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ABSTRACT

This document describes several time-sharing computer programs developed by the Department of Anthropology at Dartmouth College for undergraduate instruction in the various sub-fields of anthropology. The programs include teaching programs in elementary general anthropology and general inquiry into cross-cultural research. The teaching programs are similar to programmed instruction. The student is presented with certain concepts, required to master them, and apply them to the solution of set problems. The general inquiry programs permit the formulation of complex hypotheses whose testing requires or permits some form of multivariate analysis. Ten programs are described for the teaching and for the general inquiry program. (MJM)

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FINAL REPORT: TIME-SHARING COMPUTER APPLICATIONS IN UNDERGRADUATE ANTHROPOLOGY AT DARTMOUTH COLLEGE

INTRODUCTION

In 1968 the Department of Anthropology at Dartmouth College undertook the development of several time-share computer programs to be used in connection with undergraduate instruction in the various sub-fields of anthropology. From January, 1970 to May, 1971 this project was supported by the National Science Foundation under grant number GJ 719. It was conceived, written and carried out by Professor James W. Fernandez. Professor Hoyt S. Alverson assisted in the formulation and writing of several of the programs included in the final package.

The hardware and software environment of this project is the following: dual processer General Electric 635 with two IBM 2314 direct access storage facilities with a total storage capacity of 72 million words. Over 200 teletypes are now serviced by this system, with 140 on campus and 70 in Maine, Vermont and New Hampshire high schools and sister institutions. The BASIC language in use at Dartmouth is well along in the second generation of its development and now possesses extensive string handling, text editing and file capabilities. The third generation BASIC language has just been put into operation this fall (1971). Since all of the programs were written in $BASIC_2$, some rewriting of the programs will be necessary to take advantage of the new capabilities of $BASIC_3$. Batch processing is also available with other languages. Approximately 80% of Dartmouth undergraduates have hands-on experience with the computer, and this figure is an important consideration in development of time-sharing applications in the social sciences.

The strategy we have followed has been one of developing programs in two areas of application: (1) teach programs in elementary general anthropology; (2) general inquiry in cross-cultural research. There is some overlap between these areas and, in fact, one challenge we have felt is to develop programs useful for purposes of introduction to the field and general inquiry alike and relevant for both student and professor.

The actual formulation and writing of the several diverse programs conceived for this project led us on several occasions to abandon preconceived notions and strike out in new directions. The result has been in the main a package of programs both more diverse and in part of greater depth than we initially envisaged. Below are listed the programs developed with a brief description of each. All of the programs are available for use by Dartmouth students through the library of the Kiewit Computation Center.

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PROGRAM DESCRIPTIONS

1. TEACH PROGRAMS IN ELEMENTARY GENERAL ANTHROPOLOGY:

Certain of the teach programs are quite akin to ordinary programmed instruction. The student is presented with certain concepts, required to master them, and apply them to the solution of a set of problems. His errors of omission and commission are rigorously corrected in typical Skinnerian fashion. Other programs permit the user to formulate and test simple hypotheses concerning correlation and covariation on nominal and ordinal scales. Usually the subject must have prior knowledge of one or more institutions whose distributions and contexts of occurrence he wishes to ascertain. The major strength of these programs lies in their capacity to sift through enormous quantities of data at high speed.

(A) LIFEWAYS
(B) ETHATLAS
(C) ETHCODE
(D) RACEMYTH
(E) RACECHEK
(F) GENETICS
(G) EPOCH
(H) FOSSIL
(I) PEASANTS (PEASLIS)
(J) KINTYPE

2. GENERAL INQUIRY IN CROSS CULTURAL RESEARCH:

The general inquiry programs permit the formulation of complex hypotheses whose testing requires or permits some form of multivariate analysis. The data are those found in the HRAF and TEXTOR archives and may be used to the limits of their a priori validity. The programs are capable of far more varieties of analysis than the data may actually be legitimately subjected to. It is assumed that the student has received some training in elementary and intermediate statistics, and is familiar with the fundamentals of cross-cultural comparison.

(A) POLYCOMP
(B) ETH-DGRE
(C) ETHRAND
(D) TEXTOR
(E) TEX-CODE
(F) CULTCOMP
(G) ETH-INFO
(H) CULT-PIK
(I) CENSUS
(J) CONTENT

1. TEACH PROGRAMS IN GENERAL ANTHROPOLOGY

A. LIFEWAYS: The program presents Charles Morris' 13 Ways of Life which the user ranks in two ways. The computer decides by Spearman rank correlation in which of 6 cultures the user would be most at home and prints out a chart with rankings of the user, all the program's users and those of five countries. Social correlates are taken in the process of the program and stored in a permanent file. Data from this file are periodically dumped and used for more complex statistical analysis under the IMPRESS program of the departments of Sociology and Government at Dartmouth.

COMMENT: This program has proved very popular at Dartmouth and is now used as a general demonstration program in the Computer Center. The accumulated data have proved a valuable data base for studies of the relationship between cultural values and social, economic, educational and religious variables.

B. ETHATLAS: This program scans the data from the Murdock and Berry card version of The Ethnographic Atlas. The user may run presence-absence correlations between any two characteristics in the Atlas, defining for himself the attributes which characterize them. A codebook has been written for ease in making decisions. Five conditions may be held constant. The program prints out a contingency table with Chi Square and Q calculations.

COMMENT: This program is designed to teach the introductory student basic principles of cross-cultural and correlational analysis. Laboratory exercises designed for this program demand first that the student postulate correlations before he brings his hypothesis to the computer and the Atlas data. They demand, second, that he assess the quality of random selection that lies behind the Chi Square measure.

C. ETHCODE: This program is an aid to those not involved with the introductory use of ETHATLAS (where a code book is provided). The 48 major characteristics of The Ethnographic Atlas are listed and the option is provided to have any portion of the codesheet listed.

D. RACEMYTH: Data on the occurrence of 12 physical characteristics have been obtained from 35 Old World locations. A display map of the Old World with these locations is printed out. These characteristics are: skin color, hair structure, stature, skeleton index, facial morphology, Mongolian eye, nose index, horizontal cephalic index, height of skull index, and blood factors A, B, O. The program asks the student (1) to examine the notion of race as "clusterings" of physical traits by testing for high correlations in the distribution of these traits in selected Old World locations; (2) to test intuitive notions concerning magnitudes of physical differences by choosing any sample population from among the Old World locations and predicting increasing "degree of difference" in 4 selected additional populations listed in order of expected divergence from datum group; (3) to test the notion that diversity of traits within groups is less than between groups by dividing the Old World into 4 races and selecting, for each racial grouping, 6 sample populations by reference to the coordinates of the display map. The deviation of the 12 traits about the mean within each of the 4 groups is compared with the grand mean of observations on all the groups to establish relationship of within-group

diversity to between-group diversity. Sum of squares, degrees of freedom, mean square are computed between races, between traits, in interaction, between cells and within cells. An F test is applied in each case.

COMMENT: Experience with this program in an introductory course indicates it to belong more properly to advanced undergraduate work.

E. RACECHEK: Nine of the most widely used diagnostic indicators of "racial difference" are employed along with frequencies of occurrence of the various indicators among four "widely recognized" racial groups to determine the probable racial group to which the user belongs. The user supplies personal data obtained in the laboratory on blood type, ABO, Rh factor, stature, nasal index, PTC tasting ability, cephalic index, hair texture, hair color and skin color. The program sums along all nine indicators and computes an "index of belongingness."

COMMENT: This program is designed to teach the difficulties and vagaries of racial classification. Probabilities of belongingness are carefully explained by reference to allele frequencies. It is fair to say that this program makes a persuasive attack on stereotypes of self (and other) racial identification.

F. GENETICS: By leading the student through various calculations of allele frequencies in combination and recombination, the Hardy-Weinberg Law is demonstrated. The student is graded on his performance. A record is kept of that grade in a separate file.

G. EPOCH: This program displays the Pleistocene chart and vacant slots. A lexicon of tool traditions is provided for Western Europe and the student is asked to correctly fill in the chart. A corrected chart is provided. The student is graded.

H. FOSSIL: A Pleistocene chart is displayed with slots. A lexicon of fossil finds is given and the student asked to fill in the slots. A corrected chart is provided. The student is graded.

I. PEASANTS (PEASLIS): A program in four parts. The idea of mathematical expectation is first presented, using simple ethnographic examples. Second, a presentation and critique of game theory, using Davenport's data on Jamaican fishermen. Third, the student chooses an axiomatic or non-axiomatic derivation of basic game theory principles. Fourth, he applies these principles to further examples of peasant strategy behavior. The student is graded on his application of the formulae presented.

J. KINTYPE: This program enables the user to learn about different kinship systems and social organizations as though he were conducting an interview in the field. The user can ask about the kinship terms for informants from different parts of the world and with different cross-cousin terminology in each part. The program draws on the data from Murdock's Ethnographic Atlas and has its own algorithm for determining a society's type and sub-type of social organization.

KINGRAPH: Subprogram for KINTYPE--prints out the cross-cousin kinship terminology diagram. Data is read in the main program from two files for each society in the sample. See the description and instructions for program KINTYPE.

KINCOMP: This program is chained to program KINTYPE where the notions of the semantic space of kinship terms and kinship designation as a tree branching operation from primaries is presented. Program provides user with a listing of "distinctive features" in world kinship classification. Student can select a kinship system whose main kin terms will be defined extensially by primary terms. User can then determine the most parsimonious "componential" definitions for all the kin terms in the selected system, using the "distinctive features" inventory.

2. GENERAL INQUIRY IN CROSS CULTURAL RESEARCH

A. POLYCOMP: This program employs the computer version of The Ethnographic Atlas to explore the problem of cultural diversity and culture unity as a factor in nation building. The user has the option of working with either one or two groups of cultures (i.e. political units) anywhere in the world. He may select up to twenty cultures within these units employing the program ETH-INFO to establish the geographical coordinates of cultures. A comparison is first made for each unit with each of the 92 characteristics from the Atlas compared for each culture against every other culture in that political unit. The user receives a gross count of similarities, dissimilarities and discounted comparisons. The user has the option of having the identity matrices of similarity and dissimilarity printed out in either graphic or numeric format. The second portion of this program enables the user to list the characteristics of The Ethnographic Atlas and weight (or reject) each one according to their importance, in his view, in contributing to national unity. A new count of similarity, dissimilarity is made and new identity matrices are printed out.

COMMENT: This has proved to be the most popular of our advanced programs and students believe that it gives at once an understanding of the complexity of the problem of cultural integration at the national level and, at the same time, some power to deal with it.

POLLY1: This subroutine performs the culture comparisons for "POLLY." The 92 characteristics of The Ethnographic Atlas are either weighted from 0-3 or all have the weight of 1. Each culture in a division is compared to every other culture in the division on all 92 characteristics. If the characteristics have been weighted (A9=1) then statistics are kept and recorded in a scratch file for each of the three weights: very important, important, and slightly important (all others are assumed to be unimportant and are treated the same as "insufficient info" and discounted). Statistics are also kept for the similarities, dissimilarities and characteristics discounted for the division, or divisions, as a whole.

POLLY2: This subprogram weights the 92 characteristics of The Ethnographic Atlas. The user is expected to have listed and studied the codesheet.

POLLY3: This subprogram prints an identity matrix for either a normal comparison or weighted comparison. Either a numeric or graphic format may be selected.

POLLY4: This subprogram collects data on input from the user as to the divisions and cultures he wishes to work with. This information is stored in C$, A$, and A matrices as well as being stored in the user's scratch files, ZILCH1 & ZILCH2.

POLLY5: This subprogram initializes the first part of the program, POLLY (POLYCOMP).

POLLY6: This subprogram computes a commonality score for each pair of ethnic groups. These values may be printed out by typing in a 'YES' when the option is presented. These values are computed by using the "weighted" values of each characteristic established in POLLY2***, also there will be the printout of 2 "relative belongingness" or "group" commonality coefficients, this number is the mean weighted character differences within a group divided by the mean weighted character differences between the groups.

B. ETH-DGRE: Respecting the 3 degree rule, this program randomly selects one culture (if any cultures have been recorded to exist in the sample) in each of the 72 cells of 30 degree latitude and longitude on Mercator Projection. Each selected culture is then reviewed with cultures already selected from neighboring cells to conform with the 3 degree rule. . . This review includes comparison of cultures on the far west with those on the far east and those on the far north with those on the far south. Failure of review begins a new random selection within a cell.

COMMENT: This program is designed to teach one kind of randomizing procedure and its inadequacies... Not every culture in sample has an equal opportunity of being selected.

C. ETH-RAND: This is an alternative method of random selection of a sample of cultures. The program first randomly selects a point with specific longitude and latitude coordinates. A Mercator Projection is applied with this point as an origin and 50 longitude and latitude points are randomly selected. These are then converted to points on the normal Mercator Projection. The culture closest to each of these points is then selected or, failing the 3 degree rule, the next closest culture.

D. TEXTOR: This program reproduces Robert B. Textor's A Cross Cultural Survey. The dichotomy for any pair of 536 "finished characteristics" is printed out from the sample of 400 cultures. Sentences are then printed out based on significance of association. The cultures in each cell may be listed. Chi Square and Phi coefficient calculations are given.

COMMENT: Textor's 400 characteristics gives the user a greater range for postulation of "functional" relationships than The Ethnographic Atlas and, therefore, is appropriate for advanced course work.

E. TEX-CODE: This program is an aid to running TEXTOR. It gives the user the option of listing portions of the codesheet for the finished characteristics of A Cross Cultural Survey. 44 divisions are first printed out and from these the user selects the portions of the codesheet he wishes to examine.

F. CULTCOMP: This program prints out all characteristics for either one or two cultures from any of the 1168 cultures recorded in The Ethnographic Atlas. There is a bibliography option whereby the user may access the most relevant and recent works on either of these cultures or both.

COMMENT: This program has proved to be most useful for students and professors alike. There is a power of comparison when two cultures are listed out side by side and characteristic by characteristic that is not obtainable by any other procedure.

G. ETH-INFO: This program prints out information on any 861 cultures in The Ethnographic Atlas. Geographical coordinates, population, date of population estimate and date of ethnography, upon which coding is primarily based, are returned.

H. CULT-PIK: This program works with data from either the Murdock or the Textor packages. The user chooses any set of cultural characteristics up to 15 and the computer locates all cultures exhibiting these characteristics. An option for identifying all cultures within defined geographical coordinates is being added.

I. CENSUS: Program to compute demographic totals, display population pyramid, perform correlational analysis and trace out and map genealogical relationships in census data from peasant villages. Present census data are from Iberian peasant villages. Students are encouraged to work with census data in punch card form and this program is intended to facilitate analysis.

J. CONTENT: A series of programs now being written designed to teach the fundamentals of folktale analysis. Several of these programs will have application to any textual materials. Part 1: The student types in and edits a folktale. He is asked to assign a one-word character tag and a one-sentence thematic summary (Icarus: Men reach for what they cannot grasp and fall). An instruct option lists examples. The user is then required to perform two subdivisions of the tale: by episode and by eventclass. Instruct option defines episode (motivation, engagement, resolution) and eventclass (the Propp-Colby Divisions). Program counts word frequencies and standard deviations for total tale and for subdivisions. User may, alternatively, have computer subdivide the tale into two to nine equal parts (by word count or sentence count). Computer will make word counts for each part.

Part 2. The general inquirer system of content analysis is brought to bear upon the tale. At the present time only the Santa Fe III. dictionary is on line at Dartmouth. Other dictionaries will be added. User has option of selecting key words for tagging or of tagging the entire tale. Computer lists and user marks words for which syntactic markers are necessary. User has option of seeing text and tags in interlinear format or having entire tale translated into tags. A tag tally (histogram) by entire tale or by subdivisions is given.

Part 3. 10 folktales of the same genre (syntactically marked) from 6 different societies (Japan, Eskimo, Zuni, Dahomey, Russia, Tsimshian) are stored for analysis by the user. He may compare any two sets at any one time. He may list and study any one tale or study all ten tales at once. Word frequencies for each set of tales will be listed by entire tale or by proportional divisions. The user has the option of listing key words in

in context. Tag tallies for each set of tales will be provided by entire tale or by subdivision. On the basis of tag tallies user postulates cultural differences and may use CULTCOMP for further comparison.

CRITICAL EVALUATION OF PACKAGE

All of the programs in this package are ideally self-contained and self-explanatory. In practice each requires some degree of preparation on the part of the student to be used effectively. We have found that for programs to be intellectually challenging to undergraduates, they cannot be used in a totally self-teaching or self-explaining fashion. Thus, they should be employed in connection with formal course instruction and reading.

The success of these programs clearly hinges on the enthusiasm and competence of the instructor. Anthropology is a humanistic science, often attracting students with a strongly humanistic, existential outlook. This outlook is not incompatible with quantitative cross-cultural research. However, for many students there appears to be an incompatibility. Some of the brightest undergraduates see the computer, as well as many other kinds of technical hardware as debasing and anti-human. This prejudice can only be overcome by exposure to the computer in a game-like, playful, non-punitive, flexible environment. Only the instructor can provide this environment. Generally we have succeeded in showing students that anthropology and the computer can be incorporated into an intelligent studia humanitatis.

The programs vary in the degree to which the students may interact "creatively" with the computer in working through them. There appears to be wide variation in students' preferences for rather structured as over against "open-ended" type programs. Neither type of program appears to be inherently more salable to undergraduates as a whole. Since these programs can be used by the student, on his own, outside the classroom, an instructor can increase the scope and depth of materials covered without having to increase course length or contact hours with students. Conversely, students can achieve greater contact with anthropological materials without having to commit more time to formal classroom participation. The content of courses can be enriched with these programs in ways that would not be possible without the aid of high speed computing equipment. This is particularly true where the scanning and sorting of massive quantities of archival data are called for.

Wider use of these programs, some of which have been tried but once or twice in classes at Dartmouth, will permit appropriate revision and improvement. Users in other colleges--even secondary schools--will no doubt discover bases for improvement as experience accumulates. The strength of the programs lies in the fact that much of the tedious program writing has been worked out to handle certain problems of instruction and data analysis. Revisions will not require reworking of these programs de novo, but can, rather, be built on the program frameworks already established.