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ABSTRACT

This paper suggests that the occupational hierarchy is based on functionally important differences among workers and their jobs and proposes a modified functional theory of occupational stratification. Section I examines the role of education in social stratification. Sections II, III, and IV review (1) functions of schooling, (2) evidence about the relation of intelligence to performance at work and in school, and (3) evidence for the multidimensional nature of job demands. Section V presents new evidence showing that cognitive and non-cognitive demands of work are related to the activities occupations actually require workers to perform and the more difficult jobs tend to be the most critical and prestigious. Section VI provides new evidence that educational requirements for jobs can be explained largely by intelligence demands. Section VII presents a theory of naturally occurring occupational hierarchies. A review of the contributions of previous sections to a modified functional theory is followed by speculations about how occupational hierarchies arise in response to differences in intelligence in a population. The issue of how education relates to these structural processes is explored. Section VIII discusses implications of the theory for educational policy and stratification research. Additional detail about data, tables and figures are appended. (YLB)

THE ROLE OF INTELLIGENCE AND EDUCATION IN THE DIVISION OF LABOR

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Linda S. Gottfredson

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The Center

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through three research programs to achieve its objectives. The School Organization Program investigates how school and classroom organization affects student learning and other outcomes. Current studies focus on parental involvement, microcomputers, use of time in schools, cooperative learning, and other organizational factors. The Education and Work Program examines the relationship between schooling and students' later-life occupational and educational success. Current projects include studies of the competencies required in the workplace, the source of training and experience that lead to employment, college students' major field choices, and employment of urban minority youth. The Delinquency and School Environments Program researches the problem of crime, violence, vandalism, and disorder in schools and the role that schools play in delinquency. Ongoing studies address the need to develop a strong theory of delinquent behavior while examining school effects on delinquency and evaluating delinquency prevention programs in and outside of schools.

The Center also supports a Fellowships in Education Research Program that provides opportunities for talented young researchers to conduct and publish significant research and encourages the participation of women and minorities in research in education.

This report, prepared by the Education and Work Program, addresses the issue of how education is related to occupational outcomes. A modified functional theory of occupational stratification describes the roles of intelligence and education in preparing people for jobs.

Abstract

This report reviews evidence that the occupational hierarchy is based on functionally important differences among workers and their jobs and it then proposes a "modified functional" theory of occupational stratification to explain the relation of education to occupation. The theory reflects a change in emphasis from current sociological theories of social stratification in several respects: (a) it gives greater attention to explaining structural phenomena, such as the occupational hierarchy, and how they relate to individual-level career processes, (b) it gives a central role to differences in intelligence in the evolution of social structures, and (c) it treats education as a useful but perhaps not necessary mediator between individual-level and structural-level occupational processes.

The central assertions of the theory are that:

(1) Occupations differ in the general intellectual difficulty of the tasks they require workers to perform on the job.

(2) The occupational prestige hierarchy primarily reflects an ordering of occupations according to intellectual difficulty level.

(3) Occupations that are higher in intellectual difficulty level are more critical to the employing organization.

(4) Large differences in intelligence in the population are evident by the early school years and this distribution is not substantially changed, at this time in history, by school or work environments.

(5) The occupational hierarchy has evolved and is sustained over time because enduring differences in intelligence within populations create pressure for segregating work tasks into different occupations by difficulty level.

(6) The degree of differentiation (i.e., mean differences in difficulty among occupations) in a hierarchy is affected by the efficiency (i.e., validity) with which people are sorted by intelligence to occupations.

(7) Only moderate levels of efficiency in sorting by intelligence are necessary to sustain a highly differentiated intelligence-based occupational hierarchy.

(8) Education (primarily years of education) influences allocation processes (i.e., the status attainment of workers) to the extent that employers use education as a signal of worker quality.

(9) However, employers will rely on educational credentials only to the extent that education actually is a useful signal of worker competence (useful meaning not only valid but also having a favorable cost-benefit ratio compared to other possible signals).

(10) Educational level has been the most useful (but not the most valid) indicator of worker intelligence in recent history, but its value to employers can wax and wane as social policies and practices change its relative costs and benefits as a signal of worker quality.

The implications of the theory both for educational policy and stratification research are also discussed. It is argued that the widespread failure among both laymen and researchers to appreciate the limitations of schooling in preparing people for jobs leads to educational reforms that are bound to disappointing and that thus stimulate a new round of criticisms of the school system. And the widespread failure in stratification research to distinguish between the value of education for getting a job versus performing it has created enormous confusion in the literature.

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Table of Contents

I. INTRODUCTION: DEBATES ABOUT THE ROLE OF EDUCATION IN OCCUPATIONAL STRATIFICATION

A striking feature of all complex societies, now as well as throughout history, is that they are highly stratified; that is, there are large and enduring socioeconomic differences among members of those societies. At least in industrialized countries, these inequalities are intimately related to an occupational hierarchy in which some jobs are widely considered more attractive and rewarding than others. The nature, origins, and fairness of inequalities in life circumstances have been central issues in sociology and, because educational attainment is so important in determining who gets good jobs and who does not, these issues have formed the backdrop to much of the research in the sociology of education. The effectiveness and fairness with which schools prepare students for the workplace have long been of great concern to many people throughout our society, but arguments about <u>how</u> the educational system may be unfair have shifted over time.

I begin this paper by examining these shifts in opinion because they mirror an increase in the apparent popularity within sociology of "nonmeritocratic" over "meritocratic" theories of occupational stratification. The paper describes some severe defects in current meritocratic theories, defects that help to explain why such theories are falling into disfavor in many quarters. However, it also reviews evidence, both old and new, that the fundamental premise of meritocratic theories is sound: namely, there is a functional basis or value for the occupational hierarchy that accords with meritocratic principles. This paper proposes a third approach--a "modified functional"

theory--for understanding how occupational hierarchies develop and are maintained and what role education plays in those processes. The social problems that have stimulated shifts in public opinion about the value of education are quite real. It is argued here, however, that commonly-proposed solutions to these problems are unlikely to prove very effective because they are generally based on fundamental misconceptions about the value of education for preparing workers to actually perform the work it enables them to obtain.

A. Shifting Basis of Claims that Educational and Occupational Processes are Unfair

The closed competition. Prior to the 1960s, concern seems to have focused on opening the competition for education and jobs and on allowing talent to rise to the top unimpeded by artificial barriers. The adoption of statutes against discrimination on the basis of race, sex, and religion, the provision of free public elementary and secondary education, the establishment of relatively inexpensive state institutions of higher education, scholarships on the basis of merit, and an increasing emphasis on using universalistic standards (e.g., standardized test results) for selection in education and employment all reflect an effort to find and cultivate talent regardless of sex, ethnic group, race, and social class background.

The unfair competition. By the mid-1960s, persistent social class and race differences in educational and occupational attainment alerted many people to the possibility that the competition was organized to favor or handicap certain types of people. It was frequently argued that less advantaged youngsters entered school already behind in the competition as a result of earlier cultural deprivation. It was also argued that schools provide better educa-

tion and more rewards to white and more affluent students, thus dooming disadvantaged youngsters to fall further and further behind their more advantaged peers as they advance in grade level. The educational and occupational aspirations of such youngsters are thereby also assumed to be severely dampened. Unequal distribution of financial and other school resources, ability tracking by classroom, racially segregated schools, differential teacher expectations, and biased testing were suggested as prevalent and important sources of bias in the schooling process. Remedial programs, open admissions, and scholarships based on need were widely adopted in order to reverse earlier adverse circumstances. However, research on the putatively biased school practices as well as on recently-implemented "remedies" showed that neither the negative or positive attributes of schools has had substantial, if any, effects on inequalities in achievement and so has dashed hopes for an easy or quick reduction in the troubling differences in attainment (e.g., see Hurn, 1978).

Competition as subterfuge. The results of the foregoing research and social experimentation have made it more difficult to argue convincingly that specific educational practices are biased in favor of or against any particular group and those results have blunted the force of the more general argument that the competition is grossly unfair. As this has occurred, another basis of iticism has gained in popularity: the competition is a sham. For example, Berg (1970) is widely cited for his argument that education is not related to on-the-job performance. Bowles and Gintis (1976) have attracted a lot of interest with their claims that the actual function of schools is to select and create, not merit, but social class and personality attributes that allow the ruling class to perpetuate its own social and economic advantages. Although academic abilities may be a by-product of schooling, they claim that

these abilities are not actually relevant to the work people perform on the job. They further claim that by stressing the importance of these abilities, dominant social classes create the illusion of fairness and so help to legitimate their own advantages and self-serving practices. This position denies that there is any functional basis for the occupational hierarchy, and implies that the fairness of the process by which people find their way onto the occupational hierarchy is irrelevant because the hierarchy itself is neither necessary nor fair. Educational performance and attainment thus become suspect as qualifications for work, and some theorists (e.g., Collins, 1979) have advocated banning the use of educational credentials in hiring. This position also leads to the conclusion that the hierarchy might be abolished or people assigned to it in much different ways (e.g., rotated through it) than they are now without adverse consequences (and perhaps with positive consequences) for productivity. Although they might not feel comfortable with the particular theories or social policies that have been developed in this vein, many people do feel that the relevance of differences in academic ability and achievement to the workplace has been overemphasized.

B. Current Stratification Theories and Their Defects

The various approaches to the study and explanation of social stratification generally fall into two categories that will be referred to here as revisionist theory and functional theory. The first includes theories that claim that stratification is not meritocratic, including approaches referred to as Marxist, radical, or conflict theories. Functional and meritocratic theories in sociology and human capital theories in economics constitute the other position. Neither of these two general theoretical approaches represents a

fully developed, completely explicit, or single theory, nor is there probably even much consensus within either one about the various issues they address. But they do represent a set of consistently different assumptions about the nature of human talent and the nature of work. (See, for example, Rehberg and Rosenthal's, 1978, comparison of these two perspectives.)

Before discussing either of these general categories of theory, two issues concerning the aims of stratification theory must be clarified.

A focus on hierarchical issues. Social stratification, by definition, refers to the ways in which society is organized hierarchically. When we study occupational stratification, we are concentrating on only one dimension of the division of labor. In addition, although income, occupational prestige, authority, education, and other indicators of social or economic advantage are not perfectly correlated, they do correlate so highly in fact and in common perception that it does make sense to talk about "the" occupational hierarchy and to give it a central place in theories of social stratification. My point here is not that the hierarchical aspects of social and occupational organization are all that matter, for indeed I will argue quite the contrary. The point is that this paper concentrates on that single dimension because it is central to all debates, both inside and outside of sociology, about the functions and fairness of schools in relation to work. It should also be noted that this paper focuses on only one among the several highly correlated hierarchies that are of interest to stratification researchers--the hierarchy of occupational prestige (e.g., the Duncan Socioeconomic Index scale) that constitutes the dependent variable of current status attainment research in sociology.

Distinction between person-level and occupational-level processes. Occupational stratification is best conceptualized as the product of two very different but empirically related pr· .sses: (1) the origins, form, maintenance, and consequences of the occupational hierarchy and (2) che attainment or mobility processes by which individual people find their way onto and across that hierarchy. I shall refer to these, respectively, as "structural" versus "allocation" processes. The long tradition of mobility research in sociology that looks at the fate of individuals or groups in society has examined the second process, but different data are required to study the emergence and functionality of the occupational hierarchy or any other aspect of the division of labor. Conclusions about the fairness of mobility processes are not always especially relevant to the structural issue, although it often appears to be assumed otherwise because researchers (e.g., Crouse, 1979, p. 115) seem to have ignored the possibility that a functional hierarchy can exist despite considerable slippage, and even some systematic biases, in allocation processes. Although allocation processes supply the workers who sustain the hierarchy, and so are clearly important in any theory of stratification, aggregate data about occupations themselves are necessary for constructing any convincing theory of occupational stratification. This paper examines occupational-level data in order to describe structural processes; it then relates these structural processes to the processes of allocation that have been researched so widely in sociology.

One structural feature of occupational hierarchies is of particul·r concern in this paper and will be defined to avoid confusion in later sections. Differentiation of occupations on a hierarchy refers to the shape or form of the hierarchy; it is the degree to which jobs within one occupation are separated

from each other or spread out on the attribute underlying the hierarchy (say, intellectual requirements). Differentiation is not necessarily a stable attribute of hierarchies and, ultimately, any theory of stratification must also account for changes in differentiation over time. This includes not only the original emergence of the hierarchy but also its mutability in the face of various influences. Although many discussions of the changing skill demands in an economy focus on increases or decreases in the elevation of entire hierarchies over time, differentiation is really the feature of most direct concern in occupational stratification because it refers to degrees or extent of inequality between different occupations.

Revisionist challenges to functional theory. Functional or meritocratic theories of occupational stratification (e.g., Davis & Moore, 1945) assert that some occupations are more important to society than are others and that greater rewards are necessary for attracting the best educated and most talented individuals to the most important occupations. Status attainment research focuses only on the issue of allocation and essentially takes the hierarchy for granted, but it does provide some evidence that is inconsistent with the revisionist position. Despite revisionist claims that one's socioeconomic fate in adulthood depends primarily on one's social class background, status attainment research has consistently shown that one's ability and years of education have greater independent effects on occupational prestige and income than does the social class of one's parents (see the review by Campbell, 1983; see also Eckland's, 1980, book review of Jencks et al.'s Who Gets Ahead?, 1979). Furthermore, research has consistently shown that school achievement itself is more highly related to intelligence than to socioeconomic status (Follman, 1984). Similarly, revisionist claims for the impor-

tance of social class-related personality traits in schooling and work have not been substantiated (Olneck & Bills, 1980).

Although allocation processes seem more consistent with functional than with revisionist claims, functional theory has been quite vulnerable to attack in other respects. Revisionists directly challenge the functionalist premise that the occupational hierarchy does in fact have functional value for society, and the functional position has never provided evidence to support it. Furthermore, existing evidence about the functional value of education has been quite damning to the functional position. For example, differences in the educational level of workers are not consistently related to differences in their performance within different occupations; the rise over time in the educational requirements of jobs cannot be accounted for by increases in their skill demands; a high proportion of our population is "over-educated" for the types of work they do; employers are frequently mistaken about the benefits of employing better-educated workers; some employers pay more attention to personality and appearance than to cognitive traits in hiring workers; and the socioeconomic returns to education are not consistent across all types of workers and occupations (see Berg, 1970; Collins, 1979; a variety of chapters in Gordon, 1974; Freeman, 1976; Wright & Perrone, 1977; among many others). While some of these criticisms are more damaging than others, they clearly indicate that functional theory as usually stated has some serious shortcomings.

Four shortcomings of current functional theory that will be discussed in considerable detail later in this paper can be briefly described here. Some of these defects simply reflect a lack of data in the field as a whole; oth-

ers represent overly simple or incorrect conceptions of the nature of work, education, and human talent. One shortcoming is that the nature of work itself--what workers do on the job and the worker traits and competencies required to do that work well--has been almost totally ignored by stratification researchers. The tasks performed by workers do not even have a place in labor market segmentation research although that research is considered an advance over status attainment work because it focuses on a greater variety of characteristics of work and workplaces than does the former (see Kalleberg & Sorensen, 1979, for a review of labor market segmentation research).

A second shortcoming is that stratification research ignores the hiring process as well as the attendant uncertainties in job search and employee selection that lead employers to rely on valid but imperfect signals of worker competence. Employment practices are rarely mentioned, let alone investigated, in the large status attainment literature. This gap in the literature is in striking contrast to the great amount of attention that has been devoted to the links between family, ability, and schooling processes, for example, in "social-psychological" models of status attainment (cf., Kerckhoff, 1976, p. 377).

A third shortcoming is that the multidimensional nature of work, human competencies, and worker aspirations is not sufficiently appreciated. For example, a multidimensional view of the cognitive and non-cognitive demands of work leads one to expect employers to look for and reward different worker traits; this in turn leads one to expect differences in "payoffs" to education, intelligence, and personality across different types of work, but status attainment researchers have generally interpreted such differences as evidence

of unfair discrimination. Status attainment theory also seems to assume that people seek to maximize their occupational status, but this is not so. People's preferred "social selves" as revealed by their occupational aspirations differ along a number of dimensions, including prestige, and many of these differences develop in childhood long before youngsters become aware of constraints in the labor market (Gottfredson, 1981b).

A fourth shortcoming has been particularly serious not only for functional theory but also for its real-world consequences. The value of education in the workplace has been badly miscontrued and it has been overestimated relative to that of differences in intelligence. Too much emphasis has been given to the power of education to produce, as opposed to just select, people with the competencies that are most important in the occupational hierarchy. Demonstrations that education does not have its widely expected effects thus provide revisionists an easy but inappropriate way of dismissing the entire functional position.

C. Modified Functional Theory: A Reconceptualization of Occupational Stratification

The general objectives of this paper are to show that the occupational hierarchy is based on functionally important differences among workers and their jobs, and then to propose a view of occupational stratification that differs from both functional and revisionist theory. Because this reconceptualization is much more akin to functional than to revisionist theory, I refer to it as a modified functional theory. The theoretical objective of the paper is pursued by triangulating data and argument concerning a variety of phenomena from several disciplines. Relevant data from previous research are

organized and interpreted in the context of social stratification theory; new analyses about the worker behaviors and competencies required to perform different occupations are presented; and ideas are adapted and elaborated from work in economics about the role of education in hiring and promotion processes. I largely take for granted sociological research on attainment and focus instead on reviewing research that is unfamiliar to most sociologists. In particular, I summarize relevant data from the decades of research on human intelligence and personnel selection in psychology because they provide direct evidence about the validity of basic assumptions of current stratification theories. At first the paper ranges across topics that may seem complex and not clearly relevant to occupational stratification. Although the paper eventually weaves all these threads of evidence together to create a coherent fabric, it is helpful to preview the end result before proceeding to the more detailed evidence and arguments.

Preview of the modified functional theory. The theory focuses on the evolution, form, maintenance, and mutability of occupational hierarchies. Allocation processes are not the primary object of explanation, but are examined only to the extent that they interact with and are required to explain different aspects of the occupational hierarchy. Particular attention is given to education in the allocation process because it is currently the most important single mediator between worker competencies and occupational demands. The central assertions of the theory, which are stated below in oversimplified terms, are that:

(1) Occupations differ in the general intellectual difficulty of the tasks they require workers to perform on the job.

(2) The occupational prestige hierarchy primarily reflects an ordering of occupations according to intellectual difficulty level.

(3) Occupations that are higher in intellectual difficulty level are more critical to the employing organization.

(4) Large differences in intelligence in the population are evident by the early school years and this distribution is not substantially changed, at this time in history, by school or work environments.

(5) The occupational hierarchy has evolved and is sustained over time because enduring differences in intelligence within populations create pressure for segregating work tasks into different occupations by difficulty level.

(6) The degree of differentiation (i.e., mean differences in difficulty among occupations) in a hierarchy is affected by the efficiency (i.e., validity) with which people are sorted by intelligence to occupations.

(7) Only moderate levels of efficiency in sorting by intelligence are necessary to sustain a highly differentiated intelligence-based occupational hierarchy.

(8) Education (primarily years of education) influences allocation processes (i.e., the status attainment of workers) to the extent that employers use education as a signal of worker quality.

(9) However, employers will rely on educational credentials only to the extent that education actually is a useful signal of worker competence (useful meaning not only valid but also having a favorable cost-benefit ratio compared to other possible signals).

(10) Educational level has been the most useful (but not the most valid) indicator of worker intelligence in recent history, but its value to employers can wax and wane as social policies and practices change its relative costs and benefits as a signal of worker quality.

This theory reflects a change in emphasis from both revisionist and functional theories in several respects: (a) it gives greater attention to explaining structural phenomena and how they relate to individual-level processes, (b) it gives a central role to differences in intelligence in the evolution of social structures, and (c) it treats education as a useful but perhaps not necessary mediator between individual-level and structural-level occupational processes.

The paper develops these assertions in the next six sections. The next section to follow (Section II) organizes and reviews the various functions of schooling that have been proposed in the literature; this helps to clarify the direction this paper takes and how it differs from previous theory. Section III reviews evidence about the relation of intelligence to performance both at work and in school and thereby provides evidence that flatly contradicts the claim that intelligence is not very important, as well as the claim that the occupational hierarchy is not functionally based. Section IV reviews evidence for the multidimensional nature of job demands. This evidence is important because it shows that demands for non-cognitive traits are often functionally important and variability in payoffs to education can often be traced to such traits. This not only counters revisionist claims that hiring and rewarding workers for their non-cognitive traits is non-meritocratic, but also it lays the base for a more general theory of the functional basis of the division of labor in both its lateral and vertical aspects. Section V presents new evidence showing that the cognitive and non-cognitive demands of work are in fact related to the activities occupations actually require workers to perform. It also provides evidence that it is the more difficult jobs that tend to be the most critical and prestigious. These two types of evi-

dence are necessary to support a functional theory of occupational stratification but they have not been available before. Section VI provides new evidence that the educational requirements for different jobs can be explained largely by the intelligence demands of jobs, but that other dimensions of work activities and contexts help to explain otherwise unexpectedly high or low educational requirements. Section VII presents a theory of how occupational hierarchies evolve "naturally." After reviewing the contributions of previous sections to a modified functional theory, this section speculates about how occupational hierarchies arise in response to differences in intelligence in a population. It next takes up the issue of how education relates to these structural processes. Specifically, I show that conceptualizing educational credentials as a valid but fallible signal of worker intelligence can account for phenomena that have often been perceived in the past as inconsistent with functional theories of stratification. Finally, Section VIII discusses the implications of the theory both for educational policy and stratification research. The widespread failure among both laymen and researchers to appreciate the limitations of schooling in preparing people for jobs leads to educational reforms that are bound to be disappointing and that thus stimulate a new round of criticisms of the school system. And the widespread failure in stratification research to distinguish between the value of education for getting a job versus performing it has created enormous confusion in the literature.

II. WIDELY HYPOTHESIZED FUNCTIONS OF SCHOOLING IN PROCESSES OF OCCUPATIONAL STRATIFICATION

A major goal of this paper is to clarify what role schools actually play in maintaining the occupational hierarchy and in allocating workers to it. It helps to have in mind first what the widely hypothesized functions of schools relative to work are. An outline of such hypotheses not only helps to clarify the terms of the debate in the literature, but also it helps to dispose immediately of some distracting issues by noting that some widely discussed functions of schooling are not very relevant to the issues being debated by functional and revisionist theorists.

A. Ten Common Hypotheses and Their Relative Importance in the Debate between Revisionist and Functional Theories of Stratification

Table 1 lists ten ways schools are commonly hypothesized to affect the occupational attainment of students. As is apparent from this list, one major distinction in hypothesized functions is whether or not schools actually change students or whether they primarily sort and label them. Another distinction, of course, concerns what types of attributes schools select for or foster--for example, intelligence, non-cognitive traits, knowledge, and occupational aspirations.

Insert Table 1 about here

The foregoing distinctions often form the lines of debate between functionalists and revisionists, although both positions would agree that one or more

of these functions of schooling does play a central role in stratifying individuals in society. Neither theoretical position has been entirely clear about the relative importance they assume each of these ten functions to have, nor is it likely that there would even be consensus within either camp. Nevertheless, it is clear that functionalists give greatest weight to the sorting and fostering of cognitive aptitudes (functions 1 and 6) and to the development of specialized skills and knowledges (8), with perhaps some weight being given to the functions of either selecting for or fostering ambition (4, 10). They certainly give least weight to the possibility that schools function to channel youngsters to adult social positions strictly on the basis of their social class backgrounds (5). In contrast, the revisionist position maintains that schools are primarily a device to sort students by social background (5), often accomplishing this by fostering or selecting social-class related habits and attitudes (3 and 9). Although revisionists often refer to such traits as "non-cognitive," they do not consider them to be functional aptitudes or skills, so I have labelled them habits and attitudes (3, 9) to distinguish them from non-cognitive <u>aptitudes</u> (2 and 8). To the extent that schools influence aspirations (10), the revisionist position maintains that it is only to blunt the potential aspirations of the lower classes and so resign them to their less favored circumstances. Intelligence is treated as a non-functional trait by the revisionists, but it is variously seen as simply a matter of cultural definition, a non-functional by-product of schooling, or a (non-functional) trait of the higher social classes that can be used as a criterion in superficially fair schooling processes to perpetuate the advantages of those social classes. Specialized skills and knowledges tend not be mentioned except to say that most job skills can be obtained on the job. In other words, prior training (in schools) is generally not necessary.

Most theorists from both positions would probably agree that education is important in allocation processes, that is, in determining the occupational fate or destination of individuals within society. In light of the high correlation between educational and occupational attainment (usually around .6), this would be hard to deny. Both positions also appear to give education a key role in maintaining the occupational hierarchy (which is a structural rather than an allocation issue). The argument between the two positions is primarily about why education is important in maintaining the hierarchy, the revisionists claiming that schools simply legitimate non-functional inequalities and the functionalists often stressing that schools actually provide the skills and knowledge needed to perform many jobs.

B. A Modified Functional View of Schooling

I take for granted that education is important in allocation processes and concentrate on outlining which of the ten functions are most important in supplying workers to the hierarchy and maintaining its form over time. I argue in this paper that the two most important functions of schools in relation to occupational stratification are that schools sort by intelligence (function 1) and that they provide specialized job-related skills and knowledges (8). This is consistent with current functional theory except that I place greater emphasis than other functional theories appear to do on the sorting than the training function of schools in explaining the occupational hierarchy.

Schools do sort by intelligence, because school achievement is correlated from .5 to .9 with intelligence at various grade levels (Follman, 1984; Jensen, 1980, chapter 8) and because years of school completed is correlated about .6 with intelligence (Matarazzo, 1972, chapter 12; Duncan, Featherman, &

Duncan, 1972, chapter 5). I do not argue that schools do not or cannot change intelligence (6), but only that whatever effects schools or other social settings have on intelligence have not been large enough in the past to disrupt the overall stability of intelligence that has been observed in the population.

Providing specialized skills and knowledges (8) is less important than is sorting by intelligence (1) because the former largely overlaps and is dependent upon the latter. This conclusion follows from the fact that it is precisely their success at the learning of skills that sorts students by intelligence. Successively higher grades present not just different information to be learned, but they present more difficult information, and people who have trouble passing the earlier performance hurdles will find it increasingly difficult to pass later ones successfully in a timely manner, if at all. Not only do schools tend to screen out the less academically successful at higher grades, but the less successful also tend to screen themselves out as well, as is clearly suggested by the higher secondary school dropout and college attrition rates of less intelligent students (see reviews by Matarazzo, 1972, pp. 282-283; Super & Crites, 1962, p. 86; Jensen, 1980, p. 334). So while it is true that the higher level knowledges and skills provided by the formal educational system may be necessary on a job, even for the most intelligent of workers, these knowledges and skills will be acquired most successfully, on the average, by the most intelligent students. Furthermore, much of the knowledge that students gain in school does not seem to be relevant to the jobs in which they end up.

Several other functions of schools are relevant to the form of the occupational hierarchy only to the extent that they interfere with the foregoing two functions. For example, sorting by intelligence is depressed to the extent that students obtain more education because they can better afford it, net of intelligence (which amounts to explicit selection according to social class, function 5), or because they have higher aspirations net of intelligence (4, also often associated with higher social class). To the extent that reward systems in schools encourage able students to pursue higher levels of education than they might otherwise (10), schools increase their efficiency of sorting by intelligence. The fact that schools and students function in ways that decrease the efficiency of sorting by intelligence does not mean that the hierarchy is not functionally based; it means only that differentiation of occupations by intelligence on that hierarchy will be suppressed to some degree.

Identifying or fostering non-cognitive aptitudes (2, 8b, 8c) are explicit and primary objectives of relatively few schools (e.g., schools of art, dance, or music), but they are by-products of many. Extra-curricular activities provide settings in which personality and other "non-cognitive" traits (e.g., leadership or athletic ability) may be revealed or augmented. Coursework in different majors also provides a way for students to test their interests and potential success in different fields of work at similar occupational levels (e.g., nursing, social work, accounting, teaching, engineering). Although this function of schooling may have relatively little effect on years of schooling attained, it probably helps produce and sustain lateral differentiation of the division of labor (e.g, by situs or field of work).

The remaining schooling functions listed in Table 1--selecting or changing work habits and attitudes (3, 9) and providing basic skills (7)--are frequently discussed in the context of how schools can make less successful students employable. The concern here is not one of increasing the job level that these youngsters are able to attain as much as it is to increase their chances of even securing employment. What this amounts to is a concern with getting everybody at least onto the bottom end of the occupational hierarchy. Although where the low end of the occupational hierarchy terminates relative to the lower end of the distribution of human capabilities is an important issue, this issue and the potential role of schools in "extending the bottom end" of the occupational hierarchy (e.g., by decreasing the costs of hiring some types of people) will be disregarded here because of this paper's focus on the form of the entire hierarchy.

It might be noted that some of the foregoing functions of schools are shared by other institutions. For example, families probably exert at least as strong an influence on occupational aspirations as do schools. At the present time, however, schools dominate all other institutions in the function of sorting by intelligence and in providing specialized knowledges and skills for many high level jobs. They almost certainly do not dominate in either sorting by or providing the non-cognitive (e.g., interpersonal and motor) aptitudes that will be shown later to be important for performance in some jobs at a variety of levels of the occupational hierarchy.

III. THE CENTRAL IMPORTANCE OF INTELLIGENCE IN EXPLAINING THE OCCUPATIONAL HIERARCHY

Research shows quite clearly that intelligence is a major determinant of educational attainment, which is in turn the major determinant of occupational level, and it shows that intelligence influences occupational level obtained primarily indirectly via its effect on educational attainment. The question of whether either intelligence or education are functional or necessary in the workplace is an entirely different matter, however, and the determinants of worker productivity cannot be assumed to be the same as the determinants of worker attainment. The previous section argued, in fact, that education is of functional value in the workplace primarily because it sorts prospective workers by intelligence level and only secondarily because it teaches them skills that are useful on the job. The advisability of distinguishing between the determinants of worker attainment and worker productivity is illustrated in the public arena by the suits that have been brought against some employers in recent years for their use of intelligence tests and educational credentials in hiring and by the resulting court decisions requiring employers to show that their selection procedures are in fact job-related (e.g., valid for predicting performance) when those procedures have adverse impact on the employment of blacks and other protected groups.

As the existence of such suits demonstrates, the question of whether worker attributes such as intelligence and education are functionally important cannot be answered by studying status attainment processes. The question can be answered only by determining what tasks jobs actually require workers to per-

form and the attributes of workers that contribute to good performance of those tasks, but stratification researchers have not yet collected or examined such data. On the other hand, a massive amount of relevant data has been collected in psychology, but these data have not yet been interpreted in the context of stratification theory. The fields of job analysis, personnel selection, and intelligence testing within psychology have produced especially useful data, and this section is the first of three that examines such data for the insights they provide into the structure of work from a sociological perspective.

A. The Common Perception that Intelligence is Not Very Important for Job Performance

Many people are willing to believe that differences in performance in school can be traced largely to differences in intelligence and, indeed, the research is very consistent in showing that this is indeed the case. Fewer people, however, seem willing to believe that intelligence is also a critical ingredient in explaining differences in job performance. One very common argument is that intelligence measures the ability to do well in school, as could be expected because that was an intent of the first intelligence tests, but that academic ability has little or nothing to do with the capacity to carry out other tasks in life. For example, one eminent economist (Okun, 1975, p. 84), in his book on the tradeoffs between market efficiency and equality, asked rhetorically: "Why would anyone expect business or political or most professional hierarchies to be dominated by IQ differentials in any sensible system of promotion and career evaluation? Only in academic hierarchies might IQ tend to dominate--since the test is structured in part to serve

as a predictor of academic learning ability. Stress on IQ is a form of narcissism peculiar to intellectuals, and fortunately has no counterpart in the marketplace."

In their classic article outlining the functional position, Davis and Moore (1945, p. 244) seemed specifically to single out intelligence as not being particularly important. In the context of arguing that an innate talent has to be rare before it will be highly rewarded, they state: "Modern medicine, for example, is within the mental capacity of most individuals but a medical education is so burdensome and expensive that virtually none would undertake it if the position of the M.D. did not carry a reward commensurate with the sacrifice." Conflict theorist Randall Collins (1979, p. 54) has taken such arguments further and written: "...the great majority of all jobs can be learned through practice by almost any literate person....How hard people work, and with what dexterity and cleverness, depends on how much other people can require them to do and on how much they can dominate other people."

Such illustrations could be multiplied and supplemented by statements from the popular press, but they suffice to show that functionalists and revisionists alike do not accord much functional importance to intelligence.

B. The Practical Meaning of Intelligence and Why It Could be Expected to be Related to Job Performance

The research reviewed in this section shows that these views substantially underestimate the importance of intelligence in the workplace. However, the research may make more intuitive sense to readers by first discussing what intelligence means empirically and why it could be expected to be related to

job performance. Although that discussion will be based on widely-known data and concepts in the field of psychometrics, this information seems not to have made its way into general sociological knowledge. The empirical literature on intelligence and its correlates is vast and only a few points will be highlighted below. Matarazzo (1972), Jensen (1980), and Anastasi (1982) provide some of the more recent and comprehensive discussions of research on intelligence.

The concept of intelligence is most usefully operationalized as g, where g is the first principal factor obtained from factor analyses of a heterogeneous set of cognitive tests (e.g., the subtests of the WISC or WAIS). It is important to understand that this first principal factor represents what is common to the ability to perform well on tests which often differ considerably in their specific content, some of these tests being clearly related to what children learn or do in school (e.g., arithmetic tests) but others not (e.g., block design tests, Jensen, 1981). And even when the task to be performed is within the capacity of almost any third grader, the speed of being able to perform it may be dependent on g. For example, more intelligent people tend to perform choice reaction time tasks more quickly, and differences in reaction time by IQ level become larger the more bits of information that must be integrated to reach a decision (Jensen, 1984; Fox & Taylor, 1967, as cited in Jensen, 1980, p. 353).

These choice reaction time tasks are analogous to the demands of many jobs, demands that are illustrated quite clearly by some military jobs. For example, tank gunners need to react quickly and accurately to one or more moving targets when they themselves may also be moving. The more targets there are

and the more of them that are moving in relation to the gunner, the more difficult the gunner's job becomes. It has been the Army's experience that differences in performance level by intelligence increase as training progressively includes more of the elements that a gunner is likely to have to cope with in the field. Even if all trainees could be trained to perform the more difficult levels of the gunner's job, which apparently is not the case, it seems clear that the survival rate of the less intelligent men is likely to be poor in wartime if their opponents are more intelligent and thus likely to react more quickly than they do.

It is also important to understand that both cognitive and non-cognitive tests can be more highly or less highly correlated with g (i.e., more or less "g-loaded") and thus more or less dependent on intelligence. A factor analysis of scores for 23,428 individuals taking the General Aptitude Test Battery (GATB) presents typical results which illustrate the point: verbal and numerical aptitude both correlated about .9 with g, spatial aptitude about .8, form and clerical perception both about .7, motor coordination about .5, and finger and manual dexterity both about .2 (Gottfredson, 1984). In other words, intellectual tasks are highly g-loaded, perceptual tasks somewhat less so, and motor tasks are generally not very g-loaded. Standard omnibus intelligence tests such as the Wechsler tests and Stanford-Binet generally load about .9 on g (Jensen, in press, p. 17). The g-loadings of many standardized achievement tests are probably just as high because Humphreys (1974, p. 263) notes that "a total score on a broad series of achievement tests is correlated about as highly with the Stanford-Binet IQ as one form of an intelligence test is correlated with another." The fact that intelligence tests predict academic achievement in no way implies, however, that intelligence is nothing but aca-

demic achievement. Of the many tasks that people perform in life, doing well in school is probably just one of those that is highly dependent on g. A look at some specific skills generally considered to reflect intelligence illustrates that performance in most human tasks, and in jobs in particular, can be expected to depend on g to some extent and to depend strongly on g in many cases.

The following skills could be expected to contribute to better performance, probably even in the simplest jobs, and to be very highly correlated with g: diagnosing problems, solving problems, reasoning, analyzing, integrating information, applying old knowledge to new situations, determining what information or procedures are relevant to a task, ability to profit from experience, spotting inconsistencies or mistakes, making fewer mistakes, and figuring out better or faster ways to do things. Many of these skills constitute the broader traits employers say they look for or value most in their employees: e.g., adaptability, trainability, promotability, and problem solving ability (Selz, Jones, & Ashley, 1980; Wiant, 1977; Short, 1979; Growth potential, 1979). Prediction of trainability has been one of the major concerns behind the use of aptitude tests by the military, for example, and the widely-used Army General Classification Test was explicitly designated a test of trainability (Hale, 1983, p.23).

I shall now review evidence that intelligence actually is important, not just for getting jobs (which has already been well established in the sociological literature), but also for being able to perform those jobs well.

C. Occupational Differences in Average and Minimum IQ Levels of Incumbents

The first large-scale mental testing programs, which were conducted by the Army during World War I, revealed systematic differences in the IQs of men in different occupations. These median differences in IQ by occupation from WWI are largely mirrored by results from studies by the military during WWII (see Matarazzo, 1972, Chapter 7, for a detailed review of these studies). What is of particular interest, however, is that occupations differ more in the minimum than in the average IQ levels of their members. Members of low-level occupations can be found at all levels of the IQ distribution but the reverse is not true; members of high-level occupations are rarely found at low levels of the IQ distribution. It is this fact that led the early researchers to surmise that occupations differ in the intellectual capacities they require but that high intelligence is necessary but not sufficient for high-level jobs. Of particular relevance to this paper is the fact that median IQ is very highly correlated with the prestige level of occupations--.96 in a study by Canter (1956). Thus, although there is substantial overlap in the IQ distributions for most occupations, the average differences in IQ reflect the occupational hierarchy that is of interest to stratification researchers.

Although these data are consistent with the claim that intelligence is particularly important in some jobs, although the data are consistent over long periods of time, and although the median differences are highly correlated with occupational prestige, it could be argued, as it sometimes is, that such median IQ differences reflect nothing more than the unfounded prejudices of employers as to whom they prefer to hire. By themselves, these data prove nothing about the functional nature of the hierarchy, but they provide circum-

stantial evidence and they would be expected in a system that is functionally based and where IQ does affect job performance.

D. Illustration of the Magnitude of Intelligence Differences among Occupations

More persuasive evidence will be provided below for the functional importance of intelligence. Before doing so, however, it is useful to provide a concrete illustration of the magnitude of the differences in intelligence requirements among occupations by showing what proportion of the population is likely to possess the intelligence necessary to perform occupations at different levels of the occupational hierarchy in at least a minimally satisfactory manner.

The U.S. Employment Service (USES) has investigated the types and levels of cognitive and motor aptitudes required for satisfactory job performance in over 500 jobs (U.S. Department of Labor, 1970). Table 2 presents data for 15 occupations. This table shows means and standard deviations on the General Aptitude Test Battery (GATB) intelligence scale (G) for people either training for or working in the 15 occupations. These means do not represent IQ scores, per se, but the data do indicate to what extent members of these various occupations overlap in intelligence level. (Mean and standard deviation for the G scale are 100 and 20.) It is evident that there are large differences in G within each of the general content areas reflected here--medical, mechanical, and mathematical/accounting. There is generally a three standard deviation difference between the highest and lowest level jobs. Although there is substantial overlap between any two adjacent occupations, there is far less or almost none for more distant pairs of occupations.

Insert Table 2 about here

The second two columns show the minimum levels of G that are probably required for adequate performance in those occupations. Minimum requirements are clearly quite different and also differ by two to three standard deviations. The last three columns of Table 2 provide estimates of what percentage of the population equals or exceeds the average intelligence levels of the incumbents of the 15 occupations, and it provides alternative estimates of what percentage equals or exceeds the minimum level of intelligence required for those occupations. These percentages certainly do not reflect what proportion of people could perform those jobs, because intelligence alone is not sufficient, but they do show what proportion is likely to be ineligible because of intelligence alone. These percentages indicate that at least half the population fails to meet the minimum IQ levels necessary for the higher level jobs and probably only one in ten has the intelligence to perform the highest level jobs. As will be made clear later, however, there is good reason for selecting workers who possess more than the minimum level of intellectual aptitude required by a job.

Matarazzo (1972, chapter 7) has reviewed other studies that provide a useful comparison to those reported above, because the results of those studies provide IQ scores for which there are norms for the general population. A considerable amount of data has been collected for the professions (e.g., scientists, physicians) and executives in industry. Median IQs for such occupations are generally at least 125 and range up to around IQ 130. (Standard deviations are about 10 IQ points.) If we take IQ 115 to be the minimum IQ

for these high level occupations and IQ 101.8 to be the white population mean and 16.4 to be its standard deviation (1937 Stanford-Binet standardization sample, Terman & Merrill, 1972, p. 18), this means that only about one out of five people in the general population has the necessary intelligence for such jobs. More accurately, only one in five equals or exceeds the intelligence of the least intelligent workers (i.e., the lowest 10% to 20%) in those occupations. This is double the estimate provided by the GATB data in Table 2, but it still certainly contradicts the claim by Davis and Moore (1945) that the occupation of physician is "within the mental capacity of most individuals." That statement may apply to one's colleagues in a university setting, but not to the general population with which most academics have relatively little immediate experience in work-related matters.

E. The Relation of Intelligence to Performance within Occupations

Job performance is not a matter of being able to do a job versus not being able to do it. Job performance is a matter of degree. There can be substantial variation in performance among people performing the same job and these differences can have enormous economic consequences for employers. Even in simple jobs, the ratio of productivity of the poorest to the best workers generally is at least 1 to 2 and can range up to 1 to 5 or more (Landy & Farr, 1983, p. 250). Schmidt, Hunter, McKenzie, and Muldrow (1979) showed that computer programmers at the 85th percentile in performance level were worth $10,871 a year more to their employers than were programmers at the 50th percentile and $20,826 a year more than those at the 15th percentile. Other estimates of the financial impact of increasing or decreasing the validity of personnel selection procedures also illustrate that the consequences of

employing better-performing workers can be enormous (Schmidt & Hunter, 1981; Hunter & Hunter, 1984). Hunter and Hunter (1984, pp. 72-73) concluded that "even minute differences in {selection test} validity translate into large dollar amounts." In short, performance within an occupation varies along a continuum from very bad to very good and the practical value of a worker to an organization likewise ranges from very low (or negative) to very high. Our concern, then, should not be just whether a person "can be" a plumber or "can be" a physician, but whether that person is likely to be a <u>better</u> or <u>worse</u> plumber or physician.

It has long been known that cognitive tests are valid predictors of training and on-the-job performance for at least some occupations and that tests that predict success in training also predict success on the job (e.g., see Ghiselli, 1966, who reviewed hundreds of studies of the predictors of job performance from earlier decades). For many decades the "specificity doctrine" in industrial psychology held that the aptitudes required by jobs differed widely depending on the particular tasks performed and on the particular settings in which they were performed. However, recent advances in meta-analysis have provided evidence that broad aptitudes are much more "generalizable" than previously assumed and, in fact, that cognitive tests are valid for predicting performance in <u>all</u> jobs (see the review by Schmidt & Hunter, 1981; see also Jensen, 1984, for a wider perspective on the specificity doctrine). In a meta-analysis of hundreds of studies Hunter and Hunter (1984, p. 81) found that the mean correlation of cognitive ability with training success was .54 and the mean correlation was .45 for job performance. Furthermore, the relation of intelligence to job performance is linear (Schmidt & Hunter, 1981). This means that job performance depends not just on some minimum level of

intelligence above which additional intelligence provides no advantage, but instead that the more intelligent the worker, the steadily better the job performance on the average. (The relation of intelligence to education achievement is also linear, Jensen, 1980, p. 319.)

The most concrete description of how intelligence is related to job performance across the full range of occupations and thus how it is related to the occupational hierarchy is provided by Figure 1, which is reproduced from Gottfredson (1984). This figure is based on U.S. Employment Service studies of over 500 jobs which related the GATB test scores of workers and trainees to their performance on the job or in training. (Data from these studies are published in the GATB manual, U.S. Department of Labor, 1970.) These data were in turn used by the Employment Service to estimate the minimum requirements for most of the 12,000 occupations in the Dictionary of Occupational Titles (DOT) on the three or four most important of the nine aptitudes measured by the GATB (U.S. Department of Labor, 1979). Figure 1 represents this author's reorganization of the USES data on job requirements according to similarities and differences in both the types and levels of aptitudes required by different occupations. Although different aspects of this "occupational aptitude map" will be discussed at various points in this paper, two aspects are relevant in the present context. First, the GATB scale General Intelligence (G), which is correlated .95 with g and thus actually does measure intelligence, was found to be one of the three or four most important aptitudes in 9 of the 13 occupational clusters. These are also the clusters that would be considered the most prestigious. Second, the minimum level of intelligence required for satisfactory performance increases with the occupational level of those clusters. For those clusters where G was not determined

to be among the most important aptitudes, other data (not shown here) indicated that IQ levels were successively lower in the lower-level jobs. Third, neither motor aptitudes nor any specific cognitive aptitude seems to be as pervasively important as general intelligence, a finding which is supported by the recent meta-analyses by Hunter and Hunter (1984).

Insert Figure 1 about here

Although these GATB data are based on studies of actual job performance, once again it could be argued that they reflect nothing more than the prejudices of employers. Specifically, employers and supervisors may simply rate more intelligent workers as better workers whether in fact they are or not, and the minimum levels of intelligence required could be expected to be high in high-level jobs because employers will only hire the most intelligent for such jobs even though they do not actually need such workers. The evidence is inconsistent with this argument. Most importantly, validities for the GATB intelligence scale (i.e., its correlations with job or training performance) are higher in the jobs with the highest levels of mean intelligence among workers. A minimum estimate of the correlation between means and validities for G is .4 after correcting for unreliability in G (but not in the performance criteria because those data were not available) and after correcting for restriction of range in G (Gottfredson, 1984). That is, the higher the general intelligence level required by the job, the more noticeable or marked are performance differences for the same absolute difference in intelligence. Stated more concretely, 10 extra IQ points make a bigger difference for performance when a worker is in a high-level job than in a low-level one. When we speak of intelligence being more important in some jobs, what this really

means is that the validities for IQ, not the means, are high--in other words, intelligence makes more difference or is more critical for performance within high-level jobs.

It would seem difficult to account plausibly for the correlation between higher validities and means for G by some mode of employer or supervisor prejudice. Validities for G range over .5 in the higher-level clusters in Figure 1, and it is doubtful that job supervisors are adept enough at distinguishing differences in intelligence, especially in the relatively IQ-homogeneous high-level jobs, to account for such correlations with job performance. In fact, Sticht (1975, p. 67) provided data showing that a measure of intelligence (the AFQT) correlated much higher with objective job sample tests than with supervisor ratings; this pattern remained after partialling out years of education, months on the job, and age (Vineberg & Taylor, 1972, as cited in Jensen, 1980, p. 350). However, if one maintains that the occupational hierarchy arises from differences in intelligence in the population, as is proposed later, then it is precisely the rise in validities with job level that can lead to, and which are necessary in a functional system for sustaining differences across occupations in the mean intelligence levels of workers--differences we now observe but which by themselves do not constitute direct evidence of the functional importance of intelligence. In short, this correlation between validities and means for G is to be expected when g is the primary functional basis of an occupational hierarchy, but it seems inconsistent with the revisionist point of view.

F. Intelligence as a Cause Rather Than an Effect of Work Behavior

The foregoing section provided data on the relation between intelligence, job level, and job performance. It might be claimed that differences in intelligence are the result of working in jobs with different cognitive demands. Indeed, this seems to be the way Kohn and Schooler's work (1983) on the effects of holding "cognitively complex" jobs is sometimes interpreted. However, several types of evidence show that intelligence is clearly more a cause than an effect of occupational attainment, just as, for that matter, intelligence is much more a cause of academic achievement than it is an effect of schooling.

Correlations of intelligence from one year to the next increase from early childhood to late adolescence when they become quite high (Anastasi, 1982, p. 324). Growth in mental age in childhood is irregular to some extent and proceeds somewhat in spurts, but that growth begins leveling off in adolescence. Small changes in individual IQ (e.g., up to 12 points) often occur from one year to the next, but large changes are rare and are usually associated with unusual circumstances such as severe emotional problems, physical deficiences, and drastic changes in a child's environment. To some extent, small changes in IQ are themselves an artifact of the less than perfect reliability of tests and of the impossibility of testing different age groups with exactly the same test items (Jensen, 1980, chapter 7). The prominent psychometrician Anastasi (1982, p. 324), who appears quite sympathetic to claims for environmental effects on IQ, nevertheless has concluded that "An extensive body of data has accummulated showing that, over the elementary, high school, and college period, intelligence test performance is quite stable." Overall ability level

on omnibus tests of general intelligence shows little change from adolescence until advanced old age (Jensen, 1980, pp. 287-288; U.S. Department of Labor, 1970, chapters 15 & 18; Duncan, Featherman & Duncan, 1972, chapter 5).

If stability in intelligence were not the rule, we would not expect results such as the following. IQ in Grades 2 to 6 predicts educational level, adult IQ, and occupational level about as well as does IQ in adolescence (McCall, 1977; Crouse, 1979). Intelligence measured before entry into training or into a job itself predicts later performance in training and on the job. Were differences in intelligence a result of working on the job, we might expect concurrent validities to be higher than predictive validities, whereas the reverse actually seems to be the case (Gottfredson, 1984; Jensen, 1980, p. 350). Whatever changes may occur in intelligence, they are likely to be small in relation to the full range of intelligence and they are likely to occur before entering the labor force, most probably even before leaving high school. In short, for all practical purposes intelligence is stable by the time the most important job-relevant sorting processes begin--that is, the pursuit of higher education and post-schooling employment. (See Jensen, 1980, chapter 8, for a more detailed review of this issue.)

Furthermore, there is no reason to believe that the variance in intelligence in the U.S. white population has changed since the first Stanford-Binet. In particular, Stanford-Binet standardization samples from 1916, 1937, and 1972 are all consistent with a white standard deviation of 16 (Terman, 1916; Terman & Merrill, 1937, p. 37; 1972, p. 357); likewise, standard deviations for the WISC have not changed (Wechsler, 1949, pp. 10-13, 1974, pp. 36-46).

The claim here is not that intelligence cannot be changed, but only that under present conditions it is quite stable and that individual differences are fairly fixed by adulthood. In short, employers have to select for intelligence; they cannot create it.

G. Summary

Differences in intelligence are clearly functionally important in the workplace. Not only is there evidence that differences in intelligence predict differences in performance in all jobs, but intelligence differences also make the most difference in performance (i.e., are more important) in the higher level job levels. The evidence also suggests that intelligence is more often substantially related to job performance than are other aptitudes when the full range of jobs in the occupational hierarchy is considered. Moreover, mean differences in intelligence by occupation correspond closely to the prestige level of those occupations, which suggests that differences in the intellectual requirements of occupations may be the ultimate basis of the occupational prestige hierarchy.

IV. THE IMPORTANCE OF A MULTIDIMENSIONAL VIEW OF JOB DEMANDS AND WORKER APTITUDES

I have just argued that intelligence is the one dimension of human aptitude that is most important in explaining variation in job performance. And as will be discussed in detail later, intelligence is the human competency most important in explaining the form and origins of the occupational hierarchy. Many status attainment studies have shown that intelligence is important in

influencing the occupational destinations of individuals, which is a relation necessary for maintaining an intelligence-based hierarchy over time. However, intelligence is not the only aptitude that is related to job performance and therefore functionally important. A functional theory that focuses only on g is still a powerful theory, but any comprehensive and more convincing explanation of occupational stratification must take account of the multidimensional nature of human talent and of job demands.

A. Three Major Dimensions of A tude

Variations in aptitudes and job-aptitude requirements can be usefully represented by classifying aptitudes into three domains: cognitive, interpersonal, and motor. Interperso 1 competencies are often studied under the rubric of personality, but interpersonal competencies clearly constitute only a small subset of all traits classified as "personality." As noted earlier, cognitive aptitudes such as verbal ability are very highly g-loaded whereas motor aptitudes tend to have low g-loadings. Interpersonal competencies probably fall more in the middle range of g-loadings, but the evidence for this is less systematic. Because both interpersonal and motor skills are at least somewhat g-loaded, they are not completely "non-cognitive." They are only less cognitive. Nevertheless, I will refer to them as non-cognitive to be consistent with the sociological literature. Specific aptitudes within the three domains are not perfectly correlated, a fact that leads to the existence of profile differences. For example, equally intelligent people can often be classified as more verbal than quantitative or vice versa.

Some mention should be made of the cluster of non-cognitive traits often referred to as dependability. When employers or workers are asked to name

critical worker traits, dependability (Crain, 1983), integrity (Gottfredson et al., 1984a), character (Noland & Bakke, 1949), and similar references to reliability and honesty often top the list in frequency of mentions. Does this mean that cognitive ability is not so important after all? What these results reflect is the need for workers to exhibit good faith toward their employers. In order for workers to be of minimal value to their employers, whatever the workers' talents, they need to show up at work, they must be motivated enough to carry out the tasks assigned to them, they must not steal or sabotage the employers' operations, and they must not embarrass or otherwise discredit employers or their products. The closer the worker is to the heart of a business, the more important it is for the worker to show good faith (e.g., see Noland & Bakke, 1949, on the importance of character and prison records at different occupational levels). However, the lower the level of the job, the less impor. intelligence is for job performance and thus the more susceptible job performance is relative to intelligence to differences in dependability. It is also likely that the dependability of job applicants is lower on the average for low-level and entry-level jobs, and hence of more concern in hiring for them, both because they are the jobs for which young inexperienced people disproportionately apply and because, for a variety of reasons, the less dependable people will tend to have been rejected as applicants for higher-level jobs. I bring this issue up because the apparent importance of dependability, especially in low-level or entry-level jobs sometimes leads researchers to infer that what high schools teach or do not teach, and therefore the quality of education, is of little concern or actual value to employers. Although the data support the contention that schools may be less important for the skills and knowledges they provide to most workers than is

commonly assumed, it in no way indicates that non-cognitive traits such as dependability are more important determinants of job performance across the full spectrum of jobs than are the cognitive aptitudes for which schools sort. That dependability might be the best predictor of job performance in low-level jobs does not contradict the argument that the occupational hierarchy primarily reflects differences in demands for general intellectual ability.

B. The Relatively Low Explanatory Power of Non-Cognitive Traits in Past Stratification Research

Sociologists have generally characterized human aptitude in unidimensional terms and made use of any cognitive aptitude or achievement test that happened to be available for the population under study. When research shows that the "payoffs" or "returns" to education or intelligence differ in different populations or in different kinds of work, or when personality traits are found to influence how employees are selected or rewarded, such a unidimensional view can easily lead one to the conclusion that some non-functional or social class bias is responsible for the results (e.g., Beck, Horan, & Tolbert, 1978; Wright & Perrone, 1977; Wright, 1978). Consistent with this, some revisionist theories structure their arguments about the supposed non-functional basis of educational and employment practices by postulating that personality factors (e.g., conformity) are extremely important in mobility processes even though they do not actually contribute to job performance. Furthermore, they argue that these personality traits are more important than cognitive ones (e.g., Gintis, 1972, p. 87). Empirical research has not supported these hypotheses (e.g., Olneck & Bills, 1980), as could be expected in light of the results about intelligence cited above. Furthermore, the personality traits that have

been found to help predict status and income are not closely linked with family background (Mueser, 1979, p. 157). Status attainment researchers, who generally seem to be either functionalists or theoretical agnostics, have tended to dismiss the importance of non-cognitive traits because the effects of non-cognitive traits have seemed so unimpressive compared to those for other variables such as intelligence and social class background (e.g., see Mueser, 1979, for such data). The empirical picture is one in which non-cognitive traits introduce disconcerting variation from the point of view of a simplistic unidimensional functional theory, but they also show a disconcerting lifelessness from a revisionist perspective.

Studies that catalog the distinctive attributes of successful workers in specific jobs (e.g., critical incident analyses in industrial and organizational psychology) show that various non-cognitive or personality traits (e.g., consideration toward subordinates, personal appearance, courage, and getting along with coworkers) are important in some jobs (Dunnette, 1976, pp. 491-496). However, what reason is there to believe that such non-cognitive requirements are relevant to stratification processes, particularly given the unimpressive effects of such variables in status attainment research? Research reviewed below suggests that traits which have only moderate to low g-loadings (i.e., "non-cognitive" traits) are important in some but not most types of occupations. It also suggests that such variations are responsible for the deviations in attainment processes that are often assumed to reflect unfair rather than meritocratic processes.

C. The Relevance of Non-Cognitive Aptitudes to Functional Theories of Stratification

Although functional theory, at least as formulated by Davis and Moore (1945), certainly allows for multidimensional talents, no sociological theory or body of evidence provides guidance about what those talents might be or for which occupations they may be important. Nor does the literature in industrial psychology provide much guidance because of its traditional focus on particular jobs in particular settings rather than on comparative differences across the full range of jobs. In contrast, vocational and counseling psychology has long emphasized non-hierarchical differences among people and jobs and has developed a large literature about the differences in personality, interests, values, and competencies of people drawn to and working in different occupations. One theory and the vast body of research accompanying it (Holland, 1973, 1984) raises the possibility that somewhat different specific talents are sought and rewarded in different fields of work and thus that these differences could be expected to lead to systematic variations in status attainment processes by field of work. Research testing these notions with Holland's theory will be reviewed to show that variations in attainment processes by Holland field of work do occur and that they accord with common perceptions about how jobs deviate from the general rule that a higher education is required for a better job.

When regression models for predicting occupational status and income are estimated separately by Holland field or situs of work, the prestige and economic returns to years of education are dramatically different by field of work (Gottfredson, 1977a). What is perhaps more informative, however, are the

differences in mean prestige and income by field of work of adult men when they are grouped by years of education completed and the six Holland fields of work: (1) "realistic" (manual and technical), (2) "investigative" (science and medicine), (3) "artistic" (aesthetic and literary), (4) "social" (social service and education), (5) "enterprising" (sales and management), and (6) "conventional" (clerical and accounting). Among men with exactly 16 years of education, 1970 mean incomes ranged from $13,900 to $25,600 for men aged 46-55 across the different fields of work (Gottfredson, Finucci, & Childs, 1984b; see also Gottfredson, 1978). Salesmen and managers received the highest incomes at all educational levels but the highest (i.e., at all levels except 17 or more years of education). In fact, salesmen and managers who had only 12 years of education earned more than men with 17 or more years of education who held jobs in social service and education ($15,400 vs. $13,900), although the prestige level of the jobs was considerably lower for the former (50 vs. 64). Other research which followed male adolescents into the labor market also showed that workers holding enterprising jobs have less education than do men in <u>equally prestigious</u> jobs in other fields of work (Gottfredson & Brown, 1981).

These results are consistent with widespread perceptions that workers in the enterprising category are overpaid and workers in the social category are underpaid (Westbrook & Molla, 1976; see also Edelwich & Brodsky, pp. 17, 90-98). These two broad fields of work represent significant deviations from the general rule (and the general status attainment model) that higher level and better paying jobs require higher levels of education. And as the income differences attest, these deviations are not inconsequential. Furthermore, it is worth noting that these two Holland categories represent the types of work

that most often deal with people. Although both types of work are clearly people-oriented, the aim of workers in the social category is generally to manipulate people in order to help them (e.g., teach or counsel) whereas the aim in enterprising work is to manipulate people to fulfill organizational goals (e.g., sales). This indicates that interpersonal skills need not have the same payoff in different jobs, even when considering only occupations that have substantial dealings with people.

The foregoing studies also suggest that formal schooling is not the essential conduit to good jobs in some fields of work (sales and management) that it is in others (e.g., science and medicine or social service and education). A reasonable hypothesis for explaining these differences in payoffs to education is that formal schooling does not perform the sorting and training functions for non-cognitive skills that it performs for cognitive skills. Jobs such as manager may require interpersonal competencies that are more likely to be revealed, selected, or augmented in non-academic than in academic settings, even though those skills may be substantially g-loaded--for example, organizing or persuading people. In contrast, performance in other highly-paid or prestigious work (e.g., in science and medicine) depends more heavily on information and skills which can be imparted via large bodies of recorded knowledge in formal school settings.

A multidimensional view of job aptitude requirements may explain some phenomena which do not seem to fit comfortably within the current unidimensional status attainment paradigm. The foregoing results suggest that we should not expect education to fully mediate the "effects" of some personal characteristics on later prestige or income. For example, we would expect leadership to

be a more important trait in highly-paid managerial jobs than in academic fields of work requiring more education than does management, and it turns out that leadership behavior and self-ratings are indeed related to higher earnings net of education or occupational status (Mueser, 1979). Sewell and Hauser (1975) observed, but were unable to explain, their finding that father's earnings (i.e., not including wealth or unearned income) has an effect on son's earnings that is not mediated by education (i.e., their "direct social inheritance of earnings performance," pp. 72-75, 87). However, because managers and salesmen earn more than would be expected on the basis of their education alone, we should expect to find that the tendency to earn high incomes is sometimes "passed" from father to son independent of formal schooling (i.e., from salesman father to salesman son).

These studies suggest that formal schooling plays different roles in the occupational attainment processes for different types of work. To return to Table 1, which outlined the potential functions of schools, schools may perform the same intelligence-sorting function for all occupations (function 1) but they may provide the specialized knowledges (8) for some high-level jobs (e.g., science, education) but not for jobs where performance depends more heavily on non-academic competencies and on less general and less stable bodies of knowledge (e.g., management).

But the question remains, do these differences in allocation or mobility processes by field of work actually stem from differences in the tasks and abilities required in these occupations for successful performance? Although not providing a complete answer to this question, the following pages provide evidence that different broad types of work do in fact require somewhat different competencies net of g.

D. The Relations of Cognitive Profiles and of Non-Cognitive Aptitudes to Job Performance.

Figure 1, which was discussed earlier in another context, provides a starting point for illustrating the role of different domains of aptitude, as well as variations within those domains, for job performance. In regard to variations in demands within the cognitive domain, Figure 1 shows that spatial aptitude is an important predictor of job performance in the middle- to high-level work "dealing with physical relations" (e.g., hard sciences, engineering, technical work, crafts work), but not in work "dealing with social and economic relations" (e.g., administration, law, teaching, nursing, sales). It is also important to note that these cognitive profile differences seem to be rooted in the tasks workers perform, because spatial aptitude (here, the ability to visualize or manipulate objects in three-dimensional space) is important in jobs where "complexity of dealing with things" is high relative to "complexity of dealings with people" whereas the reverse is true for clerical perception (the ability to see pertinent detail in tabular or verbal material, Gottfredson, 1984). Thus, although requirements for clerical and spatial aptitude are both moderately correlated with demands for g (about .6 and .4, see Gottfredson, 1984, Table 2, panel 2), there are distinctive patterns of demands for these two aptitudes depending on the mix or balance of complexity of dealings with things vs. people.

Turning to the domain of motor aptitudes, Figure 1 shows that the lower the level of the job, the more likely it is that motor aptitudes will be among the most important of the nine GATB scales for predicting job performance. In fact, when validities for the different GATB scales (i.e., their correlations

with job performance) are correlated with job level (as measured by either the mean intelligence scores of workers in the job or mean scores on complexity of dealings with data for their jobs), the results for manual dexterity are the inverse of those for general intelligence--about -.4 vs. .4. This means that the higher the mean level of the job, the more useful intelligence is for predicting job performance but the less useful manual dexterity is for that purpose (cf., Hunter and Hunter, 1984, p. 81). This pattern for the relative importance of cognitive versus motor aptitude requirements reflects the head versus hand distinction among jobs which is often referred to in sociology. This head versus hand distinction among occupations in their principal aptitude requirements and its coincidence with the prestige hierarchy is further evidence of the driving force of intelligence differences in structuring the hierarchy because intelligence and motor aptitudes are somewhat positively, not negatively, correlated among workers (e.g., see Gottfredson, 1984, Table 2). It should be made clear, however, that the occupations with the highest validities for motor aptitudes are not necessarily the occupations requiring the highest levels of motor aptitude. Correlations of means with validities are -.13, -.08, and -.12, respectively, for motor coordination, finger dexterity, and manual dexterity (Gottfredson, 1984). This finding is in contrast to the patterns found for intelligence where intelligence means among workers are correlated .4 with intelligence validities. Although relatively few high-level jobs require motor skills, it is among such jobs that the highest requirements for motor skill are found (e.g., dentist, see Gottfredson, 1983, pp. 54-55 and F2). In summary, Figure 1 reveals the importance of different cognitive profiles for performance in different fields of work at the same level; it also reveals a negative relation between the functional importance of motor skills and job level.

The relation of interpersonal competencies to job performance in different types of work is more difficult to discern because of a lack of research that is as comprehensive and comparable in its coverage as that for cognitive and motor skills. Although one might guess that interpersonal competencies are more important in the "dealing with social and economic relations" focus of work than in the other three shown in Figure 1, the GATB does not provide tests of interpersonal aptitude and so does not allow a test of that hypothesis. This is not an omission peculiar to the GATB because the literature on the structure of human abilities focuses on cognitive and motor aptitudes (e.g., see the review by Dunnette, 1976, of aptitude classification systems). One study described below was undertaken specifically to provide evidence on this issue, however.

Dealing vs. not dealing with people on the job is correlated about .4 with job level, and complexity of dealings with people is correlated .6 with job level (e.g., see Gottfredson, 1983, p. B4). In addition, many specific interpersonal skills are undoubtedly highly g-loaded. In fact, there may be a minimum intelligence level required in order for jobs to include extensive dealings with people (i.e., with customers rather than coworkers or supervisors), because low-level jobs dealing with people are rare. Whereas over 38% of all workers in the U.S. in 1970 had jobs "dealing with people," less than 4% of the lowest 28% of jobs (i.e., 1% of the total workforce) "dealt with people" (Gottfredson, 1983, Table 1).

Not only may interpersonal activities be highly g-loaded, but customers, clients, and even immediate coworkers may also question the quality of a firm and its services if they perceive the workers they deal with to be of much

lower intelligence than themselves. Noland and Bakke (1949, p. 63) suggested such a link between interpersonal activities in their study of hiring practices: "The fact that personality traits rank high in the roster of qualifications for clerical workers can be accounted for by three facts: The work requires a high degree of intelligence even when it is routine; customers and visitors 'see' the office workers and their impression helps form their picture of the company; and these workers are in close personal contact with ofice executives. It is not surprising, therefore, to find that obvious subnormal intelligence and previous attendance at a school for the feebleminded would practically exclude an applicant for a {clerical} job" (italics in original). (It is interesting to note that Noland and Bakke repeatedly discuss intelligence itself as a personality trait, e.g., see pp. 47, 63, 78.) All the foregoing data suggest that requirements for interpersonal competence will to a large extent parallel those for general cognitive aptitude.

Nevertheless, large differences can be found in the importance of interpersonal tasks and behaviors required at any given job level. The occupational attainment research for different fields of work that was reviewed earlier suggested that many high-level jobs can be characterized as academically-oriented because they require many years of formal schooling, whereas others can be characterized as non-academic because of the lower-than-expected levels of education among their incumbents. As will be illustrated below, interpersonal competencies are especially important in the less academic jobs. This academic versus non-academic distinction is implicitly incorporated into many occupational classifications because the most academically-oriented types of work as identified above--science, medicine, social service, and education--are generally classified together as professional work, with mana-

gerial work being allocated to a separate category. The academic versus non-academic distinction is also useful in characterizing the differences in the tasks, behaviors, and skills--not just the educational levels--required in professional versus managerial work. In a study of the traits and abilities that workers consider critical to good performance in their own occupations (Gottfredson, Finucci, & Childs, 1984a), both professionals (primarily physicians and lawyers) and managers frequently cited as critical presumably highly g-loaded abilities such as "think logically and analytically," "handle several tasks at one time," and "plan ahead and anticipate problems." The largest differences between the two groups involved personality attributes, interpersonal skills, and traditionally academic skills. More professionals than managers cited reading, writing, and higher degrees as critical (61%, 42%, and 45% vs. 30%, 29%, and 3%), whereas fewer of them cited non-academic traits such as "take initiative and responsibility," "be persuasive and motivating," and "evaluate, discipline and praise others" as critical (37%, 26%, and 24% vs. 62%, 44%, and 46%). Being persuasive, competitive, and representing the company well to the public were especially important for salesmen compared to the professionals and managers, but the salesmen did not always rank academic skills lower than did the managers.

The lack of importance managers attributed to educational credentials is consistent with the relatively low levels of education found to characterize managers in other samples. It is especially interesting to look at the responses of the men at the highest levels of business--vice presidents, president, and chief executive officers (three-quarters of whom owned or shared ownership of their businesses)--because capitalists are often assumed by revisionist theories to be the dominant class and thus those presumably most

interested in legitimizing the functions of schooling. Of almost all the individual occupations examined in the Gottfredson et al. (1984a) study (e.g., stock and bond salesman, elementary teacher, engineer, and bank officer), these high-level managers were the least likely to consider a higher degree to be important in their own line of work. Even insurance salesmen were more likely to say that a higher degree is at least somewhat helpful in their own work (Gottfredson, 1983, Appendix D).

E. Summary

Although the foregoing studies only begin to outline how less g-loaded (i.e., non-cognitive) aptitudes affect job performance, they do make clear that such aptitudes are important, but differentially so, in different kinds of occupations. The observed differences in aptitude requirements are consistent with a little evidence and much common wisdom about what tasks workers have to perform on those jobs. They are also consistent with the systematic differences in the income and status payoffs to education that have been observed for different fields of work. Together, these studies support the notion that different aptitudes are functionally important in different kinds of work and that employers look for and reward somewhat different aptitudes depending on the type of work they are filling. Intelligence has the most important affect on occupational attainment, but non-cognitive aptitude requirements create "disturbances" in attainment processes which are not predicted by current functional theories even though those deviations are functionally based.

V. NEW EVIDENCE FOR THE FUNCTIONAL BASIS OF THE OCCUPATIONAL HIERARCHY: AN ANALYSIS OF OCCUPATIONAL ATTRIBUTES

A. Evidence Needed

Earlier sections have reviewed existing evidence for the functional basis of aptitude requirements. Most importantly, intelligence was shown to be important in predicting job performance, especially in high-level occupations. Furthermore, differences in job performance can be quite costly to employers and thus presumably to society itself. The kinds of talents required for successful performance vary somewhat from one kind of work to another but these variations are important primarily for accounting for the lateral differentiation (i.e., field) of work. It is differences in intelligence that are most central to theories of stratification because they are important in explaining the form of the occupational hierarchy. People differ widely in intelligence level and these differences are quite stable at the individual as well as the aggregate level; this means that intelligence is a scarce talent and therefore intelligence or some correlate of it is likely to be highly valued by employers.

By showing that intelligence and other aptitudes enhance worker productivity, the foregoing evidence is a first step in demonstrating that the employer demands for different types of workers are justified. The main question, then, is why different jobs require different types and levels of aptitudes. Therefore, a more convincing case could be made for functional theory if it were shown that aptitude requirements arise from the nature of the activities workers have to perform on the job. Functional theorists have not provided such evidence. Neither have they provided much evidence to support some key

assumptions, for example, that high-level jobs are more important to society and that such work actually requires more demanding types of training for successful performance. Cullen and Novick (1979) attempted to test the importance hypothesis but were restricted to a measure of perceived importance of the occupation's situs, not of the occupation itself.

The study from which Figure 1 was drawn (Gottfredson, 1984) provided some evidence that aptitude requirements are related in systematic ways to the DOT worker functions of complexity of dealings with data, people, and things. As reviewed earlier, that study showed that higher-level clusters of work require more complex dealings with data. That study also showed that spatial aptitude is particularly important if complexity of dealings with things is high relative to dealings with people, whereas clerical aptitude is especially important when the reverse is true; that is, when complexity of dealings with people is high relative to dealings with things. It should also be remembered that the data on aptitude requirements used in that research are based on studies of actual job performance. Although this evidence is valuable, more is clearly needed. This section provides extensive new evidence that aptitude requirements are systematically related to the behaviors (e.g., specific skills) required of workers, the job conditions to which they are subject, the difficulty of their training, and the importance of their work to the employing organization.

B. Sources of Comprehensive Occupational-Level Data for Testing Functional Hypotheses

The basic assumptions of functional theory concern the relations among different attributes of occupations (e.g., importance, difficulty of training),

and occupational-level data are required to answer them. Three existing bodies of occupational data are particularly useful in this context because they provide measures of diverse job attributes for a large proportion of all occupations in the United States: the 47 rating scales of the Dictionary of Occupational Titles (DOT, U.S. Department of Labor, 1977), the archives of the Position Analysis Questionnaire (PAQ, Mecham, McCormick, & Jeanneret, 1977a; McCormick, Jeanneret, & Mecham, 1972), and published data from the 1970 U.S. census of population (U.S. Bureau of the Census, 1973, Tables 1 and 38). Census data are frequently used in sociological research, as are a few of the rating scales of the DOT (e.g., data, people, things). However, the PAQ provides invaluable data of high quality which apparently have not been previously used in stratification research.

Together, these three sources provide data on the following six classes or domains of job attributes whose theoretical relations with each other will be discussed in Section VII.

(1) job context: the job conditions to which workers are subject (e.g., degree of structure, amount of supervision, interpersonal conflict),

(2) job importance: the potential impact the job allows incumbents to have on the organization (e.g., level of responsibility, criticality of differences in job performance),

(3) worker behaviors required: the activities or actions workers must carry out to get the job done (e.g., decision making, persuading),

(4) worker traits required: the psychological, social, and emotional traits that enable workers to carry out required work actions (e.g., aptitudes, interests, temperaments),

(5) education and training required: the amount and difficulty of training which provides specific skills and knowledges (e.g., specific vocational preparation, general educational development level, years of experience), and (6) characteristics of job incumbents: the traits of people who actually are employed in different occupations (e.g., median years of education completed, percent of workers who are female).

A total of 47 DOT occupational ratings, 96 PAQ occupational ratings, and 12 census descriptors of occupational incumbents were used in the analyses reported in this paper. The PAQ attributes include 64 of the most relevant 194 "job elements" of the PAQ and 32 "divisional" factor scores which had previously been obtained from separate factor analyses of the six sections of the PAQ. Two other sources were also useful. Measures of occupational prestige and self-direction were obtained from Temme (1975); codes representing the six Holland (1973) personality and job types were obtained from Gottfredson and Brown (1978).

All data were aggregated according to 1970 census occupational category and complete PAQ, DOT, and census data were available for 274 of the relevant 427 census categories. These 274 occupations comprise 86.5% of employed workers in 1970 and so provide very comprehensive coverage of work in the U.S. economy. The foregoing sets of data are described more fully in the appendix to this paper.

C. Predictions Tested

The strategy adopted here was to determine first the major dimensions of the nature of work--that is, the dimensions of work activities, demands, and contexts--by factor analyzing a small but comprehensive set of such attributes. In particular, a principal components analysis (with varimax rotation) was performed on the 32 broad PAQ divisional dimension scores, the DOT rating for physical strength, and eight of the nine DOT aptitude ratings (these latter being parallel to the aptitudes tested by the GATB that were discussed earlier). Next, all individual job descriptors that had not been used in the factor analysis, including the DOT rating for intelligence requirements, were correlated with the factor scores for each occupation that were generated from each of the ten factors having eigenvalues greater than 1.0. Finally, the standing of particular occupations on each of the factors was inspected. These latter two procedures provide additional information for interpreting the factors obtained by the first procedure.

Although to a large extent the analysis reported here was exploratory, the following general predictions were made.

H1: Multidimensional nature of worker aptitude requirements. Jobs differ in their aptitude requirements both for levels of aptitudes required and for the types of aptitudes they require. Research reported earlier in this paper suggests that cognitive, interpersonal, and motor aptitudes will be associated with somewhat different work factors. No direct measures of interpersonal aptitude are included, but measures of worker behaviors (i.e., specific skills such as "persuading") provide relevant evidence.

H2: Primary importance of cognitive aptitudes. Cognitive aptitude requirements are more useful in distinguishing among occupations than are non-cognitive aptitudes. That is, the highly g-loaded DOT aptitudes will load most highly on the first principal component and will load more highly than aptitudes from either the interpersonal or motor domains.

H3: Functional link between work behaviors and worker aptitudes required. The types and levels of aptitude requirements (e.g., verbal, spatial) are related in systematic and functionally relevant ways to the types and levels of worker behaviors (e.g., using oral information, using patterns) required to perform the tasks of an occupation.

H4: Link between work behaviors and job context. What workers are required to do (work behaviors such as coordinating others) and what they are required to tolerate on the job (conditions such as interpersonal conflict) have a common origin in the particular products or services workers are expected to produce. Measures of work tasks (i.e., work products) are not available here, but systematic relations among work behaviors required and job conditions provide relevant evidence. (See Dunnette, 1976, on the distinction between work tasks and work behaviors.)

H5: General intellectual difficulty level of tasks is the major dimension of work. Work behaviors which are commonly perceived as intellectually difficult (e.g., reasoning, decision making) load very highly on the first principal component. (This hypothesis follows from H1 and H3.)

H6: Intellectually difficult jobs require difficult training. Occupations which require more intellectually difficult behaviors also require higher

level academic skills (e.g., higher levels of GED) and longer periods of job-relevant training (e.g., specific vocational preparation). Specifically, intellectually difficult behaviors and difficult training will both load highly on the same first principal component.

H7: Intellectually difficult jobs are more critical to the organization. Criticality of work and level of responsibility load highly on the first principal component which represents the general intellectual difficulty level of work. Note that criticality is with reference to the organization and not directly to society at large. Although the latter is what Davis and Moore (1945) hypothesized, worker performance is most directly relevant to the worker's organization and only indirectly to society via the social value of the organization's product. The macrosociolgical perspective adopted by Davis and Moore may have been too broad to register the true functionality of worker performance at the organizational level.

H8: Intellectual difficulty is the primary determinant of occupational prestige. Occupational prestige loads very highly on the first principal component, which represents general intellectual difficulty of work.

D. Results: Ten Dimensions of Work

Table 3 shows the factor loadings of the variables on each of the ten factors with eigenvalues over 1.0; the 41 job descriptors are ordered according to the job factor with which they are most highly correlated. Only loadings of .25 or above are shown and all loadings of .40 and above are underlined. To aid in interpreting these factors, Table 4 shows correlations with the ten factors of the 64 PAQ elements, the remaining 34 DOT scales, 9 types of census

data about workers, the six Holland categories, prestige, and self-direction. Only correlations of .20 and above are shown. These variables are also listed in order according to the factor with which they are most highly correlated. Because so many variables (77) are most highly correlated with the first factor, they are further subdivided according to the type of job attribute they represent.

Insert Tables 3 and 4 about here

Table 3 shows that the ten factors together account for over 75% of the variance in the 41 job descriptors, with the individual factors accounting for from 26% to 3% of the variance. Data from Tables 3 and 4 provide the following portraits of each of the factors. Data about the composition of the 32 PAQ divisional dimensions shown in Table 3 were also used in interpreting the factors (see Mecham et al., 1977c).

Factor 1: Overall intellectual difficulty of dealings with data and people (25.7% of the variance in job attributes; correlation with intelligence requirements: .84). This factor is clearly a general job level or difficulty factor. Both the factor loadings for the PAQ divisional scores (Table 3), the DOT aptitude ratings (Table 3), and the individual PAQ, DOT, and census variables (Table 4) show that the first factor represents high-level mental activities (e.g., reasoning, decision making, and analyzing) and mental aptitudes (e.g., verbal and numerical aptitude). It is highly correlated (.84) with estimates of the general intelligence level required by the job as well as with the prestige it affords (.82). To a lesser degree, this factor also represents dealing with people in complex ways (e.g., negotiating and

instructing) and being subjected to the stresses generated by such dealings (e.g., interpersonal conflict and strained contacts). Jobs high on this factor are personally demanding in other ways (e.g., civic obligations and personal sacrifice) but represent physically undemanding and safe work in business-like settings. Jobs low on this factor require physical strength and tend to expose workers to unpleasant (e.g. noisy or hazardous) environmental conditions. Not surprisingly, the work high on Factor 1 tends to be "investigative," "social," or "enterprising" according to Holland's typology of work, and jobs low on the factor are generally in Holland's "realistic" category. This factor also represents jobs that require high levels of GED (general educational development), job-specific training, continual updating of knowledge, self-direction, and general responsibility. Criticality of position to the organization is more highly related to this factor (.71) than to any other. This factor is moderately correlated with working for the government, moderately negatively correlated with percentage of workers who are black, and uncorrelated with percent female. Judges, physicians, urban planners, and chemical engineers are examples of occupations high on this factor; clothing ironers, farm laborers, and bottling operatives are low.

The validity of the first factor as a general intelligence or intellectual difficulty factor is supported by data (Mecham et al., 1977b, pp. 127-128) showing that the two PAQ dimensions that have the highest correlations with the mean scores of workers on the General Aptitude Test Battery (GATB) cognitive tests are the same two PAQ dimensions that load most highly on the first factor here: Using Various Sources of Information (dimension 2) and Communicating Judgments/Related Information (dimension 17).

Factor 2: Complex dealings with things and use of patterns (11.3% of variance; correlation with intelligence requirements: .21). This second factor shares some aspects of the first factor in that it is moderately correlated with demands for training, math, and interests in creative vs. routine work, but it emphasizes dealing with things rather than people. It represents skilled technical work that requires spatial aptitude, manual dexterity, form perception, use of patterns or pictorial materials, adherence to set limits, tolerances, or standards, and interests in science and tangible products rather than in business or social esteem. The work tends not to be involved with people. Work high on this factor tends to be either "investigative" or "artistic" according to Holland's typology; work low on the factor tends to be "social" or "enterprising." Like the first factor, but to a lesser degree, it is negatively correlated with percentage of workers who are black; it is not correlated with percentage who are female. Physicians, architects, draftsmen, and painters and sculptors are examples of jobs high on this factor, as are some of the more artistic crafts jobs such as pattern and model maker.

Factor 3: Vigilance with machines and processes (10.6% of variance; correlation with intelligence requirements: .08). This factor represents the need to be aware of the environment and events and to be alert to changing conditions while controlling machines, processes, or vehicles. Responsibility for both materials and for the safety of others are more highly correlated with this factor than any other, and licensing or certification tends to be required. Jobs high on this factor tend somewhat to involve interaction with, observation of, and stress in dealing with other people, and they tend to be unstructured and to be performed outdoors. Airplane pilots, taxi drivers, and crossing guards are examples of jobs high on this factor.

Factor 4: Operating machines (6.2% of variance; correlation with intelligence requirements: -.24). This factor is highly correlated with operating any of various types of machines, tools, equipment, or devices and interpreting sensory information (e.g., recognizing sound patterns, estimating speed of moving objects). Vigilance to infrequent or changing events, responsibility for the safety of others, following set procedures, and cycled activities are moderately correlated with this factor. Like the first factor, but to a lesser degree, this machine factor is associated with the need for short-term memory, attending to detail, precision, working under some time pressure, and working indoors. In contrast to the first factor, however, this factor is somewhat correlated with repetitive or structured activities. Work schedules tend to be non-typical (e.g., variable or night shifts). Longshoremen, electrotypers, radio operators, and radiologic technicians are examples of occupations high on this factor.

Factor 5: Controlled manual activities (4.6% of variance; correlation with intelligence requirements: -.07). This factor involves the use of any of a variety of tools or the direct use of hands for assembling or adjusting tasks. The work tends to require reasoning, planning, being alert to changing conditions, and the use of patterns and pictorial materials, as well as considerable physical demands such as stooping, climbing, exertion and strength, and above average hours per week. Experience, training, and responsibility for materials and safety are moderately correlated with this factor. The work requires considerable interaction among workers for exchanging information necessary to carry out the work, and it requires instruction and supervision of helpers and apprentices. Other than the first factor, this one is the only one to be correlated with criticality of the work. The work tends to be

hazardous and performed outside and in an unpleasant (e.g., noisy or dirty) environment. It tends to be "realistic" but not "conventional" according to Holland's typology. This factor is moderately negatively related with percentage of workers who are female; it is not correlated with percentage black. Most occupations high on this factor are crafts occupations such as brickmason, carpenter, millwright, and railroad car shop mechanic.

Factor 6: Catering to people (4.2% of variance; correlation with intelligence requirements: -.02). This factor represents supervising non-employees and dealing with children or adults to entertain or serve. It is moderately positively correlated with Holland's "social" category of work and negatively with the "conventional" category. Coordination of activities (without line authority) and instruction are somewhat correlated with this factor, as are observing behavior and events for information, an interest in social welfare, and responsibility for the safety of others. The work tends to involve considerable bodily activity (e.g., walking, standing) but not strength. Jobs high on this factor tend not to have set limits, tolerances, or standards or measurable or verifiable criteria. Further, they tend not to involve math or quantitative information. Public speaking, personal sacrifice, civic obligations, and an irregular schedule are moderately correlated with the factor. Licensing and certification requirements are more highly related to this factor than to any other. Kindergarten and elementary school teachers, musicians, and physicians are examples of occupations high on this factor.

Factor 7: Physical coordination without visual control (3.8% of variance; correlation with intelligence requirements: -.07). This factor correlates most highly with the PAQ dimension General Physical Coordination, which in

turn correlates highly with physical activities such as moving limbs without visual control and finger manipulation and moderately with keyboard devices (Mecham et al., 1977b). This is consistent with the factor's moderate correlation with the DOT measure of motor coordination. There is a tendency for occupations high on this factor to require coding, transcribing, short-term memory, working under distractions, and an interest in business, and they fall most often in Holland's "conventional" category of work. The work also tends to be structured and characterized by set procedures and a specified workpace; reasoning and decision making are somewhat negatively correlated with this factor. This factor is moderately correlated with percentage female, and occupations high on the factor tend to have younger workers. Many of the occupations high on this factor are clerical occupations such as stenographer, typist, and keypunch operator, but musicians, and practical nurses also are high on this factor.

Factor 8: Selling and variable pay (3.4% of variance; correlation with intelligence requirements: -.12). This factor appears to represent work selling goods or services because it involves dealing with public customers, sales personnel, and buyers. In addition, it is correlated with Holland's "enterprising" category of work. The work tends to require persuading and influencing, working under distractions and time pressure, serving or catering, and an interest in business. Tips and commissions are both moderately correlated with this factor, reflecting the fact that pay is variable rather than salaried. Hucksters, advertising agents, waiters, and real estate agents are high on this factor.

Factor 9: Using senses to inspect or evaluate (3.1% of variance; correlation with intelligence requirements: -.10). This factor involves using senses such as touch, taste, odor, and body movement sen ing and involves judging objects or processes according to speed, quality, size, and related aspects (Mecham et al., 1977c). Factor 9 consists entirely of sensory acuity and perception; none of the other variables are correlated with it. It should be noted that specific auditory and visual skills are not associated with this factor. Inst ad, sound recognition is related to Factor 4 (Operating Machines) and visual perception (e.g., depth, color) to Factors 3 and 4 (Vigilance with Machines and Operating Machines). Occupations high on this factor include decorators, inspectors, athletes, and photographers.

Factor 10: Specified apparel (2.5% of variance; correlation with intelligence requirements: .06). This factor is very highly negatively correlated with the PAQ dimension of wearing optional vs. specified apparel, for example, not wearing uniforms. It correlates moderately (negatively) with handling activities such as arranging/positioning and feeding/offbearing and positively with receiving tips. Occupations high on this factor include garage workers, waiters, bartenders, foresters, and practical nurses.

E. Discussion

The f going results are consistent with the predictions listed above. A general intellectual difficulty factor dominates among all dimensions of the nature of work and it represents work that is prestigious for the worker and often critical for the organization. The other dimensions of work revealed by the factor analysis are also meaningful because aptitudes, behaviors, and work context were all related in sensible ways and in ways which are consistent

with what is already known about the organization of work. For example, the dimensions are consistent with research and theory in vocational psychology about how interests, competencies, and job activities cluster together by field of work. To take a specific example, Factors 6 and 8 (Catering to People and Selling) reflect the distinction in Holland's (1973) typology between two types of people-oriented work--manipulating people to help them ("social" work) and manipulating people to fulfill organizational goals ("enterprising" work). And as was described in an earlier section of this paper, educational attainment appears to be related quite differently to status and income in these two fields of work.

The results also help clarify certain aspects of the occupational hierarchy that are perhaps misunderstood. First, jobs that require difficult or lengthy training and education also require more experience and continued updating of knowledge. Thus, education and on-the-job training (including experience) tend not be <u>alternative</u> means of job preparation as is often assumed. Furthermore, jobs that require more training for entry also require <u>continual</u> learning <u>after</u> training is completed. This may help to account for the fact that when cognitive tests predict performance in training, they also predict performance on the job.

Second, high-level jobs are not uniformly pleasant for workers, as many burnt-out human service workers (Edelwich & Brodsky, 1980) and harried executives can confirm. Stratification researchers have quite accurately decribed low-level work as physically arduous, environmentally unpleasant, dull, and constricting in contrast to the environmentally pleasant, challenging, and more interesting work at the higher levels. However, it is clear from the

foregoing analysis that high-level jobs tend to be emotionally taxing and to require off-the-job sacrifices. Many high-level workers are probably also ambivalent about the amount of responsibility and ambiguity which accompanies unstructured, self-directed work. Indeed, although few people refuse promotions, half of those who do refuse them say that it is because they do not want the added responsibility (Gordon & Thal-Larsen, 1969, p. 358).

Third, stratification research has long drawn a head vs. hand distinction among jobs, referring to the latter as manual work. Figure 1 showed that this is an accurate characterization when considering which aptitudes are most important for job performance. However, the factor analysis is consistent with the earlier research (Gottfredson, 1984) in suggesting that the jobs designated as manual probably tend to be low-level jobs requiring physical strength. They are not necessarily the jobs requiring either high levels of psychomotor skill or complex dealings with things. The aristocrats of manual work (i.e., craftsmen) must often exercise high levels of motor skill and deal in complex ways with machines, materials, or tools, but this is also true for many clerical, technical, and artistic workers who are never considered to be manual workers.

VI. NEW EVIDENCE FOR THE FUNCTIONAL BASIS OF EDUCATIONAL REQUIREMENTS: AN ANALYSIS OF MEDIAN EDUCATIONAL LEVELS IN DIFFERENT OCCUPATIONS

A. Evidence Needed

Earlier sections of this paper made the case that schooling is important primarily because it sorts people roughly according to intelligence. Extensive evidence was also presented, however, that jobs at the same level may

require differert non-cognitive aptitudes, knowledges, and skills and that settings other than schools may be most effective in selecting and in enhancing those traits. In short, explanations of the educational requirements of occupations should take into account the multidimensional nature of work demands and should allow for the possibility that education may be relevant to fulfilling some of them but not others.

This section analyzes the levels of education that are typical of workers in different occupations, these levels being taken here as a de facto measure of the educational levels employers have and have not required of their workers in the past. The results of these analyses provide evidence about why schooling is important in allocation (i.e., mobility) processes. The final section of this paper will evaluate these results in terms of their implications for a different issue--the role of schooling in sustaining the occupational hierarchy itself. That section will also turn this issue on its head by describing how the success of schools in sustaining the flow of qualified workers to this hierarchy via their intelligence-sorting function can affect the extent to which employers will rely on educational training and credentials when hiring workers and thus sustain the importance of credentials in the mobility process.

B. Predictions Tested

The general hypotheses were that (a) educational levels are accounted for primarily by the intelligence requirements of jobs and that (b) other dimensions of work can help account for educational levels that are high or low net of intelligence requirements. Testing these hypotheses required a two-stage analysis. First, median educational levels were regressed on the estimated

intelligence requirements of those occupations in order to determine the extent to which those requirements can account for occupational differences in educational levels. Second, the ten job factors and median age of workers were used to predict the degree to which educational levels are either above or below that expected on the basis of intelligence requirements alone. The latter was accomplished by regressing median education of workers on the ten job factors and worker age after removing the component of those variables associated with intelligence. Specifically, the regressions were performed on partial correlations between all variables where intelligence requirements was the one variable partialled out of all the others. All analyses were performed twice--once using data for female incumbents and once for males.

Four hypotheses are presented below. The last three (H10 to H12) refer to educational levels which represent systematic deviations from the expected. These three predictions can only be partially tested because they specify constructs which are not directed measured in the data. They do, however, illustrate the sorts of relations that might be expected between educational requirements and multidimensional work demands in a largely functionally-based division of labor, so they will be justified in some detail. These latter three predictions do not refer specifically to any of the ten job factors used in the analysis because all predictions were made prior to the factor analysis of job attributes.

H9: The educational levels that are typical of workers in different occupations can be explained primarily by the intelligence requirements of their occupations. Most of the variance in median educational levels should be accounted for by DOT ratings of intelligence requirements. However, because

one can plausibly argue that DOT job analysts were influenced by the educational levels of workers in making their intelligence ratings, an alternative test of the hypothesis is also provided. Factor 1 clearly represents a general intellectual difficulty dimension of jobs that is derived from the activities workers actually have to perform and the competencies they have to display rather than from the credentials they may possess, so the relation of Factor 1 with educational levels is compared to that of the DOT intelligence ratings.

H10: Higher-than-expected schooling levels are found where the specialized skills and knowledge required by jobs are academic rather than interpersonal or motor. Providing specialized knowledges is an important manpower function of schooling but, as already noted, formal schooling provides such job preparation for some types of work but not others. To the extent that academic intellectual skills (e.g., extensive reading, writing, or higher mathematics) and a familiarity with a large recorded body of knowledge are required for the job, the more likely it is that workers will be trained for long periods of time in formal educational settings. If motor or interpersonal skills are also required but are secondary to the academic skills, they will probably be supplied in the formal educational settings as well (e.g., nursing, medical or dental training, laboratory science) or administered by schools (e.g., internships). To the extent that special motor or interpersonal skills are more critical than academic skills, a more hands-on training will continue after leaving formal schooling (apprenticeships in the crafts, job training programs within companies, or gaining experience by working one's way up some job ladder such as to foreman). Once requisite academic skills are obtained, there is no advantage (and probably only interference) by continuing training in

"book-learning" settings, because formal educational settings are poorly suited to fostering or assessing the motor skills, interpersonal skills, or personality traits critical in some jobs; these non-academic skills will be honed only in settings where they can be exercised and realistically tested. If the most critical skills on a job cannot be obtained in an educational setting, then there will not be any particular premium for being educated beyond the average required for a given intelligence level as there will be for jobs where formal schooling is more suitable for providing specific job knowledges.

H11: Higher-than-expected schooling levels are found in jobs where poor worker performance puts people (e.g., clients or customers) in personal jeopardy (physical, emotional, psychological), but poor performance is difficult to detect or discipline (e.g., not very measurable). Stated another way, reliable performance is required in the absence of direct supervision, evaluation, and accountability for inflicting personal injury. These tend to be jobs where workers deal with people in complex ways either as people or as objects (e.g., psychological and medical services), often as individual clients, patients, or students. "Excess" education would be expected to be higher where the vulnerability of the "consumer" vis-a-vis the provider of those services is higher (e.g., the more risky the service, the younger the client, the more personal the service, the less open it is to outside scrutiny, the less able the consumer is to judge its quality, the less direct the redress the consumer has). Because clients are not in a position to evaluate services before they are obtained, and because they place themselves at some personal risk if performance is poor, they are most likely to use those services if the organization or the occupation providing them has a reputation for providing good, or at least safe, services. It is generally difficult

even for the workers who provide human services to measure their own accomplishments (Edelwich & Brodsky 1980, pp. 16-17). Thus, organizations and occupations providing those services use extraordinary schooling in an effort to impress potential customers of, and in fact to help assure, before-the-fact quality control. Professions and semi-professions are the primary occupations where this strategy has been pursued to develop and maintain a market for some particular service. This hypothesis is consistent with Collin's (1974) finding that educational requirements are highest in organizations stressing a service rather than a market orientation, and emphasizing normative control over employees.

H12: Lower-than-expected schooling levels are found where reasonably clear and accepted criteria for judging workers' job performance exist, poor performance can be effectively disciplined, and non-academic (e.g., interpersonal or motor) skills are most critical for job performance. Because non-academic skills are most important, specialized training is not likely to take place within formal schooling settings. Because it is fairly clear whether or not a worker is doing a satisfactory job and the worker is likely to be penalized, disciplined, or fired for consistently poor performance or gross mistakes, employers or customers are more concerned with worker output than with worker training or technique. Thus, in addition to not placing any premium on additional formal education beyond some minimum, a history of good performance or the demonstration of the requisite skills can override a lack of schooling or training of any sort (except where union rules may restrict the eligible supply of labor). This means that employers not only can risk hiring workers with weak educational credentials (because they can get rid of them if they do not work out, they can link compensation to performance, or they can exercise

some other control for poor performance), but also that they will be willing to hire or promote proven effective workers whatever their educational or training credentials. Such a hypothesis is consistent with evidence that many successful executives, entrepreneurs, and salesmen are not highly educated, and also that they report that neither educational credentials nor academic skills such as reading and writing are critical on their jobs, but instead claim that non-academic ones are (Gottfredson, 1977b; Gottfredson et al., 1984a).

C. Results

Intelligence requirements predict educational levels in different occupations. Table 5 shows (above the diagonal) the zero-order correlations between intelligence requirements, job factors, median age of workers, and years of schooling completed by males and females; correlations below the diagonal are partial correlations after controlling for the intelligence requirements of jobs. Intelligence requirements and schooling levels are very highly correlated for both men (.86) and women (.81), which is consistent with the hypothesis that occupational differences in educational requirements are determined largely by the intelligence requirements of jobs. Educational levels are correlated almost as highly with Factor 1, which represents a general intellectual difficulty factor of work (.83 for men and .76 for women). It is also interesting to note that educational levels for men and women are themselves correlated .92. Considering the fact that many women might not be expected to obtain the full return on their investments in education because of their less regular and less sustained participation in the labor force, this correlation seems quite high and reinforces the impression given by the foregoing results

that whatever process governs educational requirements is common to both sexes.

Insert Table 5 About Here

Other aspects of work help account for unexpectedly high or low levels of education across occupations. Table 5 indicated that intelligence requirements can account for 74% of the variance in schooling levels across jobs among males (i.e., .86 squared) and 66% of the variance for females (i.e., .81 squared). Table 6 shows to what extent age of workers and the ten job factors increase the amount f variance explained beyond that explained by intelligence requirements alone. The upper panel of Table 6 represents the regression of the residuals for education (i.e., educational levels net of intelligence requirements) on similar residuals for age and the ten job factors; it therefore represents the proportion of the variance in educational levels which has not been explained by intelligence requirements which can be explained by the other 11 variables. The lower panel of Table 6 shows what proportion of the total variance in years of education that additional amount constitutes. The regression coefficients in that upper panel provide evidence about the degree to which each of the individual eleven predictors is related to educational levels that are either above or below those expected on the basis of intelligence requirements alone. Once again, because the intelligence requirements scale may be of questionable validity, an alternative regression for each sex is provided which excludes that variable and which relies on Factor 1 to measure intelligence demands.

Insert Table 6 about here

Median age of workers can account for an additional 2% of the variance for men and 6% for women; the ten job factors can account for 6% and 8%, respectively; and age and the job factors together can increase variance in educational levels explained by 8% and 12% to a total of 82% and 78%, respectively. The regression coefficients for the ten job factors are largely unaffected when age is included in the regression equation, so attention can be focused on the third and more elaborate regression model. Median age of workers in an occupation is negatively related to educational levels. This probably reflects the fact that educational levels in the population have risen over time for all segments of society, and that occupations that are declining in size or growing only slowly are likely to have somewhat older and less well educated workers, net of the intellectual demands of those jobs. Conversely, new or fast-growing occupations are likely to have younger and better-educated workers net of intelligence. Turning to the job factors, Factor 1 (General Intellectual Difficulty) is strongly associated with higher than expected levels of education for both sexes; Factor 6 (Catering to People) has a smaller positive effect but only for females. It should be made clear that although controlling for intelligence requirements does not reduce variance in nine of the ten job factors much if at all (e.g., see the zero-order correlations in Table 5), it leaves only 29% of the original variance in Factor 1. The large regression coefficient for Factor 1 is therefore especially impressive. Factor 4 (Operating Machines) and Factor 8 (Selling) have moderate negative effects on the educational levels of different occupations for both sexes; Factors 5 and 7 (Controlled Manual and Coordination Without Sight) have smaller negative effects.

The fourth equation for each sex shows the regressions of the non-residualized educational level on the non-residualized eleven predictors (ignoring the intelligence requirements rating altogether). The results are the same as for the preceeding regressions in the sense that Factor 1 is clearly most important in accounting for higher educational levels; having younger workers is moderately associated with higher educational levels; and Factor 6 (Catering to People) has a small positive effect for women. Once again, selling and various types of machine and manual work are associated with lower than average educational levels net of intellectual difficulty level as measured by Factor 1. (The ten job factors are completely uncorrelated in the last regression analysis, as shown in Table 5, and therefore their effects are entirely independent of each other--but not of age--in these later regressions). The factor which best represents high-level motor skills--Factor 2 (Work with Complex Things)--is not significantly associated with educational level, but this may be a result of its positive correlation with intelligence requirements (.21), requirements that are not completely controlled in this regression.

D. Discussion

The foregoing results are consistent with the first hypothesis (H9) that the intellectual difficulty level of occupations can account for most of the variation in worker educational levels across occupations. The ten job factors do not directly operationalize the conditions laid out in the other three hypotheses (H10 to H12), but they do provide evidence consistent with them. Specifically, it was the case that the most academic of the factors--Overall Intellectual Difficulty (1)--was related to unexpectedly high schooling lev-

els. In contrast, three of the factors representing motor activities were associated with lower than expected schooling: Operating Machines (4), Controlled Manual (5), and Coordination Without Sight (7). As hypothesized, dealing with people was related to either higher or lower than expected schooling depending on the type of activities performed, although the relations were found only among women in one of the two cases. Specifically, catering to people's needs was associated with higher than expected schooling levels, which is consistent with Hypothesis 10; selling to people was associated with lower than expected schooling, which is consistent with Hypothesis 12. Although several factors are correlated with responsibility for the safety of others, the only one which specifically involves people-oriented work is Catering to People (6). This is consistent with Hypothesis 10 which predicted that workers who provide services with some personal or bodily risk to their clients will be more highly educated than otherwise expected. Recall also that licensing/certification requirements are more highly associated with the Catering to People factor than with any other (Table 4).

To illustrate these results more concretely, people who deal with others in a helping capacity--such as social workers, most types of teachers, and chiropractors--have schooling levels substantially above what might be expected on the basis of the intellectual difficulty of their jobs. However, workers who deal with things and exercise important non-academic skills--such as musicians, farmers, tailors, shoe repairmen, and farm product buyers and shippers--have substantially lower than expected schooling levels. Some of the latter are also older than average workers, which accounts in part for the lower than expected schooling levels.

The importance of tips and commissions for jobs high on Selling (Factor 8) and the tendency to receive wages and not a salary for Operating Machines (4) are also consistent with Hypothesis 12 which stated that the ability to tie rewards to performance can relieve employers of the need to assure competence before-the-fact via educational credentials. Measurable and verifiable criteria and set standards, tolerances, and limits are both negatively correlated with Catering to People (6), which is related to higher than expected schooling. Although this is consistent with the predictions, these measures were not related in the hypothesized manner to the other factors.

In short, the results of the two alternative procedures--one using the intelligence rating and one not--are somewhat different in detail, but they give the same overall impression: educational demands vary primarily according to the intellectual difficulty level of occupations but also to some extent according to the non-cognitive demands and the structure of activities that characterize some jobs.

VII. A THEORY OF NATURALLY-OCCURRING OCCUPATIONAL HIERARCHIES

This section of the paper clarifies how each of the preceding types of evidence constitutes a piece in the larger puzzle of occupational stratification. Although they are all essential pieces of the puzzle, these data do not provide information about certain key aspects of stratification processes. Therefore, much of this section is devoted to outlining the probable dynamics of two structural processes: (a) how occupations become differentiated over time according to level of intelligence requirements (i.e., how the occupa-

tional hierarchy evolves) and (b) how "signals" of worker quality (in particular, schooling history) can enhance or suppress occupational differentiation as well as affecting the fate of individual workers in society. These final speculations are included here both to strengthen the case for the empirically grounded components of the modified functional theory as well as to show what types of data are needed to increase our understanding of the role education plays in occupational stratification.

A. Summary of Major Components of the Theory

Figure 2 graphically organizes the various issues examined in this paper. It helps to pull together into a coherent picture the diverse types of evidence already discussed; it also helps provide an orientation to the remainder of this paper. This figure does not constitute the theory being presented here, but it does illustrate its major components. It should be made clear at the outset that Figure 2 is not intended to portray all that we know about occupational stratification; for example, it ignores the status and income attainment processes that have been researched extensively. Instead, Figure 2 is an attempt to outline some of the less well understood processes in occupational stratification which this paper specifically addresses.

Insert Figure 2 about here

Figure 2 shows the distinction between structural and allocation processes that has been so central to this paper, and it shows that hiring and promotion processes constitute the interface or link between workers and the occupational structure. Another distinction is portraye.. near the top of the figure: (a) the underlying traits of individua and jobs which constitute the

fundamental functional reality of those entities versus (b) the more public differences among workers and jobs by which they are understood and evaluated and which thus are the differences that most directly influence employer preferences for workers and worker preferences for education and jobs. To take two examples, worker education is an important signal of worker quality to the employer and occupational income is an important signal of job quality for the worker. Processes of stratification cannot, however, be understood only in terms of these public and simplified faces that workers and jobs typically present to the world. The occupational hierarchy, for example, can be understood only with reference to the human aptitudes jobs actually require for their successful performance. As will be discussed more fully below, hiring may depend more on public signals of worker quality than on workers' underlying traits, but worker performance depends more on the underlying traits; thus the underlying traits operate as constraints on the types of signals employers will continue to rely on in the long run if they are at all concerned about performance levels.

It is useful to draw distinctions between work tasks, work context, worker behaviors required, aptitudes required, and specialized knowledges required. These are illustrated to the l ft of the figure. The tasks to be performed by workers are a consequence of the type of product that the organization strives to produce. These tasks are associated with certain types of job conditions or contexts that arise from both the nature of the task and organizational goals. For example, building a road is dirty and outdoors work, and dealing with people is often emotionally stressful. These tasks in turn require certain types of worker tolerances, interests, and values. The latter are not of direct relevance here, however, because they relate more to issues not dealt

with in this paper--lateral differentiation among occupations and the mix of monetary and non-monetary rewards necessary to recruit people to different types of work. Most relevant in this context is that tasks require certain behaviors of workers (e.g., using certain tools or equipment, persuading or influencing others). In order to perform these behaviors adequately, workers must in turn possess certain general aptitudes (e.g., intellectual or motor aptitudes) and specific job-related knowledges or proficiencies. Because the learning of special job-related knowledges and skills itself depends on aptitude level, the figure shows that the aptitude demands of a job stem from the behaviors required both in training and on the job. When viewed across the full spectrum of jobs, the general aptitudes and specific knowledges required of workers different jobs array themselves into skill hierarchies, of which the intelligence requirements hierarchy, is the most important.

Functional theories of stratification imply that differences in occupational demands, and thus occupational rewards too, stem ultimately from differences in the nature of work performed in different occupations. This paper widened that focus somewhat by noting that differences in the nature of work and the aptitudes jobs require are multidimensional. From this perspective, functional theories of stratification have really been concerned with only one special case (the vertical aspect) of a more general problem. This paper, too, focuses primarily on the vertical dimension of the functional requirements of work, but one reason other dimensions of work were discussed at some length was to strengthen the functional claim that the aptitude demands of work do indeed stem in large part from the nature of work itself. This was one contribution of the factor analysis--showing that work contexts, worker behavior and training requirements, and aptitude requirements are all syste-

matically and rationally organized along several dimensions of work. Another contribution of that analysis was, of course, to show that the prestige hierarchy essentially mirrors a hierarchy of intellectual demands, and that this intellectual difficulty dimension dominates all others.

While laying out the general functional case for the entire division of labor, the figure also portrays some components of the more special case of its hierarchical aspects. For example, the three constructs that Davis and Moore (1945) seemed to identify as critical for explaining the hierarchy of occupational rewards are represented in Figure 2: importance of the occupation, scarcity of the required talent, and arduousness of training. Although this paper has dealt with only one aspect of occupations that is typically considered a reward--occupational prestige--it has shown that prestige, criticality, scarcity, and length and difficulty of training are all highly correlated with the same dimension of work--overall intellectual difficulty. Although the data provide evidence consistent with the general arguments by Davis and Moore about the role of these three constructs, two of three constructs are defined differently here and so represent significant departures from their theory. Criticalness refers here to the consequences of variable worker performance for the organization. Davis and Moore stressed the importance of individual occupations for society itself, but this would seem to be another issue entirely and one which requires the study of the contributions of organizations to society and their role in mediating the contributions of individual workers to society. Most workers sell their services to organizations and not directly to the public. Scarcity simply refers here to the fact that the higher the level of intelligence required by a job, the smaller the proportion of the population that possesses at least that level of intelli-

gence. Although Davis and Moore did not identify the specific talents they thought scarce, it is clear from the quotation presented earlier that they did not consider intellectual capacity to be scarce.

So far, this model provides a picture of an intelligence-based occupational hierarchy which corresponds to the functional demands of work. But how did this hierarchy arise? And what role does education play in such structural processes? Figure 2 is a static portrayal of stratification processes at one point in time, but it does indicate that there are feedback mechanisms. Hiring and promotion processes have consequences both for the productivity of organizations and the socioeconomic outcomes of workers which may influence the future behavior of those organizations and workers as well as that of interested observers. Many of the interesting questions in stratification concern when a social system will be in equilibrium and what sorts of changes will occur over time.

In the immediately following section, I will outline how tasks probably are reorganized over time by difficulty level and so lead to differences in aptitude requirements and the emergence of an intelligence-based occupational hierarchy. Then I will return to what may seem a forgotten issue in this paper--the role that education does and does not play in this process. Revisionists speak of the occupational hierarchy and its associated allocation processes as if they were the conscious creations of the dominant social classes. Another objective of the following pages is thus to show how "naturally-occurring" processes can account for the order that we presently observe.

B. The Role of Intelligence in the Development of Occupational Hierarchies

Occupational difficulty levels. Jobs can be conceived of as fairly stable configurations of tasks. In turn, jobs can be grouped according to their similarities into categories which we refer to as occupations. That there is a considerable variety of jobs within any occupation is evident from glancing at the Census Bureau's Classified Index of Industries and Occupations (1971). There may also be considerable variety in tasks among jobs with the same title. Nevertheless, we generally feel certain enough about the overall similarities and differences in the configuration of tasks constituting jobs that we are able to classify jobs fairly reliably into widely-understood occupational groups.

The segregation of tasks into fairly homogeneous sets occurs for diverse reasons, including technological constraints and the efficiencies to be gained through specialization. Occupations of quite diverse content areas exist at similar prestige levels, but what is of concern in stratification research is in essence why tasks become segregated according to general intellectual difficulty level. No job is likely to consist entirely of easy or difficult tasks, but mean task difficulty levels apparently differ across occupations.

There is some precedent for characterizing a job's overall difficulty according to the average difficulty level of tasks performed in that job within a given period of time (Christal, 1974). That research also supports the claim that rated job difficulty level reflects intellectual difficulty level. When reviewing the Air Force's large occupational research program, Christal (p. 14) described how after considering many alternative definitions of difficulty level, they settled on "the amount of time it takes individuals

to learn to perform a task adequately," and ratings generated according to this criterion were highly correlated with independent ratings of estimated aptitude requirement levels. The difficulty level of jobs appeared to be most clearly dependent on the average difficulty level of the tasks comprising that job, but the number of different tasks (i.e., probably the variety of tasks) also increased rated difficulty level. Number of different tasks performed and number of people directly supervised appeared to peak in middle-level Air Force jobs, and more intelligent workers tended to have been assigned fewer types of tasks but more complex ones.

Changes over time in difficulty levels of individual jobs. One key to understanding changes in occupational demands over time is that individual jobs are generally molded to some extent to conform to the traits of incumbents. As noted above, the tasks comprising a job are somewhat heterogeneous in difficulty level; that is, some tasks in a job are harder or easier than others in that same job. Likewise, the jobs that are recognized as belonging to the same occupational group are also somewhat heterogeneous in average task difficulty level. Some of this heterogeneity is a response to the range of capabilities of the workers with which occupations are manned, because workers and their supervisors will tend to target the job to the capabilities of the individual--capable people drawing the more difficult assignments and less capable people tending to end up, by choice or not, with somewhat easier tasks on the average. In short, jobs are somewhat flexibl and allow the "matching" of people to jobs to continue to some extent after people are hired for jobs. It might also be noted that many jobs do not even exist as job vacancies before they are filled: Granovetter (1981, p. 27) found evidence that many jobs (35% in his sample of high-level workers) are "created only because

employers had come across a person whose characteristics and skills they considered particularly appropriate for this work--even when they had not actively searched for such a person."

It may help to illustrate how this adaptation of job to person can occur in several ways. First, number and difficulty level of tasks within a job probably increase in the early stages of employment as the worker becomes oriented to the job. Christal's (1974) data on the regular increase in job difficulty levels between the 5th and 36th months of service in the Air Force is consistent with this hypothesis. Presumably, as workers learn to master some tasks they are given others to perform. We might further assume that in most employment settings workers are often assigned new tasks as they are judged capable of performing them, which will generally be sooner for more intelligent workers if the tasks are g-loaded. We might further assume that more g-loaded tasks are more likely to be <u>permanently</u> assigned to the more capable workers because they are more likely to perform them successfully, all else equal.

The average difficulty level of a particular worker's job can also change later in employment if employers delegate tasks to those employees. Higher level workers often delegate tasks to lower-level workers that are actually the responsibility of the higher-level worker. "Delegating a task" is generally understood to be the temporary or ad hoc assignment of a task of one job to another. The tasks delegated tend to be of lower than average difficulty for the job from which they are delegated but are of higher than average difficulty for the job to which they are temporarily sent. If the worker who receives the task assignment performs it well, that worker is likely to

receive more such tasks. Furthermore, if the worker is highly capable, tasks of above average difficulty may be permanently delegated to that worker; in effect, the presence of an above average worker in a job can change the average difficulty level of the tasks permanently assigned to that job.

The segregation of tasks by difficulty level into different jobs can also be observed on an on-going basis in our society in the case of craftsmen and other entrepreneurs who build businesses from the ground up. If the concern becomes a growing one, the entrepreneur successively delegates and then permanently assigns the simpler tasks (e.g., production, maintenance, clerical, sales, low-level supervision) to other personnel in order to concentrate on the more difficult and critical ones for the survival of the business (e.g., planning, obtaining financing, hiring). It is apparent, of course, that this process also depends to some extent on the intelligence level of the entrepreneur, because the concern will not grow much unless the entrepreneur is successful at performing the most difficult tasks.

Changes in difficu' y level of occupations (i.e., of collections of jobs). Occupations are collections of jobs and their change over time is contingent upon the types of changes that occur among their constituent jobs. The most likely source of change is when a sustained change in the flow of workers into an occupation raises or lowers the average intellectual ability level of workers in that occupation. For example, if the case of the hypothetical employer who permanently delegated more difficult tasks to the highly capable (i.e., above average) lower-level worker were repeated frequently throughout the system, a new job might be spawned to characterize this new stable configuration of tasks or the occupation as a whole would be perceived as having been

upgraded. So, too, might the jobs from which the tasks were delegated be elevated in difficulty level because those lost tasks were probably among those jobs' less difficult tasks. We might also expect that the more homogeneous (that is, the less variable) the aptitude levels of workers regularly flowing into an occupation, the more homogeneous the task configurations become in difficulty level for different jobs in that occupation--a process that would decrease that occupations's overlap with at least some other occupations.

Employer responses to difficulties in filling their job openings demonstrate that employers do indeed restructure jobs if they cannot find workers with the skills they seek. A study of the employment practices of 309 establishments (Gordon & Thal-Larsen, 1969, pp. 244-247) suggests that employers first step up their recruiting efforts when faced by shortages of specific types of workers, particularly for high-level workers, but that employers also frequently resort to reorganizing the work itself to make it simpler. Relaxation of selection standards and "dilution of job content" were reported more often by employers for lower level jobs than for higher level ones (e.g., 32% for semiskilled jobs vs. 14% for professional and managerial), and such changes were reported much more often than changes in wages or fringe benefits for the low-level jobs.

System-wide changes in relative difficulty levels. If such changes affect only a small proportion of workers, then they may constitute only "local" changes in occupational requirements along the occupational hierarchy. The problem is that in a system where worker intelligence levels are fairly stable, the allocation of talent is somewhat of a zero-sum game and increases in talent in one segment of the hierarchy decrease the availability of talent elsewhere along the hierarchy.

To the extent that intellectual talent is reliably siphoned off to the top of the occupational hierarchy, high-level occupations may be upgraded or increasingly difficult occupations may be created at the top of the hierarchy, but lower-level jobs lose some of their more capable people. As occupations lose their regular supply of higher than average performers, average performance levels may fall and tasks become reorganized on an easier level. For example, this may have occurred in recent decades for the teaching profession.

An illustration of this process is provided by the Armed Forces when the draft was abolished and greater proportions of their enlistees were drawn from the lower levels of intelligence. Christal (1974) outlined three types of contingency plans drawn up by the Air Force to deal with the possibility that incoming enlistees would not as a group allow the Air Force to fulfill its mission satisfactorily. Two of the three contingency plans involved changing the organization of work itself rather than only how enlistees are trained or assigned to jobs. (See also Sticht, 1975, for research stimulated by an analogous concern in the Army.) One contingency plan involved "shredding" the easier jobs from existing job ladders to create new specialty areas consistent with the capabilities of the less intelligent men. Another alternative was to remove the easiest tasks from existing jobs and reorganize them into new and easy jobs. Because of their centralized authority, the Armed Forces represent a much more rationalized and systematic approach to job design than exists in the economy as a whole, but they do illustrate processes that have probably occurred in a less systematic way throughout this society over a long period of time.

Enhancers and suppressors of vertical differentiation. There has been some debate in the literature about whether occupational skill demands have risen or fallen over time (e.g., Rumberger, 1981; Braverman, 1974). The foregoing argument suggests that the overall average of skill demands may have remained fairly stable, but that there has been a growing dispersion or differentiation in skill levels across occupations. It is this dispersion which constitutes the occupational hierarchy.

From this point of view, various social phenomena can be examined for their effects on the form of the occupational hierarchy; they can enhance differentiation, they can suppress it, or they can elevate or lower the entire hierarchy. If we could somehow raise everyone's IQ by, say, 10 points we might expect the entire occupational hierarchy to slowly shift upwards, but for its degree of differentiation to remain much the same unless there is a ceiling of some sort on occupational difficulty levels. Most social forces that have affected the form of the occupational hierarchy, at least those forces in recent history, have probably done so by enhancing or suppressing differentiation rather than by affecting elevation. Social practices that sort people more efficiently to jobs according to intelligence would enhance differentiation. This has probably been one result of the growth of the public educational system. To take another example, as labor force participation rates rise for women and as women become more serious competitors for the high-level jobs, which many women were capable of previously but did not pursue, we might expect greater differentiation among jobs to result. Not only might we expect an upgrading ot some of the highest level jobs, but also we might expect a downgrading of lower-level jobs that women have frequently held in the past. These trends may account in part for the increasing problems companies appear to be having in finding adequate clerical workers (e.g., Price, 1984).

Other social forces can be seen as differentiation suppressors. Productivity and equality in an economy have been conceived of as somewhat inconsistent social goals (Okun, 1975), and social policies designed to produce greater equality of occupational rewards (e.g., through progressive taxation) can be expected to suppress differentiation in task and ability requirements because they probably depress the supply of talented workers available for the more difficult jobs. Differentiation can also be suppressed by policies that increase reliance in hiring and promotion on personal characteristics that are less correlated with intelligence than are the criteria they replace. Whether these policies are instituted to promote greater social justice (e.g., group parity) or whether they reflect unfair biases against certain social groups (e.g., unfair discrimination on the basis of ethnic group, race, sex, or religion), they can have the same effect of suppressing differentiation by decreasing the efficiency by which people are attracted or sorted to jobs by intelligence.

Finally, the multidimensional nature of the demands of work itself can be expected to suppress hierarchical differentiation to some extent. If a noncognitive aptitude is particularly critical in an occupation, employee selection will occur to some extent on the basis of a worker trait that may be independent of intelligence. Even if the job also requires high levels of intelligence, the probability of finding workers high on two independent traits is much lower than finding a worker high on either one alone. This could be expected to result in less than optimal selection for each of the individual traits. Physicians help to illustrate concretely what this means. The occupation of physician is unusual in that it is rated as having high-level requirements for both cognitive and motor aptitude and it presumably

requires interpersonal skills because of its complex dealings with people (e.g., see Gottfredson, 1981, Figure 1). People with high levels of competence in all three areas are surely scarce, so it is likely that to some extent physicians are less distinguished from other occupations in intelligence level than they might otherwise be in order that sufficient numbers of people with an adequate level of competence in the motor and interpersonal domains can be recruited.

The progress of differentiation need not be steady because the competing social goals of productivity and equality can oscillate in importance. Recent social history is probably testimony to this phenomenon. Nor are equilibria likely to be maintained in systems where technology is constantly evolving because technology is essentially a means for increasing output for the same input of worker mental or physical capacities.

Existence of multiple similar intelligence-based hierarchies. It is sometimes suggested that definitions of intelligence are determined by definitions of success in the world of work (e.g., Duncan et al., 1972, pp. 78-79). To the extent that occupational hierarchies differ from one society to another, definitions of intelligence would also differ. For example, Duncan et al. suggest that in hunting cultures concepts of general intelligence might "involve visual acuity and running speed rather than vocabulary and symbol manipulation." While this may have indeed been the case in some non-technological societies (but see Jensen, 1980, p. 248, who cited a study of Kalahari Bushmen of Africa that found that their concept of "practical intelligence" does not differ from ours), it is more relevant to note that few hunting or gathering societies survive in the world. Furthermore, research on occupa-

tional prestige, in conjunction with the data presented earlier, suggests that most recent occupational hierarchies throughout the world may be based on the same human substrate--individual differences in intelligence within a society.

There is much evidence that occupations are ranked in essentially the same order by people from diverse social groups and from very different economic and political systems, and U.S. rankings have varied little since they were first obtained in the 1920s (e.g., see Treiman, 1977, for a review and an international prestige scale). Although Treiman speculates that the prestige hierarchy is based on some unspecified type of power, it seems most likely that occupational power ultimately derives from the advantages of superior intelligence. As noted earlier, the U.S. population is characterized by a wide dispersion in intelligence levels that has probably remained fairly stable throughout this century; furthermore, the intelligence levels of most individuals are largely stable over the greater part of their lifetimes. There is every reason to believe that these two features of the intelligence distribution in the U.S. are mirrored in almost all societies in today's world, and certainly in the industrialized ones where severe malnutritian among children is rare. Among potential bases for the distribution of power, degree of dispersion in intelligence is undoubtedly one of the more stable over time and one of the more comparable across different societies (e.g., compared to economic and political bases of power); it can therefore be expected to best accommodate for the maintenance, if not the emergence, of quite similar occupational hierarchies throughout the world.

In a study of agents in a federal regulatory agency, Blau (1955, pp. 105-116) found that an agent's standing among the other agents in the group

depended on his competence, where competence in turn meant both not having to ask other agents for advice and information as well as being able to give it if asked. Blau's study illustrates how in day-to-day dealings with other people, superior skills and knowledge create at least respect if not power itself for the person possessing that superior knowledge. It may be largely these day-to-day encounters in which co-workers, customers, supervisors, and acquaintances in different occupations reveal their competencies and incompetencies to each other that create and sustain differences in occupational prestige over the long run. High income levels may affect occupational prestige, but perhaps primarily indirectly by their power to draw more competent workers into an occupation.

C. Education as a Signal of Worker Quality

The role of education in occupational stratification can now be better understood. It is one of the most important, if not the most important, means by which people are sorted by intelligence; it therefore may be the one social institution today with the greatest effect on occupational differentiation. That education may have been instrumental in enhancing and maintaining occupational differentiation in the past does not imply that it will continue to have this function in the future. Education is to a large extent only a signal of worker quality. Its signalling value can change over time, and worker quality can be signalled in other ways.

Research has clearly shown that differences in education are more important than differences in intelligence in determining the occupational status and income of individuals (Duncan et al., 1972; Sewell & Hauser, 1975; among many others). The correlations with adult occupational prestige, for example, are

generally in the order of .6 for education vs. .4 for intelligence. Does this not flatly contradict the argument that the occupational hierarchy is rooted in differences in intelligence and not in education? The following pages argue that this apparent contradiction results from the inherent uncertainties in hiring and promotion processes and from attempts by employers and workers alike to develop dependable "signals" of worker quality.

The problem of identifying good workers. Employers want workers who at least meet some minimum standard of job performance, because the employer's own fate (e.g., income and reputation) depends upon the ability of workers to provide products or services within a reasonable period of time, without wasting resources, and without making costly mistakes. Whatever their other biases or preferences for different types of workers, fair or otherwise, employers are pragmatists in that they try to select and retain workers with the capacity to satisfactorily perform the work they need done. And the larger the company, the more likely employers are to be involved in developing ways to actually improve their personnel decisions (Wigdor & Garner, 1983, p. 131). Productivity is not the only concern of employers, but it is an important one, even if it surfaces only when productivity slips below some acceptable level or when competitors obtain a higher level. In a book describing the hiring practices of 240 businesses, Noland and Bakke (1949, chapter 10) have discussed how hiring functions are inseparable from the employer's primary role of being a producer of goods and services. In the discussion of the hiring functions of a manager, they stated (p. 130): "A manager does not perform as a soloist. His success or failure is not dependent alone on his competence. He is the organizer and director of a team of human beings whose competence and reputation are intimately woven in with his own."

Employers cannot know, however, how well any particular job applicant will perform a job before the applicant actually enters it, but good predictions of performance are important because poor hiring decisions are costly, sometimes extremely so. If nothing else, investments in hiring and training are lost when workers have to be replaced. Less able workers require more training time and supervision. And not only may a worker's own typically low productivity level constitute a net loss for the employer, but gross errors by a worker can wreak havoc in an organization by reducing the productivity of other workers and injuring the reputation of the organization. Noland and Bakke (1949, pp. 130-132) have described how managers must function as risk and cost reducers when making hiring decisions. "Faced with no certain future, these managers were interested in reducing the uncertainty at every possible point. Every barrier set up to the employment of certain types of workers was an exercise of this function. Every effort to obtain workers with qualities one could 'count on' was an attempt to meet this responsibility and necessity intelligently." With regard to reducing labor costs, employers seemed less interested in getting workers for the lowest possible wages but in "obtaining the greatest productive and teamwork capacity for wages which going standards demand."

Although employers generally would like to be able to predict who will perform well and who will not, employers often have only limited information for doing so. One major problem is that the employer may not actually know just what kind of person (e.g., what kinds of aptitudes) are most appropriate for the job. This problem is illustrated by the very existence of the large field of personnel selection research whose primary purpose is to help develop precisely such information. Another major problem facing employers is that even

if they have a clear idea of the traits they are looking for or avoiding, they may have no good way of determining which applicants possess those traits. For example, they may wish to screen out individuals whose intelligence is too low for the jobs in question, but validating a selection test is often impossible (because of the small number of jobs in that category within the organization) or prohibitively expensive, especially given today's legal standards (Tenopyr, 1981). And even if an employer knows of an existing test that would be appropriate and legally defensible, routine administration of such tests to all job applicants may not be feasible because of either time or financial constraints. In short, the employer faces a trade-off between the costs of making mistakes in hiring and the costs of determining who is most likely to be the most successful hire (e.g., see Stiglitz, 1975b). Therefore, employers cannot be expected to always select employees by the most valid means even if they want to and even if they know what those means are (which they often do not).

In small communities employers may already be familiar with or have ready access to extensive information about the entire pool of eligibles and so may have a good idea which applicants would be the better workers (Gouldner, 1954, pp. 40-41, 64). Indeed, such employers may simply solicit the desired worker. Promotion from within a company may be so common (Gordon & Thal-Larsen, 1969, p. 321) partly because of a similar familiarity with eligibles. Most employers today, however, face the need to hire employees about whom they have little or no prior knowledge. This is certainly the case for entry-level jobs. What employers seek, then, are inexpensive but valid <u>signals</u> of worker quality (Spence, 1974). (See also Noland & Bakke's, 1949, pp. 126-129, discussion of the worker qualities sought by the application of criteria such as education,

age, and experience; see Stigler, 1962, and Stiglitz, 1975a, 1975b, on the role of information in economic markets.) This need for dependable signals becomes especially apparent when personnel selection practices have failed, been disrupted, or become overburdened. For example, employer interest in personnel selection research was stimulated early in this century by high accident rates in some industries and phenomenal turnover rates by today's standards in many others (Hale, 1983). Both world wars led to the development of large personnel research programs, both within the military because it suddenly had to train and place millions of men and also within some large firms (e.g., Sears) because they suddenly had to replace much of their workforce (Hale, 1983).

Why schooling is frequently used as a signal of worker quality. Employers use a wide variety of signals, ranging all the way from sophisticated and validated assessment devices to vague impressions of how well they would get along with different applicants. At the same time, some reliance on educational credentials runs through most approaches to hiring. For example, Noland and Bakke (1949, pp. 180-181) found that education was considered of "outstanding importance" by 62% to 88% of firms hiring administrative and executive assistants (i.e., middle management workers) and by 84% to 91% of those hiring routine clerical workers. Education was less important in hiring for service, maintenance, and lower level jobs. Those occupations in which education was considered most important as a hiring criterion had the highest level educational requirements (pp. 194-195). (See Gordon and Thal-Larsen, 1969, p. 273, for a later study of educational requirements in 309 establishments.)

The widespread use of education in hiring is easy to understand. Information about educational credentials is inexpensive, public, and verifiable. Compared to other sorts of information about applicants (e.g., job experience or references), the meaning of different educational credentials is fairly standard throughout this country and variations at the local level (e.g., in high school "quality") are probably recognized by many local employers who draw frequently from those sources. Also, the use of educational credentials is generally accepted as a fair and rational practice by both employers and workers. Finally, education does in fact "work" because better educated workers on the average are more intelligent and so perform better. These same statements certainly cannot be made about any of the other worker "qualifications" studied in the Noland and Bakke study (e.g., character, physical qualifications, sex, color, age, military service, experience).

The various signalling functions of schooling. The major function of education in the hiring process is probably that it provides employers an inexpensive and efficient way of creating acceptable applicant pools. By advertising for workers with a given minimum level of education (e.g., a high school diploma), they are in effect drawing applicants predominantly from a restricted range of the IQ distribution. To support this hypothesis, it can be observed that IQs are increasingly higher among students who complete more years of education. In a summary of diverse types of evidence, Matarazzo (1972, p. 178) estimated that the median IQ of all persons completing high school was about 105 at that time, median IQ was 115 for four-year college graduates, and it was 125 for persons receiving Ph.D. and M.D. degrees (see also Proctor, 1935, for earlier data).

It should be noted that the most highly educated people within an applicant pool (often designated as over-qualified) may not be the most preferred by the employer. Although it may be costly to hire a poor worker, it can also be costly to hire someone who is especially interested in a better job and liable to quit soon or be recruited away. In short, many employers may prefer applicant pools where educational credentials are neither too low nor too high unless they are interested in hiring "promotable" workers (e.g., see Gordon & Thal-Larsen, 1969, p. 275). For example, Noland & Bakke (1949, pp. 194-195) found that although employers preferred workers with somewhat higher educational levels than they actually required, they often did not want the most highly educated. Many employers of production workers "felt that college training was a definite handicap in that it made the worker dissatisfied with his task" (p. 33). With regard to common laboring jobs, "additional education is of little use and may even unfit them for the kind of work a common laborer has to do" (p. 49).

Many employers have little concern with educational credentials. In the Noland and Bakke study (pp. 180-181) only 43% to 55% of the employers considered education to be of outstanding importance, but this is not inconsistent with the claim that education is important as a device for sorting by intelligence because it is primarily the employers with lower-level, less intellectually demanding jobs that do not consider education important. This does not mean that differences in intelligence are unimportant in such jobs, but only that lower level educational credentials (e.g., a high school diploma today) have little discriminatory power at this end of the IQ distribution because almost everyone possesses them (cf. Crain, 1984).

After assembling an applicant pool that is fairly homogeneous in terms of educational level compared to the general population, employers will rely on additional types of information for making their final selections. A lot of additional information is likely to be sought for the highest-level jobs because hiring mistakes are most costly for such jobs for a variety of reasons. Educational credentials may continue to function in various signalling capacities at this stage of the hiring process depending upon the nature of the job in question. The employer may seek information about student performance or the quality of the school program in which the applicant was enrolled because both types of information may enable the employer to distinguish applicants more finely by general ability level. Employers seem not to be particularly interested in such information (Crain, 1984), however, perhaps because reliable information about grades is difficult or impossible to obtain. Furthermore, grading practices vary so widely across schools that grades may be of little value in improving selection by intelligence compared to the cost of gathering and verifying such information. Letters of recommendation may be sought from school personnel, particularly for high-level, entry-level jobs (e.g., college teaching), but these share many of the same ambiguities as do grades.

For some jobs, especially professional ones, particular types of degrees (e.g., MD, LLD) are extremely important to employers because of the types of specialized training and knowledge they signify. As argued earlier, however, it is doubtful that the specialized skills required for most jobs are acquired in the formal education system of high schools and colleges, so employer insistence on high levels of education is in effect often primarily an insistence on high intelligence. In terms of the functions of schooling which were

listed in Table 1 earlier, then, the most pervasive effect that education has as a signal is its so- ng of people by intelligence as operationalized by years of education (rather than by grades or other measures of academic performance); provision of occupationally useful skills and knowledge beyond the basic skills level is only a secondary function and one that Figure 1 suggests applies to less than half of all jobs.

Other signals provided by schooling are still important to some employers, but these signals are related more to lateral than to hierarchical differentiation among occupations. As noted earlier, schools provide settings in which people can manifest various non-cognitive interests, values, and aptitudes that are relevant to performance in certain types of work. To illustrate, employers prefer to recruit managers from college graduates who have majored in engineering or business rather than in the natural sciences or humanities, not only for the skills they may have learned, but also because the former are more likely to have "a commitment to the business community" (Gordon & Thal-Larsen, 1960, p. 277). To take another another example, employers for managerial jobs may also look for leadership shown in various extra-curricular activities (Endicott, 1944). Turning to a somewhat different signalling function, overall gradepoint average may be of little interest to employers, but some employers may be particularly interested in <u>patterns</u> of grades across different subjects (e.g., physical science and math vs. humanities or social science) because these patterns reflect <u>profiles</u> of abilities and interests relevant to some jobs.

In summary, a person's educational history can serve many signalling functions, only some of which may be of interest to any one employer depending on

the type of job being filled, but most employers will pay some attention to years of schooling as a rough indicator of overall worker quality.

D. Important Attributes of Signals such as Education and How They Affect Stratification Processes

While it may seem obvious that education is used as a signal of worker quality, what may not be so well appreciated are the implications of the attributes of this signal. I shall describe a few such attributes and show how they help to explain some phenomena that often have been mistakenly assumed to be inconsistent with a functional view of occupational stratification.

1. Effect, not explanation of it, is what matters. The fact that employers frequently use education as a signal does not mean that they know why it works or what it is about educated people that makes them more valuable. Some employers may not be able to explain why they use it; others are surely quite mistaken in their beliefs about education and educated workers (e.g., see Berg, 1970). All that is required for employers to continue to use education as a signal is that their expectations that better-educated workers are more valuable workers be borne out (Spence, 1974). These expectations need not be fulfilled in all cases, but only on the average. Furthermore, the effect need only be a gross one. For example, many employers are probably less interested in or aware of differences in the performance levels of individual workers than they are in differences in the aggregate output of groups of workers (e.g., whole workforces) that have higher or lower levels of education.

2. Individual workers are selected according to the signal, not according to the underlying trait being imperfectly signalled. Years of education is a useful signal of worker quality because of its high correlation with intelligence; it "works" on the average. Nevertheless, there is considerable error in the signal. If employers rely heavily on education in selecting employees, a substantial fraction of workers will end up in jobs that are either too easy or too hard for them. The point here is not to criticize employers for using a fallible signal, because years of education may contain less error than other signals they realistically can be expected to use. The point is to show how, in a society whose occupational hierarchy is rooted in differences in intelligence, the fate of individual workers can depend more on their level of education than on their level of intelligence. This formulation explains how the correlation with occupational status can be only .4 for intelligence vs. 6 for education in a system where the hierarchy is ultimately created and maintained by differences in intelligence rather than education. We would expect intelligence to become more important than education in allocation processes only if employers replaced education with a less fallible indicator of intelligence, say mental tests.

As I have already argued, the specific knowledges and skills provided by schools are essential for some jobs--particularly for high-level professional jobs. But this does not mean that the occupational hierarchy is any less intelligence-based or that a higher education can compensate for low intelligence; it means that poorly educated or poorly motivated highly intelligent individuals are not likely to be found in high-level jobs. As described earlier, there are many individuals of high intelligence in low-level jobs but few individuals of low intelligence in high-level ones.

3. Worker performance depends not on the signals workers send but on the traits they actually possess. If education were important primarily because it provided the traits that enhance job performance, years of education would not be as fallible an indicator of worker quality as it now is and there might be no significant distinction between the signal and the trait being signalled. This identity of signal and underlying trait appears to be the assumption behind expectations that differences in education should be related to significant differences in performance within specific occupations (e.g., Berg, 1970). This is an unrealistic expectation for several reasons. One is that if employers use education to select employees into an occupation, then there may not be much variation in the educational levels of workers within that occupation. Greater variance in intelligence might be expected, however, because workers were not directly selected for intelligence. (It might be noted that this variation in intelligence within occupations has been misconstrued as evidence that intelligence is not really very important.) As was described earlier in this paper, a considerable amount of research shows that intelligence is related to performance within all occupations, and especially so in higher level ones. If indeed years of schooling is used to screen applicants for jobs, performance within occupations would be expected to be better predicted by differences in intelligence than by differences in educational level. Consistent with this hypothesis, Hunter and Hunter (1984, Table 9), in their meta-analysis of job performance studies, found that correlations with performance averaged only .10 for educational level vs. .53 for an ability composite for entry-level jobs. Results were similar for other samples of jobs as well.

4. As workers accumulate work experience, performance in that work may, but often does not, compete with education as a signal of that worker's quality. To the extent that experience influences hiring and promotion decisions but the type of job in which one gains experience is a function of one's educational level, then experience merely locks in place the effects of the original signal (years of education). However, to the extent that performance in jobs is observable and attended to, there will be a certain amount of "corrective" mobility (Berg, 1970) after people get on the job. As noted earlier, because intelligence is far from perfectly correlated with education, many people will end up in jobs that are either too easy or too hard for them if employers rely on education in making their hiring decisions. Highly capable individuals may be more motivated and able to move into higher-level jobs regardless of their education, and poor performers are more likely to quit or be fired than are other workers. Morton (1935; as reported in Super & Crites, 1962, p. 90) found that the first workers to be let go from a variety of occupations in the Great Depression were less intelligent than those who were released later. In an early study of clerical workers, Pond and Bills (1933, as reported in Super & Crites, 1962, p. 97) found that over a two and a half year period the more intelligent tended to leave the low grade jobs, often for advancement in the company, and the least able tended to leave the higher grade jobs. Employe also report that demonstrated ability is by far the most important criterion for promotion in non-unionized jobs and it is at least comparable in importance to seniority in unionized ones (Gordon & Thal-Larsen, 1969, pp. 325-331). Corrective mobility can occur not only because employers respond to variations in performance, but also because workers themselves feel more comfortable in jobs that are suited to their capacities.

Consistent with this, several studies reviewed by Super and Crites (1962, pp. 99-100) indicated that job satisfaction is related to having a job that is neither too hard nor too easy. Data on earnings also provide indirect evidence that there is some labor market corrective based on intelligence; the relation of intelligence to earnings increases with age (Crouse, 1979) whereas parallel analyses on the effects of education fail to find such an increase (Olneck, 1979)

Over the lifetime of individuals, then, we should expect to see some fraction of the less intelligent drifting down in the occupational structure (or not rising as would be typical for their line of work) and some fraction of the more intelligent rising up--regardless of their educational levels. (The more intelligent might also go back to school to obtain the credentials for the jobs for which they now know they are capable.) If enough of this corrective mobility were to occur, we might expect to find mean differences in intelligence between more and less educated members of the occupation to be smaller among the more experienced workers than among the less experienced because of this selective in- and out-migration. This phenomenon would also decrease the likelihood of finding a correlation between education and performance in a representative sample of members within an occupation.

But if intelligence really does affect performance independently of education, why does there seem to be relatively little corrective mobility? The personal preferences and life circumstances of individuals are no doubt important in this regard. And as already implied, structural "rigidities" such as promotion by seniority (which helps to reduce costly turnover) often prevent or restrict promotion according to demonstrated ability (Gordon & Thal-Larsen,

1969, pp. 325-331). However, corrective mobility based on job performance will be severely limited if for no other reason than that the performance of individual workers is often difficult or impossible to measure or observe, at least under current conditions. The problem of measurability has been discussed in other contexts as well, for example, in explaining wage determination processes (Sorensen & Kalleberg, 1981). Sometimes only group or team performance is readily observable, as on an assembly line (see Landy & Farr, 1983, p. 279, on who "owns" performance), but to some extent accurate performance appraisal is difficult in all jobs. Despite their decades of research on the topic, it still constitutes the "most vexing" problem facing industrial-organizational psychologists (Landy & Farr, 1983, p. 3). And as the current debate over merit pay for teachers illustrates, there is often considerable disagreement about even the possibility of ever fairly evaluating some types of workers. The very success of education as a rough signal of worker quality, together with the frequent difficulty of judging the quality even of experienced workers (especially job applicants from outside the firm), may encourage employers to insist rigidly on certain credentials even when it would be in their own best interests to ignore them in some cases.

5. Workers are very concerned about sending favorable signals to potential employers. Signals are by definition modifiable characteristics (as opposed to unmodifiable "indices" such as race or sex, Spence, 1974) and many workers are motivated to place themselves in a favorable position in the competition for good jobs by seeking a higher education. As long as the educational opportunities are available, and in this society they are relatively plentiful, people are likely to avail themselves of them in ever greater proportions. The result is the rising levels of educational attainment we find for

successive cohorts in the population--education inflation as it is sometimes called. This rise in educational levels represents an upward shift within the educational system of the entire intelligence distribution because the most intelligent will still get the most education. Furthermore, this secular rise in educational levels would be observed whether education improved the quality of the average worker or not. Employers face increasingly less select applicant pools as a greater proportion of the population passes through successive levels of the educational system, and they are forced to raise their educational requirements just to maintain the same average intelligence level of their applicant pools.

A 1930 followup of students tested in 1917 (Proctor, 1935) illustrates the necessity of raising educational requirements when there is education inflation. Proctor found that people who had gone no further than the ninth grade had an average IQ in 1917 of 105; those who graduated from high school had a mean IQ of 111; and those who went to college averaged 116. The average IQ of 105 in 1917 for people who later went no further than the ninth grade is equal to the average IQ for high school graduates, including those who went on to college, in the 1960s (Matarazzo, 1972, p. 178). Changes over time in the ratio of high school graduates to the number of persons aged 17 (a lower-bound estimate of high school graduation rates) explain this decrease in the quality of the average high school graduate over time: .17, .29, .51, .59, .65, and .76, respectively, for the years 1920, 1930, 1940, 1950, 1960, and 1970 (Grant & Lind, 1979, p. 63). Moreover, many of the skills a high school education is supposed to reflect today (Panel on Secondary School Education for the Changing Workplace, 1974) are those that four decades earlier Noland and Bakke (1949, p. 34) found employers assuming to be the function of only an eighth

grade education. When discussing the value of education for production workers, Noland and Bakke concluded: "The basic values of an eighth grade or better education one could anticipate. So many communications in modern industry are written that ability to read and write easily is essential.... Ability and accuracy in simple arithmetic is frequently required of production workers. Moreover, the added knowledge and skill acquired makes promotional possibilities more real and thus contributes to the opportunity for satisfying workers on this score."

The foregoing data suggest that the average high school graduate today is no more intelligent than the person five decades ago who had only an eighth or ninth grade education. Although being a high school dropout today may be more diagnostic of low ability than it was earlier, being a graduate says little about one's standing in the rest of the IQ distribution. Entering college is more diagnostic of high ability because four-year college students have been found to average between 115 and 120 in IQ (Matarazzo, 1972, chapter 7; Plant & Richardson, 1958).

Critics of the functional position (e.g. Collins, 1979) often point to the fact that rising educational levels cannot be accounted for by changes over time in the actual skill demands of jobs (e.g., through technological change), but it is not necessary to postulate such changes in skill demands to explain rising educational requirements from a functionalist perspective. Neither should it come as a surprise that employers complain that fewer and fewer high school graduates possess the skills employers require (e.g., Price, 1984) or that students feel increasingly compelled to pursue a higher education in order to distinguish themselves from the progressively less select pool of high school graduates.

6. Signals are used as long as they serve a purpose, and they wax and wane in use according to their value relative to other criteria for selecting workers. It is not necessarily the case that ever increasing levels of education have value for society as a whole even though they may benefit particular individuals. Concerns about over-education in our society are justified and may portend a stabilization or reversal of education inflation. It can be expected that at some point the increasing costs of ever higher educational levels relative to their value will encourage the search for alternative means for selecting and training workers. Tucker (1983) notes, for example, that some high technology firms are now providing their own training at far lower costs to both themselves and their employees.

Secular increases in educational levels increase the costs of education as a signal of worker quality, but one can also envisage changes in the benefits of education as a signal. In particular, if education were to function more efficiently (or less efficiently) as a device for sorting students by intelligence, employers could be expected to eventually make greater use (or less use) of educational credentials in hiring. This in turn would lead to education becoming more (or less) useful in predicting differences in status attainment (c.f., Herrnstein, 1973, p. 213).

Evidence suggests that the effectiveness of education as a signal for intelligence remained steady at least during the middle part of this century. Crouse (1979) reported that the correlation between intelligence and educational level was the same for different cohorts of men born between 1919 and 1938. Correlations of intelligence with occupational status likewise were stable, suggesting that education continued to play the same intelligence-

sorting role for occupational attainment during that period. Were the efficiency of sorting by intelligence to decrease (or increase), however, we might expect employers eventually to observe changes in the quality of applicants with different credentials and so decrease (or increase) their reliance on those credentials in future hiring decisions.

7. Fallible signals of intelligence can create and maintain an occupational hierarchy based primarily on intelligence. Only a moderately strong or valid signal of intelligence is required to support an occupational hierarchy based primarily on differences in intelligence requirements. To maintain the relative positions of occupations in the hierarchy, processes for the selection and promotion of workers only need to reproduce the existing average intelligence differences among occupations. There can be considerable variation in intelligence and performance levels within an occupation, but as long as the typical level of performance is maintained by members of an occupation, the organization of tasks and rewards will be stable, all else equal (e.g., technology). Assume for the sake of illustration that the typical or equilibrium level of performance by the incumbents of an occupation, in the aggregate, is represented by 80% of the members correctly performing 70% of all the specific tasks they carry out during some specific period of time--a rate that may seem dismally low at first but which is probably realistic (e.g., see Sticht, 1975, chapter 3, for a use of this rate in determining the reading requirements of jobs). This assumption suggests that wide variation in performance probably is tolerated before the occupation as a whole is devalued or restructured. In addition, the more able members of an occupation can both bolster the performance of the less able members and protect them from downward corrective mobility. For example, Blau's (1955, pp. 105-116) study of regulatory agents

showed that consultation with more competent co-workers in the same job not only helped less able agents to carry out their work but also enabled them to avoid revealing their lower competence to supervisors.

8. Increases in the intelligence-sorting validity of hiring and promotion signals lead in time to a steeper occupational hierarchy because they lead to greater differentiation of intelligence requirements among occupations, all else equal. It is important to make clear again that greater differentiation f occupations along the intelligence hierarchy means that the intelligence requirements, not just the mean intelligence levels of incumbents, become increasingly different over time. Changes in intelligence requirements reflect changes in the overall intellectual difficulty level of tasks assigned to a job. An earlier section of this paper illustrated how job difficulty levels can change in response to the aptitude levels of workers assigned to those jobs. If a signal such as schooling level were to sort workers more efficiently over time according to intelligence, high-level jobs would receive workers of reliably higher intelligence and low-level jobs would receive workers of reliably lower intelligence (even if employers did not increase their reliance on educational credentials although they might be expected to do so). Job difficulty levels could then be expected to edge up in the higher-level jobs; they would simultaneously edge down in low-level jobs as the newer less able workers were unable to sustain previous performance standards.

Comparing early simple societies with modern large industrial nations, it is obvious that the occupational hierarchy has become increasingly differentiated over time, if only because many new occupations are found on that hierarchy. There are undoubtedly many reasons for this evolution, changes in

technology being an important one. It is also likely that workers are being sorted more validly by intelligence now than they were in centuries past, partly because of the growth of large public school systems with many different levels. As public school systems cover larger and larger proportions of the population and as they make more use of highly g-loaded evaluations of student progress (e.g., standardized tests), schools increase the likelihood that highly intelligent people from all segments of society will be identified and build the critical mass of eligibles that allows the development of new types of intellectually demanding jobs. In fact, schooling may constitute the only fairly standardized and rationalized system that has ever existed for identifying intellectual talent throughout all sectors of society. It is not the only possible system, and it might be superseded in its current worker-sorting role by the widespread adoption of even more valid sorting processes for hiring and promotion. If employers were to use more valid means of selecting and promoting workers, allocation processes would become more meritocratic and improve productivity, but this would <u>increase</u> rather than decrease socioeconomic inequalities because it would allow and perhaps stimulate greater occupational differentiation. This paradox of greater equity leading to greater inequality has also been predicted in other contexts (Herrnstein, 1973, chapter 5).

VIII. IMPLICATIONS OF MODIFIED FUNCTIONAL THEORY FOR EDUCATIONAL POLICY AND STRATIFICATION RESEARCH

A. Schools and the Social Goals of Equality and Productivity

This paper began by describing the recent evolution of concern about how education influences occupational attainment and whether those processes are fair or not. This paper's odyssey through issues of intelligence, the organization of work, and the ways employers try to find suitable workers illuminates some of these common concerns. It illuminates these debates by questioning the assumptions upon which so much educational criticism and reform have been based. For example, as long as differences in intelligence in student populations remain unchanged, schools will probably always be criticized for failing to meet sufficiently one or both of the two conflicting social goals--socioeconomic equality and economic productivity. Moreover, the pursuit of occupational equality through changing schooling processes is self-limiting if it is not accompanied by acceptable and effective techniques for equalizing student intelligence levels, something that still eludes educators.

There is a widespread hope that schools can decrease inequality in society by more equally preparing students for the workplace (e.g., see Levin's, 1977, discussion of the central role of education in anti-poverty programs of the 1960s). This hope takes several forms. One is the assumption that schools can reduce differences in intelligence--most often by raising the intelligence of less intelligent youth. Indeed, colleges have often claimed that they teach people how to think, learn, and be adaptable, and there are certainly many efforts in the earlier grades to teach youngsters how to think (Beyer, 1984). To the extent that schools succeed in reducing the variance in cogni-

tive aptitude, we might expect to see some eventual compression of the occupational hierarchy and thus probably greater socioeconomic equality as well. Unfortunately, efforts to teach people how to think have been notably unsuccessful (Beyer, 1984), as have been programs designed explicitly to change intelligence levels (Hurn, 1978; Levin, 1977). Although the variance in schooling has decreased during this century (Crouse, 1979; Mare, 1978), there is no evidence that variance in intelligence has decreased.

Many people appear to believe that occupational outcomes can be equalized by equalizing educational achievement rather than intelligence itself. Crouse (1979, p. 115) has suggested, for example, that instruction might be altered so that youngsters of low intelligence can learn as much as youngsters of higher intelligence, thus equalizing their occupational chances as adults. However, equalizing the prior knowledge of workers does not make them equally valuable to employers, because intellectual aptitude continues to be important for job performance.

Many researchers and laymen have argued that one way to improve occupational outcomes for disadvantaged groups is for them to complete more years of education. They base this recommendation on the fact that educational level and occupational level are highly correlated. However, if education is important in occupational attainment primarily because it signals intelligence, the pursuit of higher levels of education will produce the desired elevation in occupational level only under certain circumstances. If only a small proportion of people follow this recommendation, highly educated people of low intelligence do indeed increase their chances of getting higher level jobs. However, if people of low intelligence were disproportionately and in large

numbers to increase their educational levels relative to the rest of the population, there would be a noticable decline in the efficiency with which schooling sorts by overall quality (i.e., intelligence) and employers would turn away from schooling as a signal of worker quality. Under these circumstances, the benefits to less intelligent people would be short-lived. In reality more intelligent individuals also will increase their educational levels in order to remain competitive for high-level jobs and will thereby maintain the high correlation between intelligence and educational level. The net result will not be a decrease in occupational inequalities, but education inflation.

Social policies might be adopted to equalize occupational outcomes by equalizing educational outcomes, but to the extent they are successful in equalizing outcomes they are likely to decrease productivity. The negative impact of reduced productivity can be expected to eventually stimulate countervailing social forces that subvert or circumvent those policies. Likewise, to the extent that social policies are successful in increasing educational levels in the less-educated segments of society, the egalitarian objectives of such policies will be thwarted by an increased demand for even higher levels of education by other segments of society. The experiences of diverse countries are consistent with this hypothesis of the self-limiting nature of many egalitarian social reforms. Farrell (1982, pp. 51-52) described how with increasing national development, problems of educational equality and access move from primary, to secondary, and then to postsecondary education with the result that the "most critical screening point for most children moves upward through the system." Likewise, Levin (1982) described how concerns about equality of educational opportunity have shifted to the postsecondary level

since the institution of comprehensive secondary school reforms in Western Europe. Furthermore, Fiszman (1977) described how differences in educational and occupational outcomes remain large in Eastern Europe despite the great social upheaval following World War II and despite official ideologies espousing a classless society. Although he attributes the continued existence of social stratification largely to "old traditions well entrenched," its persistence just as likely reflects the workings of the relentless reality that differences in intelligence are functionally important, something implied by Fiszman's own discussion of Poland's more recent "decision in favor of quality over quantity" (p. 405). In short, loosening the link between educational attainment and intelligence is not likely to lead to large and sustained decreases in occupational inequality because the adverse consequences of that achievement are likely to set in motion changes elsewhere in society or in the structure of education that restore the linkage.

Turning to the role of schools in fulfilling the social goal of productivity, there is a widespread assumption that schools have the power to provide students the skills they will need in the workplace and that will thus make them more productive workers. Concern is growing that the educational system is doing a poorer job of producing high school graduates of the quality our economy will need to remain competitive in the world (e.g., National Commission on Excellence in Education, 1983). The recent National Academy of Sciences Panel on Secondary School Education for the Changing Workplace (1984) identified a set of core competencies that, from the employer's point of view, students should obtain in high school. Those competencies ranged from basic skills such as reading and writing to interpersonal competencies and good habits and attitudes. If schools were to be more successful in imparting such

competencies, the value of high school graduates would no doubt improve, perhaps quite considerably, from the employer's perspective and benefit individual workers and society alike. The panel (p. 20) also urged "in the strongest possible terms that all educational programs be evaluated on the basis of their abiltiy to provide the skills all young people will need" (emphasis added).

Prominent in the panel's list of core competencies to be taught, however, was the capacity to reason and solve problems, a capacity the panel (p. 20) considered to be "the central indication of an educated person." Moreover, the first of the panel's three major findings (p. xi.) was that "The major asset required by employers of high school graduates seeking upwardly mobile careers is the ability to learn and to adapt to changes in the workplace. The continual evolution of work functions will require that workers master new knowledge and new skills throughout their working lives. The ability to learn will be the essential hallmark of the successful employee." What the panel correctly identified is that intelligence is important on the job, particularly for people with high aspirations. Given the current state of instructional technology, it is unrealistic to expect schools to do more than make marginal improvements in the underlying intellectual capacities that contribute to worker productivity. As noted earlier, small gains can make big differences nationwide, so this is not an unimportant achievement. However, educational reforms that overestimate the power that educators currently have for changing the distribution of cognitive capacities (e.g., bringing most high school graduates up to some minimum standard) are bound to be disappointing--particularly as high schools retain larger proportions of their less-able students until graduation.

As I have tried to show in this paper, schools are more the handmaiden of stratification processes than their creator. Schools play an important role in matching individual talent with occupational demands, but they are less powerful than generally assumed in creating differences in those talents and in maintaining the occupational hierarchy itself.

B. The Failure to Distinguish between Explanations of Social Practices and Explanations of their Effects on Individuals: A Major Source of Confusion in Stratification Research and Theory

The title of a recent major book on social stratification captures well the goal of most social stratification research in the last few decades--Who Gets Ahead? (Jencks et al., 1979). Such research has helped to explain why some people fare better than others by describing some of the social practices that determine individual-level socioeconomic outcomes. A goal of this research has also been to determine how fair the system is, and to determine how it might be made more equitable or how current differences in outcome by race, sex, and social class might be decreased. Unfortunately, the research has not led to many answers. Although criticisms of the system have changed over time, there seems to be as much if not more disagreement today about the fairness of educational and occupational processes in the United States as there was prior to the last two decades of research. Reviewing Who Gets Ahead?, Mare (1980) argued that the last two decades of refinements and elaborations of status attainment research have been unable to "adjudicate among alternative explanations" for the relations among family background, ability, education, occupation, and income that the research has documented so well. Stratification research has not explained why education is important in getting

higher-level jobs and so has failed to answer important questions such as: "What are firms doing when they reward persons with more schooling?...What would happen if formal educational qualifications were equalized or if employers were prohibited from discriminating on the basis of educational status?" (Mare, 1980, p. 709). As noted earlier, some revisionist theorists have even advocated banning the use of educational credentials in hiring.

One obvious explanation for the failure to answer these questions is that past stratification research has not investigated the social practices that link education and occupation. "Social practices" refers here to the conventional or customary ways in which people attempt to meet their own recurring needs or those of other individuals or groups in society; these procedures are often learned or adopted and consciously performed by people in the course of fulfilling their particular social roles (e.g., as parent, employer, teacher). Some practices that influence <u>educational</u> attainment, such as curriculum tracking and parental encouragement, have been studied. But supply side practices that "translate" education into occupation (e.g., the job search behaviors of individuals), although clearly important, have been studied by only a few people (e.g., Granovetter, 1981). And demand side practices that mediate education and occupation--in particular employer recruitment, selection, and promotion practices--have been ignored by stratification researchers almost totally.

Thus, the allocation of research attention accounts in part for the failure to answer the types of questions raised by Mare. But there are even more fundamental problems behind that failure. These problems relate less to the content of research than to its strategy and its assumptions about the social

order. Mare's questions deal with why certain social practices exist (e.g., why employers generally prefer to hire more highly educated workers) and what might happen if those practices were intentionally changed. Unfortunately, the status attainment field has sought answers to these questions by working backwards from data on the socioeconomic outcomes of individuals who presumably have been subject to these practices--a strategy fraught with many pitfalls.

In order to explain why social practices that create large socioeconomic inequalities persist, we must also examine the other effects those practices have on society. Employer practices clearly affect not only the phenomenon of most direct interest to stratification researchers--socioeconomic inequalities--but also productivity; yet worker performance and economic productivity essentially have been ignored in the stratification literature. Revisionists seem to assume that employers in their roles as employers are as preoccupied with socioeconomic differences and as little concerned with productivity as are the revisionists themselves; they also ignore the tradeoffs between degree of equality and level of productivity in a society. Nevertheless, whether one is ultimately most interested in social inequality or in productivity, <u>both</u> outcomes must be taken into account to explain the persistence and nature of the employer practices that create them. And both need to be taken into account when designing social policies to <u>alter</u> either productivity or inequality by changing employer practices.

Having ignored the issue of productivity, it is but an easy step to claim that employment practices are structured <u>in order</u> to create socioeconomic distinctions in society and that it is the primary <u>intention</u> of employers to

create such disparities. Revisionist theory takes this step when it claims that socioeconomic inequalities are perpetuated because the people who profit from them structure the system for that purpose. A related and perhaps clearer illustration of such illogical thinking is the common claim that if an employment policy has an adverse impact on some social group, this is prima facie evidence that employers intentionally and unfairly discriminated against those groups. In short, we will not understand why employers reward people for their education until we understand what employers, as employers, get in return for that education.

One reason that productivity has been ignored, even by functionalists, may be the common failure to appreciate the fact that employer practices are only social practices. Employers do not have any greater power than the rest of us to fulfill their needs and goals. Often employer practices are procedures employers consciously follow in an effort to accomplish their own work without realizing that these procedures may be less than optimal. To illustrate concretely the adverse consequences of ignoring the reality behind employer practices, I shall refer again to the relative importance of intelligence and education for occupational attainment.

Years of education has a substantially greater effect than does intelligence on an individual's level of occupational attainment. This is true largely because it is the practice of employers to screen workers by education but not directly by intelligence. A common but mistaken inference from the fact that education has a bigger impact than intelligence on the ability of workers to obtain high-level jobs is that education therefore also must be more important than intelligence, and to the same degree, for employers to

achieve their goal of hiring competent workers. Specifically, researchers apparently assume that education has a substantially greater effect than intelligence on job performance just as is the case for the occupational levels workers attain. But there is no reason to expect the effects on worker job performance and worker job level to be parallel. Although employers may wish to select workers according to the criteria that best predict the value of workers to the employer, this cannot be expected of them in the real world. Realistically, employers typically discover better selection criteria through trial and error over long periods of time. Eventually, these criteria come to constitute a common wisdom that is accepted routinely by new employers. When an employer selects a highly educated person, what the employer generally gets is a person who is likely to perform well primarily because of having above average intelligence. Note that the employer need not realize this to profit from it, and as long as the employer benefits from the practice no less than competitors benefit from theirs, the employer will most likely continue to select workers in much the same way in the future despite the procedure's less than optimal results.

It may be helpful to think of employer practices as social rituals, not to demean employers or to question their rationality, but only to point out that many social practices (e.g., dietary practices) that clearly benefit individuals and societies have an overlay of myth as to why they are beneficial. Moreover, these practices may not serve their intended purposes as well as their practitioners would wish. More effective practices evolve gradually as employers observe the effects of past practices and experiment with new ones. With perfect knowledge of the effects of their actions, the hiring policies of employers might eventually come to mirror their functional needs precisely.

Then it would be safe to assume that if education is more important than intelligence for getting a job, it is also more important than intelligence for performing it well. Clearly, this is not the case now, where in the absence of perfect knowledge employers must grope toward better ways of doing things.

An expectation of parallelism between the worker traits employers select for and the traits they benefit from constitutes the starting point for most scientific and lay theories of the value of schooling for employment. To highlight certain confusions that result from following that mistaken premise along one path of reasoning, four abbreviated syllogisms are listed next that seem to underlie revisionist theory, together with some indications of the correctness of the revisionist premises and conclusions.

(1) Intelligence is less important than education for getting a high-level job (true), therefore intelligence is less important than education for performing it (false).

(2) Education does not explain differences in job performance (largely true), therefore intelligence cannot explain differences in job performance (false).

(3) Because neither education nor intelligence are important for job performance (false), higher rewards to people in higher levels of work are not justifiable in utilitarian terms (false).

(4) Because these differential rewards are not justifiable in utilitarian terms (false), the occupational hierarchy would not exist if it were not maintained by illegitimate or unfair means (false).

The first two syllogisms appear to be widely accepted in stratification research, but they are tacit assumptions that remain hidden by people's neglect of the performance issue. The widespread tacit acceptance of these first two syllogisms does not imply a corresponding acceptance of the latter two syllogisms. Nevertheless, it may account in part for the continued neglect in sociology of the powerful role that intelligence plays in creating and maintaining a stratified society. This paper has not examined the issue of the maintenance of differences in earnings and wealth over time, which is a central concern of stratification research, but it has argued that a highly related feature of social stratification--the occupational hierarchy--is created and maintained ultimately by the great and enduring dispersion in intelligence levels in our society. The current allocation of people to jobs may be unfair to particular individuals, it may be unfair to certain groups in society, and it may not be optimal for economic productivity. But these defects are best understood as the slippage and impediments surrounding the driving forces that create the occupational hierarchy. The employment processes that create socioeconomic inequalities originate in large part from the differential ability of the members of a society to perform the more difficult and critical tasks that individuals and societies rely on for their well-being. The irony, of course, is that non-meritocratic employer practices do not create the occupational hierarchy as revisionists have maintained; non-meritocratic practices put a brake on the power of intelligence to do so.

While the evidence is not yet available to test these claims adequately, that evidence will not come from further individual-level studies of status attainment, as useful as these studies are for some purposes. Nor will the evidence come from studies that ignore differences in the actual, as distinct

from the presumed, productive contributions of individuals to their societies. Instead, the needed evidence will come from studies that examine the talents of people available for employment, the ways in which work is structured, the ways in which jobs and workers influence each other, and the ways in which employers try to fulfill their roles as producers of goods and services. Many of the processes that create and change occupational hierarchies can be observed daily in the workplace as jobs are adapted to new workers, as employers face shortages or surpluses of qualified job applicants, and as the composition of the work force changes. This constant flux in the minutia of the system opens a window on the processes that, over time, have shaped the form of the entire structure.

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Appendix

Additional Detail about DOT, PAQ, and Census Data

This appendix provides additional information about the quality and coverage of DOT, PAQ, and 1970 census data. Descriptions of the almost 200 individual items can be obtained from the sources cited below.

Dictionary of Occupational Titles (DOT)

As of the latest edition of the DOT (U.S. Department of Labor, 1977), the USES provides ratings for 12,099 job titles on 47 job attributes: worker functions (3), training time (5), aptitudes (11), temperaments (10), interests (5), physical demands (6), and environmental conditions (7). These data provide coverage of a wide variety of occupational attributes but are most valuable in the present context for their estimates of aptitude requirements. Nine of the aptitude scales are analogous to those measured by the GATB that were discussed earlier. A National Academy of Sciences review of the DOT (Miller, Treiman, Cain, & Roos, 1980) provides a description of the scales and reviews their derivation, strengths, weaknesses, and uses. Further information about how ratings were derived and what they mean are provided in the Handbook for Analyzing Jobs (U.S. Department of Labor, 1972). The data themselves were obtained on computer tape from the Occupational Analysis Branch of the U.S. Department of Labor.

The DOT data provide the most comprehensive coverage of occupations in the U.S. by any job analysis system. The 12,064 civilian job titles represent 396 of the 427 relevant occupational titles in the 1970 census classification of occupations, and they represent the jobs of 93.2% of all employed workers

(Gottfredson, 1983). Census titles not covered by the DOT consist primarily of various sorts of college professors; workers not covered by DOT data are primarily from the census "allocation" categories. Although neither the reliability nor the validity of the rating scales has been well established (Miller et al., 1980), DOT data are based on job analyses done according to standardized procedures by experienced analysts at the U.S. Employment Service.

Position Analysis Questionnaire (PAQ)

The PAQ was developed by a team of industrial psychologists during the last two decades to describe what workers do in different jobs. This questionnaire provides a structured means for rating a wide spectrum of jobs according to 194 "job elements:" types of information input (35), mental processes used (14), work output (49), relationships with other persons (36), job context (19), and other job characteristics such as work schedule and method of receiving pay (41). (See McCormick, Jeanneret, & Mecham, 1969, or Mecham et al., 1977a, for a list.) The developers of the PAQ factor analyzed the job elements within each of the six sections of the PAQ for a large set of occupations and obtaining separate sets of factors for each of these six sets of elements. They use the resulting 32 factors to provide "divisional dimensi· scores for each occupation; the derivation and composition of these factors are described in Mecham, Jeanneret, & McCormick (1977b, 1977c).

The questionnaires are completed either by someone intimately familiar with the job (e.g., a job analyst, worker, or supervisor) or by interviewing someone who is familiar with the job. Objectives of the PAQ are to enable firms to create more effective and equitable compensation, performance

appraisal, training, and career guidance systems. The PAQ is widely acknowledged in industrial organizational psychology to have been a major advance in job analysis techniques because it provides a structured, systematic, and replicable technique for gathering comprehensive and comparable data for a wide variety of jobs. (See Mecham, et al., 1977b, for user evaluations of the PAQ.)

Like the DOT, the PAQ covers a variety of job characteristics, from specific capabilities workers must have to physical working conditions. Both rating systems are "worker oriented" rather than "task oriented" (McCormick, 1979), that is, they describe jobs according to the behaviors workers must manifest (what workers do) rather than according to the tasks that must be accomplished or products produced (what gets done). Nevertheless, there is an important difference between the DOT and PAQ for the purposes of this study. As already discussed, the DOT rates jobs according to general aptitudes required, but the PAQ does not. Instead, the PAQ focuses on more specific behaviors or skills (e.g., making decisions, instructing people, persuading people, interpreting behavior) which may require or reflect general abilities but which are more specific, narrow competencies or developed proficiencies.

The PAQ data are less comprehensive in occupational coverage than are the DOT data, but they still represent a large and heterogeneous set of occupations. At the time the PAQ data were purchased for this study, there were ratings available for 1813 job titles representing 304 of the relevant 427 census categories. Health professionals, college teachers, and private household workers are poorly represented, with the remaining missing data being scattered throughout the remaining groups of census titles.

The PAQ data are proprietary and are not available for the 1813 individual job titles. Data were purchased for 96 scales already aggregated to the level of the 1970 census categories. They included the 32 divisional scores as well as 64 job elements that measured interpersonal or cognitive activities or that were otherwise of particular theoretical or practical importance for the author's research.

The manuals for the PAQ (Mecham et al., 1977a, 1977b, 1977c) provide detailed information about the PAQ; the questionnaire itself (McCormick et al., 1969) is readily available and is also useful for understanding the meaning of the data. Other discussions of the PAQ are available in McCormick (1979), McCormick, Jeanneret, and Mecham (1972), and Dunnette (1976).

1970 Census Data on Occupations

The U.S. decennial census collects various types of information about workers that are subsequently published in tabular form according to the Census Bureau's job classification scheme. In 1970 that classification consisted of 441 categories of which 14 are irrelevant in the present context, usually because they are residual categories (e.g., "allocation" categories). The 1970 census data that were transferred to computer tape in this study for each occupation included: number of employed men, number of employed women, percent government workers (by sex), percent of male workers who are Negro, percent of female workers who are Negro, mean hours worked (by sex), median age of worker (by sex), and median years of school completed (by sex, U.S. Bureau of the Census, 1973, Tables 1 & 38). All data are based on a 5% sample of workers in the U.S.

Several limitations of the census data should be noted. One is that schooling refers to the experienced civilian labor force (which includes experienced unemployed as well as employed workers), while percent government, Negro, and female refer to employed workers only. The latter constitute 96% of the former on the average, but the percentages vary somewhat from occupation to occupation. Median age was available for both experienced and employed workers, and the two are correlated .98; the former is used here. A second limitation is that years of schooling was truncated by the Census Bureau at 17+. The foregoing limitations can only be expected to decrease the power of any explanatory model.

Finally, it should be noted that complete data are not available for all census categories. Where very few men or women were employed in an occupation (and sampling error is therefore high), worker characteristics such as hours worked were not published.

Representativeness of the Merged DOT, PAQ, and 1970 Census data

The DOT and PAQ data were aggregated according to 1970 census category and merged together with 1970 census data on occupations according to procedures described elsewhere (Gottfredson, 1981). The number of PAQ and DOT titles in each of the census categories is also available elsewhere (Gottfredson, 1981, 1983). Complete Census, DOT, and PAQ data were available for 274 of the 427 relevant census categories. One advantageous by-product of aggregation according to census titles is that it ameliorates one serious problem with the DOT data--their gross overrepresentation of manufacturing jobs relative to service jobs (e.g., see Gottfredson, 1983). These 274 categories represent 86.5% of all employed workers, which provides quite good coverage of jobs in the U.S. economy.

Nevertheless, it should be remembered that the reason data are not available for certain occupations is that they are unusual in important ways: for example, DOT job analysis procedures are not well suited for, and thus tend not to be applied to, jobs requiring the completion of complex tasks over long periods of time (e.g., college professors); census data on education and other attributes are not published for occupations where there are too few men (or women) to provide accurate estimates of worker attributes.

A number of analyses suggest that the results are not seriously biased by excluding those occupations for which data were not complete. Although only 274 occupations had complete PAQ, DOT, and census data, 301 had both PAQ and DOT data. The factor analyses used to derive the major dimensions of work were repeated for the larger set of 301 occupations as well as for the set of 276 reported in this paper and the results were almost identical. For example, degree of factor concordance (Harman, 1967, p. 270) for each of the ten pairs of factors was, respectively, .999, .994, .993, .985, .984, .988, .993, .975, .973, and .924. These comparisons indicate that excluding the smaller occupations dominated by one sex or the other (e.g., most of the apprentice categories) does not bias the factor analysis results.

Table 7 shows means, standard deviations, and ranges on occupational prestige and five census variables for all occupations for which those data were available as well as for the subset of 276 used in this paper. The means are essentially the same; the major difference is that the occupations in the subset are less variable than occupations in general. The highest-level occupations (e.g., 23 of the 24 types of college professors, 5 of the 11 types of engineers) and the lowest-level occupations (e.g., 25 of the 37 service work-

ers and 4 of the 5 household workers) are both underrepresented in the subset. Correspondingly, correlations among job attributes (not shown here) are sometimes slightly lower in the subset than in the full set.

Insert Table 7 About Here

Definitions of Some Important Variables

It is important to point out that the names assigned to the various DOT and PAQ scales do not always convey well the meaning of those scales, so a knowledge of the individual scales is necessary for fully understanding the meaning of results of analyses using them. A few of the more important and the potentially confusing variables are described briefly below. General Educational Development (GED) level is often assumed to refer to years of education required and various translations into years of education are used, one provided by the U.S. Employment Service itself (U.S. Department of Labor, 1971). However, what GED actually represents is the highest score on one of three scales (reasoning, math, and language) which usually measure curriculum content (e.g., calculus vs. shop math).. Specific vocational preparation (SVP) refers to time spent in directly relevant job training, whether that be in schools or on the job; values range from 1 (short demonstation) to 9 (over 10 years). Intelligence requirements refers to estimates made by raters about whether workers need to be in the top 10% of the IQ distribution, the top third (exclusive of the top 10%), the middle third, or above the bottom 10%. As described in the PAQ itself (McCormick, et al., 1969), criticality of position refers to "the degree to which the performance of activities associated with this job are critical in terms of their possible effects on the organi-

zational operations, assets, reputation, etc., or on the public or other people. In rating a job, consider particularly the possible detrimental effect of inadequate job performance; consider the duration of such consequences, whether immediate or long-term, their seriousness, and the extent to which they have restricted or wide-spread effects."

Table 1

Ten Commonly-Hypothesized Functions of Schooling
in Relation to Occupational Stratification

Sorting students according to their attributes (selecting, discriminating, classifying, labelling)

1. general cognitive aptitude (learning ability, intelligence, academic ability)
2. non-cognitive aptitude (e.g., motor or interpersonal)
3. habits and attitudes (cooperativeness, deference to authority, conformity)
4. goals and aspirations (socioeconomic and field of work)
5. socioeconomic background

Changing the attributes of students (educating, training, socializing, remediating)

6. general cognitive aptitude (learning ability, judgment, intelligence, adaptability)
7. basic skills and knowledges ("tool" knowledges such as reading, writing, and arithmetic)
8. specialized skills and knowledges
   a. cognitive (recorded bodies of knowledge on a topic, analytical techniques)
   b. motor (athletics, dancing, typing, surgery, woodworking)
   c. interpersonal (techniques for motivating, leading, teaching, and counseling people)
9. habits and attitudes (good work habits, reliability, cooperativeness, deference to authority, conformity)
10. goals and aspirations (socioeconomic and field of work)

Table 2

Estimates of the Percentage of People Who Possess the Average and Minimum Levels of Intelligence Required for 15 Different Occupations

Occupation	GATB G (intelligence) scores [a]				Estimated % of people above this level of G: [c]		
	$\bar{X}$	SD	Minimum needed		$\bar{X}$	$\bar{X}$ - SD	GATB Norm
			$\bar{X}$ - SD	GATB Norm [b]			
General practitioner [d]	136	11	125	125	4	11	11
Nurse, general duty [d]	117	12	105	100	20	40	50
Radiologic technologist [e]	106	15	91	95	38	67	60
Nurse, licensed practical [d]	96	13	83	85	58	80	77
Nurse aid [e]	88	15	73	80	73	91	84
Engineer [f]	135	13	122	125	4	14	11
Draftsman [f]	116	12	104	--	21	42	--
Electrician [e]	106	14	102	--	38	46	--
Auto mechanic [e]	97	17	80	--	56	84	--
Cable assembler [e]	83	16	67	75	80	95	89
Mathematician [d]	143	14	129	130	2	7	7
Accountant [f]	118	12	106	105	18	38	40
Teller [e]	109	13	96	90	33	58	69
Distribution clerk [e]	97	15	82	90	56	82	69
Stock clerk [e]	84	12	72	--	79	93	--

a Source U.S. Department of Labor (1970, Tables 9-1 and 9-2). These G scores are similar to, but do not constitute, scores in the IQ metric.

b GATB norms are the minimum levels of an aptitude the USES has determined to be required for adequate performance in the occupation. Norms for G are not available for all occupations (because G is not considered one of the three or four most important aptitudes for that occupation), so $\bar{X}$ - SD was used as another estimate of minimum aptitude requirements.

c Percentages were obtained by transforming G scores to z scores ($\bar{X}_G = 100$, $SD_G = 20$) and then consulting Table A-4 for the cumulative normal distribution in Dixon and Massey (1969).

d Samples(s) consisted of students.

e Samples(s) consisted of employees.

f Samples(s) consisted of students and employees.

Table 3

Loadings from a Principal Components Analysis (Varimax Rotation) of 32 PAQ Divisional Factors and 9 DOT Aptitude Ratings

	Factors									
PAQ dimensions/ DOT aptitudes	1: Overall difficulty	2: Work /c complex things	3: Vigilance /c machines	4: Operating machines	5: Controlled manual	6: Catering to people	7: Coordination c/o sight	8: Selling	9: Using senses	10: Specified apparel
2-Using various info sources	.92									
17-Communicating judgments	.91									
30-Job-demanding circumstances	.90									
DOT Verbal aptitude[a]	.87			-.26						
26-Businesslike situations	.82				-.27					
23-Personally-demanding situations	.81					.27				
7-Making decisions	.80				.34		-.26			
DOT Numerical aptitude[a]	.80									
DOT Clerical perception[a]	.76						.29			
DOT Strength	-.72				.37					
8-Processing information	.71						.38			
12-Skilled/technical activities	.62	.47								
10-General body movement	-.49				.28	.55				
24-Hazardous job situations	-.38		.36						.27	
DOT form perception[a]		.86								
DOT Finger dexterity[a]		.81					.32			
DOT Spatial ability[a]		.76	.26				-.27			
DOT Motor coordination[a]	-.30	.72					.40			
DOT Manual dexterity[a]	-.52	.70								
3-Watching devices/materials		.59	-.38		.25		-.34			
5-Aware of environment			.77	-.33						
11-Controlling machines/processes			.73							
32-Alert to changing conditions			.68	.34	.31	.29				
14-Misc. equipment/devices			.60							
9-Using machines/tools	-.40			.70						
1-Interpreting what sensed	-.28		.30	.63						
31-Structured work	-.48			.59			.29			
25-Typical day schedule			-.46	-.46		-.32				
13-Controlled manual activities	-.27	.38			.63					
20-Exchanging job information			.31	.25	.59		.38			
22-Unpleasant environment	-.48		.27		.56					
19-Supervisory/coordination			.26		.56		-.32			
18-General personal contacts						.86				
29-Regular schedule						-.49				
16-General physical coordination	.25						.82			
21-Public/related contacts								.80		
28-Variable pay vs. salary								.73		.29
6-Using various senses									.87	
4-Evaluating what is sensed									.81	
27-Optional vs. specified apparel										-.82
15-Handling/related manual			-.34	.37		.35				-.41
Eigenvalues	10.5	4.6	4.3	2.5	1.9	1.7	1.6	1.4	1.3	1.0
Percent of Variance	25.7	11.3	10.6	6.2	4.6	4.2	3.8	3.4	3.1	2.5

[a] DOT aptitude scales are reversed for ease of interpretation.

Table 4

Correlations of Selected Individual Job Attributes from the PAQ, DOT, and Census with the Ten Job Attribute Factors

(N=276 Occupations)

Variable	Factor 1: Overall difficulty	2: Work /c complex things	3: Vigilance /c machines	4: Operating machines	5: Controlled manual	6: Catering to people	7: Coordination without sight	8: Selling	9: Using senses	10: Specified apparel
	Correlated most highly with Factor 1									
Mental requirements										
Compiling information, importance of	.90									
Combining information, importance of	.88		.20							
Language, level of (DOT)	.88			-.23						
Advising, importance of	.86									
Reasoning, level of (DOT)	.86	.22		-.22						
Writing, importance of	.86									
Written information, extent of use	.84									
Intelligence (DOT)[a]	.84	.21		-.24						
Reasoning, level of	.83				.22					
Planning/scheduling, amount of	.83				.28					
Analyzing information, importance of	.83									
Complexity of dealings with data (DOT)[a]	.83			-.29						
Decision making, level of	.82						-.21			
Math, level of (DOT)	.79	.26		-.23						
Interest in data vs. things (DOT)	.73			-.20						
Math, level of	.70	.30			.20	-.21				
Quantitative information, extent of use	.68					-.27				
Coding/decoding, importance of	.68						.24			.20
Direction, control, planning (DOT)	.59			-.27			-.20			
Sensory/judgmental criteria (DOT)	.55			-.22						
Transcribing, importance of	.51			.24			.38			
Short-term memory, importance of	.40			.36			.24	.22		
Recognize/identify, importance of	.36		.26	.30	.23	.20		-.28		
People-related requirements										
Staff functions, importance of	.79									
Negotiating, importance of	.79	-.22	.21							
Persuading, importance of	.79							.21		
Work under distractions, importance of	.78						.23	.23		
Frustrating situations, importance of	.77				.20					
Interpersonal conflict, importance of	.76		.22							
Coordinate without line authority, import	.74					.30				
Strained contacts, importance of	.69	-.23	.21			.26				
Complexity of dealings with people (DOT)[a]	.68					.29				
Oral information, extent of use	.68				.25					.20
Talking (DOT)	.68									
Public speaking, importance of	.68		.20			.38				
Instructing, importance of	.67				.35	.30				

Table 4, cont.

	1:	2:	3:	4:	5:	6:	7:	8:	9:	10:
Personal contact required, extent of	.66					.23				
Personal sacrifice, importance of	.65		.27			.38				
Civic obligations, importance of	.64		.23			.34				
Behavioral information, extent of use	.59		.32			.37				
Dealing with people (DOT)	.59	-.29				.23		.22		
Interest in social welfare vs. machines (DOT)*	.55	-.37				.35				
Influencing (DOT)	.42	-.24								
Physical requirements										
Wet (DOT)	-.37									
Hazards (DOT)	-.39		.22		.30					
Atmospheric conditions (DOT)	-.45				.22					
Stooping(DOT)	-.48				.46					.21
Noise (DOT)	-.53			.20	.20					
Physical exertion, level of	-.56			.25	.44	.20				
Reaching (DOT)	-.66	.38		.25						
Job structure										
Self-direction (Temme)	.88			-.23						
Prestige (Temme)	.82	.21						-.21		
(Lack of) structure, amount of	.79		.24		.20		-.20			
General responsibility, degree of	.76		.23		.26					
(Lack of) supervision, level of	.73		.21							
Criticality of position, degree	.71				.27					
Salary (yes/no)	.70			-.24						
Interest in creative vs. routine work (DOT)	.63	.34		-.25						
Time pressure, importance of	.55			.22				.29		
Attention to detail, importance of	54			.31						
Precision, importance of	.53	.28		.27						
Variety and change (DOT)	.41		.21		.22	.20				
Interest in product vs. esteem (DOT)	-.48	.43								
Repetitive activities, importance of	-.49			.37						
Wage (yes/no)	-.66			.21						
Repetitive or continuous (DOT)	-.74	-.25		.20						
"Realistic" field of work (Holland)	-.74				.26					
Education and experience										
Education, level of curriculum	.88									
General Education Devel. (GED) level (DOT)	.86	.22		-.22						
Update job knowledge, importance of	.85				.21					
Specific vocational prep (DOT)	.76	.33		-.24						
Experience, months/years	.62				.41					
Training, months/years	.51	.23			.47					

Table 4, cont.

	1:	2:	3:	4:	5:	6:	7:	8:	9:	10:
Type of workers										
% gov't-females (Census)	.45									
% gov't-males (Census)	.45									
% of females who are black (Census)	-.48	-.23								
% of males who are black (Census)	-.53	-.25		.20		.24				
Correlated most highly with Factor 2										
Complexity of dealings with things (DOT)	-.28	.77								
Seeing (DOT)		.66								
Set limits, tolerances, or standards (DOT)	-.28	.53	-.28			-.33				
Pictorial materials, extent of use	.44	.44			.29		-.29			
Measurable or verifiable criteria (DOT)	.30	.43				-.22	-.23	-.21		.25
Interest in science vs. business (DOT)		.42					-.22	-.37		
Patterns, extent of use		.41			.32		-.25			
"Investigative" field of work (Holland)	.33	.37								
"Artistic" field of work (Holland)		.20								
Correlated most highly with Factor 3										
Information from events, extent of use			.58			.28				
Vigilance: changing events, importance of			.57	.42						.22
Outside vs. inside location (DOT)	-.27		.48	-.21	.29					
Responsibility for materials, degree of			.48		.32		-.23			
Responsibility for safety, degree of			.47	.41	.34	.32				.21
Median age - males (Census)			.31				-.23			
Performing under stress (DOT)			.27							.25
Correlated most highly with Factor 4										
Follow set procedures, importance of				.54			.22			
Specified work pace, importance of	-.26			.44						
Cycled activities, importance of		-.25		.42			.25			
Vigilance: infrequent events, importance of	.20		.41	.40				-.20		

Table 4, cont.

	1:	2:	3:	4:	5:	6:	7:	8:	9:	10:
Correlated most highly with Factor 5										
Climbing (DOT)	-.30		.27		.42					.21
Mean hours - male (Census)	.22		.21		.31					
%female - (Census)			-.33		-.37		.36			-.23
Correlated most highly with Factor 6										
Supervising non-employees, importance of	.39					.64		-.21		
Catering/serving, importance of				.23		.61		.40		
Entertaining, importance of						.59				
"Social" field of work (Holland)	.35	-.21				.45				
Licencing/certification (yes/no)	.35		.28			.42				
Non-job-required social contact, opportunity for						.25		.23		
Feelings, ideas, or facts (DOT)						.22				
Mean hours - females (Census)					.33	-.34				
Correlated most highly with Factor 7										
"Conventional" field of work (Holland)			-.24		-.22	-.28	.51			-.20
Median age - females (Census)		-.21			.22		-.28			
Correlated most highly with Factor 8										
Commissions (yes/no)								.53		
Tips (yes/no)						.20		.50		.37
"Enterprising" field of work (Holland)	.31	-.29						.33		

*Note: All variables are PAQ elements unless specifically labelled as DOT or Census. Two PAQ elements (supplementary compensation and incentive pay) and two DOT items (cold and heat) did not correlate with any factor and so are excluded here.

[a]Scale has been reversed here for ease of interpretation.

Table 5

Correlations among Job Factors, Age of workers, and Schooling Levels
(N= 276 occupations; numbers above the diagonal are zero-order correlations;
numbers below the diagonal are partial correlations after controlling for intelligence requirements;
correlations in diagonals are between residualized and non-residualized variables)

		Job Factors										Age		Schooling			
	Intel	1	2	3	4	5	6	7	8	9	10	M	F	M	F	$\bar{X}$	SD
Intelligence required	1.00	.84	.21	.08	-.24	-.07	-.02	-.07	-.12	-.10	.06	.08	-.10	.86	.81	3.22	.73
1. Overall difficulty	.00	(.54)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	-.06	.83	.77	.00	1.00
2. Work /c complex things	.00	-.33	(.98)	.00	.00	.00	.00	.00	.00	.00	.00	-.04	-.24	.11	.16	.00	1.00
3. Vigilance /c machines	.00	-.13	-.02	(1.00)	.00	.00	.00	.00	.00	.00	.00	.31	.18	-.03	.00	.00	1.00
4. Operating machines	-.01	.38	.05	.02	(.97)	.00	.00	.00	.00	.00	.00	-.05	.02	-.21	-.19	.00	1.00
5. Controlled manual	.00	.11	.02	.01	-.02	(1.00)	.00	.00	.00	.00	.00	.19	.26	-.12	-.17	.00	1.00
6. Catering to people	.00	.02	.00	.00	.00	.00	(1.00)	.00	.00	.00	.00	-.12	-.01	.02	.09	.00	1.00
7. Coordination c/o sight	.00	.10	.01	.01	-.02	.00	.00	(1.00)	.00	.00	.00	-.23	-.25	-.06	-.03	.00	1.00
8. Selling	.00	.18	.03	.01	-.03	-.01	.00	-.01	(.99)	.00	.00	.02	.11	-.15	-.19	.00	1.00
9. Using senses	.00	.16	.02	.01	-.03	-.01	.00	-.01	-.01	(.99)	.00	-.16	-.06	-.05	-.04	.00	1.00
10. Specified apparel	.01	-.10	-.01	-.01	.02	.00	.00	.00	.01	.01	(1.00)	-.03	-.14	.01	.01	.00	1.00
Age - Males	.00	-.05	-.06	.31	-.03	.20	-.12	-.22	.03	-.15	-.04	(1.00)	.66	-.09	-.11	38.7	6.6
Age - Females	.00	.04	-.23	.19	.00	.25	-.02	-.26	.10	-.07	-.13	.68	(1.00)	-.23	-.32	39.2	5.9
Schooling - Males	.00	.39	-.14	-.19	-.02	-.10	.07	.00	-.09	.08	-.09	-.31	-.28	(.51)	.92	12.7	2.1
Schooling - Females	-.01	.28	-.02	-.12	.00	-.19	.17	.04	-.17	.08	-.07	-.30	-.41	.74	(.59)	12.4	1.8
$\bar{X}$	3.22	.00	.00	.01	.01	.01	.00	.00	.01	-.01	.00	.01	.01	.00	.00		
SD	.73	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.00	.99	1.00		

172

Table 6

The Relation of Ten Job Dimensions and Age of Workers to the Median Educational Levels of Workers in Different Occupations: Relations After Controlling for Intelligence Requirements and Relations Without Controlling for Intelligence Requirements (N = 276 occupations)

Predictor	Standardized regression coefficients: RESIDUALIZED years of education regressed on RESIDUALS for:[a] Males (1)	Males (2)	Males (3)	Females (1)	Females (2)	Females (3)	Years of education regressed on:[d] Males (4)	Females (4)
1: Overall difficulty		.54*	.54*		.48*	.46*	.83*	.76*
2: Work /c complex things		.05	.04		.16*	.06	.10*	.10*
3: Vigilance /c machines		-.12*	-.03		-.04	.03	.02	.04
4: Operating machines		-.23*	-.24*		-.20*	-.19*	-.22*	-.19*
5: Controlled manual		-.17*	-.12*		-.25*	-.14*	-.09*	-.11*
6: Catering to people		.06	.03		.16*	.15*	.01	.09*
7: Coordination c/o sight		-.06	-.12*		-.02	-.11	-.09*	-.09*
8: Selling		-.19*	-.19*		-.27*	-.22*	-.14*	-.17*
9: Using senses		-.02	-.06		-.02	-.04	.07*	-.05*
10: Specified apparel		-.04	-.04		-.01	-.07*	.00	-.02
Age (same sex)	-.31*		-.28*	-.41*		-.40*	-.15*	-.24*
R^2: adjusted[b]	.09	.24	.31	.17	.23	.36	.79	.76
Increment to total variance in schooling[c]	.02	.06	.08	.06	.08	.12	n.a.	n.a.
Total variance in schooling accounted for by intelligence requirements plus these attributes[b]	.76	.80	.82	.71	.73	.78	.82	.78

* $p \leq .05$

a Based on partial correlations after controlling for the intelligence requirements of jobs.

b Adjusted for number of variables and cases used in the regressions.

c Based on differences in adjusted R^2 for equation including intelligence requirements only vs. equation including intelligence requirements plus all the variables specified for each equation.

d Regressions in equation (4) based on zero-order correlations.

Table 7

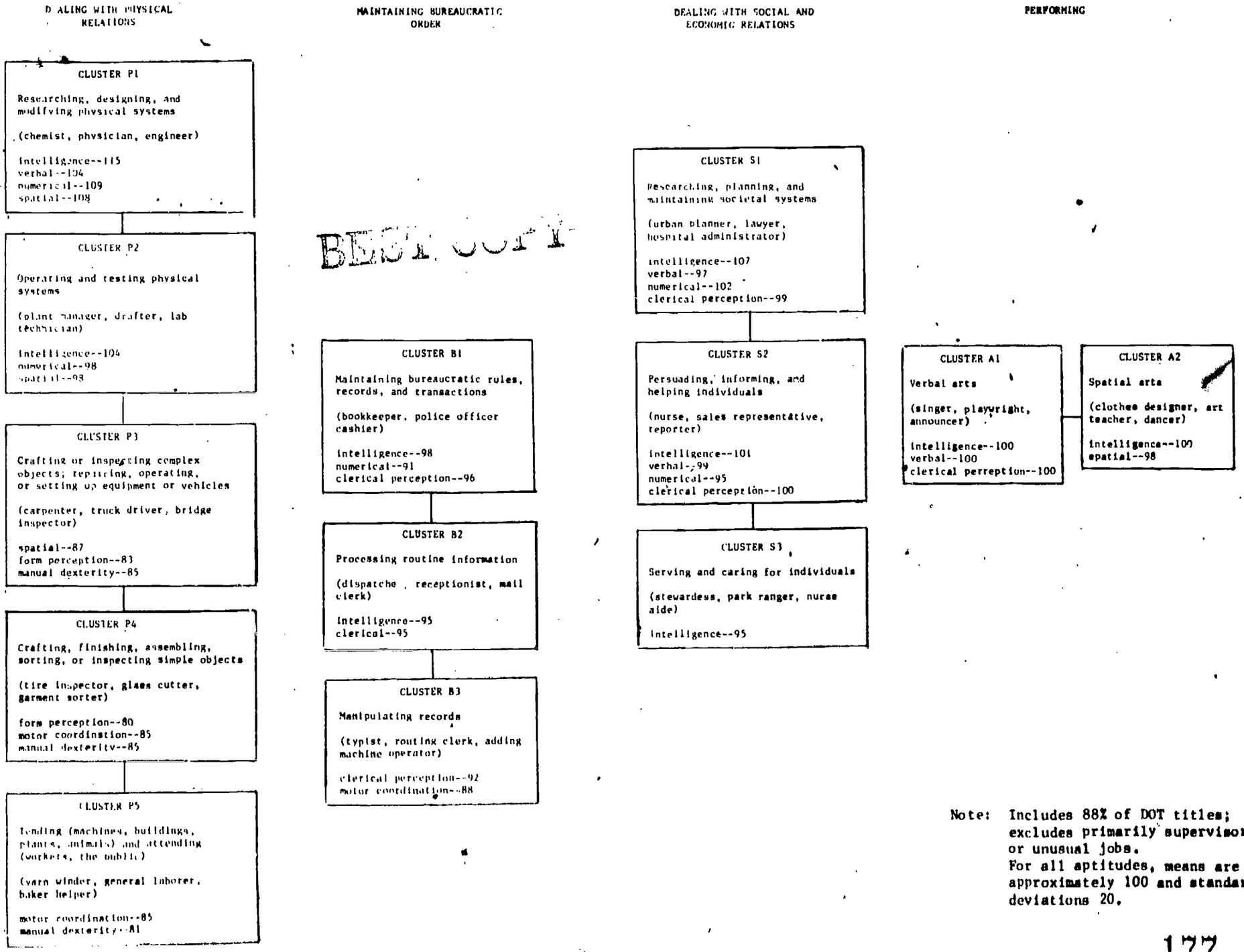
Mean, Standard Deviation, and Range for Six Job Descriptions: Total Set of Occupations Versus Subset Used in the Analyses

Job Attribute	$\bar{X}$	SD	range	(N)
Occupational prestige				
Total	42.0	17.0	0 - 88.4	(427)
Subset	41.3	15.0	10.8 - 77.6	(274)
Median years education-male[a]				
Total	12.8	2.3	8.2 - 17+	(422)
Subset	12.7	2.1	8.3 - 17+	(274)
Median years education-female[a]				
Total	12.7	2.1	8.7 - 17+	(380)
Subset	12.5	1.8	8.1 - 17+	(274)
Mean age-male[a]				
Total	38.2	7.6	17.7 - 64.5	(422)
Subset	38.6	6.5	19.2 - 64.5	(274)
Mean age-femal[a]				
Total	39.1	6.5	19.0 - 60.3	(380)
Subset	39.1	5.9	23.4 - 58.9	(274)
Percent female[b]				
Total	27.9	30.3	0.6 - 98.8	(427)
Subset	30.9	30.5	0.9 - 98.8	(274)

[a]Experienced workers.

[b]Employed workers.

Figure 1: Map of Job Clusters Based on Similarities Among Occupational Patterns (OAPs) and Which Shows Typical Tasks, Typical Job Titles, and Minimum Levels Required of the Most Important Aptitude Predictors of Job Performance



Note: Includes 88% of DOT titles; excludes primarily supervisory or unusual jobs.
For all aptitudes, means are approximately 100 and standard deviations 20.

Figure 2

Major Components of a Modified Functional

Theory of Occupational Stratification