A STRUCTURE OF WORKER Functions

THE STRUCTURE of worker functions to be described was developed in connection with an occupational classification research project at present being carried out at the United States Employment Service [7]. This research is designed to develop a single occupational classification structure to replace the two now in use—Volume II and Part IV of the *Dictionary of Occupational Titles*. Four thousand jobs have been evaluated according to the factors of eight components such as aptitudes and interests. One of these eight components is Work Performed consisting of three subcomponents: (1) Worker Functions (to be described); (2) Materials, Products, and Subject Matter (500 items classified in groups of ten in large part adapted from the commodities index of *Standard Industrial Classification*); and (3) Methods Groups (108 defined groups of methods of getting work done).

What Is a Worker Function

The worker functions are intended to answer the question, "What does the worker do on the job?" as oppose; to the question, "What gets done on the job?" The need for distinguishing between these two questions is that commonly when the question is asked, "What does the worker do?" it is answered in terms of what gets done on a job, or what the machine, equipment, or even organization is doing. In the case of a *Drill Press Operator*, for example, the common answer to "What is the worker doing?" is "The worker is drilling." The inquiry into drilling yields information about drilling techniques, materials drilled, and machines, but very little information

about the worker other than that he should know about some of these things. If the question were answered thusly: "The worker is tending a machine," then the inquiry into tending would reveal other requirements: (1) moderate strength in reaching for and handling materials; (2) a certain amount of dexterity and coordination in the feeding, offbearing, and adjustment of work to tools; (3) rhythmic, paced movement in connection with repetitive short cycle tasks, etc.

A classification of occupations that seeks to establish occupational relationships on the basis of common requirements of workers needs to have the second kind of information. Hence the asking of the two questions indicated above and the avoidance of taking for granted what it is that workers do. The 26 worker functions listed in *Figure 1* and defined in *Appendix A* express what it is that workers do. A brief discussion of the structure and definition of these functions is followed by a discussion of their reliability and their application.

Structure and Definition of Worker Functions

Each worker function is defined both as a word or concept and also in terms of its position in the structure.

The structure consists of three hierarchies of functions pertaining to Things, Data, and People. The first two functions in each hierarchy are Observing and Learning. Successive functions in a hierarchy include all those that precede it and exclude all those that follow it. Thus, the relationship of a given function, say Compiling, to its immediately adjacent functions, Computing (above) and Analyzing (below) is, "includes Computing (which in turn includes Copying, etc.) and excludes

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Some additional patterns based on definitions in the *Dictionary of Occupational Titles* follow below: (The definitions should be consulted to properly evaluate the analysis.)

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Analyzing." This set of relationships is common in everyday experience, similar to those delineated by a family tree, organizational chart, or grade structure of the educational system. It can easily be confused with an absolute skill hierarchy. This it is not. It merely establishes the relative position of what a worker does *in a given line of work as it pertains to a given hierarchy.*

In a job, a worker functions in relation to Things, Data, and People. Thus three worker functions, one from each hierarchy, are necessary to express a worker's total relationship to what gets done. This is an essential theorem of the structure and is vital to its ultimate applications.

However, the worker's involvement with Things, Data, and People may differ in degree in each job. The device used at the USES (one of many possible) for expressing this difference in degree is to assign weights of one to eight to the worker's involvement with Things, Data, and People in each job so that the weights total ten. This automatically ranks the involvements and places the worker functions in proper perspective to each other. Thus both a Plumber and a Concert Violinist would be rated for Precision Working but the weights would be say 6 for the Plumber and 3 for the Violinist in the respective over-all patterns:

Plumber
Precision Working 6
Computing 3
Taking Instructions 1

Violinist
Precision Working 3

Reliability of Worker Function Ratings

Can judgments about worker functions be made reliably? This should be determined in several ways, especially at the

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point of observation of job-worker situations. This has not yet been done but what might be considered as the next best thing was tried out. One hundred job definitions selected by chance from the *Dictionary* were independently rated for worker functions (among other things) by four trained raters.[1] The proportion of exact agreements of each rater with every other rater was computed separately for the Things, Data, and People hierarchies (TABLE 1). The averages of these proportions were 0.59, 0.66, and 0.88 respectively. The first two averages reflect the greater variety of functions utilized in those instances. As noted, these proportions show the extent of exact agreement among the raters. However, since the choices of functions can also reflect more or less agreement (depending on whether the raters were one, two, or more levels apart in their choices), this relative agreement among Things functions was computed using a coefficient of contingency. The mean coefficient (c) was 0.87 for Things functions. Chi squares and coefficients of contingency were computed for the weighting of worker functions and are shown in TABLE 2. These computations showed the weights to be significant and to correlate 0.76.

Applications of Worker Functions

The discussion on the applications of worker functions is largely an outline of research that might be carried out on the basis of the rather encouraging results in the few areas that have already been explored and will be mentioned below.

Job Analysis: Worker functions should be very helpful in getting the facts about jobs. One of the great difficulties in getting reliable observations and mutual understanding about jobs is the nonstandardized use of terms. Worker functions, as we have described them, are standardized. Furthermore, they are comprehensive in coverage. If a worker is not functioning on one level,

he must be functioning on another. Using worker functions as a focus it may be possible to shape interview questions to obtain facts that are relevant with regard to a particular function. In this connection it should be noted that although in many jobs workers do function almost entirely in one way, in a great many others they function on several levels of a given hierarchy. The one used to define the job is the highest significant one but all the information is important. Frequently, for example, what makes a job "professional" or "skilled" is the range of functions in which the worker must be involved. In a paper given by the writer to the American Psychological Association [1], seven rules were outlined for carrying out functional job analyses.

Another possible use of these worker functions is in developing job analysis survey check lists. Check lists, it has been pointed out [6] could be a very effective way of obtaining job analysis information. Two basic weaknesses need to be overcome it seems to us, before check lists can be effective: (1) maintaining a consistent pitch in the items and insuring that comprehensive coverage is obtained; and (2) organizing the items so that those not applicable to a given person can be quickly located by the person and skipped in the checking off process. Worker functions define the areas to be explored in given jobs and suggest the wording of items so that all possible levels of functioning can be explored. They might be particularly useful for checking a whole field of work such as "metal machining." Tentative check lists have been developed for the vocational counseling and metal machining career fields. The former check list is undergoing research at the present time.

Criterion Dimensionality: Worker function may also be a means of indicating that "workers assigned to the same job perform quite differently in a qualitative as well as a quantitative sense." [2] Present means of describing jobs largely in terms of what gets done gives the impression that a job is a fixed, static thing. This is not so [4] but is not evident until attention is focused on how workers function, how they fit their own

[1] It is essential to point out that the job definitions in the *Dictionary* although formalized, do not involve standardized terminology and are weak in describing *what workers do* as opposed to *what gets done.*

TABLE 1

Proportions of Agreement in Rating Worker Functions for Things, Data, People (100 Jobs, 4 Raters)

		Things					Data					People		
	A	C	D	E		A	C	D	E		A	C	D	E
A	X	0.56	0.61	0.60	A	X	0.67	0.70	0.58	A	X	0.91	0.91	0.88
C		X	0.60	0.53	C		X	0.68	0.67	C		X	0.89	0.81
D			X	0.65	D			X	0.63	D			X	0.86
E				X	E				X	E				X
Averages:		0.59					0.66					0.88		

TABLE 2

Chi Square* and Coefficients of Contingency† in Weighting Things, Data, and People Hierarchies of Worker Functions

	"C" Rater					X^2‡ Rater			
	A	C	D	E		A	C	D	E
A	X	0.79	0.76	0.76	A	X	497.43	406.07	411.49
C		X	0.77	0.76	C		X	437.28	409.03
D			X	0.74	D			X	366.93
E				X	E				X

Median "C" = 0.76
"C" (based on average X^2) = 0.76

* Chi squares are all significant at less than 0.01 level. (30 degrees of freedom at 0.01 level is 50.892). Table of chi squares is entered in these instances with 49 degrees of freedom.
† This method of statistical treatment was utilized in view of the fact that the data accrued in 10 x 10 fold tables. Under such conditions, the coefficient of contingency approaches the Pearson r in size, the maximum c obtainable being practically unity.
‡ Data are based on comparison of actual weights assigned (1-8).

personalities and perhaps projections of self into the work situation. Consider the *Drill Press Operator* (hat and cap): "Operates a drill press to bore holes through cap visor linings for the insertions of snap fasteners: Places drill of specified size in chuck and tightens chuck by hand or with a key. Places a pile of cap visor linings on table of machine. Starts machine. Centers end of drill over mark on top visor and pulls a lever to feed rotating drill through pile of visor linings." The employer specification on worker functions for this job probably would be:

Operating 7
Comparing 2
Taking Instructions 1

However, assuming several workers are on this job it is entirely possible that in-

formally some of them, resisting the set-up, are functioning thus:

Tending 8
Comparing 1
Taking Instructions 1

While one or another, adjusting to this situation in their own way, are functioning thus:

Setting-Up 6
Comparing 2
Taking Instructions 2

Since the latter workers were not hired to "set-up" but the incidence of "tenders" in the previous group compels either ignoring them (in which case production is slowed and the "tenders" face the consequences); or some "operators" "set-up" for some "tenders" and their lost production

through assumption of this function is made up by "tenders" who work more rapidly. Thus the production equilibrium of the group is maintained.

This type of situation when studied sociologically is seen as "teamwork" or "group solidarity." However, it would seem to have its origins in basic individual behavior orientations. In any case, it should be evident that in gathering criterion data for test standardization it might be essential to know how the workers in a given occupation are in fact functioning, not only how they are believed to be functioning.

Job Classification: The worker functions described here have been applied to 4,000 job definitions, an 18 per cent sample of the *Dictionary of Occupational Titles.* Independently made ratings on Aptitudes, Interests, Temperaments, Physical Capacities and Working Conditions, Training Time, and Industry are available for these same jobs.[2] Present research is directed at determining whether specific worker function patterns have been independently rated for consistent worker trait patterns. There seems some possibility of this and if so, then the possibility of grouping job-worker situations according to common requirements will be greatly facilitated.

A special application of job classification might be the evaluation of jobs for wage administration purposes. Additional information such as training time, responsibility, and esteem with which certain jobs are regarded would have to be brought into play. However, significant advantages might be gained by considering all jobs having the same functional pattern and evaluating them according to their weight differences. The reverse approach might be equally helpful; that is, considering all jobs having the same weight pattern and evaluating them according to their functional differences. The significant thing is that the same basic information gathered in the job analysis could be used directly in the job evaluation.

Worker Classification: Worker functions

present the possibility of classifying workers in the same way that jobs are classified. Using the weight system described above[3] and the threefold breakdown of Things, Ideas, People, the National Employment Service of Great Britain [3] devised a simple standard interview record form on the basis of which an applicant's relative orientation to the three areas was established. Workers were then recommended to jobs judged to require similar involvements with Things, Ideas, and People. Research here requires the development of a patterned interview which would explore the background (school, family, leisure time) of the individual, his interests, and perhaps his attitudes. It is entirely possible that the same worker functions and weights might be applied to characterize different stages or periods of an individual's life. If this is indeed possible a rather effective device might be available to trace the evolution of an individual's vocational choices and evaluate their reality and fantasy content.

For maximum usefulness in matching workers and jobs it will of course be necessary to have all jobs classified in the same way, that is weighted according to their involvement with Things, Ideas, and People. Present research at the United States Employment Service is exploring this possibility.

Performance Evaluation: The ineffectiveness of traditional rating of rather abstract traits has long been known [5]. Even the use of production indices of a tangible nature are frequently inadequate bases for evaluating performance. What is needed is a device that permits a supervisor and worker to exchange views on how the worker is functioning in relation to how he is expected to function. It seems likely that worker functions can serve as such a device. It makes possible a clear statement of what is expected of the worker and an evaluation of how he is performing in positive rather than negative terms. For example, if a worker is hired to Operate, Compute, and

Take Instructions in a 3-6-1 involvement pattern and he performs these functions but in an involvement pattern of 6-3-1 (and this pattern is unsatisfactory) then a clear basis is available for discussing correction with the worker. Similarly, he may be involved as specified, but his functioning may be out of line, thusly: Operating-Copying, Taking Instructions. Both of these departures from the desirable pattern can be rather clearly discussed by resorting to the definitions of the functions and applying them to the specific content of the job. This, of course, might be done initially to establish appropriate standards so that departure from them are all the more evident.

Job Satisfaction: To a considerable extent a worker's satisfaction depends on his orientation to the over-all work situation, his understanding of what is expected of him and his feeling that when he puts out, his work is appreciated. It is surprising how frequently workers do not know what is expected of them or when they do know and put out, how frequently this is not recognized. Worker functions should be helpful from a training standpoint to orient worker and supervisor to each other within the perspective of plant or installation objectives.

However, there is a further hypothesis about the worker function structure that, put to the test, might add to our understanding of job satisfaction. The hypothesis is that a worker's satisfaction with his work is directly related to his feeling of being able (having the opportunity) to function on the highest possible level regardless of the functional specification for which he was hired. The test would be to compare the results on a measure of job satisfaction for separate groups of workers, engaged in the same activity, but functioning in widely different opportunity situations; or in a given situation to compare the satisfaction score of workers with their own explicitly stated feelings about their opportunities. This hypothesis is in part based on the analysis that job experience differs from life experience (school, family, social, etc.) in the restrictions it typically places on how an individual might function.

Summary

A worker function structure developed by the United States Employment Service in connection with job classification research shows possibilities as a useful research device in connection with job analysis, the study of criterion dimensionality, job classification, worker classification, performance evaluation, and the study of job satisfaction.

Things	Data	People
	Observing	
	Learning	
Handling	Comparing	Taking Instructions
Feeding-Off-bearing	Copying,	Serving-Helping
Tending	Computing	Speaking-Signalling
Manipulating	Compiling	Persuading, Diverting
Operating-Controlling,	Analyzing	Supervising, Instructing
Driving-Controlling	Coordinating	Negotiating
Precision-Working	Synthesizing	Mentoring
Setting-Up		

Notes:
1. Each successive function reading down includes all those that precede it.
2. Feeding-Offbearing and Tending, Operating-Controlling and Driving-Controlling, and Setting-Up are special cases involving machines and equipment of Handling, Manipulating, and Precision Working respectively and hence are indented under them.
3. The hyphenated factors Feeding-Offbearing, Operating-Controlling, Driving-Controlling, Serving-Helping and Speaking-Signalling are single functions.
4. The factors separated by a comma are separate functions on the same level separately defined. They are on the same level because although excluded from the one above it, usually one or the other and not both are included in the one below.

Figure 1   Worker Functions Hierarchies

Appendix A

Definitions of Worker Functions

Observing: Applying selective attention to the work environment, or a part of it, as perceived through any of the senses. This function is a necessary base for all other functions, though it is not to be assigned as a rating.

Learning: Observing and studying to acquire knowledge and skill. Applies to apprentices, helpers who are informal apprentices, and students. (To be used either for Things, Data, or People depending on which of the three hierarchies gets the highest weight.)

Handling: Using body members, hand tools, and/or special devices to work, move, or carry objects or materials and involving little or no latitude for judgment with regard to precision attained or in selecting appropriate tool, object, or material.

Feeding-Offbearing: Inserting materials in or removing them from machines or equipment which are automatic or tended or operated by other workers.

Tending: Starting, stopping, and observing the functioning of machines and equipment. Tending may involve handling of controls of the machine or material as the work progresses, but does not involve setting up the machine.

Manipulating: Using body members, tools, or special devices to work, move, guide, or place objects or materials, and involving some latitude for judgment with regard to precision attained and selecting appropriate tool, object, or material although this is readily manifest.

Operating-Controlling: Starting, stopping, manipulating the controls and adjusting the progress of machines or equipment designed to fabricate and/or process things, data, or people. Operating machines involves setting up the machine and adjustment of the machine or material as the work progresses. Controlling equipment involves observing gages, dials, etc., and manipulating valves and other devices to control such items as temperature, pressure, flow of liquids, speed of pumps, and reactions of materials.

Driving-Controlling: Starting, stopping, and manipulating the controls of machines for which a course must be steered or guided in order to fabricate, process, and/or move things or people. Excludes such manually powered machines as hand trucks and dollies.

Precision Working: Using body members and/or tools, or equipment to work, move, guide, or place objects or materials in situations where ultimate responsibility for attaining precision occurs and selection of appropriate tools, objects, or material, and the adjustment of the tool to the task, require exercise of considerable judgment.

Setting-Up: Adjusting machines or equipment by replacing or altering tools, jigs, fixtures, attachments, etc. to prepare them to perform their functions, change their performance or restore their proper functioning if they break down. Workers who set up one or a number of machines for other workers or who set up and personally operate a variety of machines are included here.

Copying: Transcribing, entering, or posting data.

Comparing: Judging the readily observable functional, structural, or compositional characteristics (whether similar to or divergent from obvious standards) of things, data, or people.

Computing: Performing arithmetic operations and reporting on and/or carrying out a prescribed action in relation to them. Does not include counting.

Compiling: Gathering, collating, or classifying information about things, data, or people. Reporting and/or carrying out a prescribed action in relation to the information are frequently involved.

Analyzing: Examining and evaluating data. Presenting alternative actions in relation to evaluation is frequently involved.

Coordinating: Determining time, place, and sequence of operations, or action to be taken on basis of analysis of data; executing determinations and/or reporting on events.

Synthesizing: Integrating analyses of data to discover facts and/or develop knowledge concepts or interpretations.

Taking Instructions: Attending to the work assignment instructions or orders of supervisors. (No immediate response required unless clarification of instruction or order needed.)

Serving-Helping: Attending to the needs or request of people or animals or expressed or implicit wishes of people. Immediate response involved. Helping applies to "non-learning" helpers.

Speaking-Signalling: Talking, conversing with and/or signalling people to convey or exchange information.

Persuading: Influencing others in favor of a product, service, or point of view.

Diverting: Amusing others.

Supervising: Determining or interpreting work procedure for a group of workers, assigning specific duties to them, maintaining harmonious relations among them, and promoting efficiency.

Instructing: Teaching subject matter to others, or training others (including animals) through explanation, demonstration, and supervised practice.

Negotiating: Exchanging ideas, information and opinions with others to formulate policies and programs and/or arrive jointly at decisions, conclusions, or solutions to problems.

Mentoring: Dealing with people in terms of legal, scientific, clinical, spiritual, or other professional principles.

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KEEPING FARMERS WITH HEART DISEASE ON THE FARM

The first program in the United States designed to help farmers with heart disease continue to lead productive lives has been announced by the American Heart Association and its affiliate, the Iowa Heart Association. The "Cardiac-in-Agriculture" project, supported jointly by the two Heart Associations, consisting of a one-year pilot study among farmers of Iowa's Washington County, started September 1. It is hoped that the findings will provide a pattern for similar projects throughout rural America.

The project will represent an extension of the American Heart Association's "Cardiac-in-Industry" program into the field of agriculture. As part of this program, work classification units have been established during the past few years in urban centers to assist factory workers, office personnel, and professionals who have cardiovascular ailments.

As a forerunner of the Iowa study, a five-year research project was launched last year at Purdue University, Lafayette, Indiana. Its purpose is to determine energy requirements for various farm tasks to provide information on time and work-saving short cuts for the cardiac farmer. The Indiana Heart Foundation, another affiliate of the American Heart Association, is one of the sponsors of the Purdue project.

Cooperating with the Heart Associations in the Iowa study will be the College of Medicine of the State University of Iowa; the Extension Service of the Division of Agriculture, Iowa State College; the Division of Vocational Rehabilitation; the Washington County Medical Society; the Heart Committee of the Washington County Tuberculosis and Health Association; the Washington County Health Unit; the Iowa Farm Bureau Federation; the Washington County Farm Bureau; and the Washington Evening Journal. The Iowa State Medical Society has approved the project.

Enrollment in the study will be limited to persons at least 16 years of age who are employed in agriculture and suffering from coronary, hypertensive, rheumatic, congenital, or other heart disease. Referral must be made by the family physician. After the patient undergoes a full medical examination, he will be interviewed by a rehabilitation counselor to determine his economic status, skills, training, experience, employment history, and employment preferences. The patient's farm operation will also come under study.