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FUNDAMENTALS OF RESEARCH IN HUMAN RESOURCES

21 October 1952

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Dr. Aaron B. Nadel, Executive Director of the Committee on Human Resources, Research and Development Board, was born and educated in New York City; received the degrees of B.S. in Social Science at City College of New York in 1932, and Ph.D. in Psychology from Columbia University in 1938. He acted as a research assistant at the Graduate School of Columbia University and for the College of Physicians and Surgeons of that institution at the Montefiors Hospital in New York for 2 years, studying psychological behavior connected with organic diseases of the brain. Following this, he spent 4 years in New York and later in Washington planning, developing, and monitoring research programs in various fields of interest to educational, health, and related social science research agencies. During the war he was commissioned as a lieutenant (j.g.) in the Naval Reserve and assigned as an aviation psychologist. He was with the Veterans' Administration after the war for more than 4 years, first charged with the responsibility of organizing a medical statistical program and later as Special Assistant to the Chief of Psychology and Neurology. He has been Deputy Director of the Committee on Human Resources, Research and Development Board, becoming Executive Director of the Committee during December 1951.

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COLONEL PRICE: Admiral Hague, General Greeley, gentlemen: As we study the manpower of our country, we find that there is a bottom to our manpower barrel. Due to this limitation, it is necessary that the quality of our manpower be improved, and that the best utilization be made of that available to the armed forces.

The Committee on Research and Development of Human Resources, Research and Development (RDB), Department of Defense, coordinates the activities of the various services in this field. This morning, Dr. Aaron B. Nadel, Executive Director of the Committee on the Research and Development of Human Resources, will again speak to us on the developments in this field. Dr. Nadel.

DR. NADEL: Admiral Hague, General Greeley, gentlemen: I am going to talk largely in terms of the relationships between the Committee's interests on research in the human resources field insofar as the military may be concerned at the moment, and the general pattern with regard to research elsewhere in the country. So from time to time, I may be talking about research in this field in general, and at times I will switch into specific research as it concerns the military.

The concept of human resources was originally selected as an area of RDB interest early in the developmental history of this organization. It was believed, at that time, by Dr. Vannevar Bush and others, that the information to be gathered under the aegis of a Human Resources Committee would provide the military organizations and the scientific counterparts of the RDB with statistical facts about manpower--that is, information would be developed on the nature and kinds of manpower of particular interest to the military departments.

This was an interesting concept, but the members of this new Committee had somewhat different ideas. Dr. Bush wanted to pursue the direction taken during World War II by the National Roster of Scientific Personnel, which was a census-like type of program. With a committee consisting largely of psychologists, however, you can readily see why an entirely different program developed. Dr. Bush's ideas were not just simply thrown out, but relegated to a relatively small program on manpower research which is still one of our interests.

The Committee then formulated a broad program in the psychological and social sciences. This program was based essentially on the contributions made during World War II by the psychologists working within each of the services and by the National Defense Research Committee's Applied Psychology Panel. Each of the services had already instituted

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on a continuing basis several important psychological laboratories which were initiating research investigations into several vexing problems, most of which had plagued the military for many years.

You may well ask at this point: Why psychology? What is the background for this science to justify an extensive program for the study of human behavior? Wars are the reason. Well, war--what people have been doing for thousands of years, anyway, and the only new things are weapons, or equipment, that is, hardware of all kinds--not a different breed of people.

The science of psychology really goes back historically a fairly short time, especially when one tries to compare it with chemistry, physics, or engineering. Much of one's thinking about human behavior takes the form of, "This is common sense. Everybody knows that!" But, we have learned much about the science of behavior these last 20 years to realize that human beings are individuals, with many and varying combinations of traits, capacities, temperaments, interests, motivations, and other characteristics that common-sense thinking just doesn't explain.

This type of looking at the science of behavior is not confined to seeing man through the military eye alone. It is the way we would look at a more common denominator of man, since he tends to behave in a basic pattern in responding to stimuli, whether in school, in the military, or in a factory. What we really want to do is to exercise control of a series of conditions for the sake of science, to use man as a guinea pig, hopefully, with full knowledge of the variables we want to measure under controlled conditions so that general principles of behavior can be better formulated and knowledge about the differential characteristics of human behavior can be better utilized in assisting man to make his way through life.

Intelligence, for example, has been defined by some psychologists as the capacity for adjustment. Whether or not we agree completely is beside the point at this time. What we are concerned with is the fact that man is almost continually making adjustments. Scientists in this field are trying to develop more knowledge about this kind of behavior. Man's adjustment to his environment actually starts before birth, when, like any animal fetus, he is subject to the environmental pressures that affect the embryo. Continuing readjustments are the rule rather than the exception, and these go on during his lifetime. The impact of his family, especially his parents, during the first few years of his life actually provide the engram or basic pattern of emotional behavior which will stay with him from then on. When he is ready for school at the age of six, he is usually tested to determine his intellectual readiness for school. Has he reached the proper stage of maturity at this point?

It is here that we really learn there are two kinds of problems, one, the cognitive or intellectual, the other, noncognitive or personality and temperament characteristics. In the cognitive areas, the

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scientific psychologists have specialized over the years and have been quite successful in understanding and measuring intellectual capacities of individuals. They have also emphasized and re-emphasized the fact that there is a tremendous range of individual differences. Study after study has proven this, but many people still refuse to listen. The military is slow in accepting this fact, too.

In the noncognitive areas, the psychological scientists still admit they are babes in the woods. There is some knowledge about these elusive characteristics, and there are many measuring instruments, but it is admitted that very little of a conclusive nature has so far resulted. The variables are too complex. They cannot be properly segregated, and our tools are as yet too crude to give conclusive evidence which would provide suitable principles of behavior which can be generalized. Therefore, we must concentrate much of our effort on noncognitive variables which are known to have strong influence on cognitive behavior, but about which we can only surmise, rather than truly understand and predict.

Why is it we are so intent on developing so comprehensive a knowledge of behavior? One of the prime objectives of the science of psychology is prediction. Obviously, the more you know about an individual, the better you can predict certain facets of his future behavior. That is what the psychologist wants to do. He hopes, as he progresses with his science, to achieve such predictions within extremely narrow limits of error. For example, by administering certain tests, he can predict that an individual grammar school student will be able to complete college successfully 10 or 15 years later. His tests, however, are not refined enough to permit parallel predictions of interests, motivations, or other related characteristics, at the same time. Therefore, we can only say that the student has the ability to succeed at the college level.

Progress, nevertheless, has been achieved in the cognitive areas where the psychologists deal with attitudes or special abilities. This program has been relatively successful in the many selection and classification activities found in the school systems, in industry, and in the military. As soon as the research worker can determine the proper criterion for a given job against which he can validate his testing instruments, he can construct a very useful predictive device that will really work.

I bring in this technical fact to indicate that what is relatively easy to do with the several areas of cognition--that is, with enough money and scientists to tackle the variety of jobs in the country--becomes much more difficult when one follows the same procedure with noncognitive traits.

Here are some questions to demonstrate the difficulties involved. What kinds of personalities are best for staff officers, or for line officers? What are the fundamental traits and characteristics of good leaders? What kind of person makes a good pilot? Think these questions over, as you may wish to discuss them later, either with me or among yourselves, and you will find great variety in the answers among a group such as this.

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The armed services have recognized the value of research such as I have so far described, and are supporting it as an important part of military activity. Such investigations also have a weighty influence on military economics, and ultimately on taxes, in which all of us are really interested. The better a selection, classification, and assignment program is, the shorter are training programs, the less is economic waste, the more realistic are the costs. The research really pays off here, because industry, too, recognizes this saving, as do the educators in almost all of the States.

Let us take a look at some other facets of our research and see where they, too, are important. Machines, weapons, equipment, radar, sonar, vehicles, guided missiles--none of these sound like a psychologist's paradise, but they really are. It will surprise you to know that the demand created by the armed services and industry for psychologists to undertake what we call human engineering research and consultation could absorb three to four times as many as are already working in this field.

Let me illustrate with a simple example. Human engineering means engineering for human use. Your automobile, as it is now designed, occasionally needs minor repairs which have to be made under the hood. The repair job today costs two to four times as much as it did before the war, not because dollars are cheaper, but because the time required in man-hours is much greater for the same simple adjustments. The new car is not designed for ease of maintenance. Try changing a tire--in fact, drive many of these cars and reach for one of the knobs to activate a switch without looking. It is very easy to manipulate the wrong switch. As a result, the operator must use his eyes--something that he should not be forced to do. The airplane instrument panel, the tank's controls and instruments, range finders, gun sights, many items of equipment have become too complex and difficult either to operate or maintain, by virtue of design which took no cognizance of the human, either as operator or maintenance man.

We heard recently about a vehicle that was produced at the request of the Army Ordnance Corps. Somebody examined it and found something like 250 items which could have been designed differently and more beneficially to the people using that truck. For example, the exhaust and the air intake for the cab heater were located something like 6 inches apart. You can see who is going to get the carbon monoxide.

We have another problem in this field. The engineers have demanded automatic or semiautomatic weapons and equipment. Many of them work extremely well, but for only 20 to 30 percent of the time needed. These are expensive gadgets, especially since wars are fought 24 hours a day, not seven or eight. Therefore, we carry three or four of each of these complicated items to fight around the clock. I am thinking especially of various radar and sonar equipments, those which are essentially electronic in nature, and where the problem of reliability has become quite important

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We need very few operators for these gadgets, but there are never enough maintenance men around, competent ones, to do quick and satisfactory repairs. This is a serious note--when your equipment is needed every moment.

Two years ago bombing missions showed as much as 40 to 60 percent aborts due to equipment failure. Today this is down to 15 to 20 percent--still too high a figure. New plans and new weapons systems cannot carry built-in maintenance men. We must re-evaluate the trend towards automatic equipment for many tasks, and determine whether a complex of less automatic equipment plus reliability plus men is or is not as costly for the specific mission as fully automatic equipment plus unreliability plus maintenance men and maintenance costs.

New weapons give the soldier greater security in battle, but new weapons also create added problems at times, and security becomes meaningless. The new 3.5 bazooka did very well against the enemy in Korea in the daytime. At night the flame from the bazooka outlined a beautiful target to the enemy. Obviously, the bazooka boys became less anxious to use the weapons at night. Something has to be done about this flame if this weapon is to be used for fighting during night combat.

Air accidents have decreased tremendously in the past 10 years. Many innovations are now available in the new planes. These have been contributed in large measure by the human engineers, improving lighting conditions, legibility of instruments panels, placement of control systems, and so on. If we could really compute the savings here alone, they would run into millions of dollars per year.

Those of you here are well able to examine the progress and changes in education over the last 20 to 30 years. The methods used here in your education are not all identical to what you yourselves experienced in high school or in college. The school programs in general have modified their activities, their philosophy, as a result of scientific studies, but controversies still exist. The newer or more progressive type of education has developed a so-called child-centered curriculum which is based on the idea of teaching the whole personality and exposing the child to a variety of experiences in order that his interests and experiences may be enriched in all respects. This is in contrast to the teaching of the three R's.

There are many external factors in this controversy which are not our particular concern here. Let us take this newer concept and look at industry, where so many organizations have taken the responsibility for more than the workers' 8-hour day. Studies show that in many instances such paternalism may have no effect on actual productivity, but it has cut down on labor turnover. This is an important element when you examine the relationships there and what it means to industry. Turnover is an extremely serious and costly problem to industry. It means more time wasted in training new people, more employees to do the training, added supervision, and of course, added costs.

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The armed services have a similar problem, but since the whole environment is so different, the research must consider many different variables. Training is expensive, but many military jobs are not found in industry, so that the labor force upon which the armed forces draw is not by any means a skilled group in the sense that you have a skilled die cutter who may be moved from one factory to another and bypass training. When you can count on your labor force for a possible 2-year maximum, and certain skills for military service take up to 1-year of training because of basic training, transfer time, leave, and developing on-the-job experience of a practical nature, your investment doesn't really begin to pay off until you can count on at least one re-enlistment.

Science has to find ways and means of providing better training methods, of shortening training time, of improving the level of training, of evaluating training and training results, so military objectives can be met and maintained with reasonable economy of operations. An industrial organization can go to Office of Price Stabilization and ask for a price increase for their product, if they can justify the increased cost. The Department of Defense can go to Congress and find out they are wasting manpower and that industrialists can tell them how not to waste it, despite the great disparity between industrial and military economics.

American industry has successfully developed and used the assembly-line technique. The armed services have also found ways of using this method in somewhat limited fashion for certain types of tasks. The advantage that favors industry is that training for assembly-line routines is minimum and need require only an unskilled person for most line tasks. I recall some figures of two years ago on employees of a certain automobile company. Of approximately 110,000 factory personnel, some 17,000 were skilled artisans. The remainder were semiskilled, a new word coined to cover only a minimum of training for those who would insert a bolt or tighten a nut.

But the armed forces have other problems in training. New weapons, new tasks, new organizations, all mean new kinds of training. Job requirements must be established, training curriculums and content devised, and these must all produce trained personnel proficient at new tasks and weapons, not at all comparable to the job on the assembly line.

Let me add certain additional points. Men in training must be interested; they must be motivated. Training must be accepted by the trainee to qualify him to the level of proficiency predetermined as desirable to meet the requirements. Incentives are available. Sometimes they are used, sometimes not. Some of our research is aimed at evaluating the use of incentives. Here industry seems to do better. They negotiate on incentives; the military does not.

The military must learn more about assessing attitudes, and what changes attitudes, or how they change. During World War II there were

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any instances of the perpetual trainee--the fellow who would wash out, if he could, near the end of a course, and then manage to get to another school, so he could avoid an operational assignment.

I am reminded of some typical actions during World War II with respect to the way in which assignments followed training. I was associated with one of the aviation training programs. Each of the individuals, upon graduation from the training school, was asked to designate that kind of flying he would like to do. The program was then handled by individuals who had no real understanding of how people differed and how interests and motivations were important in trying to make assignments. True, we didn't have the tests, as we would like, but we did try to consider the interests of the individual. When John Doe said he wanted to be an instructor, he was usually sent out to a squadron for assignment in the field, because he was supposedly a coward, according to the feeling of the person evaluating him. For the fellow who asked for immediate field or combat duty, they would say: "He's a good guy. He ought to make a good instructor." That's the kind of relationship that went on. It is not the fault of research. It is the fault of those people who had no idea of research techniques nor what research procedures could produce, and so on.

In some places that is still going on. It couldn't go on outside the services. I am thinking about the perpetual trainee, and the boy who falls from operational assignment because that is his own motivation, his own interest. Outside the services the answer is, "No, unless father can afford it."

I am using these examples to point out there is much to motivation that we don't see in training, as well as in classification or selection. There are many questions and, as yet, few answers. You may know about this. I am bringing this question of motivation into the picture as I discuss each of the activities with programs with which we are concerned. It is a field that we, the research people and the nonresearch people, talk a great deal about and one about which we know relatively little in terms of the real effects on behavior, except as we see it in general terms. Our knowledge is little; our hopes are great.

In the training field there is another program that we are all very much concerned with. It involves the problem of training devices and training aids, and the evaluating of these aids and assuring that they mean something in terms of the training program. The evaluation of training devices and training aids is very necessary because of the costs involved.

You take a navigational trainer--it costs perhaps one-half million dollars, or close to it. Does it provide the training, or can you do that with a piece of chalk and a blackboard? Actually, one such experiment was done on a rather specific navigational trainer right after the war. It was found a few simple charts could do the same job and at a great deal lower cost.

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By this time I trust you are all on my side and that you are willing to help me defend and justify a research budget in human resources. Perhaps we can become a little less formal, and I can talk with you about the operations of your individual committees. These committees are small groups. They are task- or problem-oriented, and require that three or four of you work together on the problem that the committee has selected. How about the other fellows in the group? Take Jim--he's a fine worker, but stubborn. It takes 3 days for you to sell him a point. How about Bob? He is slow. He means well, but he should be on someone else's committee. Henry? He is a bear for work--if he would only stop talking about those youngsters of his! This could go on for some time.

The compatibility of group members is something of great importance to the kind of job the group will do--a committee, a tank crew, aircraft crew, manager-labor dispute, football team--any group or unit that has a common task. What are the variables which in combination produce compatibility? How does this compatibility affect the job to be done? Does one rotten apple spoil others in the group and hurt the job? How does a commanding general pick his staff? How can he do it better?

Those are questions another facet of our research is trying to solve. Social psychologists and sociologists are trying to find out something about interpersonal relations in small groups in a variety of situations, so we can bring together units which can really operate as teams. It is still too early to predict final success in this field, but some exploratory studies are showing real results for the specially selected crews or units as against ones selected at random. We need better techniques for measuring group performance.

Industry has gone into some of this in a large way in many places. You will find many large industrial organizations have developed measures of, first, group productivity, and second, job satisfaction. They try to relate the two in determining how much job satisfaction is required to develop the maximum output in productivity, and how much of the productivity level one needs to develop a satisfactory index of job satisfaction.

A former co-worker of mine developed a job-satisfaction device that you might say sold him to a certain company very quickly, because that was the kind of measure or instrument that company was looking for in order to get a better picture of its entire personnel structure and the way in which management was operating their program.

This is not something that the military are doing on their own hook. There is enough experience, enough examples from industry to point out that many of these research techniques pay off. They pay off in cutting down personnel problems. They pay off in raising and maintaining good levels of productivity. Both of those are extremely important, whether it be for industry or the military. Industry has found that the cost of research, studying the characteristics of interpersonal relations

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between the first-line supervisors, or foremen, and the workers on the one hand, and between the foremen and the executives on the other, has paid off in many ways. Those foremen who tended to be more authoritarian in nature were by far consistently less successful than those whose attitudes and relationships were friendly, helpful, and understanding of their crews' problems. Simple changes, such as retraining the less successful individuals, or where necessary, replacing them, either eliminated personnel problems, increased productivity, or did both.

Stress is another area where we have to take a second look. This is an influential factor affecting the behavior of everyone, though it is dependent on the characteristics of the individual, the environment in which it occurs, and its meaningfulness to the person involved. Fear and anxiety are particularly stressful, and may exist within each of us at times. Noise or other distractions may become stressful. Research is looking into the components of stress and stress situations, to determine not only causes but possible antidotes.

For example, how many of you would volunteer to fly a nuclear-powered airplane? Or, let me ask it this way, How much and what kind of factual information would you require to convince you it would be safe to pilot this plane? Preventive measures can be developed, but it is necessary to isolate and understand stresses if countermeasures are to be taken. In industry, the stresses may take different forms, such as job security, economic status, group pressure (unions or other similar types of organizations) even the stress of a wife, at times--but the same general problems and conditions are there. Our concern is to minimize the effects of stress on behavior, and therefore on productivity, in the military situation.

Let me shift for a moment to mention a kind of research approach which is interesting the United States as a whole today--the Presidential campaign, as we see it in the daily papers. Every day we see the results of opinion polls that show the estimated progress each candidate is making. Opinion polling is essentially a technique devised and improved by social psychologists and sociologists. It is a relatively fast way of assessing the opinions of a population. It was used with marked success during the war by the War Department to study troop morale and to determine the effects of various policies as they affected troop behavior. It was also used to assess public reaction in advance of war-bond drives to evaluate whether or not certain kinds of bond programs would be more effective than others.

You are all familiar with this technique to predict election results. One of the real problems in this field is sampling. The 1948 election was not accurately predicted because of sampling errors. Today polling groups are much more cautious, you will note. I have been informed a number of them are supporting research to improve their sampling procedures and reduce the areas of doubt. This is one time a research organization is paying another research organization to do some good work for them.

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We have talked on for some time about the relationship between science and society, with particular emphasis on military problems with a sort of domestic flavor. I should like to discuss briefly some of these relationships, but this time international in character. Those of you who have spent time among peoples of other nations and other cultures know that as a general rule the American overseas tends not to make friends very easily. Foreign people have frequently described American visitors as uncultured, boorish, unsympathetic with other ways of life, and in other unfavorable terms. Fortunately for us, the Russians are a few steps lower down on the same ladder, but we should not feel safe in this respect.

If we want to be looked up to as a people, we have to do a lot of learning about the behaviors and meanings of behavior to others than Americans. This is true of the Latin Americans, as well as Europeans and other groups. We need to know a great deal more than we do about the characteristics, customs, the mores, and the relationships of other cultural groups. Social scientists are hard at work trying to extract, understand, and clarify many of the traits and characteristics of the many national groups, cultures, and societies we are meeting today in the international area.

It is true that they must learn as much about us, but if we want really to live the role of international leadership which we are obliged to take on, we must do something much more active in living this role successfully. Propaganda must make sense to the target audience in terms of their own culture. Contradictions between the broadcast or written word and the behavior of military or civilian personnel can detract very quickly from our national policy of international security.

Research here again is seeking to determine the skeleton which becomes the structure for the flesh and blood policy and administrative procedure. This is not unlike the negotiations between labor and management, or government and industry, except the framework is different and the stakes higher.

There is one more program I would like to talk about, which is not essentially a research program, but research is being put into it. It is the problem of utilization of research results.

Here we have an interesting dilemma, because, in our field, the field of psychology, and in the social sciences, we don't have the engineers, as do the physicists and the chemists, to see that the research is put into meaningful fashion for use in the developments for those who need that kind of equipment. Psychologists and the social scientists themselves are partly to blame, because they are small in number in comparison with the natural scientists and their associated disciplines. It is a very new thing, in a sense, because the history of psychology is essentially only about 40 or 50 years old, and everybody in the field is interested in becoming a research investigator.

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One of our problems is to try to develop some sort of educational program which will produce what we might call, temporarily at least, the "social engineer"--the person who can take the technical reports and put them into more useful form, so that the public and the military organizations can receive that benefit. It is being done in a few areas where psychologists have worked for longer periods, and where their research has become an accomplished development.

I am thinking of testing programs in the educational field, the military field, and the industrial field. But there are many other facets for social engineering that are not being utilized properly. Too many psychological reports that have value are put on the shelves. Somebody reads one and says: "It's interesting, too technical for me. It isn't any good for my program today or tomorrow." That's chiefly because he may not understand it; also, because it may not be written for him to understand.

That is one element we are trying to overcome. I may say we are at fault on the one hand. On the other hand, shall we say, our users are also at fault because they are a little reluctant to accept something they do not know. We have got to develop what amounts to an intermediary--a person who can understand the user's problems perhaps better than the pure scientist can, and also understand the scientist's point of view, and bring the two together in a more or less satisfactory fashion.

I have tried to give you a picture largely in terms of military psychology, but I have spread it out a bit so you can see it is in a sense psychology as a whole. Actually, military psychology is nothing different from the psychological research we do elsewhere, except it is largely confined to military programs and the military problems. It will take us time before we can convince you and others that what we are producing will affect military operations, military activities, in a way that will be useful in future military campaigns, in a way in which a military program can operate with greater economy and greater acceptability by both the people in it and the public outside it.

Of course, along that line I would like to say just one final word. Research is a gamble. We need not kid ourselves. It means you pay extra dollars for two or three chances, to try to develop one technique that may pay off. Two or three procedures are tried. One may pay off. None may pay off, because of our lack of knowledge in a given technical field at this stage of the game. Five or ten years later you may get an answer which will ultimately save millions of dollars.

All I can say in this regard is that you take a second look at research and at science, and realize that it is not all in terms of hardware. It also concerns the human being, who, we may say, is still around and is likely to be around for some time; because, if you are going to replace him with all the hardware, I don't know who is going to do the directing, the planning, and the actual day-to-day operating in a military campaign.

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QUESTION: Doctor, I understand some research work has been going on up at Bethel, Maine, in connection with group behavior. Can you tell me more about that?

DR. NADEL: I can tell you a little about it. The course at Bethel is really a training program. What they try to do is get groups of people together and let them learn through experience how to handle themselves in a group situation. It is called leadership training. In association with that are various research activities where teams from several universities spend a period of time at Bethel attempting to collect data for their research studies on group processes in one way or another.

For example, take one of your committees where three or four of you work together. If you are concerned with the job itself primarily, any relationship among you may be minimum and create no problem. On the other hand, depending on the problems of the individuals, they may, at times, interfere with the job you are doing because of disagreements, and so on, stemming from individual personalities. Areas of that nature are where some of the research on authority and training is aimed.

QUESTION: Dr. Nadel, at what period in the progress from design to testing can you apply rather effectively your human engineering? A closely related question would be, To what extent have you been able to measure all physiological characteristics that would enable you to set up zones of effective operation, which information could be made available to the engineer at the time he is designing the equipment?

DR. NADEL: Replying to the first part of your question, actually it is our feeling, and it is the attitude that our people in this field have taken, that we can contribute human engineering elements at any stage from the initial design or blueprint--if you will, the initial stages of design--to the actual presentation of the equipment for acceptance. For example, if you build a plane, the usual tendency in the early mock-up is putting in all sorts of black boxes. When you are all finished, you say, "Where do we put the pilot?"

This last year the demand for our people has been increasing. As an example, in many of the mock-ups they can offer assistance in early design of a plane. In other activities we have prepared a few handbooks. I may say that, within the last 2 weeks, the departments have, at least informally, agreed to support a research activity which the human engineering panel proposed. It would aim towards developing a general engineer's guide in human engineering. It will present the data on the equipment and systems in which these data are to be used by the design engineers and, as an added fact, written so the design engineers can understand the information. As far as data are concerned, many of those reports have been turned over to design engineering groups, but the data were not all presented to be utilizable by the engineers. A new activity developed about a year ago which the departments in many instances have continued, especially

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where they have contracts with industrial organizations for design of new equipment. It was proposed that each contract contain a clause to assure that all appropriate equipment has had human engineering guidance. And I may say that the psychologists ultimately hope that the engineers themselves can incorporate in their own training enough human engineering so that they can count on the psychologists largely for the research data that are needed for human engineering new equipments.

QUESTION: Industry is doing a lot of attitude surveys to evaluate the strength and weakness of their working conditions, their employment conditions, and the other factors that affect their efficiency. Have we gotten into any of this attitude survey in the military field?

DR. NADEL: Yes, sir, as a matter of fact, with problems. During the war we had the troop Information and Education (I&E) activity which had a rather large-scale Morale Branch. They all involved attitude survey types of approaches. Since the war, with unification, in the Department of Defense there is an Armed Forces I&E Branch that is located in the office of Mrs. Rosenberg. Their responsibility, on requests from the services is to undertake attitude surveys to determine what problems exist in certain areas, what the opinions and attitudes of the troops are, and as a result of that, to attempt to formulate any changes in policy if such is necessary.

QUESTION: I was interested in your remark about supporting the choice of careers of men, where you said that they sent everybody who requested instruction duty to combat, and everybody who requested combat to instruction duty. Now, perhaps some of the people did honestly want to be instructors, and they would make very fine ones. By the same token, perhaps some of the people who requested combat simply did it because they thought it was the thing to do and they would be criticized if they didn't. How much progress have we actually made in determining that sort of attitude, actually getting to the determination of what a man really wants and what he can do best?

DR. NADEL: We have a fair amount of research going on there that fits into this problem I mentioned in the field of interest and motivations, where we have to admit we are still somewhat stymied. We are not doing as well in producing the kinds of techniques for making those tests as we are in the intellectual and aptitudinal areas. The possibilities are that we will have some results in the next year or two that will indicate better ways of understanding that particular kind of behavior in individuals. That is our problem, and that is where we are really working at its solution. We won't deny that, because we realize how big a problem it is.

Colonel S. L. A. Marshall, 1/ after World War II, pointed out that on the basis of surveys he became aware that only about 25 percent of the 1/ Officer in Infantry Reserve, former regimental commander in World War II, journalist, and author of Men Against Fire, etc.

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men in combat actually fired their weapons. He took that hypothesis and went over to Korea for the Operations Research Office for the Army, and found that at first there was no great difference. Then the information was passed to the command in Korea, and they started trying to develop, you might say, on-the-spot techniques for motivating the men to improve the percentage of those who would fire their weapons.

There are many reasons why they did not fire their weapons--they were hiding out in a hill or, at times, the conditions of the environment were such that nobody was anxious to stick his neck out to see what was going on. Other times they were preserving their ammunition. It becomes difficult to fire a gun at a target you can't see.

Many of these factors have to be taken into account. I might also say that when Colonel Marshall completed this investigation over there, he found that the percentages could be increased now to about 70 percent as against 25 percent. All of this represents motivation and many other factors.

QUESTION: Doctor, normally in this human engineering you find that there is probably more money spent and more accomplishment in the cockpit and the general setup of an airplane than there are in navy ships or automotive equipment, or services having tanks. Why?

DR. NADEL: I wouldn't make it as broad as you would like, because the submarine force, for example, has accepted human engineering with a longer history than the aircraft industry. The aircraft industry has been forced into it, because there are many more planes and their have been more accidents with tragic results. Safety factors primarily based on human engineering have become important and acceptable to the aircraft industry and to the aircraft groups in the military.

QUESTION: Look at the cars, automobiles. Over a period of years you have accidents, with more damage. There ought to be more people interested in getting safety built into them.

DR. NADEL: Sure. The aircraft industry when it comes to flying, is essentially a public utility, like a railroad. If the busses had as many tragic accidents, if there were accidents on the bus lines and street railroads, you would find the public gets incensed. You own your car. I own my car; that's private property. We have no rules created by government or public utility commissions. That is one of the things you have to take into account. There has been a lot of improvement in automobile design that takes safety into account, but the prime interest is on sales and sales promotion. Designs that have gone into automobiles have been for eye appeal first and safety effects secondary, in relative terms. Anything that is essentially a public utility or public transportation has a pattern which is quite different.

QUESTION: Doctor, would you care to elaborate on any of the results of research in the selection of leadership or staff members?

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DR. NADEL: Well, I can't give you too many of the actual details in the characteristics. I can say this, that some of the leadership studies, and there have been many different kinds of studies, are actually trying to develop characteristics that make sense and can be utilized; but, like the same area in the question asked a few moments ago, the problems of motivation are not yet clear enough. We can take two people, both of whom actually seem to be capable as leaders in a given kind of work. This fellow can be a leader in anything; this fellow can be a leader in only one kind of thing. You try to put him in another job and his leadership characteristics fall apart. What the basis for that might be, I don't know. We haven't been able to pull out individual characteristics or traits so that we can weigh one thing with another.

The same thing goes in trying to get a definition of leadership. We can define leadership and try to get a program at hand under that aegis, but many people have different ideas of leadership. We keep up research in that field because we are trying to find out something that, you might say, will develop a common pattern that we can accept and analyze and make use of in leadership selections. There are some techniques available. I can tell you what the traits are. They have not been isolated, but they have been assumed to fit certain patterns and have been put into various test instruments. They're working to some degree in certain kinds of situations.

QUESTION: Can you tell me the relationships, if any, that exist between the military programs in scope and their affiliated agencies, such as the National Science Foundation, the National Institutes of Mental Health, and many others?

DR. NADEL: At RDB level we have a committee and a number of panels. We have a complete exchange in our meetings and in our literature with both the NSF and with the National Institutes. The individual in charge of the psychological programs at the NSF is an associate member of our Committee and also sits with one of our panels which has interests similar to the Foundation in their program of the selection of students for graduate training, for fellowships, and so on. He meets with that panel and also with our Committee. We are also represented through the Chairman of our Committee, who is on the advisory group in psychology to the NSF.

In regard to the National Institutes of Mental Health, we work closely together. The individuals in charge of their research program knows what we do, and we know what he does. We happen to be, in a sense, a small branch, by virtue of our mixed interests. The people involved up there are people we know rather well. We do get together, formally and informally.

QUESTION: Dr. Nadel, in thinking about the problem that you spoke of last, or applying results of research to various situations, there are two broad approaches to that, as I see it. There is what you might

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call the direct communication approach, or the written approach, which I gather from what you said you are using largely in developing these intermediaries. Is my conclusion correct on that point? Have you made any progress, and do you see any advantages in trying it? Also, there is the alternating communication approach, or the face-to-face communication approach, which is more difficult. It is slower, perhaps, but it has a great advantage of feedback, which you recognize as being an advantage.

DR. NADEL: As far as the details of communications are concerned, you are getting down to methodology with which, at the committee level, we are only indirectly concerned. It is not my job, for example, to sell the Bureau of Aeronautics in the Navy, or G-1 in the Army, on this or that particular research project. It is up to G-1 to find ways of transmitting this research, so it can be utilized, to the technical services, and the technical services to prepare the appropriate directives, etc., which are accepted. In terms of such alternating techniques, etc., I could not answer that one way or the other. The work is being done. We feel, however, that a scientific psychologist who is not really trained in the application of many of these research results for everyday life is not always the best person to do that kind of a job.

QUESTION: Doctor, to what extent have you met with success in testing the adaptability of candidates for flight training?

DR. NADEL: Quite a great deal of this goes back to the early days of World War II. Both services have developed rather good techniques in their testing programs. For example, I was associated with Naval aviation training during the war. I know a little bit about that, perhaps better than I do about the Air Force program, which had a parallel kind of history. The programs there developed test batteries which correlated rather well with success in training.

For example, we had a group of five flight aptitude ratings for candidates, and we knew that 5 percent or less with flight aptitude rating A would fail. They usually fail for other reasons--a few of them for aptitude reasons. In the group with flight aptitude rating B, as many as 15 percent would fail. Of flight aptitude rating C, 30 to 35 percent would fail. Of flight aptitude rating D, 50 percent would fail. Those with flight aptitude rating E we didn't take into the program.

In the Air Force they have the "stanine" system. Before that the selection was by guess or "by gosh" in a lot of aviation pilot selection. That was based on estimates of intelligence. As a general rule, 50 percent or more of the candidates were washed out. Through the tests that have been brought in, with allowance that the failure rate, you reach into levels where--of course, we don't always know which individuals will fail--we know that at least 5 to 15 or 30 percent will wash out. In the last 10 years the failure has been something like between 23 and 28 percent

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per year, as compared with the 50 percent per class on the average, or worse, before these tests were introduced. You add that up in terms of \$30,000 early in the war per candidate, \$40,000 in 1945 per candidate, and between \$60,000 and \$80,000 per candidate now, and you can see what that means in savings.

QUESTION: Doctor, you mentioned some of the things we should do, particularly with motivation. I don't think anybody will argue with you about the need for that. The question I would like to ask is in connection with phasing of some of the psychological testing and approaches to some of the problems; that is, the phasing of the application of the test as applied to whether or not this is the proper time--how far you can go, or should go, at this time with a particular formula. Perhaps there are areas of caution that should enter into that phasing before going all out on something which could be costly, perhaps, in the budgets or other fields of motivation or interest.

DR. NADEL: Let me put it this way--perhaps that may give you the answer. The research people in this field are extremely cautious. Nobody likes to have half a test, that seems to be proved, put into operation. I say "half a test" in the sense that certain elements of the test and items, etc., gotten to put together for one part of the answer, may be evaluated and used the same way as a whole test. They are very reluctant to let part of the job be turned over for application. They prefer waiting another 6 months, or sometimes 3 to 6 years, to get a full job adequately accomplished.

There are lots of tests that are available, and many places that they have been validated against military jobs. These tests by themselves still make sense and may do a good job, but so long as they are not validated, we will not know what they are trying to measure concretely.

I will say the members of our profession are very reluctant to throw them into the mill for the sake of having something available.

QUESTION: Doctor, would you care to comment about what is being done leading toward the improvement of officer effectiveness reports?

DR. NADEL: Well, I may say that within the last 6 months I have seen about three to five reports in from the Army on kinds of studies that are being made on ways and means to improve the officer effectiveness report.

What I would like to say is that research is going on in all the services to improve these reports. On the other hand, I am going to turn the tables and say, many officers don't like to fill in such reports, no matter how brief or how extensive they are. It is the same thing with any kind of evaluation work. There is tremendous reluctance to do it, because in some instances it may not fit the characteristics that you yourself would like to enter.

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It is being developed in this way for certain reasons. First, we have got to get a spread. I am familiar with the Navy efficiency report. I don't know how many times during the war it was very difficult to find anybody who got less than 3.5 out of 4. Anybody who got 3.4 or below that was looked upon as being not particularly good material. We are trying to get instruments that allow for spread, because that is the only way you can determine the relative effectiveness of individuals in groups as related to other people.

You see this is going to be a running battle between the research people and the officers for the next one or two generations; at least until somebody finds another technique that doesn't show itself by the name "efficiency report" or "effectiveness report." That is something we are going to have to work out together.

QUESTION: We have been discussing these various tests and research on the individual. Does your Committee have any recommendation to give the Department of Defense on how to pick students for a college of this type?

DR. NADEL: Well, it is another selection program. We have got to consider certain possibilities. What do we want ultimately? I will approach it as if it were a particular research problem. What is the criterion we are after? We want generals and admirals who are capable of having certain kinds of understandings and outlooks about their programs. Therefore, we have got to find out something about people at that level, and what the usual rate of progress is there. We can work backwards, taking the characteristics that apply and translating them into test items of one kind or another. It may lead to a particular test, or it may include items of an individual's background, motivations, interests, and the like, putting them together as instruments for interview or as a technique for review of the individual's background. What we would look for are the critical items or incidents which are found. If they are on one side, they would help to project a successful person at top levels, as against critical incidents which, if they are on the other side, indicate people with these characteristics who are failures if they come up to this level, and so on. It is the kind of procedure you have at every level along the line.

I will say this. In many ways the research people have not been asked to tackle certain of the selection problems that would fit into what we call advance selection that takes a matter, in many cases, of administrative assignment. On the other hand, there are things the military does that give advantage to the top echelon, commanding generals or admirals in different areas. The admiral or general has the prerogative of picking his staff organization. The assumption there is that he knows the kind of people he wants. Then the problem always arises: How are we going to train people for that operation? Does that mean that every time a new staff is picked, the officers have to undergo an orientation

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program to understand what a staff officer's function is? You know people who have served on staffs all through their military history. They don't know what an operating program is like, because they have not been in any field operation.

You have an operating complex, but you have compensatory approaches for these things. If research is to be done, there are ways of doing it. It will take a little time to work out the characteristics that make sense--motivations and interests. We have that problem all over again, because in incidents, decisions, and other places are where combinations build these characteristics.

QUESTION: In the human relations and leadership field you find a heavy reluctance on the part of people to assume that real authority comes from those who work for it. If that is a fact, how do we go about convincing people that you get effective performance by willingness and enthusiastic participation on the worker level?

DR. NADEL: Well, I can't relate it; that is, I can't relate the second part of your question to the first part. I will answer the second part. That is largely a matter of history and tradition. If you go back historically, I think you will find that we have had the general feeling--that is not only true in the military; it has been true in the American culture pattern in many ways--that the authoritarian type of person who gives orders should have those orders carried out. For example, youngsters are taught in the school room that the teacher's word is law--you don't argue or dispute with the teacher. You get a certain authoritarian concept that way. When you go out into business, the boss is the boss. You can have it in school and in industry, and you have it in the military--the feeling that when the commanding officer gives an order, there is no question or dispute about it.

So much of that depends upon the situation. Of course, as far as the other concept is concerned, it is a problem of guidance, if you will, of fighting for some idea--what many of us believe to be the traditional and basic complex of democratic principles--something we have got to learn and relearn in many ways. We cannot do it completely in the military situation, because there are circumstances and situations where somebody has to give an order because it is a matter of life and death.

Now, in industry, and in certain kinds of trade activities you get in the military, you can modify the relationships to get that accomplished. I think I mentioned that briefly in my earlier discussion about the ways in which foremen are found to be successful or unsuccessful.

Does that answer your question?

COLONEL PRICE: Dr. Nadel, for the faculty and the students I wish to thank you for a very instructive morning.

(12 Jan 1953--350)H-G/sgh

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