

COMPUTER SIMULATION OF CONCEPT LEARNING BY
INDIVIDUALS IN A MINIMUM SOCIAL SITUATION*

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SUMMARY

Following five laboratory studies a computer model was constructed that simulated the behavior of the individual player in the three-person common target game. The model, COMTARG, contained three model-relevant individual difference parameters as well as general deterministic mechanisms. Computer subjects were constructed according to a specified method of sampling the values of the three parameters. Program runs for the computer subjects were then made previous to making experimental observations on humans playing the game under two previously unobserved treatment conditions. ANOVAs failed to distinguish human from computer subjects.

- i) widely different rates of acquisition of various strategies,
- ii) unequal probabilities of using various strategies on the first and early trials,
- iii) non-stationarity of errors prior to last error, and
- iv) individual differences in acquisition.¹

No known stochastic or response conditioning model is sufficient to account for these results.

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COMTARG

A concept-selection model of individual strategy acquisition was constructed following these studies. The model—COMTARG— was written as a computer program and consists of over 5,000 statements in IPL-V. The model was developed in the format characteristic of any hypothetico-deductive model; namely, general behavioral postulates, deductive consequences and linking definitions to observables. Unlike other models of concept learning COMTARG's postulates were derived from two social psychological theories—Festinger et al's Social Comparison theory and the Carnegie-Mellon theorists' views on organizational choice.

The information processing model has the following characteristics:

- 1) It postulates a conceptual structure of simple game-relevant numeric concepts that are stored in a memory structure.
- 2) It postulates an ordered search and evaluation through successively less accessible parts of memory structure for a set of concepts for three players that match those uniquely required under any experimental condition.

INTRODUCTION

Five pilot studies were carried out using Leavitt's three-person common target game as the experimental task. The game was played over an intercom system in which the players could not communicate with one another and received game information on performance feedback from the experimenter on each trial. The studies were designed to produce the rapid and reliable acquisition of various strategies by individuals in the groups. Subjects in these studies demonstrated:

- 3) The search is directed by the goals of change other versus change self and concepts are tested and evaluated by criteria that differ as goals change. Goals change as a function of outcomes and of the value of an Independence parameter. The first concept(s) evaluated that satisfies the current criteria on any trial is (are) accepted and search stops. The search and evaluation mechanisms are completely deterministic.
- 4) The model postulates a specific probabilistic distribution of individual differences among subjects on three parameters; viz. Independence, and in the initial loading of concepts in two memory lists, FAMILI (Fast Access Memory List) and SAM (Slow Access Memory).
- 5) The model postulates the selection of concepts from a store of known concepts in memory and the association of specific concepts with specific players. It does not take the further step of learning to associate player-concept pairs with differing equivalence classes of target numbers.
- 6) COMTARG was constructed with strong postulates about the control that cognitive processes exercise on behavior in that environmental information is used as a source of concept evaluation but not of concept induction.

COMTARG's structure and inclusion of individual difference parameters made it susceptible to standard methods of experimental verification. A number of such tests are reported.

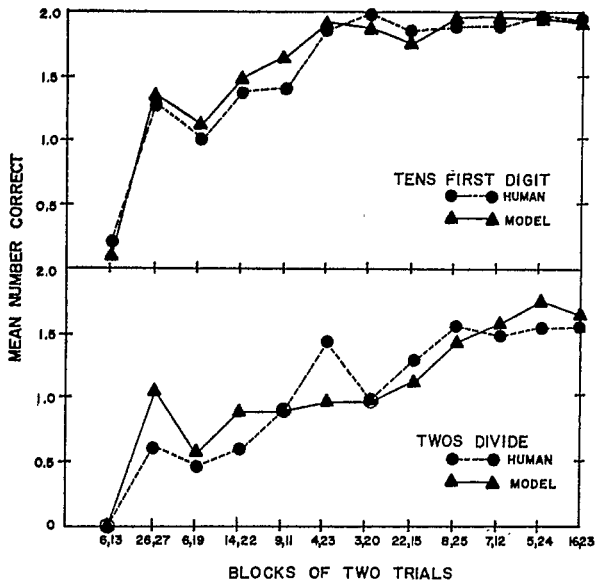


Fig. 1 Strategy acquisition curves showing the mean number of correct sets of numeric responses for blocks of two trials made by Human and Simulated (Model) subjects under the TENS First Digit and TWOS Divide conditions. Target number sequence shown on abscissa.

RESULTS

COMTARG was tested predictively through making the computer runs previous to observing data from a sixth study under two previously unobserved treatment conditions. These data are shown in Table 1, Table 2 and Figure 1.

ANOVAs failed to distinguish human from computer subjects under these conditions. Additional postdictive tests were made by comparing COMTARG with behavior observed in the fourth and fifth pilot studies.² Again the fit is good across most of these conditions.

The report concludes through briefly describing some related and concurrent research that bears on the development of computer-assisted group problem solving.³

REFERENCES

Joyner, R.C. A process model of individual concept learning in groups. Monograph, Carnegie Institute of Technology, 1966, Graduate School of Industrial Administration

_____ SIN - Simulation of interaction in communication networks II; experiments with the common target game. Working paper, GSIA, Carnegie Institute of Technology, 1965.

_____ & Green, G.J. Demonstration of computer-augmented group problem-solving. *Behav.Sci.*, in press.

TABLE 1

Descriptive Statistics for Two Treatment Conditions Showing Number (N) of Human (H) and Simulated (S) Subjects, Number of Trials, Number of Subjects who Acquired The Strategy, Mean Trials to Last Error and Mean Number of Correct Responses

Treatment	Subjects	N	Trials	Subjects who Acquired Strategy	Trials to Last Error	Correct Responses
TENS First Digit	H	39	24	36	7.14	18.49
TENS First Digit	S	39	24	35	6.23	18.74
TWOs Divide	H	15	24	10	12.20	12.13
TWOs Divide	S	15	24	12	10.25	12.47

TABLE 2

Summary of F Ratios From Analyses of Variance of Correct Sets of Numeric Responses of Human (H) and Simulated (S) Subjects in Two-Trial Blocks for All Blocks of Trials and for The First Six Blocks of Trials under Two Experimental Conditions.

Condition	All Blocks of Trials				First Six Blocks of Trials			
	Source	df	F	p	Source	df	F	p
TENS First Digit	H vs S	1,76	.09	<.001	H vs S	1,76	1.56	<.001
	Trials	11,836	98.40		Trials	5,380	61.74	
	HS x Tr	11,836	1.23		HS x Tr	5,380	.63	
TWOs Divide	H vs S	1,28	.01	<.001	H vs S	1,28	.05	<.001
	Trials	11,308	22.68		Trials	5,140	12.29	
	HS x Tr	11,308	1.19		HS x Tr	5,140	1.65	