faces [see A. V. MacRae, *Science* **139**, 379 (1963)] appears to be growing rapidly. A general description of the technique and a discussion of the interpretation of diffraction patterns were given in an invited paper by W. T. Peria of the University of Minnesota. Recent developments in the technology and apparatus of low-energy electron diffraction were described by C. W. Caldwell, Jr., of the Bell Telephone Laboratories and by J. C. Helmer of Varian Associates. A paper by J. Morrison of the Bell Telephone Laboratories described the use of low-energy electron diffraction in studying the epitaxial growth of some Group III and Group IV elements on a (111) surface of silicon.

The use of mass spectrometers for partial-pressure measurements in vacuum systems has steadily increased in the decade since Alpert and his colleagues first employed the omegatron for residual gas analysis. This improvement in technique was reflected in the many papers describing experiments which included mass analysis. Realization of the inadequacy of total pressure measurements has lead to much developmental work on many types of analyzers. What one would like in such an instrument is high sensitivity—that is, easily measured outputs at the lowest partial pressures—with moderate resolution, for example, adjacent mass separation up to 100 atomic mass units. In addition, the ion source should be an open structure in order to allow gas molecules to enter the ionizing electron beam with a minimum number of collisions with solid surfaces. Several instruments, including magnetic deflection and radio-frequency instruments, have been demonstrated to be capable of satisfying these requirements. The "monopole" analyzer, a recent variation by von Zalm on the quadrapole, has additional advantages of not requiring either a magnetic field or onerous electronics. J. B. Hudson, of Rensselaer Polytechnic Institute and General Electric, and B. A. Wightman, of the Canadian National Research Council, reported very promising results with monopole analyzers. Partial-pressure sensitivity better than 10^{-12} torr was achieved using an electron multiplier detector. Scan speed is only limited by the time of flight of ions through the analyzer region (approximately 10 μsec).

At the annual banquet of the Society John C. Lilly of Communications Research Institute provided a welcome change from the preoccupation with vacuum, and introduced the audience to a novel and very interesting field of scientific activity with his talk on "The Bottle-Nosed Dolphin."

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Psychological Testing and Public Responsibility

The subject of psychological testing is of both historical and current interest. The Army alpha and beta tests used in World War I represented the first large-scale application of testing. In the next two decades, the test movement expanded both in the range of subjects covered and in psychometric theory. During World War II millions of Americans were tested for various aptitudes and abilities as they were processed into military service, and in the last twenty years psychological assessment has become commonplace. With the rapid growth of psychological testing there has been concern on the part of both the public and professional psychologists that standards and practices be at an appropriate level. It cannot be emphasized too often that many aspects of an individual's life may be affected by testing programs. These developments were outlined by Launor Carter in his introductory speech at a symposium on psychological tests and public responsibility sponsored by the Board of Professional Affairs of the American Psychological Association.

At the symposium a report on a study of "American attitudes toward intelligence tests" being conducted by the Russell Sage Foundation was presented by Orville G. Brim, Jr. In this study the opinions of 1500 adults and 10,000 high school students regarding tests have been collected. One question asked was:

"Given tests as they are now, do you think it is fair (that is, just) to use intelligence tests to *help* make the following decisions?"

To decide who can go to certain colleges?
To put children into special classes in school?
To decide who should be hired for a job?
To decide who should be promoted?

Brim reported, "If one asks a representative group of Americans over eighteen these questions he finds that many of them are against the use of intelligence tests. Forty-one percent are opposed to using tests to help decide on admission of students to colleges; 37 percent are against using tests in job selection, and 50 percent against their use to help decide on job promotion; about one-fourth of the adult population is opposed to using intelligence tests to help establish special classes in school. One might expect that a younger group of respondents having had more experiences with tests would have more favorable attitudes. This is not true. High school students in the United States are more strongly opposed to the use of intelligence tests than is the adult population. Thus, 54 percent think it unfair to use tests to help select students for colleges; 53 percent are against using tests in job hiring; and 62 percent against their use in deciding on promotion; almost half are opposed to using intelligence tests even to help in establishing special classes in schools."

Brim pointed out that there were a number of reasons for this opposition to the use of standardized ability tests. He listed the following.

First is the problem of the confidentiality of test data. Many professionals feel that test scores should not be made available directly to the student or parents on the grounds that such data need to be interpreted by professionally trained personnel before their significance can be assessed. On the other hand, many parents and children feel that they have a right to test data and that it is often denied them.

The second criticism concerns the invasion of privacy. Although professionals may assure those taking tests that the information obtained will be held confidential, there have been instances where confidentiality has not been maintained. It is also sometimes felt that no one has the legal and ethical right to ask the type of questions that have been included in some inventories.

A third objection to tests is their use early in the life of an individual to determine various educational or career opportunities. Rigid use of test

material does not give adequate consideration to changes resulting from an individual's maturation. This is all the more a point for criticism because the surveys show that people believe that intelligence increases throughout life, viewing it more as knowledge and wisdom than as a genetically determined quality.

A fourth concern has to do with the antagonism developed toward ability tests by those who are denied certain opportunities because of them, particularly since many Americans believe that intelligence per se is not one of the important factors in career achievement. Finally, tests have been criticized on the grounds that because of a possible bias toward the more culturally privileged they are used either consciously or unconsciously as means of discriminating against culturally deprived groups.

Brim pointed out that most of these problems could be significantly ameliorated by improved techniques and practices. Nevertheless, he felt there were four additional reasons that a large number of Americans would tend to reject intelligence testing no matter how adequate the techniques were. First, he felt that those with authoritarian personality characteristics, who were intolerant of diversity, or who were strongly opposed to social change, would generally tend to reject testing. Second, he emphasized differences in general philosophical orientation. Those tending to favor an equalitarian philosophy, as well as those favoring an aristocracy, might take exception to testing as being contrary to these philosophical positions. Third, he felt that damage to the self-esteem of those who had done poorly on tests might continue for most of their lifetime. His fourth point was related to this, since a major source of resentment against tests may reflect the punishing effect they have had on the individual's chances in life. Brim concluded his paper by saying, "It appears that the technical problem of tests and their use are properly a matter for psychologists, but that the deeper sources of opposition are inherent in human nature and in the social order."

Following Brim's assessment of attitudes toward testing, John Stalnaker described one of the largest national assessment programs, the National Merit Scholarship Program. He said, "The National Merit Scholarship Program uses various assessment devices including tests. Because the scholarships or awards available are substantially fewer than the applicants for them, some method of selecting the winners is necessary. The Merit Program starts with some 800,000 students in the eleventh grade and eventually recognizes one way or another somewhat under 50,000—roughly 6% of the participants. The largest group recognized (some 35,000) receives a letter of commendation. The semi-finalists number about 14,000; almost all become finalists and each receives a certificate of merit. The winners of paying scholarships, the highest attainment, numbered about 1,650 this past year. Thus you will note that the selection process is a severe one, going from 800,000 to under 2,000.

"NMSC [the National Merit Scholarship Corporation] is committed to no single method of selection or assessment technique. No requirement forces NMSC to limit itself to any single type of test. We are dynamic and quite capable of change. However, we do run a competition each year and each year we must go from 800,000 original entrants to under 2,000 who receive the final scholarship awards."

Stalnaker went on to say that after the semifinalists have been selected as finalists they are given a second test, the Scholastic Aptitude Test of the College Board. Each finalist also supplies a transcript of his high school record, school recommendations, personal data, an assessment of himself in writing, a report on his activities outside of school, and a report on family income and assets. From this information a committee, working on a state-by-state basis, examines the record of each of the 14,000 finalists and makes final selections.

In evaluating the program he said, "There are many problems in designing a national program which schools and colleges generally approve, is attractive to scholarship sponsors, and appeals to the general public. Its methods must be professionally acceptable, of course, but in addition, it must have the widespread general support of the schools, the public and sponsors in order to be successful. The selection process followed is of great interest to every group involved in the program. It starts with a nationwide qualifying test. A test is the most efficient, economical, and valid method generally available for screening large groups of students from diverse backgrounds. Furthermore, the public, the schools and the students themselves accept test results as fair and reasonable in a way very few other devices are accepted."

Stalnaker pointed out that the National Merit Scholarship Corporation is engaged in a long-range research effort to evaluate the success of these assessment techniques. He emphasized that an ultimate evaluation would take into consideration long-term factors of career success and overall adjustment. So far the program is too new for this type of validation. He was, however, able to report on the first group of merit scholars who entered college in 1956. He said, "This group of 520 on whom we have data entered college in 1956. The group includes about 72% men and 28% women. At this time 96% have graduated from college. Over one-half of the men have an advanced degree as have 40% of the women." He concluded his report by saying, "NMSC is very much concerned with public reaction to its selection techniques. It is also even more concerned with making selections of individuals who will be successful beyond college graduation. NMSC is not satisfied with its current selection techniques although the evidence indicates that the selected group is graduating from college and doing well while in college, to the extent that grades reflect success in college. Thus far, the Merit Program has experienced no major problems with the public in understanding its techniques. The public has been generous in its acceptance of the Merit Program. As for those who write books which directly or indirectly condemn the selection procedures being used by colleges and scholarship-granting agencies, these critics have not proposed feasible substitutes. Rather, they imply that other safer or better techniques are available but they do not in any case describe them. We find such alarmists have little long-range effect."

Next, Samuel Messick gave a paper on "Personality measurement and the ethics of assessment." He pointed out that in order to avoid external controls and to maintain the autonomy of psychology in the assessment area, it is argued by many that psychologists should seize the initiative by moving toward stricter self-regulation. "But self-regulation of psychological assessment is no simple matter," he said, "not only because the normative standards and values that should govern

such regulation are manifold but primarily because many of these norms and values are in conflict." The problem of conflict of commitment in the assessment of personality and its implications for the regulative process were extensively developed. He argued that psychologists should not refuse to implement self-regulation, but he also urged that they should be cautious and insist that any change in standards be based upon their intrinsic merits and not upon external pressure. He agreed that a few unethical practices may have occurred along with certain inadequacies of technique, but, he said, "The majority of recent criticism seems to have been incurred more through the misconceptions and restricted purview of our critics than through the incompetence and ethical lapses of our colleagues." As an example of the dilemma faced by psychologists, he considered various uses of assessment; for example, in diagnosis and guidance, in selection of personnel for industry, and in research. Regarding the problem of industrial assessment, he said, "The institutional psychologist is especially open to conflicts in his commitment to the individual applicant and to his institution, particularly in his attempts to implement institutional policies through an assessment program. He has an obligation to the institution to see that its selection decisions are based upon optimally valid and economical assessment procedures. But he also has an obligation to protect the dignity of the individual applicant by ensuring that the assessment experience is not unduly offensive. By what norms, however, do we judge the infringement of one obligation upon the other?"

Even in research the psychologist finds himself faced with a difficult choice. He desires to further knowledge regarding psychological problems. This often requires him to use somewhat disguised techniques so that the subject will not be made aware of the particular area being studied. According to the ethical standards of the APA, "Only when a problem is significant and can be investigated in no other way is the psychologist justified in exposing research subjects to emotional stress." Messick asked by what criteria we judge when the potential significance of a research problem offsets the possible threat to the subject's welfare. Messick attempted to resolve these difficulties by saying, "Thus, in our consideration of possible ethical bases for self-regulation in assessment, it seems imperative that we go beyond ethical absolutism and espouse an 'ethics of responsibility' in which pragmatic evaluations of the consequences of alternative actions form the basis for particular ethical decisions." Summing up his position, Messick said, "If the pressures of reality lead us to establish further policy-based self-regulation in psychological assessment, it would seem imperative to include at the same time formal provisions for its continuing reappraisal. The intention here is not to subvert the utility of policy as a regulative principle, but to moderate its impact on the atmosphere of the regulated domain and, above all, to keep the dialogue open."

The final presentation was made by Ralph Berdie, chairman of the American Psychological Association's *ad hoc* committee on social impact of psychological assessment, who described the committee's work. Berdie said, "Broadly, the Committee is concerned with assessment in terms of what psychologists should do, what they do, and how they are seen." He said the functions of the committee include keeping APA informed of the opinions of various audiences regarding psychological assessment, advising APA regarding actions necessary to increase the desired and decrease the undesired impact of assessment, and advising APA concerning the consequences of assessment on society and also on professional and scientific psychology.

Berdie cited a large number of illustrations from the committee's files regarding both negative and positive actions toward assessment practices. He mentioned several instances where test booklets and questionnaires have been burned by various educational agencies. He also cited a number of instances where important policy decisions about tests have been made by education departments or other public institutions without consulting experts in the field. Among positive instances he cited cases in which state psychological associations and guidance groups have become active in educating legislators regarding these problems. The recent deletion of a proposed amendment to the National Defense Education Act which would have prohibited certain types of testing was cited as another example. Recently Harvard University has published a statement of rules governing the use of humans as subjects of research. These and other examples were cited as the raw material upon which the committee would base its recommendations.

A lively discussion followed the presentation of the formal papers. A number of speakers from the floor emphasized the seriousness of the problems discussed and felt that professional people interested in assessment should take a very active role both in helping to formulate technical solutions and in educating the public regarding good assessment techniques. There were also comments from the audience regarding the questionable quality and professional standard of much of the current criticism of psychological testing. There seemed to be agreement that the American Psychological Association and other concerned professional associations should take active and vigorous steps to establish and enforce appropriate standards. At the same time, we should mount an educational program directed to other professions, legislators, governmental agencies, and the public emphasizing the very important role assessment techniques play in our present civilization and outlining proper standards of practice.

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Rapid Mixing and Sampling Techniques

An evaluation of currently available techniques and an exploration of the possibilities of future developments in the study of rapid reactions in biological systems were made at a colloquium held at the Johnson Research Foundation, University of Pennsylvania, Philadelphia, 23–24 July 1964.

Rapid mixing and fluid flow in continuous and stopped flow apparatuses were considered first, together with supplementary methods (flash photolysis and temperature jump) for perturbing the chemical systems. F. J. W. Roughton described the development in methods and showed that the method used in 1923 is the forerunner of most of the methods under study today. A discussion on the current problems of today's apparatuses, namely the rapid flow and mixing of fluids, followed. R. L. Berger presented a detailed evaluation of four to ten jet mixers; the latter shows 98 percent mix-