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## Societal Research Archives System : Retrieval, quality control and analysis of comparative data\*

### INTRODUCTION

The Societal Research Archives System (SRAS) was created by the author in 1966 as a computer-based retrieval and research facility for comparative data in social science. The basic idea was to integrate all of the available cross-societal coded data from published and unpublished sources into a single data base, and secondly to develop computer programs which would facilitate all of the steps in comparative research, from sample selection and data retrieval to correlation, data quality control, and testing for genetic, diffusional, or functional sources of correlation. This paper will serve to explain the present operation of the system. Additional work is being done at the University of Pittsburgh's Cross-Cultural Cumulative Coding Center, beginning in 1968, on the refinement and expansion of the system, which will be the subject of a future report.

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## SCOPE OF MATERIALS INCLUDED IN SRAS

As of fall, 1967, the comparative ratings from 55 of the major books and articles in the cross-cultural field have been incorporated into the SRAS computerized archive (see bibliography, and White, 1967a). This represents 40 % of the approximate total number of such publications, but over 90 % of the actual ratings, since the remaining publications contain fairly scanty data.

Three major cross-polity surveys (Banks and Textor, Rummel, and Russett et al.) have also been incorporated on an experimental basis. Ultimately, it is expected that SRAS will be entirely cross-disciplinary, including data on all types of social units from nations, states and cities to villages, tribes and bands.

Comparative psychology, sociology, political sciences, and anthropology are already well represented by the research topics presently included and rated in the archive. Also planned by the author is the addition of data which would be of use in the study of social change and in comparative history. The first involves delimiting a sample of the societies presently in the archive which can be re-rated for a second time-period, or drawing up a new sample of societies in which change has been well documented. The second involves adapting the data of comparative history so that it may be coded for successive periods in the great historical traditions. Kroeber's data from *Configurations of culture growth* has already been keypunched to form one nucleus of coded material for a comparative historical data pool which will be expanded over the next two-year period.

## SRAS AS A REACTIVE RETRIEVAL - RESEARCH SYSTEM

A common dilemma in the use of computers for social research has been that designs were applied to retrieval of information, instead of the research process itself. The real potential for the computer in social science, largely untapped as yet, lies in the areas of communication: a) communication between a researcher and a "reactive" system which can provide an information pool, research procedures and results in a form selected by the user; b) communications between researchers, and storing of information and research programs via telecommunications and time-sharing computer systems; and c) educational communications, or the use of a select body of data and retrieval or research procedures for individual or classroom "reactive" learning, or question-

and-answer exchange between learner and the learning system, or computerized console.

The technological component — or console — must be backed up by a well-designed “ Reactive Retrieval-Research System ” (with the appropriate acronym of the “ 3R'S ”) which is a complex of data-storage equipment, retrieval and analytic programs, and a mediator language very close to plain English which enables the user to ask questions or to request that operations be done with the data and available programs, and to specify how the results are to be returned to him. Behind the ultimate simplicity of a user at a keyboard, communicating in his native language, there is of course a technological maze of which he need not be aware in all its detail. The ultimate technological simplicity, however, is that once a single such system is established (and hopefully this will be the case at the University of Pittsburgh), it is accessible to anyone, no matter how far away (theoretically), through telecommunications (telephone or telegraph dial-ups), just as though he were in an office adjoining the computer center on one side, and the SRAS staff on the other.

It must be stressed that while all of the operational programming for such a “ 3R'S ” console system has been completed (*i.e.*, programs which do the required operations for each step in comparative research), the development of this system by the author is still in its experimental stages. The Cross-Cultural Cumulative Coding Center at Pittsburgh will support this work over the next two-year period (1968-1970). Since the “ mediator language ” for the reactive console system has not yet been translated into “ plain English ” with built-in, programmed-learning devices to aid the uninitiated user, those desiring to use the system in its present state should have a fair amount of technical sophistication in computer languages. Anyone seriously interested in establishing telecommunication linkage with the console system, or in using these facilities at the University of Pittsburgh, now or in the future, should contact the author. With the coming diffusion of console units across the country, it will not be long before the console system is available for research and experimental teaching use on a national basis. This will be one of the objectives of the Center at Pittsburgh.

## CROSS-CULTURAL RESEARCH STRATEGIES

### 1. *Theoretical*

There are two kinds of strategies for research underpinning the existence of SRAS. The first involves the possibility of culling out the statistically significant correlations from the consolidated data pool containing all available cross-cultural studies. After this step, a variety of control variables can be applied to determine whether a particular correlation

is probably due to historical factors (common origin or common diffusion for those societies in which the correlations hold good), or may be due to kinds of systematic error endemic to comparative data (errors in data collection, bias or inadequacy in ethnographies, or misinterpretation by coders). Naroll's work on "Galton's problem" (1965) and *Data quality control* (1962) has shed sufficient light on these problems that they need not be discussed here in detail. Suffice it to say that only after the influence of spurious or historical factors has been screened out can the remaining correlations legitimately be considered the subject for functional explanation. It is, of course, also possible that a correlation is due to chance coincidence, a possibility which can be evaluated statistically by the null hypothesis, but is ultimately subject to retest using a new sample. Such a rigorous culling out of "genuine" correlations is the first research strategy which is facilitated by SRAS. This is not done in most contemporary cross-cultural studies because of the extreme laboriousness of compiling "control variables", and of massive statistical computations. By use of the computer, SRAS goes one better: given a correlation between two variables, A and B, the entire data matrix can be searched for any other variables which correlate highly with both, and which thus may play the role of "intervening variables" or account for the correlation between A and B. The pooling of all comparative coded data, with a present inventory of over 2000 variables, gives great depth to this possibility. Thus, three dimensions of refinement in research have been added which were not formerly feasible in cross-cultural methodology: intensive historical and data quality controls, and identification of other intervening variables. Each of these points are discussed in the paragraphs below.

A second research strategy made possible through SRAS, discussed in the article "Cybernetics and social research" (White, 1967c), operates on the Bayesian principle of seeking correlations which *do not* confirm theoretical expectations. This becomes a take-off point for testing the extensibility of present theoretical models vs. the need for developing alternative models which would differ in their deductive implications and so might better incorporate a range of facts and correlations which the older model could not explain adequately. Strodtbeck (1964) has noted the suitability of the cross-cultural method to this kind of "discovery procedure", but in labelling the technique "retroduction" or "abduction", in the tradition of C.S. Peirce, he loads the dice in favor of always extending our existing models instead of working out better alternatives which may start from different assumptions. For a discussion of a Bayesian view contrary to Strodtbeck and Peirce the reader is referred to "Cybernetics and social research" (White, 1967c).

## 2. *Applied*

In another vein, the SRAS materials are not by any means limited in their use to world-wide or "hologeistic" comparisons or the standard "cross-cultural methods". The author, for example, has applied such coded material toward an inter-regional analysis of differences in the organization of kinship systems in North American and African cultures (White, 1967a), establishing correlations which hold for one continent but not for another. A regional comparison on the basis of Driver's (1957) work on North America, or Murdock's (1959) on Africa, could be attempted from the cumulative results of cross-cultural investigations, selecting societies for that area. Such regional studies could also serve as a checkpoint for the reliability and validity of the existing cross-cultural codes and categories, and would undoubtedly raise significant new ones.

It is equally feasible to do studies of particular types of societies drawn from the world's population, such as the Aberle (1961) study of matrilineal societies. Variables in the SRAS data pool could be used, if applicable, as the basis for drawing such specialized samples.

Time-depth studies, using data coded from periods of history as known for a sample of societies, will also be feasible through SRAS although such data in coded form is only beginning to be available.

Since SRAS is intended for use by social scientists without any specialized computer training, the remainder of this article presents a step-by-step analysis of how one would proceed to do a cross-cultural research project using the SRAS retrieval and research analysis programs.

### STEPS IN RESEARCH USING SRAS

The steps in cross-cultural research using SRAS are outlined below. The operating programs essential to steps one, four and five are presently installed and workable, while the "control variable" programs of steps two and three are projected on the basis of data pertaining to these control factors, which will be added within the current two-year period (1968-1970). Step six is simply the result of having screened out spurious or historically-produced correlations in steps four and five, and is in this sense operational. Step seven still awaits programming, but this presents no theoretical problems, and should be completed within the current year (1968). Step eight does not rely on programming, and is in this sense possible, but will be fully significant when all the other steps are operational.

All of the programming necessary for these steps — both retrieval and analytic procedures — will ultimately be written up in the form of a manual.

### 1. Sampling and integrating data from different sources

For most cross-cultural research designs using pre-coded data, the first problem is to draw a representative sample from the available 2000 societies and yet, through a strategic choice of societies, to maximize the amount of coded data relevant to the research topic. The use of three retrieval programs, DRT I, II, and III, is sufficient for all possible permutations of this sampling dilemma : DRT I establishes the *minimal criteria* for inclusion of a society (e.g., that it has been rated in certain of the studies) and culls out all societies which fit the criteria ; DRT II then retrieves selected ratings for only these societies ; and DRT III accepts criteria for a stratified sample (e.g., one society per culture area) and chooses the specified number of societies per strata by taking those societies which are most complete for the specified variables. DRT I and II are both operational ; DRT III is being programmed at Pittsburgh. As discussed above, regional samples and special purpose samples (e.g., matrilineal societies) can easily be drawn using these retrieval programs.

### 2. Data quality control

Differences in the ethnographic material on societies can originate from five major classes of systematic error in comparative codes : *a)* differences in the *amount* of material may reflect a selection preference for certain types of societies which are then over-represented in a sample ; *b)* differences in the *quality* of the material may lead to error such as the case where a cultural feature is rated as present because it is described in more complete ethnographies, and rated as absent where there has simply been a failure to report on this subject at all ; *c)* differences in *coding techniques* may compound error, such as the case where a coder's "hunches" are followed in those descriptions which are more scanty and subject to interpretation ; *d)* differences in ethnographers' techniques may lead to *source* errors, such as the case where ethnographers who speak the language tend to obtain better data on witchcraft, so that witchcraft ratings can be biased by this factor ; and *e)* differences in the type of primary field data which the ethnographer has used may reflect actual *vs.* verbal behavior in the society, and can produce *origin error*, as in the case where the ethnographers using informants' reports tend to describe a lower incidence of drunkenness than those ethnographers using an actual case-incidence method.

For shorthand purposes, these can be referred to as selection bias (quantity), quality errors, coding errors, source errors and origin errors. "Data quality control" for each of these factors can be rated as they apply to the ethnographic material of a society *in toto*, or as they apply to material on a particular cultural domain.

Naroll (1962) has developed the technique of data quality analysis, through inter-correlation of coded ratings (on cultures) with quality control ratings (on sources and techniques in each of the five classes of systematic error). As he has recently pointed out (1967, pp. 77-78), the influence of systematic error on coded ratings need not be a simple monotonic correlation, and the possibility of curvilinearity should be investigated as well.

SRAS is designed to facilitate the use of quality control ratings, such as planned for the new Human Relations Area Files Quality Control sample of 60 societies (*Behavioral science notes* 21, pp. 63-69, 81-88). The University of Pittsburgh's Cross-Cultural Cumulative Coding Center will also begin to provide such ratings by 1969. A matrix of all codes correlated with all quality ratings can be computer-generated and updated as part of the SRAS data pool. Any coded cultural variable which has been found to correlate with a source of systematic error will be *tagged* so that the user is aware of this limitation. The user must then be particularly circumspect in drawing interpretations from data which have been so tagged. In the extreme case, where the independent *and* dependent variables of a correlation have been tagged by the same systematic error source(s), the correlation may be completely spurious, or a by-product of such systematic error.

In an optimally designed reactive console system, as envisioned for 1970, the quality control tag-search would be performed as a matter of routine, and the user would be automatically notified of possible sources of error in his variables.

### 3. Structural controls for comparability of societal units

A "world sample" of societies, primitive and peasant, ancient and modern, has been the tool of most cross-cultural studies attempting to generalize about cultural processes. A true world sample pre-supposes a diversity of conditions: some societies are indigenous and autonomous, others acculturated and dependent; some societies are actual communities, others are networks of shifting political alliances; still others possess highly complex centralized administrative structures.

There are many reasons why a researcher may want to select or control certain "strata" of the world's societies for comparative purposes (*e.g.*, to study peasants; or politically autonomous peoples): *a*) the importance of such structural variables for cultural processes might suggest that these strata be examined separately (*e.g.*, the hypothesis that societies may behave differently at different "levels of integration"); *b*) as a preliminary to construction of a societal typology and test of the coherence of such types; and *c*) the possibility that the definition of boundaries of the societies in the sample may have produced a bias in the cultural characteristics which are being analyzed. Leach (1960, pp. 137-138) for example, has said

that the meaning of a "custom" when comparing the Tikopia (pop. : 1 800) and the mainland Chinese (pop. : ca. 650 millions) is so radically different — one being normative in the community sense, the other in a statistical sense — that quite different explanations are required.

To aid in dealing with the problem of definition of the social units in comparative studies, two classificatory devices have been included in the design of SRAS : *a*) a typology of levels of integration (band/tribe/chieftom/state, etc.) ; and *b*) a trichotomy of the six "boundary" criteria by which social units are often defined (e.g., territorial, political, linguistic boundaries, etc.), as to whether the society is a *subset*, a *singular unit*, or a *heterogeneous unit* with respect to each. This information is included along with other background data, in the codebook of societal characteristics.

#### 4. *Distributional analysis : Diffusion and historical clusters*

The problem of diffusion, or historical relations between cultures producing common constellations of social forms, has been one of the most besetting problems of comparative research ever since Galton raised the issue in 1889 at the presentation of the first paper using statistics in cross-cultural tabulations, by E.B. Tylor. The problem in the use of statistics to draw generalizations about "functional" relationships between traits, to quote Mr. Galton, is "the degree to which the customs of the tribes and races which are compared together are independent. It might be that some of the tribes had derived them from a common source, so that they were duplicate copies of the same original" (in Moore, 1961, p. 26).

Stratified sampling from different culture areas has been used to circumvent the problem, but more recently Naroll (1961, 1964 ; Naroll and D'Andrade, 1963) has proposed five solutions designed to sift out diffusion effects entirely ; in three cases his method provides a relative evaluation of diffusion vs. functional hypothesis (*i.e.*, the Cluster, Matched Pair, and Linked Pair methods).

A computer program by Naroll and Morrison has been incorporated into SRAS to calculate the "Linked Pair" solution to Galton's problem by evaluation of the type of diffusion which has occurred with each pair of traits being investigated. The "Linked Pair" solution is the most elegant, but since it requires that societies must be aligned on a diffusion arc, it will be more convenient for some samples to have programs which utilize other solutions (this programming will be done at Pittsburgh, 1968-1970).

Naroll's solutions, however, are based upon the assumption that diffusion or common origin of traits will be reflected in geographical clustering of traits. Under conditions of migration or separation of historically related peoples, the most likely clustering of traits is not by geographic

but *linguistic* propinquity, as an indication of past historical relatedness. The case of sibling terminology (Murdock, 1968) is an excellent example of high genetic clustering, with a low incidence of borrowing.

The author has developed a method for calculating the degree of clustering of traits in branches of the world linguistic tree, as classified by continental affiliations, phyla, families and sub-families (White, 1966b). A computer program called "treesort" is being developed which summarizes the levels and particular branches at which such clustering is greatest. This will provide a more refined measure of true genetic common origin of trait clusters, as opposed to Naroll's measures of geographic clustering.

### 5. *Mapping data and results*

For distributional and historical analysis, there is perhaps no technique more useful than simply the mapping of trait distributions or of trait co-occurrences and clusters. This time-consuming process has also been transformed through the application of computer programming. The SRAS mapping program will plot society locations, trait and cluster distributions, continent by continent, at the rate of hundreds of maps per minute. Plots for sequential time-periods can also be prepared for diachronic analysis. Rough outlines of each continent and a wide choice of representational symbols are a feature of these maps.

### 6. *Culling out likely "functional associations"*

The quality control and distributional programs can be used to screen out those correlations which have possible functional significance, barring those which are the result of selection bias, quality errors, coding errors, source errors, origin errors, and distributional clustering. Analogous to the results of Textor's *Cross-cultural summary*, but considerably cleaned up and pared down, this can help to establish empirical materials for building of more sophisticated theories in comparative research.

### 7. *Third factor controls*

Having found a correlation between A and B which has potential functional significance, the researcher is in a position to ask whether there is any third variable, X, which might possibly "intervene" or be correlated with both A and B, and possibly be a "hidden factor" accounting for the association.

A computer program is currently being programmed which will intercorrelate *all* of the variables in the archive, similar to Textor's (1967) undertaking. In this case, however, the results (some 36 million correlations) would be packed in binary code on a magnetic tape with entry procedures for searching any given row or column of the matrix.

When this gigantic matrix is produced, the researcher will be able to utilize a second program which will "search" for all the X's which satisfy the condition of being correlated with both traits A and B. He will receive a printout with an exhaustive list of all such possible "intervening variables" among the already coded cross-cultural variables. He can then apply the data quality control and distributional tests to determine whether any of these is a likely functional determinant of A and B.

This addition of an exhaustive "third factor" search is another example of the increase in sophistication of research design made possible through SRAS.

### 8. *Reformulation of study design*

The most critical part of comparative research is the establishment of theoretical models and postulates. Once certain hypotheses have become provisionally accepted on the basis of SRAS correlational procedures and control tests, then the researcher may wish to construct a hypothetico-deductive model in which additional hypotheses, derived deductively, are to be tested. SRAS is an ideal environment for this kind of "feedback" from the guidance of theoretical models, since it is easy to reformulate and test the new hypotheses through the same steps which have just been surveyed.

As SRAS expands or articulates with optimally researchable bodies of coded and descriptive materials, on the one hand, a computerized system for assaying previous results in theoretical domains (e.g., an inventory of hypotheses) could also be developed to accelerate the feedback and reformulation process. Effective organization of our theoretical knowledge (discussed in White, 1967c) would also aid greatly in the evaluation and construction of theoretical models. Such theoretical development will also suggest improved ways to generate new variables, by applying new coding procedures to the descriptive materials, as is planned in the Cross-Cultural Cumulative Coding Center at Pittsburgh.

### *Making S R A S available*

The results of this experiment in comparative research are presently available to the academic community in three forms: *a*) requests for information on specific variables can be automatically processed, given a sampling plan, or whole data decks for particular studies can be obtained; *b*) SRAS user manuals are available, including prospecti, reference manuals for codes, variables names, and societies, cultural and linguistic classification, and papers on theoretical and applied problems associated with research methodology and developing the retrieval-research system (see bibliography, White, 1965, 1966a, b, c, 1967a; Gold and White, 1966); *c*) the entire archive and associated computer programs can be distri-

buted, via magnetic tape, for those who want to experiment with their own procedures at another computer center\*.

The development of the console system for reactive retrieval-research, including long distance dial-ups from remote consoles at other institutions, is part of the projected two year (1968-1970) program of the Cross-Cultural Cumulative Coding Center (C5) at the University of Pittsburgh.

The C5 Center will also disseminate results of the project in another way, through publication in the journal *Ethnology* of significant correlations between variables in the data pool, and tests of whether these are likely due to systematic error, historical factors, or possible functional relationships. C5 will provide the next needed step in the expansion of new codes, coding of new ethnographies, and extension of the existing codes in the literature to larger samples of societies. Expansion of the data base itself will provide the needed multiplicative effect of increasing the sample size for any given correlation, and increasing the capabilities and the payoff of research through a reactive system such as the one described.

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\* For the near future, the original SRAS office at the Department of Anthropology, University of Minnesota, c/o Fay Cohen, Administrative Fellow, is in the best position to service requests for information retrieval, punched-card decks, SRAS manuals, and copies of the archive on magnetic tape. For information concerning the present and future development of the system and the reactive consol facilities, contact the author, Department of Anthropology, University of Pittsburgh.

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