

atCODAP: A Definition

by

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BACKGROUND

Within the United States Air Force, as well as many other military and civilian agencies, there is a fundamental technology which supports both the operational and research occupational analysis programs. The core of this technology is called CODAP, an acronym for the Comprehensive Occupational Data Analysis Programs. The CODAP "system" is a set of analysis tools and procedures which use, as raw material, information provided by the members of the occupational field being studied. This system may be used to revise classification structures, assess job related skills, verify the relevance of training courses and a host of other applications in which an accurate knowledge of job content at the task level is desirable (Thew and Weissmuller, 1979; Morsh and Christal, 1966; Christal, 1974; Levine, Ash, Hall and Sistrunk, 1983, Christal and Weissmuller, 1987).

The term "CODAP" was created as an acronym for a set of computer programs. These programs were originally designed and developed by the Air Force Human Resources Laboratory during the mid-1960's and have been updated and validated continuously by AFHRL since then. Different versions of CODAP have evolved for various mainframe computer systems such as Sperry (Univac), IBM, and CDC. The development of these alternate versions, in general, has been underwritten by Department of Defense (DoD) agencies and various universities. The military of allied governments (Australia and Canada, in particular) have also contributed to this software development (Staley and Weissmuller, 1981). Many of these versions are available free to qualified (governmental, educational, non-profit) agencies or for a nominal fee to other organizations.

With so many agencies and so many applications, one may ask, "Well, which version is the TRUE CODAP?" There is no American National Standards Institute (ANSI) definition of CODAP as there are for computer languages like COBOL and FORTRAN. In common usage, however, the term "CODAP" has grown to mean more than just the programs. "CODAP" is used as an adjective to describe both operational and research studies. The Air Force Human Resources Laboratory featured CODAP in their display at a Federal Laboratory Consortium's Transfer of Technology Expo targeted at state and local governments (Weissmuller, 1979). In an attempt to explain the usage of "CODAP", a handout was prepared. This handout, "CODAP: A Definition", gave three definitions of "CODAP." These definitions included 1. The Acronym; 2. The Procedures; and 3. The Theoretic Approach. In other words, the "CODAP system" includes not only software, but also procedures and guidelines which span from job inventory construction through the research and development of new job analysis techniques (Morsh and Archer, 1967). In the most general sense, "CODAP" means using a task-anchored approach in applying the scientific method to job analysis.

INTRODUCTION

Of all the versions available, the Air Force Human Resources Laboratory's version of CODAP has always remained in the forefront. In addition to undertaking the initial development, AFHRL has continuously updated, validated, and applied new techniques within the CODAP paradigm. Much to AFHRL's credit, the software they developed has been transferred to qualified agencies, and the algorithms they have developed have been published in public technical reports and working papers. Moreover, they have actively pursued transfer of technology programs both under the auspices of the Federal Laboratory Consortium and through their direct CODAP assistance program (Cat 3, DAL51600) spearheaded by Mr. William J. Phalen. So why hasn't the technology spread more rapidly? The answer to this question has two parts. To use the FREE Federal "CODAP system" requires knowledge and money, and unfortunately, a large quantity of both. This paper offers a first look at a new alternative to mainframe CODAP: the atCODAP system -- what it is and what it isn't (yet).

MAJOR QUESTIONS

What is "atCODAP"?

atCODAP is a commercially developed, micro-computer based version of the Comprehensive Occupational Data Analysis Programs (CODAP) system. The targeted customers are local governments without the required mainframe computers necessary to take advantage of the "free" Federal CODAP system. This system is designed to generate the most useful products which are unique to the CODAP methodology as developed, validated, and publicly reported by the Air Force Human Resources Laboratory (Archer, 1966; Christal 1972; Phalen and Christal 1973; Stacey, Weissmuller, Barton and Rogers, 1974; Phalen, 1975; Christal and Weissmuller, 1976; Finstuen and Edwards, 1980; Phalen and Weissmuller, 1981; Staley, Weissmuller and Phalen, 1985). These products are presented in a concise and aesthetic form to facilitate analysis and reporting. All products are high quality, i.e. camera-ready for direct insertion into final reports. Products include arbitrary list-based job descriptions, variable distributions, multi-way group comparisons, interrater reliabilities, incumbent/expert rating interactions, and hierarchical clustering on up to 2000 job incumbents. Import/Export to other statistical packages is available to accomplish other processing such as exotic clustering, regressions or factor analysis.

Where is "atCODAP"?

atCODAP is currently available only through service bureau support from Sensible Systems, 9311 San Pedro Avenue, Suite 700, San Antonio, Texas 78216. Although designed for smaller sample sizes (1,000 or less incumbents), occupational fields with up to 4000 job incumbents can be clustered on Sensible Systems' equipment. In this regard, however, Sensible Systems does not accept contracts from Federal agencies. This is for two basic reasons. First, to avoid a whole host of apparent conflict of interest questions. The principals in Sensible are committed to see this technology spread, and that determination has been made clear to everyone prior to accepting business relationships. Second, Sensible is committed to seeing this technology spread to the widest possible base: the city government.

This is NOT a high mark-up or profitable client. We must maintain low overhead, and this means no LEGAL department and no CONTRACTS department. If you deal with the Federal government, you should have BOTH of these departments. On the other hand, Sensible Systems will accept standard, service-bureau contracts from OTHER contractors who win Federal contracts. As a matter of corporate policy, Sensible Systems will NOT authorize any type of exclusive BID arrangement to WIN a Federal contract. Sensible stands ready to service any winner of any contract -- given it is within our standard service bureau parameters.

How is "atCODAP"?

How did "atCODAP" come into being? Sensible Systems was incorporated in 1982 to explore and develop microcomputer based technologies to support job analysis projects. The first system was an inventory development and administration package. This system was used by City Public Service of San Antonio to develop and collect job inventory data for a dozen career areas. This microcomputer based data was uploaded to their Sperry mainframe and analyzed by the CODAP system given to them by AFHRL. As the microcomputer technology became more advanced, it became clear that it was possible to do more than just "front-end" work. Work began on a system called "TAPS" for Task Anchored Personnel Systems. Although the name "TAPS" is gone, that system design work is being utilized in today's atCODAP package.

How is "atCODAP" different from mainframe CODAP? Internally, the systems are completely different. The atCODAP system is a totally new system with the design driven by the anticipated needs of the city and county governments. atCODAP no more "infringes" on mainframe CODAP than does SPSS infringe on SAS or BMDP simply because they can compute the same statistics. No source code from any existing CODAP version was used, only public domain formulae and algorithms. In addition, this total redesign was necessary in order to replicate the mainframe CODAP functionality on a microcomputer. The resource-efficiency tradeoff is very different between mainframes and micros. Dynamic memory allocations and other advanced features of the Pascal computer language have been exploited to the fullest in producing this system. New algorithms and methods have been developed to bring processing time within reasonable limits. Where precision in values is essential, the micro version exceeds mainframe CODAP. In other words, internally, atCODAP is the result of YEARS of new effort expended in achieving a SENSIBLE product.

Externally, the systems are different also. For example, one of the design advances makes full use of the microcomputer/laser printer combination. The job inventory is defined in a single file created

by a word processor. This single file is used to 1) print a master copy of the survey booklet (for data entry); 2) produce a layout of the input data file (i.e. specs for importing from optical scanners); 3) control the data entry program; 4) report all variable & task titles; and 5) identify and report all codes for all variables. In this manner, titles are never transcribed (incorrectly) nor is storage space wasted on redundant copies. Future plans include using this same file for adaptive survey administration and for producing a master survey booklet compatible with optical scanning equipment.

Why is "atCODAP"?

atCODAP exists because there is a need. The "free" Federal CODAP assumes a large, mainframe computer with its staff as well as CODAP technicians and (occasionally) CODAP programmers, not to mention job analysts trained in the CODAP methodology. Logistically, the vast majority of city governments cannot provide that level of support. In addition, Air Force assistance is justifiably limited. In the past, the Air Force has provided CODAP data processing for qualified agencies to let them "pilot test" the system. Only the first project, however, could be processed by AFHRL. For second or subsequent projects, the agencies needed to request and install the "free" Federal CODAP software on their own computer system, or find another place at which to process their data. It is important to note that the "free" Federal CODAP software is provided "as is" with no support for installation or modification (per the standard release statement). The training assistance and advice provided by Mr. William J. Phalen -- though of the highest quality, is also subject to availability and budget constraints. With DoD budget cuts looming, local governments cannot guarantee future terms or availability of these outstanding services.

Agencies that have acquired and installed the AFHRL version of CODAP include the Maryland Center for Productivity and Quality of Working Life at the University of Maryland (UOM has Sperry version), the Graduate School of Business at the University of Texas at Austin (UTA has First CDC version), and the Center for Educational Technology at Florida State University (FSU has a CDC version), to name a few. These agencies have received the AFHRL version of CODAP at various points in the past and have configured them for their computer installations. More specifically, the principals now in Sensible Systems developed the original Sperry version while in the Air Force, and later, under personal contracts, installed it at the University of Maryland and converted it to CDC equipment for the University of Texas. Florida State University acquired their CDC version from UT Austin and we were called in to fix problems introduced by local programmers. Most importantly, these organizations provide access to CODAP to other outside agencies. Because of their academic institutional charters and Air Force release statements, however, there are some limitations in the types of projects they will pursue.

Of course, atCODAP is available through service bureau support to any client interested in taking advantage of this technology. A "Client Site" system is not yet available. The user interface is currently under development and creation of products still requires intimate knowledge of the system. As Sensible Systems's service bureau business grows, staff and equipment will be expanded, freeing the system developers from having to also do operational work. With free time again the user interface will be completed and tested. By the time the interface is ready, all analytical software will have been used extensively. We will have audited all the products and identified and removed any anomalies in the system. Technologically, the goal is to produce a system which can be operated directly by secretaries and job analysts without the assistance of a single computer/CODAP expert.

What does the "at" stand for?

In keeping with CODAP tradition, here are three possible answers:

The Previous Host System The atCODAP system builds on the analysis methods in the previously most advanced version of CODAP - the Sperry UNIVAC version developed by the Air Force Human Resources Laboratory. On the Sperry system under the Exec 8 Operating System, all system commands are invoked by an "@" in column one. This symbol is called a "masterspace" in Sperry jargon, but it is referred to as an "at-sign" by most AFHRL computer technicians. Hence, in order to run CODAP on that computer, one would type "@CODAP" which is verbally reported as "at CODAP".

The Current Host System One might suspect that the "at" is to signify that this package runs on an IBM PC-AT or compatible. While the statement is correct, one should recall that the IBM usage is always capitalized as it stands for "Advanced Technology." People who subscribe to this viewpoint call the system "A" "T" "CODAP".

The Future Possibilities The Air Force version of CODAP always raised questions regarding exactly HOW MANY computer programs were in "CODAP" at any given time. Because AFHRL is a research laboratory, new programs were developed to meet new and specialized needs. If the research proved the analysis technique to be valid and useful, then the program was "added to CODAP". Sensible Systems stands ready to work with clients in underwriting, researching and validating new techniques. Like AFHRL, as we accept new procedures, they too will be "added to" "atCODAP." Although "added to" is in the correct spirit, it is too limited.

While "atCODAP" incorporates AFHRL's publicly documented CODAP analysis techniques as of 1986, it is an entirely new system. Many criticisms about CODAP's limitation to training evaluation and military applications have been addressed and resolved in the new design. We are drifting away from some of the limitations and interpretations which prevent direct usage in local government applications. We are not starting with AFHRL's CODAP, but with a system that emulates its best qualities. In this sense, and one which heralds back to our original name choice, the best definition of "atCODAP" may be "anchored to CODAP."

Where does atCODAP go from here?

There is a "PLAN." "PLAN" stands for the Position-Level Actions Network and includes very specific application modules and off-computer procedures. These application areas include such things as new position classifications, applicant-position match evaluations and career-path planning. These features are made possible by using the summarized results of an atCODAP analysis. Although these functions can be accomplished within the CODAP-atCODAP systems, they have never been simplified to the point where operational users could readily see how to achieve their goals. Sensible Systems is committed to seeing this task-anchored methodology spread. Sensible is developing an approach called "SAFETI" (Scenario Analysis For Effective Technology Implementation) to facilitate and nurture the growth of municipal "in-house" capabilities.

CONCLUSION

As with "CODAP", "atCODAP" is more than a set of programs -- it is part of a movement to insure the spread a quality methodology (not just a technology). The technology is only the tip of the iceberg. Developing atCODAP has provided a technology base upon which to research and build advanced applications. Sensible Systems is committed to support the responsible use of high-quality job analysis results. Our goal is to not only provide the best products and service to our clients, but also to make the algorithms, procedures, and theory of CODAP available to the widest possible audience. In programming a totally new system from the ground up, we have removed all constraints on the clients who can participate in this grand experiment. Remember though, this is a commercial venture; but since the competition gives the product away free, we couldn't be too serious -- or could we?

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Programs in atCODAP

Although atCODAP is not yet releaseable in a "Client Site" system, most of the core analysis programs are already completed. The final system released will NOT require knowledge of program names, only a general idea of the desired function (or output). As a partial step in demonstrating progress, the following functions are complete:

1. Initial Data Base Definition Standards (Word Processor).
2. Create Rapid-Access References into the Definition (POINTERS).
3. Print specifications to import data from opscan (LAYOUT).
4. Print a Master Survey Booklets for data entry (MAKEBOOK).
5. Do Data Entry on completed booklets (ENTRY).
6. Build the Data Base (BUILDER).
7. Compute a similarity matrix (OVERLAP).
8. Perform a hierarchical clustering (GROUP).
9. Display hierarchical clustering results (DIAGRAM).
10. Identify all members inclusion in a group (SELECT).
11. Compute a group job description (JOBDESC).
12. Print a group job description (PDESC).
13. Print individual incumbent data (PVARBLES).
14. Display demographics for a group (DIST).
15. Show the membership relationships between groups (RELATE).
16. Identify common/discriminating tasks wrt a set of groups (CORSET).
17. Evaluate Subject-Matter-Experts' [SME] ratings (AGREE).

----- the following items are still being validated -----

18. Interact incumbent data with SME data on common lists (INTERACT).

19. Display group summary data with SME summary data (PFACTORS).

20. Variable statistics by group (MEANS).

----- the following item is to be developed -----

21. List-item statistics by group (AVERAGE).

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===== Updated Information since the 1987 release of this paper =====

Sensible Systems, Inc.'s (SSI) address is now 10218 Lorene Lane, San Antonio, TX 78216-4409. Voice and Fax phone line is (210) 349-9001.

SSI DOES affect federal Purchase Orders as a services vendor as opposed to a contractor or subcontractor reporting labor hours.

atCODAP has clustered over 5,000 cases in a state-wide survey of police officers in Texas.

The computer programs, though completely original code, have been renamed to match the names of the corresponding programs in the mainframe, ASCII CODAP (and CODAP II) systems to facilitate communication. The item statistics program is complete and is called ITEMSTAT.

The atCODAP system now runs under a menu system and can be released under license or used as a service bureau.