of a policy adviser for Israel, Egypt, the U.S. or the U.S.S.R. Questionnaire responses allow us to measure the effects of scenario manipulations and respondent's attitudes on deterrence and commitment responses. One hundred and twenty-eight subjects for two complete replications of the design have been tested. Data collection and a write-up of this part of the study will be completed in the next reporting period.

Methodology for Scenario Design and Construction for International Relations Simulation Exercises

Although simulation games are finding wider usage (in universities and military colleges, as well as in political-military exercises),

practically nothing has been written on how to prepare good scenarios, nor have any systematic procedures been developed to assist the scenario designer in organizing information, materials and concepts. Scenario design remains an art in which only few practitioners achieve products of high quality. As a consequence, most scenarios are designed on a hit-or-miss basis and are excessively costly; the implications for playability, representativeness, and relevance to theory and policy concerns are left to intuitive decision.

A series of chapters have been written and others are in progress to provide general and specific guidance on scenario development for study of international crises so as to contribute to an improved quality and economy of gaming. These various chapters also will include material on how to conduct simulations, on procedures, record keeping, control problems, role playing, debriefing, etc.

In addition to providing instructions to the reader on how to proceed in the construction of a simulation exercise, and examples of exercise materials, we will attempt to explicate the step-by-step intellectual process which led us to make certain choices and assumptions, and we will provide the framework for the reader to move through a similar process on his own.

A chapter entitled "Alternative International Context for Policy Gaming" (CCBS-TM-33) illustrates one approach explored in our work group to realize this goal. This paper presents some guidelines for the game designer concerned with constructing an international contextual description (ICD) as the background setting for a crisis scenario in a political/military game. Ten essential elements of an ICD (world power distribution, world conflict structure, international economic conditions, international psychological climate, system rules, demography, ecology, political stability, national capability profiles, national foreign policy objectives) plus seven less important elements are identified, summarized, broken into their components, applied to the world situation in 1972 and to a hypothetical world situation of

1990, and analyzed for their relevance. A step-by-step guide for moving from the selected research topic to a full-fleshed ICD by using the ten essential elements is appended.

A major development during the preceding period has been the introduction of the metagame approach suggested by Nigel Howard* and its modification for the analysis and design of crisis situations. At present this approach is being explored in conjunction with the transformation of real world materials into tractable scenario elements as well as the analysis of existing scenarios and expert situational definitions to produce a greater amount of simulator control and understanding of the generated setting. Some modifications are necessary to make this general analytical approach into a useful design technique, and a preliminary report illustrates the specific problems and suggestions. (CCBS-TM-34). In this report the metagame analysis technique is explained and basic concepts defined and illustrated by the application of the technique to an existing Mid-East simulation scenario. It describes metagame analysis as a formal technique for the structuring of subjective definitions of situations; the method, itself, in no way prejudices the result of the analysis. The outcome is the result of the author's assumptions concerning the situation. Different assumptions result in different outcomes. The report is intended to show how the metagame analysis technique can be used to structure the crisis focus of a scenario, and suggests certain tentative process hypotheses. The potential use of on-line metagame techniques for an evaluation of ongoing crises in simulation exercises is being explored.

A 1974 Mid-East Scenario for a One-Team Computer-based Simulation Exercise

The general purpose in developing a one-team simulation is to create an international relations game which requires only limited personnel for administration, and affords greater control for research purposes. It is an effort to provide a simulation format that offers greater

* See Howard, Nigel. Games, Metagames and Rationality. Cambridge, Mass.: MIT Press, 1971.

efficiency, control, and standardization; this is the rationale for reducing the response roles to a single team, the U.S., while all other nation roles in the game are simulated. Not only can a number of U.S. teams be run simultaneously, but the physical presence of a number of teams adds to the credibility that these other teams are being played "live" rather than being simulated by the experimenter.

A scenario developed for the one-team format explores deterrence and commitment considerations that would motivate an American decision to give large-scale direct military assistance to Israel under conditions of increasing levels of Arab-Soviet endangerment of Israel. The question of substantive policy interest is whether players will accept the consequences of one of the pure strategies (commitment or non-involvement) or be drawn to compromise alternatives (some level of partial commitment with attendant partial involvement) which are psychologically attractive, but may be strategically poor in a series of escalation moves.

In addition to the methodological and policy focus, questions of a more social psychological nature are also being formulated for this simulation exercise. There is now a sizeable and controversial research literature* that claims groups of individuals take more risks than would the same individuals making the decisions privately. Nine dimensions that may influence such shifts in choice have been identified and a few of these will be systematically varied to determine the extent to which they would influence the decisions made in the Middle East scenario. Special attention is being given to variables that would appear to exert an influence on decision recommendations among high-level advisory staff. A conceptual model of the risky shift phenomena is under development.

Programming of the simulation for computer administration has been completed with an updated version of the scenario and game moves. Laboratory runs on the computer have been initiated. (CCBS-TM-40)

*Pruitt, D. G. Choice Shifts in Group Discussion: An Introduction Review. Journal of Personality and Social Psychology, 1971, 20, 339-360. This number of the journal is a special issue devoted to risky shift and contains a number of research reports on this topic.

A Content Analysis of a Policy-Focused Laboratory Simulation: A Middle East Nuclear Crisis.

This study, assuming that both policy and research-oriented gaming would benefit from closer theoretical and methodological ties, analyzed documents and messages produced in an earlier policy-oriented simulation. These data were used to compare game interaction patterns with those derived theoretically and by related methods. The four Middle East policy-oriented simulations centered on an Israeli announcement that it had developed a small nuclear weapons capability. The resulting protocols (i.e. team messages, actions, etc.) were content analyzed using the Stanford General Inquirer computer program.

Based on the characteristics of the Middle East political system presented in the scenario and the three empirically derived categories of the Osgood semantic differential, three sets of propositions were tested concerning (1) the perceptual basis of allied relationships, (2) national tendencies toward "misperception" and (3) a perceptual "dynamics of conflict" model. Overall, analysis of messages and documents produced in the simulation confirmed the general level propositions tested. These findings also suggest that: (1) Policy simulation exhibits processes consistent with those obtained from experimental simulations, analyses of real-world interaction data, and theoretically derived hypotheses; (2) The policy-focus need not be incompatible with the testing of more generalized hypotheses; and (3) Confirmation of general and specific level propositions made in this study not only provides additional support for the hypotheses tested but provides limited but necessary evaluation of the extent to which important processes characteristic of international behavior appear in the simulation analogue.

The results of this study demonstrate that while the specificity and complexity of the policy-oriented simulation imposes severe constraints on method assessment and theory testing, these two goals are far from totally incompatible and indeed the energetic pursuit of methods that combine these goals may provide a highly profitable middle ground for the mutual benefit of policy- and research-oriented simulators. A

paper summarizing these results is in preparation for presentation at the International Studies Association Convention, 14-17 March, 1973, New York City.

Direct Validity Tests of the Stanford General Inquirer.

This planned effort, described in some detail in the last report, has been temporarily shelved in order to focus the limited resources devoted to this area on the computer theme encoding effort described earlier in the report.

Experimental and Para-laboratory Studies of Interparty Conflict.

The simulation approach, because of its complexity, needs to be closely interrelated at many levels with other techniques of investigation to clarify its findings, to serve as a direct source of hypotheses, and as a simple setting for developing and testing new methods. It is necessary, then, that the research program continue to range widely in its approaches to problems from paper-and-pencil situations to computer-based experimentation and that data from these studies be more closely linked. While these studies are only a small part of the total effort, we believe it is particularly important to continue two lines of investigation in support of the simulation activities: 1) our earlier program of experimental studies in the new computer laboratory, and 2) SCENQUEST studies.

While no new experimental studies are being undertaken until the next reporting period when the laboratory is available, results of earlier studies continue to be analyzed and reported. The results of a study on attempts to shape cooperative behavior in a prisoner's dilemma game are being written up for publication.

SCENQUEST - A Scenario Questionnaire Technique for Studying Behavior in Complex Social/Political Setting

(Many in-process phenomena cannot be studied easily in simulation exercises because they occur rarely, or follow unique patterns

of antecedent events, or require more extensive subjective analysis than can be easily obtained during the exercise.

Furthermore there is a need for systematic evaluation of large numbers of variables under conditions which allow their assessment to be made economically, in terms of both time and money, that the present SCENQUEST (a scenario-questionnaire) procedure was evolved.

Briefly, in the SCENQUEST approach, the respondent is given a written scenario of an ongoing situation. This synopsis may be presented in dramatic, real-life terms or in bare-bone, analytical ones, and may concern situations as complex as those presented in real world crises or as simple as those in a prisoner's dilemma experiment. The synopsis provides a summary history of the events and decisions made by all relevant actors up to a given point. The respondent reads the scenario from the point of view of one party in the situation; he is then asked to respond as if he were in the situation with the history as it is given and in the designated party's place. He then records his responses to a questionnaire that is designed to assess the respondent's interpretation and response to the situation presented.

The Effects of Variation in Size and Reducibility of Objective Conflict on Pre-Bargaining Perceptions. Mutual incompatibility of one party's goals with another's is at the very heart of most definitions of social conflict¹, yet the outcomes of conflicts are usually not rigidly set or completely determined by objective constraints. These are frequently open to redefinition. This view of conflict as open in scope found enthusiastic support from social psychologists whose focus is on individuals and small groups in settings where attitudinal and emotional issues are primary and where real, inherent conflicts are secondary. More than a decade of psychological studies on social conflict, in both the laboratory and the field, demonstrate that conflict may occur where there is no actual incompatibility of goals and that it may be exaggerated

¹Fink, D. F. Some conceptual difficulties in the theory of social conflict. Journal of Conflict Resolution, 1968, XII, 412-460.

through motivated misperception and misunderstanding², through limited cognitive comprehension or faulty or incomplete information³.

If conflict expansion could be traced to psychological determinants, psychologists optimistically argued that through the elimination, reduction, or control of these factors, more successful conflict reduction could be achieved at all levels of intra- and extra-societal conflict. This optimism was generally not shared by scholars of international conflict. They criticized psychologists for failing to recognize the discipline-limited nature of findings derived from experimental conflict settings that have rarely exhibited the high levels of mutual incompatibility and important asymmetries of real world conflict.

In a study currently being written up for publication, we explore the effects of low versus high levels of objective conflict, defined by the amount of incompatibility in the division of an outcome under conditions where bargaining over the division of a fixed amount is to be completed in a single session or divided over ten separate occasions. As in an earlier paper on the effects of size and form of bargaining incentives by Lanto and Shure⁴, we assume that the size of incompatibility of interests and the fractionation of conflict issues over time will have important effects on conflict resolution behavior. As in other studies⁵

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²White, R. K. Nobody Wanted War. New York: Doubleday, 1970; Deutsch, M. The Resolution of Conflict. New Haven: Yale University Press, 1973.

³Hammond, K. R. New directions in research on conflict resolution. Journal of Social Issues, 1965, 21, 44-66.

⁴Lanto, S. and Shure, G. H. Effects of size of payoff and real versus imaginary rewards on prebargaining perceptions. Proceedings, 80th Annual Convention, APA, 1972, 231, 232.

⁵Kelley, H. H., Shure, G. H., Deutsch, M., Faucheux, C., Lanzetta, J. T., Moscovici, S., Nuttin, J. M., Jr., Rabie, J.M., and Thibaut, J. W. A comparative experimental study of negotiation behavior. Journal of Personality and Social Psychology, 1970, 16, -11-438; Shure, G. H. and Meeker, R. J. Bargaining processes in experimental territorial conflict situation. Peace Research Society, Papers, XI, 109-122; Shure, G. H., Meeker, R. J., Moore, W. H., Jr., and Kelley, H.H. Computer studies of bargaining behavior: The role of threat in bargaining. (Rep. No. SP 2916) Santa Monica, California: Systems Development Corporation, 1966.

we anticipate these will be mediated via the S's subjective definition of conflict size, perceived importance of issues, anticipated difficulties of resolution, aspirations and strategies, and feelings engendered by his view of the other party's anticipated behavior and intentions. As in the Lanto and Shure paper, this study focuses exclusively on the pre-experimental or orientation phase of bargaining and assesses a relatively large set of potentially relevant facets of the S's perception that may be affected by the variables manipulated.

A second SCENQUEST study, described in the previous technical report, has been incorporated as part of the Los Angeles Metropolitan Area Survey conducted by the U.C.L.A. Survey Research Center. At the closing phase of a structured interview, the respondent is presented with a conflict-of-interest situation with a salesman and is asked to imagine what he would do in the situation.

Two variables are studied. 1) The effect of same versus different ethnicity of salesman and respondent. (The scenario describes the salesman as "Mr. Brown, a Negro", Mr. Goldstein, a Jewish salesman", Mr. Lopez, a Mexican-American"). 2) The effect of a firm or a flexible concession.

The data collection on more than 1,000 respondents has been completed; however, the Survey Center made an error in the sampling design that will limit the value of these data. Another set of data is being collected without additional cost and it is hoped that at least a preliminary report on this study will be completed during the next reporting period.

A third SCENQUEST study has been made of misperception or bias of participants versus observers under varied conditions of incentive and ability to influence outcomes.

The U.S. and North Vietnam are active participants in the Vietnam conflict with a vast difference in ability to directly influence

the outcome of the conflict. Another group of nations who are not directly involved, nevertheless will lose or benefit directly with the outcome. Finally, other nations have little direct involvement with the outcomes but are "neutral" observers. The question posed in this study is the effect of these different kinds of involvement on the perceptions of a conflict situation and on the attributed motivations of the directly involved actor.

A popular social psychology theory during the 1960's was "dissonance theory", which assumes that man's aim, in making social perceptions, is to rationalize his "driven" behaviors and to perceive himself as acting consistently. Biases in social perceptions were assumed to result from this tendency to reduce dissonance, a motivation aroused when the individual perceives himself as acting inconsistently. The 1970's ushered in "attribution theory", which makes different assumptions from those of dissonance theory. This new approach assumes that man seeks only to perceive his social environment accurately. Biases in social perception are assumed to stem from the fact that man must make situational inferences on the basis of limited information. Thus, biased social perceptions are considered by attribution theorists to be errors in information selection and processing rather than "need-oriented perceptions".

Much of the controversy between theorists of the two schools has centered around frequent differences which occur between the social perceptions of participant actors vs. uninvolved observers of action in the same situation. Dissonance theorists assume that actors are seeking to reduce the dissonance produced by their own behavioral inconsistencies, and to justify their behavior by their social perceptions. Since neutral observers have no action of their own to justify, they experience no dissonance, and make more "objective" perceptions. Attribution theorists on the other hand assume that different historical information, causal information, and information on consequences is typically available to actors vs. observers, and that inferences based on these different sources of information lead to different social perceptions, even in the same situation.

The present study proposes a third model of social perception processes. Our instrumental learning model considers human cognizing--including the processes of making social perceptions--to be itself a form of behavior. As such, social perceptions are assumed to be controlled both by environmental stimuli which signify to the perceiver the types of outcomes likely to follow certain courses of action, and by the reinforcing consequences of the perceptions made. We hypothesize that, where an individual's future outcomes are a salient concern to him in perceiving his situation, the individual's discrimination as to whether or not he has power to affect his outcomes is an important determinant of whether he has an incentive to make a strictly accuracy-oriented perceptual response (as predicted by attribution theory) vs. whether he "rationalizes" in perceiving the situation (as hypothesized by dissonance theory). It is assumed that accuracy-oriented perceptions have instrumental value to the individual whose behavioral choices affect his outcomes, whereas they have little value to the powerless person. The powerless person may then "rationalize" his situation in order to feel better about it.

We assume, then, that differences between actors' and observers' social perceptions are complexly determined by the outcomes which they hope to attain from the situation, by their abilities to affect those outcomes, and by the need of actors to justify certain actions they may take to achieve the outcomes they desire. A study to evaluate the importance of these variables was designed. Identical information about a bargaining situation was presented to actors and observers in different conditions. Patterns of social perceptions as a function of the above-mentioned variables were investigated.

In the experimental setting devised, role incumbents expected to have varied degrees of vested interest and control over interaction outcomes. Data from 120 S's were analyzed to test a series of specific hypotheses about the effects of these variables on subjects' social perceptions; additional information was collected for a more extensive mapping of the perceptions of subjects in different roles.

The major thesis investigated was that material and psychological consequences of a situation to a party (i.e., the party's vested interest) create incentives for him to characterize the situation differently from individuals who have no vested interest in the consequences.

Results obtained were interpreted as supportive of a dual orientation--toward accuracy and self-enhancement--of social perception. A thesis reporting on this study has been completed.⁶

⁶Lanto, Sandra S. "Pre-interaction perceptions as a function of situational role and vested interest in situational outcomes". Ph.D. Dissertation, September 1972, University of California, Los Angeles Archives.

FUTURE PLANS

This section reviews our plans to accomplish the program of research, as discussed in the project's original proposal, within the funding schedules negotiated as terms of the basic contract. As reflected in our previous management and fund status reports, we have discussed a potential need for revision of these terms; because of delays associated with equipment arrival and facilities completion, many of the project developments will come to greatest fruition in the last phase of the contract. At this time it is apparent that the project is realizing its goals more adequately under the one-year-extended contract completion date that allows us to make maximum research use of supporting facilities that have been developed. The projected plans for the Center, focusing primarily on the next reporting period, are the following:

Central Computing System--Hardware

The computer hardware to support Phase I operations is complete.

With the functional design complete, work on Phase II has continued with the detailed logic design for virtual memory hardware; fabrication of the hardware will continue, with installation expected in the last quarter of fiscal year 1973. The hardware necessary for archive storage will also be acquired before the end of the fiscal year. A third component of Phase II capability concerns remote user support; specifications for hardware acquisition in this area have been deferred to insure compatibility and maximum performance in the context of the ARPA network; these requirements will be determined in coordination with our entry into the network in the next reporting period.

Central Computing System--Software

Phase I software is complete; work in this area will be confined to maintenance and selective upgrading.

Phase II software development, is, of course, ultimately dependent on the delivery of virtual memory hardware; with the design of that

hardware finalized, formulation of the software design has begun. Implementation of essential features of this software is scheduled to be coincident with hardware checkout; these consist of a revised assembler and loader and virtual-memory support software that can operate as a user job. After a suitable period of testing the virtual memory hardware as a single-user-controlled dedicated device the monitor will be revised to permit time-shared use of the hardware.

Higher-order Language

The complete JOVIAL compiler has been delivered and is being used in applications programming; the compiler will be extended and maintained under the original development contract for the next eighteen months. The principal extensions will be the development of a JOVIAL language debugger (completion scheduled for the third quarter of fiscal year 1973) and the inclusion of virtual storage capability to provide a simple mechanism to upgrade existing programs to take full advantage of virtual memory hardware development (currently rescheduled to start late in the fourth quarter, after essential operating system modifications are complete). The META compiler will be extended to support multiple input and output channels, thus permitting the development of META programs that can interact with both a user and his data files, so as to provide for dynamic user control when applied to problems such as the reformatting of data bases.

Laboratory Facilities

The basis laboratory is operational. Some minor corrections are being made, under manufacturer warranty, to the closed circuit and audio system; after final acceptance tests have been made, the laboratory development will be complete.

Laboratory Software

In addition to the on-going maintenance and upgrading of the laboratory system, major improvement in the system will focus on the development of a graphics package to be incorporated into the current display generation program. The improved graphics package will provide better protocols for building displays and will offer a better mode of user interaction especially in terms of permitting display modules to be

evoked with a single call. The improved graphics capability is addressed primarily to the anticipated need for more sophisticated situational displays.

Data Analysis/Management System

Checkout of the separate components of the TRACE system has been completed--SMART has been checked out; an initial version of the TRACE interpreter is operational; and the TRACE compiler is operating. Preliminary system checkout has been proceeding, using an artificial linkage between the compiler and interpreter that offers greater control of test conditions. Final checkout is expected during the third quarter of fiscal year 1973.

Subsequent to the system check-out, the SMART function will be replaced by the implementation of virtual memory hardware, and the TRACE compiler will be more effectively interfaced with user language requirements.

PREP-I

A major effort in the PREP system will be the development of an interface to TRACE. This package will provide interactive support to the beginning TRACE user. All of the TRACE language forms and conventions (with the single exception of string variables) will be incorporated into the interface program. Development of this package is planned to dovetail with the final check-out of the TRACE system.

Upgrading of the PREP system will include the development of a program for merging like-structured files (of special utility for handling data from on-going experimental series).

TES--Computer-Assisted Interactive Theme Encoding of Texts for Content Analysis

A LISP-based theme-encoding system is now being readied for testing in a limited operational environment. Some minor software bugs still exist here and there in the system. One separable but important component of the sentence analyzer needs extensive debugging. This will be completed shortly. The dictionary look-up routines are fully operational and the dictionary itself is in operational form. Initial testing will be

limited principally by the dictionary's deficiencies in the subject-matter area. Incremental updating of the dictionary during the next phase of development will bring the system to operational status.

A Book on Scenario Design and Construction for International Relations Simulation Exercises.

It is anticipated that two additional chapters will be completed during the next reporting period.

Formulation and Testing of Simulation-Testable Propositions in Confrontation and Commitment Theory

The final data collection phase of a SCENQUEST study on the evaluation of variables influencing credibility of commitment will be completed and analyses and reports based on these will be undertaken during the next reporting period.

A Mid-East Scenario for 1974 for a One-Team Simulation Exercise

Shake-down runs have been completed for the computer-administered version of the one-team simulation. Based on policy questions and theoretical hypotheses on individual and group decision-making, the first in a series of experimental runs have been initiated and will be continued during the next reporting period in the CCBS laboratory.

Direct Validity Tests of the Stanford General Inquirer

With the availability of the CCBS laboratory and the General Inquirer IV and the Stanford Dictionary, experimental validity studies of the kind described are being initiated during the next reporting period and analyzable results will be available at approximately the end of the next reporting period.

Experimentation

Analyses of data from earlier computer laboratory-based experiments will continue and results will be reported. With the availability of the CCBS laboratory, experiments are being initiated and used as test cases for the "entry" module of the laboratory software system.

SCENQUEST - Scenario Questionnaire Studies

A second paper on the Size of Conflict Study is in preparation. New data made available from Israel is being analyzed and a cross-cultural analysis will compare these data with our own and those collected by investigators in France.

Bargaining data collected for us by the U.C.L.A. Survey Research Center has been shown to contain a sampling design error. As a result only limited analysis of these results are possible. New data will be provided without additional charges that will allow the study as planned to be undertaken during the next reporting period.

ARPA Conference on Trust

An ARPA-sponsored conference was held at Harvard University on December 11 and 12, 1972 on the utility of the concept of trust as it might be applied to foreign policy and more particularly to the area of arms control planning and decision making. A report on the conference will be prepared for the next reporting period.

Professional Conferences, Presentations and Activities:

Gerald H. Shure

Meeting with Dr. James Rosenau, Merston Center, Ohio State University, Santa Barbara, July 29-30, 1972.

Meeting with Dr. Paul Ekman, University of California, San Francisco, California, August 23.

Meeting with Dr. Dana Main and Dr. Richard Kaplan, University of Michigan, Ann Arbor, Mich., August 24-25.

Presentation of Paper at APA meeting in Hawaii, September 2-5.

ARPA Conference on Analysis of Trust in Arms Control, Massachusetts, December 10-12.

Alvin S. Cooperband

Attended the Fall DECUS meeting, November 29-December 2, 1972.

Attended the FJCC, Anaheim, December 5-7, 1972.

Elected President of the Southern California PDP-10 Users Group for 1973.

S. S. Shaffer

Attended the FJCC, Anaheim, December 5-7, 1972.

Elected Secretary of the Southern California PDP-10 Users Group for 1973.

R. E. Martin

Attended the Fall DECUS meeting, November 29-December 2, 1972.

Attended a PDP-10 Hardware Familiarization course, Santa Ana, December 12-14, 1972.

G. R. Martins

Presentation of Paper at FJCC, Anaheim, December 5-7, 1972.

Visitors to CCBS. July - December 1972

Colonel Austin Kibbler of ARPA; Mr. James Dwyer, Major Ernest Rider, Major Robert Doty and Colonel William Thane Minor of SAGA, July 5 & 6, 1972.

Dr. Pat Langendorf, RADC, July 14.

Dr. Pat Langendorf, Al deLucia and W. Hartnett of RADC, and J. E. Lichtenauer of National Security Agency, July 18 & 19.

Mr. Kazimierz Gebarski, Psychometrician, Polish Management Development Center, Warsaw, Poland, July 31.

Miss Yveline Gastau, Sorbonne University, Paris, France, July 25 & 31.

Dr. I. Mann, Mathematician, NYU, August 2.

Mr. Herring, Vice President Computek, August 3.

Prof. Marisa Zavalloni, UNESCO, Paris, France, August 24 & 25.

Prof. Jürgen Schultz, University of Dusseldorf, Germany, September 8.

Dr. Emir Shufford and Dr. Thomas Brown, RAND Corporation, September 13.

Dr. George Stone, UCSF, September 20.

Dr. Paul Ekman, UCSF, September 20 & 21.

Dr. Steven Lucasik, Director, ARPA, September 26.

Mr. Franco Biancacci, Producer, RAI-Italian Radio & T.V. System, Rome, Italy, September 27.

Dr. George Lawrence, ARPA, October 7.

Mr. Lee Ohringer, U.S. Government, October 11.

Dr. Jacques Vidal, Dr. Marshall Buck and Miss L. Sullivan, UCLA Engineering, October 17.

Dr. Takeshi Utsumi, (Japan), October 27.

Prof. Oscar Grusky, Chairman, Dept. of Sociology, UCLA, October 30.

Mr. Meldon Levine (Legislative Assistant to U.S. Senator John V. Tunney), October 31.

Dr. Paul Hammond, RAND Corporation, November 1.

Visitors to CCBS. July - December 1972

Mr. Klaus-Rupert Busche, Digital Equipment, Germany, November 6.

Mr. Maximo Garcia Fabregat, Mexico City, Mexico, November 6.

Dr. Paul Hammond and Mr. William Jones, RAND Corporation,
November 6.

Dr. Olaf Helmer, Institute for the Future, Menlo Park, California,
November 14.

Professor Herbert Kelman, Harvard University, Cambridge, Mass.,
November 20.

Colonel Austin Kibbler, ARPA, November 29.

Dr. Roy Amara, Dr. Olaf Helmer, Dr. Herbert Lipinski,
Mr. Richard Miller, Institute for the Future, Menlo Park,
December 6.

Mr. John Kuipers, U.S. Government, December 7.

Dr. Andrew Molnar, National Science Foundation, Washington, D.C.,
December 12, 1972.

Dr. Andrew Marshall, National Security Council, Washington, D.C.,
December 27.

Project Documentation. July - December 1972

- CCBS-TM-31 Formatted I/O File Manipulation, Baker, P. S.,
July 1972.
- CCBS-TM-32 The On-line Computer as a Tool for Focused
Induction and Gaming Experiments, Shure, G. H.,
August 1972.
- CCBS-TM-33 Alternative International Contexts for Policy Making,
Weiler, D., July 1972.
- CCBS-TM-34 The Use of Metagame Analysis as an Aid to the
Construction of Scenario Simulation, Knight, K.
- CCBS-TM-35 Brief Functional Specifications for a Disc Back-Up
System, Cooperband, A. S., September 1972.
- CCBS-TM-36 Sequential Theme Encoding, Tripodes, P. and
Martins, G., December 1972.
- CCBS-TM-38 Outline of Confrontation Theory, Wilkinson, D. O.,
December 1972.
- CCBS-TM-39 A New Method of Calculating the Metric Values of
Ordinal Categories, Kirby, D. and Bonacich, P.,
December 1972.
- CCBS-TM-40 A Computer-based One-Team Simulation Exercise
Using a 1974 Mid-East Scenario, DeWeerd, H. A.,
Meeker, R. J. and Shure, G. H., December 1972.
- CCBS-P-8 Toward Confrontation Theory, Wilkinson, D. O.
Submitted for presentation to the 1973 Annual
Meeting of the Peace Science Society (International)/
Western Region, San Francisco.
- CCBS-P-9 Dimensions of Text Processing, Martins, G. R.
Also published in Proceedings of the Fall Joint
Computer Conference, 1972.
- CCBS-P-10 The Effects of Size of Payoff and Real Versus
Imaginary Rewards on Pre-Bargaining Perceptions,
Lanto, S. and Shure, G. Also presented
at the American Psychological Association Meeting,
1972.