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**An Investigation of the Psychoeducational Assessment Process:  
The Influence of Assessors' Theoretical Orientation and Previous  
Experience on their Interpretations of a Student's Case-file**

by

**Esther Karen-Fine  
Department of Educational Psychology and Counselling  
February, 1992**

**A thesis submitted to the Faculty of Graduate Studies and  
Research in partial fulfillment of the requirements for the  
degree of Doctor of Philosophy**

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## **Abstract**

The study investigated the reasoning processes used by psychoeducational assessors in interpreting a typical case-file. The methodology used was one adapted from studies of problem-solving skills in other domains. In the models of reasoning derived from these studies, expertise was associated with extensive use of causal reasoning and with a high level of integration between a selectively narrow body of information and the proposed solutions. It was hypothesised that the reasoning processes used by experienced psychoeducational assessors would show similar properties. In addition, it was hypothesised that experienced and trainee assessors could be differentiated by: a) the degree of affinity shown to a theoretical orientation in psychology, (the degree of affinity shown by the experienced assessors being greater than that shown by the trainees), and b) the numbers and types of inferences generated from case-file information. The influences of the referral information and subjects' preconceived notions of educational exceptionality on assessment were also considered.

Two groups of 12 subjects each participated in the study; experienced school psychologists (designated the experts), and trainees in psychoeducational assessment (designated the novices). Think-aloud protocols were obtained from the subjects as they interpreted the case-file. A scale for assessing relative preferences for theoretical orientations in psychology was administered to all subjects. Transcriptions of the think-aloud protocols were segmented and coded according to predetermined inference categories. The case-file text and subjects' coded protocols were used to set out formally representations of subjects' reasoning.

The experts and the novices were compared for adherence to theoretical orientation, the numbers and types of inferences generated, and the reasoning strategies employed. No differences were found between the two groups for the variables analysed. However, for some of the experts, but not for the novices, well-integrated reasoning was associated with adherence to initial theories about the case. Consistencies across both groups of subjects in the types of inferences made and the use of case-file information are suggestive of a case-specific approach to assessment. Assessors appear to emphasise a student's academic strengths and, at the same time, to attend to affective problems. Relatively little attention is paid to physiological factors. The variability in the data collected indicates that there are few criteria against which to gauge expertise in psychoeducational assessment. There was no indication that assessors test their diagnostic theories systematically. It is suggested that, in this domain, reasoning strategies of review and revision are desirable and that representational models of expertise should reflect these strategies.

## Résumé

L'étude se penche sur les processus de raisonnement utilisés par les inspecteurs de psycho-pédagogie lors de l'interprétation d'un dossier de cas typique. La méthodologie utilisée a été adaptée à partir d'études menées dans d'autres domaines en matière de résolution de problèmes. Dans les modèles de raisonnement dérivés de ces études, on associe l'expertise à un usage extensif du raisonnement de causalité et à un degré élevé d'intégration entre un corpus d'informations délibérément restreint et les solutions proposées. On a posé en hypothèse que le processus de raisonnement suivi par les inspecteurs chevronnés en matière de psycho-pédagogie indique des propriétés apparentées. On a en outre posé en hypothèse que les inspecteurs expérimentés se différencient des inspecteurs stagiaires: a) par le degré d'affinité dont ils font preuve pour une orientation théorique en psychologie, (le degré d'affinité dont font preuve les inspecteurs expérimentés étant plus élevé que celui dont font preuve les stagiaires); et b) par le nombre et le genre d'inférences qu'ils tirent des renseignements présentés dans l'étude de cas. Il a été également tenu compte des influences des informations de référence et des notions préconçues des sujets en matière de cas d'exception touchant l'inspection pédagogique.

Deux groupes se composant chacun de 12 sujets ont pris part à l'étude; des inspecteurs expérimentés en psychologie scolaire (appelés experts), et des stagiaires en inspection psycho-pédagogique (appelés novices). Des protocoles de réflexion verbalisée ont été obtenus des sujets pendant qu'ils interprétaient le dossier de cas. Il a été appliqué à tous les sujets un barème permettant d'évaluer leurs préférences relatives en faveur des orientations théoriques de psychologie. Les transcriptions de la réflexion verbalisée ont été segmentées et codées selon des catégories préétablies d'inférence. Le texte du dossier de cas, ainsi que

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les protocoles de chaque sujet, affectés du code, ont été employés pour établir des représentations formelles de leur raisonnement.

Il a été fait une comparaison entre les experts et les novices, quant à leur application fidèle de l'orientation théorique, au nombre et au type d'inférences tirées, et aux stratégies de raisonnement employées. Pour les variables analysées, il n'a été trouvé aucune différence entre les deux groupes. Cependant, chez certains des experts, mais non chez les novices, un raisonnement bien intégré s'associe avec le respect des théories initialement formulées sur le cas. Les similitudes rencontrées dans les deux groupes de sujets à propos des types d'inférences tirées et de l'utilisation des renseignements contenus dans le dossier de cas semblent indiquer une méthode d'évaluation spécifique au cas. Il paraît que les inspecteurs mettent en valeur les habiletés les plus fortes dans les domaines intellectuels et, en même temps, qu'ils soient attentifs aux problèmes d'émotivité. En comparaison, ils sont peu attentifs aux éléments physiologiques. Le caractère variable des données relevées indique qu'il existe peu de critères permettant de mesurer le degré d'expertise en matière d'évaluation psycho-pédagogique. Il n'y avait aucune indication que les inspecteurs fassent des épreuves systématiques des leurs théories diagnostiques. Il est dès lors suggéré que, dans ce domaine, des stratégies de raisonnement qui comportent de la révision et de la remise en question sont souhaitables et que les modèles de représentation de l'expertise devraient faire état de ces stratégies.

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## **Chapter One**

### **Introduction**

The profession of psychoeducational assessment has grown in scope with increasing recognition of educational exceptionality and provision of teaching services and resources to serve children with special needs. The changing attitudes to educational exceptionality and the accumulating results of research on various aspects of assessment, as well as the documented experience of school psychologists and of individuals served by this profession, show how the psychoeducational assessment process itself is under review and reassessment.

### **Educational Exceptionality**

Within school systems in developed countries and in schools catering to wealthier segments of society in less developed countries, the recognition of educational exceptionality has led to the provision of special education facilities. Legislation has been enacted in many countries to ensure that schoolchildren have access to special education according to individual needs. Since the early years of the twentieth century there have been great changes in the concept of special education. Educational exceptionality is not viewed, as it was, for example, in the early years of the twentieth century, as a category into which schoolchildren who cannot keep pace with the rest of their grade are lumped (Sarason & Doris, 1979). Rather, each child is assessed as an

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individual, and individualised learning programmes are designed in each case. This also applies to children who are gifted in one or more areas and who would also benefit from specially designed programmes. Educational exceptionality no longer implies isolation from the student's age cohort except where necessary. Policies of placing children in least restrictive environments entail minimal separation from their regular classes. The amount of time that a child must spend in a special classroom, resource centre, or in receiving individual tuition is increased only by as much as is required. It is also considered preferable that the child be returned to an ordinary classroom schedule as soon as possible. This system for integration of special measures in teaching is known as the "cascade system" of educational services (e.g., Ministère de l'Éducation du Québec, 1976). At the moment, the popular view is against the "special needs" classroom; however, not everyone agrees on this issue.

### **The Functions of Psychoeducational Assessment**

Psychoeducational assessment is the process by which trained professionals collect and analyse information about individuals that enables these professionals to identify problems that are interfering with the individuals' functioning in their environment (Lidz, 1981). The purpose of psychoeducational assessment, as it is carried out today, is to ascertain students' strengths and weaknesses so that an appropriate individualised educational programme (IEP) can be designed. Identification of the nature of learning problems includes the classification of children according to whether they are learning disabled or whether their learning problems are primarily the result of "visual, hearing, or motor handicaps, of mental retardation, or emotional disturbance, or of environmental, cultural, or economic disadvantage" (U.S. Office of Education, 1977, p.65083). Similar definitions are used in Canada (e.g., Ministère de l'Éducation du Québec, 1981). The short-term goal of an IEP is to help children reach specific

educational criteria, and the long-term goal of a programme, or series of programmes, is to help children extend their skills as far as possible (Portsmouth & Caswell, 1988). The concerns are not purely academic ones but also take into account socialisation and emotional adjustment and the contribution of environmental variables and physical health to students' general functioning. The recommendations that are made as part of assessments are, therefore, also directed towards significant others with whom the students interact, e.g., parents or guardians, teachers, physicians, and social workers. However, assessment is focussed mainly on the problems of educators and the children they serve (Fagan, 1989).

### **The Assessment Process**

The assessment process is usually instigated by schoolteachers who are of the opinion that a student is, in some way, "exceptional". For example, a student might be seen as having difficulties with schoolwork and/or manifesting unusual behaviours, or a student might be referred because he or she is thought to be gifted in one or more areas. In some cases, parents or guardians initiate assessment, either through consultation with the child's school, or with a psychologist or agency outside the school's administration.

In general a full psychoeducational "work-up" consists, among other things, of gathering educational and clinical data. Information gathered from a variety of sources must be taken into consideration in order to provide as comprehensive a picture of students and their environments as possible. Depending on the nature of the case, this information is provided by teachers, parents, or guardians or other caretakers, counsellors, medical doctors, social workers, and by the students themselves. Information is obtained from teachers and caretakers by means of interviews with or without the use of structured questionnaires. Information obtained directly from

students is elicited in the form of test results as well as through interviews. Other assessment tools include rating scales, personality inventories, and various projective instruments. Observations of students during test-taking, in the classroom, during recreational activities, and in their interactions with other individuals are further sources of data. Past histories are reviewed in addition to current information. The decisions as to what type of information is pertinent to a particular assessment is within the purview of professional responsibilities.

The information that is gathered about a student is then subject to interpretation. When standardised tests or test batteries have been administered, guidelines are available for interpretation of this material, although several approaches to test interpretation exist. For example, one of the current approaches to test interpretation is cognitive diagnosis. Cognitive diagnosis is concerned, not only with the *product* of individual learning processes, but also with the process itself. This approach involves the study of individuals' interactions with assigned tasks (Siegler & Richards, 1982). Attempts are made to model the cognitive processes through which individuals carry out a particular task. Different models can be constructed in order to characterise different groups of individuals (Cooper & Regan, 1982). The analysis by Siegler (1988) of the mechanisms of cognitive development underlines the importance of attending not only to successes or failures on set tasks, but also to individual differences in the strategies used in attempting the tasks. This type of diagnosis implies a change in what assessors need to look at in test interpretation. Few guidelines exist for the interpretation of other types of data. Just as the selection of information sources is at the discretion of assessors, so the interpretation of the compiled data is carried out according to professional judgement.

The reports that are written as a result of the assessment process convey to the concerned parties the conclusions reached as to students' abilities in the areas assessed,

and contain, if necessary, the recommendations for remediation of any perceived problems that interfere with effective functioning. However, it is not always possible to reach single, unequivocal solutions to the problems for which students have been referred. Frequently, multiple causes and correlates are suggested, which, although likely, are not all necessarily true. Consequently, reports written by experienced assessors frequently contain multiple, often interrelated hypotheses, followed by more than one recommendation for remedial measures.

The effectiveness of the programmes implemented as a result of assessments cannot be fully evaluated except by longitudinal follow-up of students' school careers and/or their general social, behavioural, and emotional adjustment. It is possible that a programme is effective even when postulated causes and effects of the problems discussed in a report present only one of several possible problem conceptualisations.

### **The Professionals Responsible for Psychoeducational Assessment**

Psychoeducational assessments are usually carried out by psychologists or psychometrists and frequently by counsellors. The precise distinctions between the roles of these professionals are not always clearly defined (Dumont, 1987). According to a demographic survey of school psychology in the U.S.A. carried out in 1984, most practitioners hold the title "school psychologist"<sup>1</sup>, although many have titles such as "school psychological examiner", "school psychometrist", "educational examiner", or "educational diagnostician" (Fagan, 1989). A term used in Australia is "guidance officer" (Ritchie, 1986). U.S.A. legislation requires that evaluation be made by a multidisciplinary team, including at least one teacher or other specialist with knowledge in the area of suspected disability (Public Law 94-142, 1977, cited in Salvia

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<sup>1</sup> The term "school psychologist" first appeared in print in 1923 (Hutt, 1923, cited in Fagan, 1989).

& Ysseldyke, 1985). Professionals who are employed by school boards work as a team in "conferencing" a student. Although "conferencing" is especially necessary when dealing with complex problems and/or ambiguous assessment outcomes, school psychologists retain the principal role of collecting and interpreting information. School boards that have jurisdiction over small or sparsely populated districts may have only one psychologist in their employ.

The training to carry out psychoeducational assessments varies considerably between institutes of higher education. Formal training courses exist at the university level, usually as part of a postgraduate programme, but formal training in assessment is not always a requirement. However, a 1984 survey showed that, in contrast to the situation that existed 15 to 20 years previously, 75 per cent of school psychologists working in the U.S.A. were trained in this particular field (Smith, 1984). Most professionals have had a background in psychology and education, but the specifics of their training vary considerably. Based on Fagan's estimation for the U.S.A. (1989), about 20 per cent hold a doctoral degree, about 66 per cent have a specialist degree or its equivalent, and less than 20 per cent hold a master's degree in psychology only. In Canada, requirements for accreditation as a school psychologist differ across the country but a master's degree suffices in most provinces (Dumont, 1987).

### **Dissatisfaction with Current Assessment Practices**

A general impression of the field of psychoeducational assessment is that there is a great deal of variation, not only in the training and qualification of practitioners, but also in their approaches to assessment. This has led to considerable dissatisfaction with the field. The lack of consistency in the administration and interpretation of testing instruments is subject to particularly strong criticism. The ongoing argument about test validity and reliability has been called an intellectual crisis in measurement

psychology (Mercer, 1988). Alternative tests have been proposed that better assess cognitive skills (e.g., Siegler, 1988; Ward, Frederiksen, & Carlson, 1980). There have also been calls for alternatives to testing that would require changes in assessment procedure. One example of an alternative procedure is process assessment. This differs from traditional practice in that students are assessed over a longer period so that interactions among the child, assigned school tasks, and the environment may be studied, and other people with whom the child is normally in contact, such as teachers and parents, may be called upon to participate in the assessment process (e.g., Meyers, Pfeffer, & Erlbaum, 1988).

Assessors themselves express dissatisfaction in terms of discrepancies between actual, desired, and perceived role functioning. Respondents in a study of job satisfaction among assessors indicated that they spent more time in assessment than they would have liked and less time in consultation, counselling, and research than they desired (Levinson, 1990). A 1984 survey found that school psychologists spent as much as 70 per cent of their time in traditional, test-related activities (Graden, Kaufman, Christenson, Ysseldyke, & Meyers, 1984). In contrast, the job descriptions for school psychologists comprise a wide range of responsibilities. For instance, the descriptions published by various ministries of education for Canadian provinces include responsibilities as diverse as direct intervention with emotionally troubled and conduct-disordered children, and consultative work among teachers to assist in the development of individualised or group treatment programmes (Dumont, 1987).

Other areas of dissatisfaction among school psychologists reported by Lidz (1981) are related to the professional judgements they are called upon to make. School psychologists are in agreement with the criticisms found in the literature concerning the validity and reliability of the test instruments used to evaluate intellectual and affective functioning. They are aware of the possible repercussions of diagnostic

labelling and its presumed long-term effects. They are also cognisant of the subjectivity involved in the interpretation of data and the ensuing selection of appropriate treatments.

Parents, school administrators, and counsellors have been content with the results of traditional assessment procedures, although, from the perspective of administrators, the function of assessment is primarily to classify a child in order to place that child in an appropriate educational programme (Lidz, 1981). Teachers have voiced several complaints about the usefulness of psychoeducational assessment: that responses to their referral requests are too slow, that reports are often incomprehensible or irrelevant, that teachers should have greater participation in the assessment procedure, and that there is insufficient follow-up to assessment (Lidz, 1981).

### **Research on Diagnostic Reasoning**

Research on diagnostic reasoning, conducted in a cognitive science framework, has been able to account for how accurate decisions are reached and representational models of expertise have been constructed. Studies of professional reasoning have been carried out in various domains including chemistry, chemical engineering, expository writing, journalism, and medicine. Models of expert information-processing and problem-solving have proved useful for improving professional functioning, and for teaching professional skills; they are essential, of course, to the design of expert systems. However, in the domains of psychotherapy and psychoeducational assessment attempts to construct formal representations of the assessment process have not had wide practical application.

One of the questions being raised is whether or not the rule systems that model reasoning in other domains apply to assessment in counselling, psychotherapy, and psychoeducational consulting. In psychology and its related fields professional



judgement is influenced by inherent factors that differentiate these domains from the others. Dumont and Lecomte (1987) have discussed the strong influence of theoretical orientation on counsellors in psychotherapy. In this profession, problem representation, extraction of client information, and solutions in terms of diagnoses vary widely across systems of psychotherapy. This absence of clinical consistency results in different diagnoses and treatment plans for apparently similar psychological disorders. Barnett (1988), focussing on school psychologists' behaviour in planning assessments and interventions, discussed the components of professional judgement in terms of the competing paradigms that exist with respect to professional practice in specific situations. It appears that psychoeducational assessment is also subject to the vicissitudes of theoretical orientation.

### **Objectives of the Present Study**

The focus of the present research is the data-interpretation phase in the psychoeducational assessment of schoolchildren. Typically, the assessment of problems underlying the difficulties a student is experiencing at school is made on the basis of information from a number of sources. Although individual tests, questionnaires, observation guidelines, and interview techniques have been studied both for their validity and reliability, each element has been looked at separately. There has been relatively little attention paid to how client data are used to draw conclusions as to the nature and remediation of the problem for which students have been referred for assessment. There has been little investigation of whether characteristics of diagnostic reasoning exist that are unique to psychoeducational assessment as distinct from other subdomains of psychology and from other professions.

The study examines how psychoeducational assessments are formed based on the information presented in a dossier that has been compiled as a result of a referral for

psychoeducational assessment. The influences of experience and assessors' theoretical orientations in psychology on professional judgement are investigated. The reasoning strategies whereby case-file data are interpreted are represented in order to determine their component processes. These processes are studied to establish whether they differentiate between experienced and trainee assessors or whether they are otherwise indicative of competence.

### **Significance of the Study**

The present research is viewed as an initial exploration of the viability of formulating cognitive-processing models for psychoeducational assessment. If the assessment of educational difficulties is as problematic as that of psychological problems in general, both experts and trainees would benefit from the formulation of a model that could serve as a guideline for assessment. Professionals who participate in the psychoeducational assessment process frequently describe their own understanding of a problem as intuitive. This study attempts to make explicit some of the thinking underlying the important decisions that are made concerning schoolchildren. The making of these processes explicit would allow for heightened awareness of how psychometrists and psychologists reach their decisions and might lead to more open-mindedness and flexibility in their outlook. If it ultimately proves possible to construct models of expert information-processing for this domain, it could result in greater consistency in the interpretation of client data, test results, and in the recommendations made in response to assessment requests. The feasibility of applying expert systems technology to psychoeducational assessment might then be increased.

## Chapter Two

### Literature Review

Research in the area of psychoeducational assessment has focussed mostly on separate parts of the assessment process rather than on the process as a whole. Similarly, research on the interpretation of assessment instruments has attended to each type of instrument separately and not to interpretation of the full dossier of information that has been gathered about a pupil. At the same time there has been a great deal of criticism of psychoeducational assessment, particularly of the continued use of standardised tests but also of the way in which assessment data are collected and interpreted. The greatest dissatisfaction has been with the interpretation process.

Standardised tests have not proved to be the reliable, valid, and objective tools they were purported to be. Moreover, despite attempts to eliminate variability in administration and scoring, the interpretation of tests is dependent, to a large extent, on assessors' judgements. The use of statistical formulas for test interpretation has been advocated, but has also been open to inconsistencies. Ideally, the use of a rule-based system to guide psychoeducational assessors would reduce variability in diagnostic decision-making. Although expert systems for psychoeducational assessment have been proposed, lack of precise, universally recognised criteria for evaluating assessment methods and outcomes has hampered their development.

There are several factors which are thought to influence decisions in psychoeducational assessment and which may account for some of the perceived inconsistencies in this domain. These factors relate to various theoretical considerations introduced by assessors into the referral situation, and to artifacts of the

typical referral procedure, particularly the preparation of the referral information that is provided to school psychologists.

Problem-solving research, in which the reasoning processes used by problem-solvers have been studied, has described the characteristics that distinguish efficient from less efficient reasoning strategies. Concurrent with this research has been the development of methodologies for studying how individuals at different levels of expertise in their professions reach their decisions. These methodologies are also applicable to the domain of psychoeducational assessment. By these means consistencies and variations across assessors in regard to the reasoning strategies they employ can be investigated and possible determinants of expertise revealed.

### **Use of Standardised Tests in Assessment**

Psychoeducational assessment has relied heavily on the scores yielded by the administration of standardised tests. Huebner and Cummings (1986) found that, for the most part, school psychologists utilise psychological test data appropriately in their decision-making practices. However, more than a decade ago Bersoff (1973) wrote about the decline of confidence in psychological testing, and recently there has been a discernible trend away from standardised tests. For example, the Quebec Ministry of Education's current guidelines for assessment do not discuss standardised tests at all (Ministère de l'Éducation du Québec, 1988). Silverman (1988) recommended an alternative to any kind of standard testing whereby the individual would be directly observed in the learning setting and the interest of the observer would be in the skill being taught and not in the skill's presumed relationship to some construct such as intelligence or perception.

One of the problems with standardised tests is that, in general, an individual's scores are compared to a norm. This may be informative but it is of more practical

value to use a criterion reference for that student so that specific achievement goals can be set, and learning programmes tailored accordingly (Glutting, 1987). (The two methods are not mutually exclusive; the use of both can be informative.) Smith (1980) advocated the non-standardised use of standardised tests. Her mode of assessment seeks to discover the factors related to the individual's learning which are unique. In order to do this the interaction between the task, the child, and the environment must be uncovered. While recognising that test manuals will argue against any changes in the test instructions or setting, she stressed the importance of being willing to alter standardised procedures where appropriate in order to determine the unique instructional needs of each child. However, the reliability and validity of tests, when put to non-standard use, are, of course, questionable. Meyers, Pfeffer, and Erlbaum (1988) have discussed yet other approaches to psychoeducational assessment; they favour process assessment. The primary goal of this type of assessment is to change behaviour rather than to label, classify, or place the child. The assessment method requires long-term monitoring of the child in his or her usual environments. Glaser (1981) has advocated that new possibilities for cognitive diagnostic measures should be used in conjunction with improved instructional design. However, the legacy of traditional IQ testing is still with us. As stated by Smith and Knoff (1981), IQ "still tips the scale" (p.55).

### **Data Interpretation in Assessment**

Psychoeducational assessment practice has been described as engaging in a highly complex set of behaviours without a suitable outcome (Ysseldyke & Algozzine, 1983). This is a harsh judgement. Perhaps a fairer criticism would address the unsystematic way in which data are gathered and the considerable variation in data interpretation, depending on who is doing it. For instance, because results of standardised tests form

only part of a case-file, the importance assigned to standardised tests may vary from peripheral to central in the assessment process. Other pertinent data include medical, social, and educational history, and behavioural observations from various sources. Although general guidelines exist for the collection of this information, it is often left up to the individual psychometrician both to gather data and to interpret them.

McDermott (1981) discussed six possible sources of error in the psychoeducational assessment of children:

1. Assessors examine identical data on the same case study, but apply different criteria in their decision-making.
2. Assessors apply principles drawn from antithetical theories in psychology and, as a result, make discrepant diagnoses.
3. Assessors are inconsistent in their weighting of diagnostic cues. This is associated with erratic perception of the relative importance of different kinds of data.
4. Assessors are not constant with respect to the diagnostic styles they employ. One assessor may change decision-making strategies within one case study as well as across case studies that are intrinsically similar.
5. Assessors show preference for unverifiable or all-inclusive diagnoses, i.e., they tend to choose diagnoses which are less easily confirmed than others, or to assign diagnoses that cover a wide range of possible problems.
6. Assessors show preference for a determinative diagnostic posture. This indicates a prevailing tendency to diagnose a problem even when the existence of a problem is not yet proven.

*Statistical criteria for use with standardised tests.* Part of the appeal of standardised tests and, indeed, an impetus for their development in the first place are that they presumably yield quantitative, objective descriptions of the characteristics of an individual. The administration and use of tests or test batteries is strictly governed by rules published in the test manuals and also by technical standards published by the American Psychological Association (1985). In the interests of reliable measures it is required that there be as little variation as possible in the administration and calculation of test results and that decision reliability be maintained. An objection to Smith's proposal for adapting standardised tests to suit individual cases is that this puts greater onus on assessors to make sound professional judgements because they can no longer rely on technical standards for decision reliability.

Although currently there is considerably less inclination to assign intelligence quotients to individuals, there is still a reliance on the use of quantitative data in attempting to eliminate bias from assessment. The advantage of labelling a pupil with several numbers rather than one number is debatable. Some statistical criteria for evaluation have been set up. For instance, to be eligible for special education services on the basis of a specific learning disability, the student must show evidence of a discrepancy between intellectual ability and achievement, i.e., that the student is not fulfilling his or her potential. This is known as the discrepancy definition of learning disabilities. The critical threshold that is frequently used is a score in a standardised achievement test that is 1.0 standard deviation below the score of the same person in a test of intellectual ability. But criteria for eligibility for special education services vary considerably (Salvia & Ysseldyke, 1985) as do teachers' stated agreement or disagreement with them (Thurlow, Ysseldyke, & Casey, 1984). A review of U.S. criteria and procedures for identifying learning disabled children by Frankenger and Harper (1987) showed that the use of criteria cannot be taken for granted; furthermore,

they are not uniformly applied even when they are used. But, as reflected in a recent survey, most states are, in fact, in agreement over using the discrepancy definition for identifying learning disabled students (Mercer, King-Sears, & Mercer, 1990).

In contrast, Siegel (1989) argued that IQ does not need to be used in defining learning disabilities. She questioned the IQ-achievement discrepancy definition on the following grounds:

1. Her own conception of intelligence includes skills in problem-solving, logical reasoning, and/or adaptation to the environment, whereas many IQ tests do not assess abilities in these areas.
2. IQ tests do not measure intelligence independently of academic achievement.
3. The formulas that have been proposed to measure the discrepancy between achievement and IQ do not all depend on the same variables and hence do not yield consistent results.
4. The use of a discrepancy definition penalises children from different cultural or minority backgrounds.
5. Even when the IQ-achievement discrepancy exists, it does not appear to be specific to children with learning disabilities. Children with mental retardation, giftedness, and physical handicaps can also show significant discrepancies.

Siegel proposed that remediation should be based on detailed knowledge of the child's academic skills rather than on extrapolation from "imprecise IQ measures and an illogical discrepancy definition" (p.477). Stanovich (1989) was also critical of the discrepancy definition, especially with regard to the use of IQ scores as measures of a child's learning potential. However, he regarded the main fallacy in the discrepancy



definition to be the assumption that "the cognitive processes in individuals with LD with low IQ scores are different from individuals with LD with high IQ scores" (p.490).

Another reason that appeal to a statistical definition is unsatisfactory is that it is difficult to assess "potential" without recourse to tests that are themselves influenced by previous learning experience. Portsmouth and Caswell (1988) stated that it is not possible to predict an individual's potential for achievement whatever kind of measure is used. They proposed that a more reliable method for planning teaching targets is curriculum-based assessment which permits more systematic and objective judgements of children's strengths and weaknesses. Nevertheless, the WISC-R and, also, the Stanford-Binet are frequently used as a measure of potential against which school progress is compared.

Alternative statistical approaches to the interpretation of the WISC-R, which do not involve the IQ-achievement discrepancy, have been proposed. Grossman (1985) presented information that can be used to calculate standard deviation quotients and standard errors of measurements for selected subtest grouping and for determining significant discrepancies between pairs of subtest combinations. Multivariate models have been developed for ascertaining whether pairs and sets of scores on a standardised test are jointly unusual for a given individual (Huba, 1985). Siegel's point about the inconsistencies that result from the use of different formulae is pertinent here. In his conclusions to a discussion of formulae for evaluating the abnormality of test-score differences, Silverstein (1984) made a further important point that users of formulae should be aware that a difference that is abnormal in the statistical sense need not imply pathology.

*Statistical criteria for the interpretation of assessment data in general.* Meehl (1954) has argued for the relative superiority of inferences based on statistical or

actuarial data over clinical data in the field of applied psychology. In virtually every one of 100 studies in which there was sufficient protection against inflated results for actuarial methods, e.g., mathematical procedures that capitalise on chance relations among variables, the actuarial method equaled or surpassed the clinical method (Dawes, Faust, & Meehl, 1989). It has been claimed that the studies misrepresented the clinical method either by denying judges access to crucial data sources such as interviews, by using artificial tasks that failed to tap their area of expertise, or by including clinicians of questionable experience or expertise. But, sufficient evidence is available to allow these criticisms to be refuted (Dawes et al., 1989). However, formulae are not infallible (Kleinmuntz, 1990), even when used in a consistent manner. There are circumstances in which the clinical judge might improve on the actuarial method (Dawes et al., 1990). Wiggins (1981) proposed that attention be given to the development of procedures that better combine both clinical and statistical prediction. This statement is relevant to the field of psychoeducational assessment although both clinical and empirical prediction criteria have yet to be agreed upon.

*Expert systems as aids to psychoeducational assessment.* . Expert systems offer potential for assisting human service professionals in making complex decisions (Shoech, Jennings, Schkade, & Hooper-Russell, 1985). Generally these are rule-based systems which apply inferential mechanisms to knowledge bases in order to extract decisions. In psychoeducational assessment, such a system would potentially make the assessment process more systematic and improve the accuracy of assessors' decisions, as well as improve the delivery of specialised services (Hasselbring, 1985). Several such expert systems are under development for use by special service providers in education. The McDermott Multidimensional Assessment of Children (M-MAC) has two main functions: the classification of childhood normality and exceptionality and

the design of individualised educational programmes (IEPs) (Glutting, 1986; Glutting 1987). Hasselbring (1986) describes two systems, Class.2 and Mandate Consultant. Class.2 has six components for evaluating student eligibility for special education funding in a specific disability area: learning disabilities, speech and language, mental retardation, behaviour disorders, physical impairment, and sensory impairment. Mandate Consultant provides school personnel with a second opinion regarding the consistency of actions by school officials as they implement the IEP process. Two other systems, Class.LD2 and Behavior Consultant, are described by Gingerich (1990a). The purpose of Class.LD2 is to classify learning disabled students. Behavior Consultant advises on data collection procedures and intervention strategies for child behaviour problems in the classroom.

These systems attempt to bring reliability and consistency to a field in which recognised human experts often do not agree among themselves (Gingerich, 1990a). But there is an inherent paradox in stating that an expert system can be constructed to aid decision making in a field, such as psychoeducational assessment, in which experts do not agree among themselves. A critical requirement for expert systems is that the experts working in the fields for which they are designed must agree on correct solutions, otherwise the system cannot be validated. It is even hard to claim that expertise exists (Gingerich, 1990b). Another problem with expert systems for the human service professions is that certain decision problems may not be solvable by expert systems in their current designs. Kleinmuntz (1990) suggested that research might focus on designs that permit the systems to recognise their inability to solve certain decision problems. When such designs are achieved, it will be possible for specialists to work together with decision aids, supplying their inputs and monitoring their outputs.

### Issues in the Interpretation of Psychological Data

Although there have been attempts to make the interpretation of psychoeducational assessment data objective, there are, nevertheless, various factors that are thought to influence assessors in their decision-making: adherence to particular theoretical orientations in psychology and to preconceived notions that govern professional practice, preference for particular views of educational exceptionality, overeagerness to diagnose problems (McDermott, 1981), and the tendency to be unduly influenced by referral information.

*Theoretical orientation and preconceived notions.* A problem that underlies interpretation of clinical data is that the clinician is strongly influenced by his or her theoretical orientation in psychology. Dumont (1987) discussed the search by psychotherapists for client data that they can interpret in terms of their theoretical orientation in psychology. Whether greater emphasis is placed on test results, on contextual factors, or on psychosocial factors is likely to depend on the theoretical orientation and also on the previous experience of the individual responsible for interpretation of the case material. Preconceived notions, defined by Barnett (1988) as "personal theories", may also exert a strong influence on the interpretation of case information (Arkes, 1981). Arkes reviewed the evidence from the fields of economics and clinical psychology that professionals have negligible awareness of the factors that influence judgements. As a result of theoretical orientation or preconceived notions, or both, it is likely that a single underlying hypothesis will be put forward to explain the given data. Once a single hypothesis is made, attachment to it grows. Then, unwittingly, the theory is made to fit the facts and the facts are made to fit the theory. These observations were made as early as 1897 by the geologist Chamberlin (cited by Platt, 1964).

Nisbett and Ross (1980) have discussed how conflicting evidence can be treated as if it were supportive of beliefs, "impressions formed on the basis of early evidence survive exposure to inconsistent evidence presented later" (p.179). Snyder and Swann (1978) showed that it is possible to evoke bias in the interpretation of information by prior suggestion of a theory. They found that their subjects attended to confirmatory evidence of the suggested theory more frequently than to disconfirmatory evidence. In fact, these subjects often failed to attend to disconfirmatory evidence, in spite of the fact that the theory was founded on a weak base. In their experiment, subjects were given a personality description of an individual. All subjects were given the identical description but at the outset half were told that the individual was an introvert and half were told that the person was an extravert. The subjects were able to find confirmatory evidence for both personality traits from within the same description and they were able to maintain the initial "theory" about the individual.

According to Barnett (1988), professional practices are founded on "lore" or opinion, and are not well researched. "Professional models of practice are described in texts and coursework, tend to be globally articulated, often result from the work of influential spokespersons or 'camps', and tend to be seductive in this sense" (p.659). If this is true, then the professional models will be perpetuated through teaching practices. Hence trainees will be just as susceptible to prevailing opinion as their supervisors.

*Conceptualisation of the presenting problems.* Differences in theoretical orientation will be associated with different conceptions of theoretical constructs in psychology and of the nature and causes of educational exceptionality. Many theorists consider prevailing conceptions of intelligence to be incomplete and include an ever-increasing number of components in their global construct of intelligence (Stanovich, 1989). This has direct impact on conceptualisations of educational exceptionality.

Quay (1973) perceived three basic viewpoints in regard to how and why a child may be experiencing educational problems. The first view is in terms of process dysfunctions which can be attributed to sensory, motor, specific internal processes (e.g., poor short-term memory) or global internal process (e.g., low intelligence, poor motivation). These are all within the child. The second conception is an "environmental" view which holds that adverse life experiences interfere with normal learning. This has been a popular view in regard to educational problems related to affective disorders. The third notion emphasises the lack of appropriate experience with direct effects on the education process. Like the second concept, the source of the problem is outside the individual. The putative correlates of learning difficulties can be broadly categorised under the following headings: affective or emotional, cognitive or educational, physiological, and ecological or contextual (Barnett, 1988). The first three categories correspond to processes within the child, while the fourth corresponds to the environmental component. Quay advocates an integrative approach, but clearly the conceptualisation of the problem will influence the choice of tests, the selection of information that is deemed relevant to the case, the assessment of educational handicaps, and the recommendations for their remediation. Conceptual differences, then, result in highly divergent professional practices (Barnett, 1988).

*The emphasis on negative characteristics of a case.* When a student is referred for psychoeducational assessment, the recognition of areas of strength as well as those of weakness is critical to the design of remedial programmes. Studies of diagnostic decisions made by psychotherapists suggest that experience produces an increased emphasis on negative characterological aspects, particularly in increased perception of maladjustment and a less generous view of clients' motivation for change (Wills, 1978). The outcome of a study by Segal (1970, cited in Wills, 1978) of professional workers'

perceptions of mentally disturbed clients suggests that, when a medical framework is used to assess clients' emotional functioning as well as their physical limitations, the social strengths that they may have often go unrecognised. The individual's strengths are not always sought because a medical model of diagnosis is most effective in describing weakness. An issue that is relevant to psychoeducational assessment is whether experienced assessors in this domain show a similar tendency to search for negative characterological features and pay less attention to, for instance, students' scholastic successes, successes in coping with physiological problems, and adaptive responses to their environment.

*Bias created by referral information.* There is another source of bias in psychoeducational assessment besides that created by assessors' adherence to a theoretical or personal orientation in psychology and which can be expected to produce a search for the negative characterological aspects of a case. This is the bias created by the contents of the referral information. Rosenhan (1973) demonstrated the biasing effect of referral information in diagnostic evaluation processes in psychiatry. Ysseldyke and Algozzine (1981) found that referral data likewise influenced the placement of children in special education programmes. Tidwell's results indicated a biasing effect when examiners were knowledgeable about the reasons for referral (Tidwell, 1976). In contrast, Huebner and Cummings (1986) found that school psychologists relied on test data and not on referral information to reach their decisions. Similarly, Ritchie (1986) found that reason for referral did not significantly influence diagnostic classification. He suggested that other information (attainment and intelligence levels) was more influential.

Ritchie suggested that more experienced assessors may be less influenced by reason for referral and that this, in part, accounted for the difference between his own findings

and those of Ysseldyke and Algozzine. Ritchie's subjects were full-time primary guidance officers, employed by an Australian school board, who perform functions similar to those of school psychologists in Canada and the U.S.A., whereas the majority of subjects who took part in the study by Ysseldyke and Algozzine were not school psychologists; regular and special education teachers, administrators and support personnel also served as assessors. The experience factor could also account for the results of Tidwell's study in which the subjects were graduate students enrolled in a school psychology internship. However, a study by O'Reilly, Northcraft, and Sabers (1989), in which the subjects were all practising school psychologists with an average of 8 years of experience, found that there was a significant tendency for eligibility (for special education) judgements to mirror the stated reason for referral. Thus the influence of referral information on assessors' decisions remains a contentious issue.

### **Psychoeducational Assessment as Problem-solving**

Interpretation of case-file information compiled as part of the psychoeducational assessment process can be viewed as a complex problem-solving task. In problem-solving research it is necessary to analyse the task itself and the performance of subjects in carrying out the task. It is then possible to specify the elements of the problem and the relations among these elements that the subjects extract or manipulate during their search for solutions. Systematic, semantic analyses of verbal data have been used to study problem-solving behaviour in tasks that are ill-defined or unconstrained, e.g., medical diagnosis based on patients' case-histories. Verbal data are obtained by requesting subjects to generate think-aloud protocols as they work through the task. Subsequent analyses of these protocols enable researchers to construct models of the cognitive processes associated with problem-solving. These models can be used to compare the characteristics of problem-solving by experts in a domain with that of



less-expert individuals or novices. Although this type of research has been used extensively, for example, in the domain of medical diagnosis, its potential in the domain of psychological assessment has yet to be explored.

*Problem-solving skills.* The cognitive processes that are involved when information is presented to a user have been modelled in studies of problem-solving skills. Much of the impetus for the research into and the modelling of human problem-solving has arisen from interest in computer simulations of these capabilities and from the continuing development of expert systems to aid (and sometimes to replace) human resources. Newell and Simon (1972) initiated much of the work in problem-solving, beginning with well-defined problem-solving tasks. The kinds of problems dealt with initially were quite restricted, e.g., anagrams, cryptarithmic, and puzzles like the "Tower of Hanoi" problem. Their methodology is less applicable in verbally complex situations that depend on a rich knowledge base. Research interest subsequently expanded to ill-defined problems, e.g., the chess studies carried out by Chase and Simon (1973), and to problem items for machine-scorable examinations that can be actually used to measure higher-level cognitive skills (Ward et al., 1980; Carleson & Ward, 1988). Interest has centred, not only on the study of the cognitive skills used in problem-solving, but also on the use of problem-solving tasks in order to assess competence. The question of how appropriate skills are acquired and the importance of systematising the teaching of such skills has meant that the comparison of experts' and novices' cognitive processes has become a prominent feature of research into problem-solving.

In Greeno's (1978) conceptualisation of problem-solving, understanding relations among concepts of persons, things, and events are like problems of inducing structure. That is, one must understand the relations present among the problem elements and

hence generate an integrated representation of these relations. A person's ability to transform a problem, as initially presented, into a "problem space" requires a process for identifying concepts in the problem with components of the person's problem-solving knowledge. The elements of a problem space consist of states of knowledge about the problem and the operations for manipulating the information it contains. These elements must, however, be generated by the problem-solver. The problem space can be identified by studying subjects' behaviour, such as by analysing verbal protocols (Newell & Simon, 1972).

One feature of problem-solving knowledge that influences people's ability to apply it in various situations is the degree to which those problem-solving procedures are meaningfully related to other general concepts in their memory structures. Strong generative skills for problems of inducing structure in novel situations would involve ability to appreciate general patterns of relations among concepts and components of situations for which the person was not specifically trained. Therefore, a representation of well-integrated reasoning would be characterised by a conceptual or semantic network in which the concepts representing each source of information are combined. The integration process is optimal if it maximises the final information content or, equivalently, minimises information loss (Massaro & Friedman, 1990). The decision-making process reflects the manner in which the information is combined. Psychological assessment, when it is viewed as one type of problem-solving task, does not have a high degree of specificity as to how to maximise information content. This is dependent on how individual assessors conceptualise the problem. Therefore, in this domain, representations of relations among problem elements and of the decision making process may reflect alternative conceptualisations of the problem, rather than efficiency and competence.

*Representation of reasoning processes.* Implied in the preceding discussion of problem-solving skills is the necessity to make explicit problem solvers' mental representations of the problem space. Individuals' knowledge of something, for example, how to proceed when confronted with a problem-solving task, depends on the ability to form mental models, inside the head, so to speak, that accurately represent the thing as well as the actions that can be performed by it and on it (Sowa, 1984.). The concept of mental representations has been developed in the context of cognitive science research which seeks both to model human cognition and to achieve greater understanding of what constitutes optimal and less than optimal functioning in various problem-solving situations. Models of cognition should represent explicitly and accurately the characteristics of the worlds being modelled (Palmer, 1978). In cognitive science "the worlds" being modelled are individuals' mental models themselves. Cognitive psychology, then, aspires to informational equivalence between its models and actual representation "inside the head" of the individual engaged in problem-solving.

Various notational systems have been developed for constructing models of representation. Cognitive representations may be modelled by semantic networks or conceptual graphs, which are data structures composed of nodes and links and for which rules are specified so that the structures within the networks can be defined (Frederiksen, 1975; Frederiksen & Breuleux, 1989). In the conceptual graphs used by Sowa (1984) concept nodes represent entities, attributes, states, events, and processes, and relation nodes show how the concepts are interconnected. "Conceptual graphs play a dual role in model theory: they make statements about the world, and they serve as structures that represent the world" (Sowa, 1984, p.167). The design of "intelligent" computing systems (expert systems and artificial intelligence [AI]) also necessitates the representation of knowledge. These representations must be in the form of

computational languages. Sowa's detailed exposition of assumptions, definitions, and theorems enables his system to be applied to the design of "intelligent" and usable computer systems

*Protocol analysis.* The function of protocol analysis is to obtain access to the mental world of the individual engaged in a problem-solving task and hence analyse how solutions are reached (or attempted). The use of verbal reports as data is described in detail by Ericsson and Simon (1984), who demonstrated that verbal data are highly pertinent to and informative about subjects' cognitive process. Verbal data can be used in developing and testing detailed information processing models of cognition. However, in order to take advantage of the power of verbal data, methodologies for encoding and interpreting these data must be developed. Ericsson and Simon demonstrated the utility of protocol analysis, but the most applicable theory of analysis must be chosen. The specific examples of analysis given by Ericsson and Simon to illustrate the use of protocol analysis, are confined to cognitive processes in problem-solving with well-defined tasks such as arithmetic and word puzzles. These analyses have limited utility in complex domains, although the models of reasoning in well-structured domains provide insight into problem-solving in a wider range of tasks, including problems which themselves require insight in order to be solved (Kaplan & Simon, 1990).

Ballsteadt and Mandl (1984) summarise some of the methods that have been used to analyse spontaneous spoken language. The simplest procedure is to use word counts and to evaluate the protocol on the basis of word frequency and word types. Analysis based on the main ideas that appear in the protocols involves marking the protocols according to the location of each new, self-contained idea. On a more detailed level, the protocols can be analysed according to Chafe's (1980) evaluation method to allow

the paralinguistic aspects of spoken language to be retained (pauses and intonation). This enables the evaluator to identify the foci of the subject's attention, as well as the main idea units.

In text research, text and recall are compared with one another using propositions (i.e., semantic structures) as units for encoding information (van Dijk & Kintsch, 1984); a proposition is a triplet consisting of two concepts linked by a relation (Frederiksen, 1975). A detailed method of analysis of verbal protocols has been developed by Frederiksen (1975). Frederiksen's model is a precise, rule-based approach to semantic, or propositional, analysis. It is a general model in that it was developed independently of any particular domain of knowledge or skills, and can, therefore, be applied to both well-defined tasks and to complex and ill-defined tasks. This method of analysis has proved to be useful in modelling text comprehension and production, and knowledge acquisition and integration in a variety of domains, e.g., clinical problem-solving in medicine, discourse processing in translation, second-language text comprehension and production, and procedural problems in chemistry and chemical engineering.

A propositional analysis of subject-generated protocols provides a method of studying the inferences subjects make when reading or listening to information, and for studying the prior knowledge that is brought to bear in, for example, a problem-solving situation. The semantic or conceptual structures that are expressed in language can be studied and sets of rules that specify particular types of structures can be identified. Furthermore, the informational equivalence between the model of representation in the form of a semantic network and the mental representations of the problem-solvers is achieved.

*The comparison of expert and novice problem-solving.* In experimental studies of problem-solving, use has been made of the expert/novice distinction in order to compare and contrast the performance of those with previous experience with the performance of those with limited experience or those for whom the situation is novel. Clear expert/novice differences have been found in studies using well-defined problems. The expert reasons from one concept to the next in a sequence of presumed causal relations, with few digressions, until a solution is reached. An important characteristic of expert performance is the expert's ability to represent problems successfully. This requires experts to possess a well organised structure of knowledge. An efficient search for hypotheses about salient features of the problem is thus facilitated (Greeno & Simon, 1984). In contrast, novices generate tentative solutions which are revised when new information is reviewed with backward reference to the information given earlier. This is a more general but less efficient search strategy, at least in situations where there are clearly defined solutions, although similar results have been obtained in studies of domains where the problems are less well defined.

The contrast between experts and novices may not be as apparent in psychological assessment where flexibility is thought to be important, when there may be a number of ways of solving the problem, and several possible solutions. The research reviewed by Wills (1978) leads to the consideration that, when a flexible outlook is needed, a strategy of review and revision might be the best one. If this is the case, alternative models of reasoning may be needed in order to represent the different levels of expertise. The literature described previously suggests that psychologists are susceptible to bias from a number of sources and that the facts of a case-history are extracted so as to conform to favourite theories and concepts. If this is true, then models of expert reasoning would not reflect review and revision strategies. If, however, as Bookbinder (1986) has urged, assessors test their opinions and modify

them if they are shown to be inaccurate, then an alternative problem-solving model to that which assumes a single, correct approach is required.

To avoid the error of absolute attachment to a single hypothesis, Platt (1964) advocated combining the method of testing multiple hypotheses, put forward by the geologist, Chamberlin, at the turn of the century, with the method of strong inference. Strong inference requires the following steps:

1. Devising alternative hypotheses.
2. Devising and carrying out ways of testing the hypotheses which will exclude one or more of them.
3. Repeating the first two procedures, making subhypotheses or sequential hypotheses to refine the possibilities that remain; and so on.

The reasoning strategy involved is one of consecutive inference in which the decision points are represented as the forks in a conditional inductive tree. A postulate is tested and, if all the necessary premises are found to be true, then the hypothesis in question can be retained. If, however, the results do not conform to the set expected, the hypothesis is discarded in favour of one or more of the alternatives which is better supported by the results. The procedure is continued until a satisfactory solution to the problem is found. Platt's discussion suggests that, when problem-solvers take a flexible approach, the use of inductive inference might be characteristic of their reasoning.

### **Studies of Reasoning Processes in Assessment**

An investigation of diagnostic decision-making behaviours among groups of school psychologists at successive levels of training and experience was carried out by McDermott (1975). McDermott used five types of measures to differentiate between

prepracticum and postpracticum trainees and experienced school psychologists. These were measures of the amount of diagnostic data required to reach a decision, measures of the time spent to reach particular diagnostic decisions, a measure of the number of diagnoses asserted previous to making final diagnostic decisions, measures of expressed confidence in various decisions, and measures of changes in confidence from one point in the diagnostic process to another. McDermott found that the groups could be distinguished and that criterion groups were closely associated with the relative point in the diagnostic process at which subjects were able to assert a diagnosis which remained unchanged through to the termination of the process.

Bus and Kruizenga (1989) conducted an investigation of the diagnostic problem-solving behaviour of expert practitioners in the field of learning disabilities in which the subjects were asked to think aloud about the information they were given. Segmentation of the transcribed protocols was based chiefly on syntactic information and articulation breaks (Ericsson & Simon, 1984). The resulting segments were coded according to eight predetermined categories which described the subjects' use of the information. For example, a segment was coded as "planning" when a subject named topics on which information was desired, as a "hypothesis" when assumptions were made or questions were raised that prompted information gathering, and as a "recommendation" when remedial prescriptions were made. From two sets of pooled data, (all subjects diagnosing the same case were pooled, and two cases were used), sequences of actions were established and frequencies per action were calculated. The action sequences were found to deviate from those associated with scientific problem-solving behaviour. Scientific problem-solving behaviour is typified by enquiry followed by collection of information in the light of particular hypotheses, which, in turn, is followed by examination of this information to ascertain whether or not the hypotheses are supported. New or modified hypotheses are formulated as required by



the data. Bus and Kruizenga found that, after initial enquiry, their subjects gathered information without formulating prior hypotheses. They also found that a great deal of the information remained uninterpreted and that recommendations were not connected to the diagnostic findings.

Bus (1989) carried out a study which focussed on the extent of agreement about information, diagnoses, and recommendations. Ten reading specialists were asked to think out loud about a simulated case of reading and spelling disability and it was found that there was very little agreement among the subjects both with regard to diagnostic statements and remedial prescriptions, even when similar information was used.

The outcome of McDermott's investigation suggests that some distinctions can be made concerning the decision-making behaviour of experts and trainees. The studies by Bus and Kruizenga and by Bus reflect the criticisms that psychoeducational assessment is unsystematic and inconsistent. All three studies and the prevalent criticism of the field point to the need for further study of the reasoning processes involved in the utilisation and interpretation of case data and in the drawing of conclusions as to the specific nature of problems and their remediation. The taking into account of assessors' own predilections for particular theories in educational psychology may show that the process is not, in fact, random, but that inconsistencies, such as those listed by McDermott (1981), are related to variations in problem conceptualisation. If so-called errors follow a pattern, this is information that can be used to achieve a more complete understanding of why certain information is selected for consideration and how it is combined into the decision-making process. The influence of a putative negative, problem-oriented approach to assessment, as opposed to a positive approach that seeks out successful responses to the demands of school, also needs to be taken into consideration. The effects of experience on case-file

interpretation could then be assessed with reference to theoretical preference, anticipatory biases, and reasoning strategies.

*Studies of reasoning in the domain of medical diagnosis.* Examples of the modelling of assessment processes have been provided in the domain of medical diagnosis. The type of methodology employed made use of think-aloud protocols and propositional analysis to construct models of representation for diagnostic reasoning. Hence the kinds of skills that led to accurate diagnoses could be studied.

The influence of the medical knowledge base of practitioners on their ability to formulate accurate diagnoses has been studied by Patel and Groen (1986), and by Joseph and Patel (1986, 1987). The methodology that was used in these studies was based on a propositional analysis of think-aloud protocols adapted from Frederiksen. Propositions in the subjects' protocols were identified. Information regarding how propositions were related were used to construct a network of nodes (propositions) and links (relations) which, in Frederiksen's system, is called a frame. Patel and Groen (1986) identified a rule system that modelled diagnostic explanations in terms of causal patterns, i.e., a network of if-then rules. They observed that experts with accurate diagnoses principally used forward reasoning (from data to theory), while experts with inaccurate diagnoses used more backward reasoning (from theory to data). Joseph and Patel (1986) studied expertise as a function of domain-knowledge. Forward reasoning via causal links was used by high domain-knowledge subjects to generate hypotheses, and backward reasoning was used to explain the relationships between cues and the hypotheses. The low domain-knowledge subjects used more backward reasoning strategies compared to the high domain-knowledge subjects. The results also indicated that high domain-knowledge subjects used links from critical cues to a greater extent than did low domain-knowledge subjects.

In a further study, in which subjects were presented with the case of an endocrinology problem, Joseph and Patel (1987) found that when the representations of low domain-knowledge subjects (cardiologists) were compared to the representations of experts with high-domain knowledge (endocrinologists), the high domain-knowledge subjects had organised information in such a way as to limit the generation of multiple hypotheses. These findings agree with those of Lesgold, Feltovitch, Glaser, and Wang (cited in Greeno & Simon, 1984) who studied the reading of X-ray films by expert and novice radiologists. Expert radiologists used salient features to generate initial hypotheses that were refined or modified on the basis of more detailed features. Their hypotheses were well integrated with their knowledge of anatomy. That is, the elements of the X-ray problem to be solved were understood in relation to their knowledge of anatomy. Interpretations by novices depended more on finding an explanation for a few features, and on assimilating other details into their initial hypotheses in an ad hoc manner.

Clear differences between expert and less expert medical practitioners were thus seen. These differences arose from the ability to recognise critical cues, and the ability to organise this information so as to reason directly towards an accurate solution without the need for revision.

*Application of the problem-solving research methodology to psychoeducational assessment.* A research method which enables the reasoning processes used by experienced and less experienced practitioners in a particular domain to be made explicit, such as the method used in the medical studies, has potential for use in studies of psychoeducational assessment. The process of interpretation in psychoeducational assessment can be considered as a type of problem-solving task. The analysis of subject-generated protocols, which has proved to be a valuable research method in the

investigation of problem-solving skills in other domains, can be similarly applied to psychoeducational assessment in order to analyse how assessors actually work through case information.

There is some similarity between medical diagnosis and psychoeducational assessment. Medical diagnosis requires consideration of data from a variety of sources, some of which may be more pertinent to the problem than others. Psychoeducational assessment also involves the study of case-files that contain information from different sources. However, there are sufficient differences between medical diagnosis and psychoeducational assessment that the medical models may not represent completely the reasoning processes involved in the interpretation of psychoeducational assessment data. Moreover, the contrast between experts and novices may not be as straightforward.

A question that arises in the domain of psychology is whether or not the perceptions of the more experienced professionals are more accurate than those of the less experienced. Because of this, it may be fruitful to ask what information about the target is sampled (Wills, 1978). It may well be the case in psychoeducational assessment that professionals' and trainees' perceptions of persons are both accurate in some sense but are based on differential use of information. In psychoeducational assessment it may not be as readily apparent what information is most salient to the case, which facts are linked, nor how they are linked. Reasoning in a forward direction via causal links may not prove to be as significant a determinant of expertise as in a domain where the identification of causal factors is directly connected with remediation. These considerations have not yet been examined in the context of psychoeducational assessment so that, within this domain, it is not known to what types of reasoning models expert and trainee assessors conform.

## Chapter Three

### Rationale

A great deal of dissatisfaction has been voiced over the process of psychoeducational assessment, particularly concerning the ways in which data are interpreted. The lack of diagnostic agreement among assessors has called into question the validity of current methods of assessment. However, the question as to why assessors arrive at dissimilar solutions to the same problem has not been answered. Comprehensive studies of the processes whereby assessors reach decisions concerning the cases referred to them are required. Much of the previous research on the methods employed in assessment has attended to separate parts of the assessment procedure. There has been relatively little research on the process as a whole. In particular, little account has been taken of the factors that influence the ways in which assessors interpret information in order to reach their decisions.

There are several factors that may be responsible for the disagreement within the profession, of which practitioners need to be aware: theoretical and personal orientations in psychology, differences in problem conceptualisation, anticipatory biases, and different reasoning strategies. These are potential systematic sources of "error" and are, therefore, amenable to investigation. Attempts to remove sources of variation in assessment outcomes, such as the use of standard test procedures and statistical methods, have not been satisfactory because it is impossible to reduce a complex human services field to computational formulae and to eliminate completely professional judgement.

An essential element in the determination of what constitutes expertise in psychoeducational assessment is the analysis of differences between the decision-

making practices of individuals with considerable experience in the field and that of trainees. In the domain of psychology and its related fields it is necessary to take into account that practitioners subscribe to different theories of human behaviour which, in turn, determine the concepts and practices that are brought to bear during assessment. Theoretical orientation can be viewed as a constraint on judgement as it acts to enhance anticipatory biases and to limit the hypotheses that will be considered. As such, theoretical orientation is seen as a powerful and pervasive influence on professional judgement.

The study of psychotherapists by Wills (1978) leads to the consideration that less experienced psychologists retain, at least in one respect, an advantage over those who are more experienced in that they are less prone to perceive maladjustment and are therefore more likely to attend to adaptive modes of behaviour. This challenges the assumption that experience is necessarily associated with superior diagnostic reasoning, at least in regard to the domain of psychology. Ritchie (1986) has suggested that experience acts to reduce the influence of referral information on decision-making in psychoeducational assessment. If, in fact, experienced assessors are less likely to exaggerate the problems stated in the referral information than less experienced assessors and are more willing to seek positive attributes than their less experienced counterparts, this would lead to findings contrary to those of Wills. However, insufficient evidence has been offered in this regard. One of the assessors' tasks is to reframe the problems if necessary and offer alternatives to the prevailing views (Dowling & Osborne, 1985). But assessors are also likely to direct their search for solutions so as to respond to the initial questions posed in referral statements and formulate their own hypotheses accordingly (O'Reilly et al., 1989; Rosenhan, 1973; Tidwell, 1976; Ysseldyke & Algozzine, 1981). The present study compares expert and novice reasoning strategies to investigate whether adherence to a theoretical orientation

varies as a function of experience in psychoeducational assessment and also produces an emphasis on negative aspects of a case description. Differences in problem conceptualisation are examined in the context of theoretical orientation to which they are intrinsically linked.

As with other domains, psychoeducational assessment can be studied as an example of problem-solving in an unstructured problem space. This view of diagnostic reasoning as problem-solving has yielded models of reasoning which represent expertise. In the domain of medicine, for instance, the expert model was found to be characterised by primarily forward causal reasoning, a high level of integration between domain knowledge and critical cues, and an organisational structure which led to early identification of the correct solution without overgeneralisation of clinical categories and re-evaluation of diagnoses (Patel & Groen, 1986; Joseph & Patel, 1986, 1987). These models serve as examples against which to compare less expert and novice modes of reasoning and can be used as aids in teaching and practice, especially when expert systems have been developed as a result. Before similar models can be constructed for the domain of psychoeducational assessment, it is necessary to investigate further how assessors interpret case-file information, to take into account the various influencing factors, and to establish whether experience acts to moderate or aggravate their effects.

The technique of obtaining think-aloud protocols is an initial step in the analysis of reasoning processes, and has already been used in studies of diagnostic decision-making in the field of learning disabilities (Bus, 1989; Bus & Kruizenga, 1989). But these studies did not work towards representational models of reasoning and only added further to the impression of assessment as highly unsystematic. However, in applying methods based on protocol analysis to psychoeducational assessment, it is necessary to be aware of the following difference between psychoeducational

assessment and other domains in which expert and novice reasoning have been modelled. In psychoeducational assessment, the selection of a single expert model of interpretation that is generally recognised as more efficient and accurate than most others is problematic because there are no fixed criteria for designating any one assessment as being more correct than others, or, at any rate, more suitable than any other for use as a template. In the medical studies cited and in studies carried out in the areas of expository writing (Donin, Denhière, & Frederiksen, 1988), knowledge integration in chemistry (Kubes, 1988), and procedural knowledge in biochemistry (Frederiksen & Breuleux, 1989) it was possible to model the reasoning of an acknowledged expert. The representations of reasoning that were obtained from the expert and less expert subjects' protocols could then be compared to and contrasted with the expert template.

### **Methodological Framework for the Study**

The present study adopts the method of think-aloud protocols as a means of investigating the reasoning processes used by psychoeducational assessors as they interpret a case-file. Several features of the interpretation process in psychoeducational assessment can be investigated by analysing the numbers and types of inferences that are made by subjects during the generation of their protocols. The aspects of the protocols chosen for consideration relate to the specific research hypotheses concerning the total number of inferences made, conceptualisation of the problem in terms of its educational, emotional, physiological, or contextual correlates, attention given to perceived negative or positive evidence of adjustment, and evidence of ability to produce alternative interpretations of case-file data. This can be carried out by categorising and enumerating the inferences contained in subjects' protocols.



Of the factors believed to influence assessors' interpretations of case-file material, the present study addresses two in particular: theoretical orientation and anticipatory bias towards negative characteristics of the case. The problem of bias created by the referral information is not specifically addressed in formulating the research hypotheses in that the present study does not include referral information as a controlled variable. That is, all subjects were presented with identical referral information at the beginning of the case-file. However, the categories of inferences made by subjects are studied for their relationship to the referral information provided. The presenting problems, as stated in the referral information, may direct subjects' attention to educational, emotional, physiological, or contextual factors and to corresponding manifestations of adaptive or maladaptive behaviours.

Subjects' formal theoretical orientation in psychology can be assessed either directly, by self-rating, or indirectly, by scaling their responses to statements that conform to various theories in psychology. The latter method is preferable because it avoids any tendency on the part of subjects to rate themselves according to what they believe is a preferred orientation in the context of the experimental situation. Therefore, the present study uses subjects' responses to items on a scale for assessing relative orientation preferences as an index of theoretical orientation. Details of the Counselor Orientation Scale (Loesch & McDavis, 1978) and the method of administration of the scale can be found in Chapter 4, and in Appendix B.

In addition, analysis of the protocols is carried out with a view to examining the reasoning processes by which diagnostic decisions are reached. The study is viewed as an initial step in the construction of a model of cognitive representations in psychoeducational assessment and, therefore, comparisons are made among subjects rather than between individual subjects and a predetermined model of expertise. Furthermore, because the model of reasoning to which experienced assessors most

closely conform has yet to be established and a causal model cannot be assumed to represent expertise in this domain as it does in the domain of medicine, the use of conditional reasoning in decision-making is investigated. A possible model that reflects strategies of review and revision, and that incorporates conditional induction, has been discussed as being appropriate to the domain under consideration. A further area of study, suggested by Greeno's concept of inducing structure in ill-defined problem spaces and by the findings in the medical domain that expert problem-solving is characterised by well-integrated networks, (Greeno & Simon, 1984; Joseph & Patel, 1987), is whether subjects attempt to integrate their inferences into a single hypothesis or generate several hypotheses as a result of trying out alternative approaches to the problem. However, in the domain of psychoeducational assessment, the assumption of highly integrated reasoning as representative of expertise has yet to be confirmed. Within the framework of the present study, the construction of representational models serves a dual purpose. The first is to elucidate the cognitive processes that are active in problem-solving in this domain. The second is to contribute towards the construction of a potential reference model that can serve as a decision aid.

### **Formulation of Research Hypotheses**

All the following hypotheses, with the exception of Hypothesis 6, are concerned with expert-novice differences.

#### *Research hypotheses regarding the numbers and categories of subjects' inferences.*

The contention that experienced psychologists become fixed in their outlook towards clients (Wills, 1978) can be taken to imply reliance on limited theories which are unlikely to be revised. Therefore, inferential reasoning will be constrained.

*Hypothesis 1. The experts will make fewer inferences from a case-file about the characteristics of a student than will the novices.*

Moreover, experience in the field of psychology has been associated with increased attention to pathology (Wills, 1978) so that trainees may be expected to maintain a more positive view of a student's overall functioning. In contrast, it has been proposed that experience in psychoeducational assessment lessens the tendency to perceive primarily negative case attributes, but insufficient experimental evidence has been offered in this respect.

*Hypothesis 2. The experts will identify more negative attributes of a student than the novices.*

*Hypothesis 3. The experts will identify fewer positive attributes of a student than the novices.*

The constraints imposed by adherence to a particular theory restrict the scope of data interpretation to that which fits the theory (Chamberlin, 1897, cited in Platt, 1964; Nisbett & Ross, 1980; Snyder & Swann, 1978). Consequently, if it is true that experienced psychologists are more constrained by theories than less experienced individuals, experts will be less likely than novices to retract inferences after reading further, possibly contradictory, evidence in a case-file.

*Hypothesis 4. Although the experts will generate fewer inferences than the novices, as stated in Hypothesis 1, they will retain more of their inferences than the novices or, otherwise stated, they will reject fewer inferences than the novices.*

*Research hypotheses regarding subjects' theoretical orientation in psychology.* A presumed cause of the less flexible outlook on the part of experts is that they are more strongly influenced by their theoretical orientations in psychology than are trainees (Dumont, 1987). Although trainees are susceptible to the influence of their teachers, they are more likely to take an eclectic approach.

*Hypothesis 5. An orientation scale<sup>2</sup> will show that the experts are more closely aligned with a particular theoretical orientation than are the novices.*

Students in psychology and related fields are influenced by various theories to which they are introduced during their courses, laboratory work, and internships. Professional practice in psychology involves application of theories acquired during training and experience. The way in which a problem is viewed is related to the theoretical conceptualisation of the correlates of learning difficulties. Therefore, the inferences based on psychoeducational assessment data, that conceptualise a student's functioning in terms of these correlates, are likely to reflect theoretical orientation.

*Hypothesis 6. The types of inferences retained throughout their interpretation of a case-file will correlate with theoretical orientation for all subjects in both expert and novice groups.*

*Research hypotheses relating to the representations of subjects' reasoning processes.* From representations of subjects' reasoning it is possible to ascertain what type of model might best represent the interpretation process in psychoeducational

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<sup>2</sup> The Counselor Orientation Scale (Loesch & McDavis, 1978).

assessment. In medicine, for example, experts construct a case representation based on the underlying causal mechanisms that produce the symptoms, and accurate diagnosis is associated with forward reasoning (Patel & Groen, 1986). A similar, causal model may prove to be representative of expertise in psychoeducational assessment.

*Hypothesis 7. The expert assessors will use more causal links than the novices to generate inferences about the student. The novices will use comparatively fewer causal links than the experts.*

The recognition of critical cues is associated with more efficient problem-solving strategies and with domain expertise (Greeno & Simon, 1984; Joseph & Patel, 1986). Although research in the field of psychoeducational assessment has suggested that assessors are random in their selection of data from a given case-file (Bus & Kruizenga, 1989; McDermott, 1981), this has not been proved conclusively. Expertise is usually associated with selectivity in the use of information (e.g., Greeno & Simon, 1984; Patel & Groen, 1986).

*Hypothesis 8. The experts will link their inferences to a selectively narrow body of information, whereas the novices will use a wider range of data from the case-file as inferential cues.*

The literature on psychoeducational assessment includes a great deal of analysis and criticism of standardised tests which reflects their perceived importance for assessing students. However a recent trend towards less reliance on these instruments has been identified. It is expected that experts are accustomed to rely heavily on standardised tests, while trainees are less likely to follow this convention.

*Hypothesis 9. The representations of the experts' interpretations of a case-file will include the standardised test scores among the critical cues and the experts will refer to this body of information more often than to any other. In contrast, the novices will refer less frequently to the test data which will, therefore, not feature so prominently in their selection of cues.*

The problem-solving literature provides evidence that not only are experts more selective in their use of information, but also that they are better able to organise information so as to reach a solution quickly and efficiently (Greeno, 1978; Greeno & Simon, 1984). An understanding of the relations among salient concepts results in a well-integrated representation of the problem space.

*Hypothesis 10. The reasoning processes used by experts will be represented by more highly integrated networks than those of the novices.*

## Chapter Four

### Method

#### Design

The effect of one between-subjects factor: experience, with two levels: expert and novice, on dependent variables representing multiple aspects of the assessment process was examined. The multiple measures of the assessment process were obtained from analysis of subjects' verbal protocols while reading a standard case-file. In addition, a second between-subjects variable, theoretical orientation in psychology, was examined for its relationship to the multiple measures obtained from the verbal protocols.

#### Subjects

Two groups of 12 individuals representing two levels of experience with psychoeducational assessment served as subjects. The "expert" group consisted of 12 professional psychologists who specialised in psychoeducational assessments. The criteria for inclusion in this group were a minimum of 5 years experience and current employment as psychoeducational assessors, working in the English language, with English-speaking students. The expert subjects who participated in the study had a mean of 14 years of experience with a range of 11 to 22 years. Twelve trainees in McGill University's educational psychology programme at the Master's level, who had participated in the course in testing and assessment within the two academic years prior to the data collection phase of the study, made up the novice group.

#### Materials

*The case-file.* A case-file (Appendix A) was compiled from information that had been gathered as part of an actual assessment of an elementary school student. This

case was chosen because the student's general level of ability was in the average range and the types of problems for which he was referred to a school psychologist were not extreme and could be examined from both a cognitive and an affective point of view. The case was judged to be interesting but not unusual, and it contained information from a variety of sources. There was sufficient ambiguity to allow for multiple interpretations of the data which could potentially reflect the assessor's theoretical orientation and interpretive reasoning. The data that were omitted when the file was prepared for the study were: a) those parts of the report that reflected the original assessor's own interpretations of the case; b) information that was gathered subsequent to the original assessment that were intended to confirm or disconfirm the original assessor's theories about the student and; c) any information that could be used to identify the student concerned and hence violate the rule of maintaining confidentiality. (The pseudonym "Edgar" was assigned to the student.) The information provided to subjects included the following: reasons for referral to the psychologist; parents' reports; school teachers' report; social and medical information; prior psychological and educational history; results of standardised tests; a brief composition written by the child; and a figure drawing done by the child.

*The Counselor Orientation Scale.* A scale for assessing relative preferences for seven major counselling orientations, the Counseling-Orientation Scale, (COS), (Loesch & McDavis, 1978) was used. The source pool for the COS component items was a counselling-approach (orientation) comparison grid that appeared in Shertzer and Stone's *Fundamentals of Counseling* (1974, pp. 242-243). This grid compares nine counselling orientations across 10 characteristics (components) for each orientation. The 35 COS items reflect five of the characteristics for seven of the counselling orientations (Behavioural, Existential, Freudian, Trait-Factor, Client-Centred, Gestalt,



and Rational-Emotive). Subjects were asked to select one of four responses to each of the 35 items: strongly agree (SA), agree (A), disagree (D), or strongly disagree (SD). The responses were weighted such that SA=4, A=3, D=2, and SD=1. The score a subject received on each scale was the sum of the weightings of the five items for that scale. The score range for each of the seven orientations was 5 to 20. The full details of the Counselor Orientation Scale are contained in Appendix B.

*The questionnaire.* A questionnaire was distributed to all subjects who participated in the study. This requested information concerning subjects' secondary and tertiary education, professional training relevant to the field of educational psychology, and details of professional experience. Two specific questions were asked both of which were aimed at eliciting information from the expert group of assessors. The first question was in regard to the kind of information usually sought when conducting an assessment. The second question asked about the situations most frequently encountered when students were referred to these professionals for assessment. Details of the questionnaire that subjects were asked to complete are contained in Appendix C.

### **Experimental Procedures**

Each subject was given preliminary training in the generation of think-aloud protocols based on tasks presented on the screen of a microcomputer. Instructions were then given concerning the experimental procedure and the case-file which they were required to analyse out loud. Following the experimental session, each subject was asked to complete the Counselor Orientation Scale and Questionnaire.

*Procedures for obtaining think-aloud protocols.* Information was presented on the screen of a Macintosh microcomputer in the form of "documents" replicating the real

case dossier. The order of presentation of information reflected the order in which the information was collected as part of the assessment procedures. Presentation of the dossier was governed by an on-line computer application, On-Line (Frederiksen, Perrault, Breuleux, Donin, Bracewell, Renaud, & Bedard, 1988), developed by the Laboratory of Applied Cognitive Science at McGill University .

On-Line allows text to be presented to the reader in a manner controlled by the experimenter. In this case the text was presented by topic, nine sections in all, and the reader was permitted to scroll back to review text. The topics in order of presentation were: 1) Referral for Psychoeducational Assessment (the child's name, age, school grade, etc.), 2) Presenting Problem, 3) Parents' Report, 4) School's Comments, 5) Birth and Medical History, 6) Psychologist's Observations, 7) Test Results and Scores, 8) Composition (a brief story written by the child), 8) Goodenough-Harris Drawing Test. Comments by the researcher were recorded on the audiotapes made of the subjects' think-aloud protocols a) to flag the points in the case-file at which subjects paused in their reading to make any remarks, b) to flag the points in the case-file at which subjects paused in their reading in order to scroll to previously read text, and c) to indicate the point in the file to which they scrolled the text for review. The subjects were free to read and reread the information with which they were presented according to their own preferences. The aim was to replicate as closely as possible the review of a case-file; therefore the subjects were free to peruse the file as they wished.

Training in the production of think-aloud protocols and the recording of protocols took place in individual sessions with each subject. No time limits were set. When subjects were familiar with the method and were comfortable with On-Line, they were asked to read the case-file and think through to their final hypotheses. They were permitted to pause in their reading of the file to "think-aloud" whenever they wished to do so. The details of the preliminary training and the full contents of the case-file are

found in Appendix A. Finally subjects were asked to summarise their interpretations of the case-file.

### **Analytic Procedures**

The case-file text was subjected to a propositional analysis. The subject-generated protocols were segmented and were then coded and enumerated according to predetermined categories.

*Propositional analysis of the case-file.* The case-file text was analysed into propositions using Frederiksen's (1975, 1986) method of propositional analysis, except for the parts of the file instructing subjects to examine the student's composition and drawing. The propositional analysis of the case-file is set out in Appendix E. (The first digit in the proposition number corresponds to the case-file topic number). The analysis was computer-assisted using CODA, a computer program designed and developed in the Laboratory of Applied Cognitive Science, McGill University (Frederiksen, Breuleux, Renaud, & Perrault, 1988).

*Segmentation of transcriptions of the subjects' protocols.* The segmentation of subjects' transcribed protocols was carried out using criteria of intonation, pausing, and clauses (Chafe, 1980). Chafe's model of thought processes is derived from an analogue of the visual system and, like vision, thought does not flow continuously but is a saltatory succession of "focuses". The latter correspond to "idea units". Change in intonation, pausing, and clausal segmentation all aid in identifying idea units, although all three criteria are not always present. The segments that were thus identified in each subject's protocol were numbered sequentially for identification when coding the protocols.

*Protocol coding categories.* The segments identified in each subject's protocol were categorised as described in the following sections, and as set out in the chart in Figure 1.

1. The term "quote" was used to designate the category indicating that the subject had quoted directly from the text, repeating the terms used in the original text of the case-file.

2. The term "paraphrase" was used for the category indicating that the subject had paraphrased information contained in the text.

3. The term "inference" was used for the category indicating that there had been a transformation of information that went beyond the text; that is, the subject drew a conclusion from the information contained in the file, but that conclusion was not explicitly stated in the file. Alternatively, the subject elaborated on the original text, that is, he or she added to the basic information contained in the text.

Inferences were designated as either category Type A or category Type B. Category Type A referred to inferences concerning the individual described in the case-file. These inferences served to indicate where subjects had formulated hypotheses or theories about the student. Type A inferences were further subdivided into the following coding categories: a) Inferences that related to cognitive or educational attributes of the student were coded as "educational"; for example, a statement in which the subject has inferred that the student has a learning difficulty, or a statement in which the subject has inferred that the student is coping well with school work: b) Inferences that related to emotional attributes of the student were coded as "emotional";

for example, a statement in which the subject has inferred that the student is experiencing difficulties at home and/or at school that arise from emotional problems:

c) Inferences that related to physiological factors were coded as "physiological"; that is, statements in which the subject has inferred something about the student's state of health or neurological functioning: d) Inferences that were contextual in character were coded as "contextual". These were descriptions of environmental influences that the subject has inferred to be acting on the student; for example, statements that contain inferences about how the parents deal with the child: e) Inferences that were prescriptive in character were coded as "prescriptive". These were recommendations for further exploration or remediation of perceived difficulties. Prescriptive inferences were subdivided according to whether the recommendations addressed education, emotional, or physical factors. An example of a prescriptive inference in the educational category is a recommendation that the student's educational programme should be modified to allow for additional tuition, or a recommendation that he should attend a certain type of high school, or that further assessment of his learning abilities should be carried out. An example of a prescriptive inference in the emotional category is a recommendation that the child should undergo psychotherapy, either alone or with members of his family. Recommendations for further assessment of emotional and/or social functioning were also included in this category. An example of a prescriptive inference in the physical category is a recommendation that the child should undergo a medical, let us say, a neurological examination to check whether treatment is required.

Inferences belonging to categories a) to d) were given either a positive or a negative designation, depending on whether the subject had inferred positive or negative characteristics to describe the student or his environment.

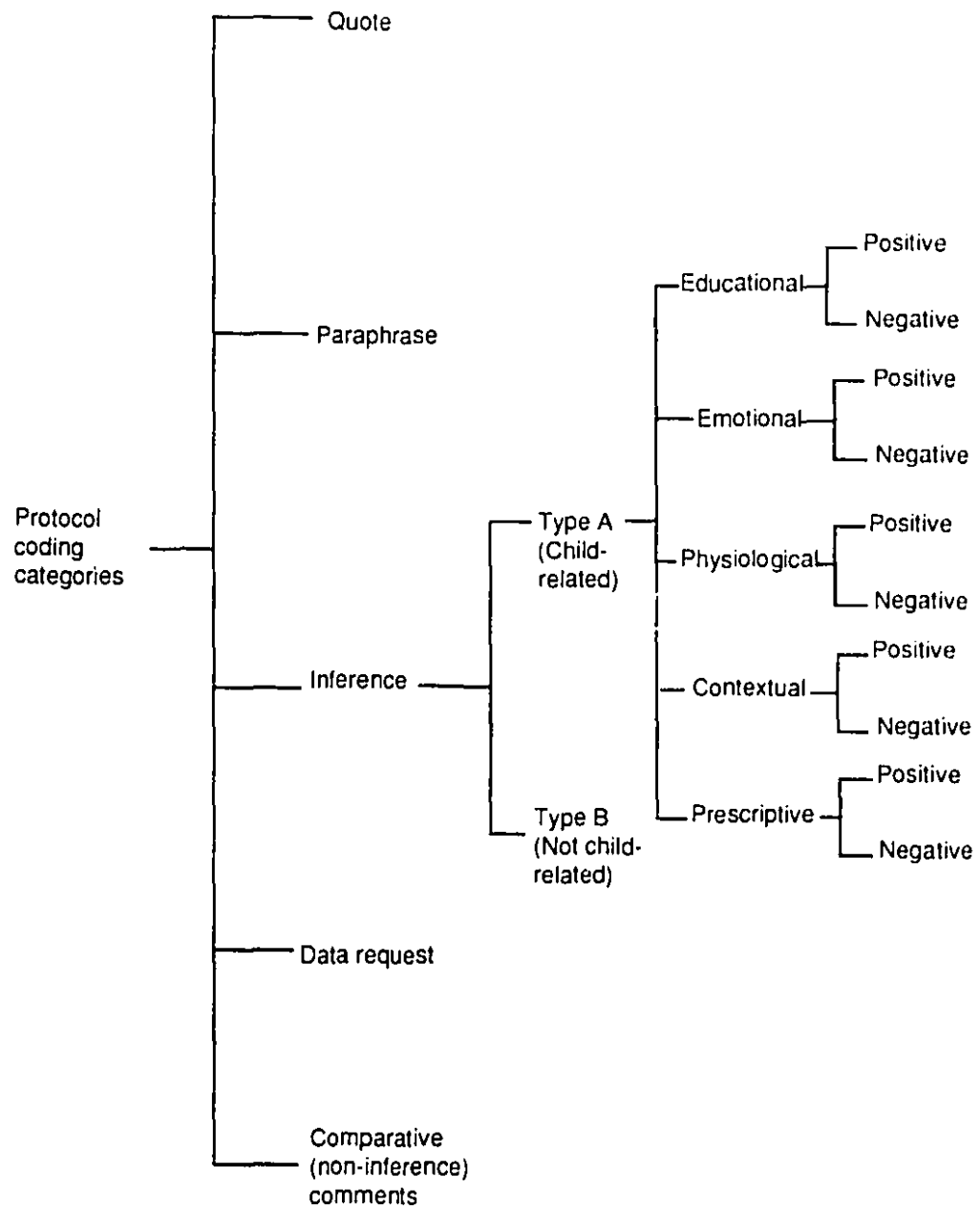
Inferences in the Type A category were also designated according to whether the subject had retained or rejected them. The following guidelines were used to determine retention or rejection. Inferences that were explicitly rejected by a subject were counted as rejected. Inferences associated with explicitly rejected inferences, that were not also associated with retained inferences, were counted as having been rejected. Inferences were counted as having been retained when there was no discussion of contrary evidence anywhere in the protocol.

Category Type B inferences were those that did not bear directly on the person being evaluated, e.g., a general statement that mathematics involves concentration.

4. A statement was coded as a "data request" when a subject requested further information about the child or mentioned test results they would have liked to have seen included in the case-file. These were coded separately to distinguish them from specific recommendations for further testing or assessment which were coded under the prescriptive category.

5. A statement was coded as a "comparative (non-inferential) comment" when a subject compared the child described in the case-file to an individual or individuals that had been encountered in that assessor's previous professional or personal experience.

Quotes and paraphrases, together with the experimenter's verbal comments on the audiotape, were used to decide to which propositions in the case-file the inferences referred. Assessors' data requests were also used to help link inferential statements to the text. (The present study was concerned with the interpretation phase of assessment and was not designed to examine assessors' preferences in regard to data collection.)



**Figure 1.** Chart of protocol coding categories

*Coding the protocols and enumeration of inferences.* Coding sheets were designed so that the number denoting each segment in a subject's protocol could be written in the appropriate column under the category heading to which it belonged. The case-file text propositions to which the segments referred were also indicated on the coding sheets.

Repetitions of inferences, based on a similar set of text information, were not counted as additional inferences. However, when subjects confirmed a previous inference on the basis of additional text information, this was counted as a new inference.

The protocols were coded by the primary researcher and by a research assistant working independently. Therefore, each protocol was double-coded. The assistant had been trained to use the coding system by working through sample transcriptions together with the primary researcher. These samples were taken from a pilot study that had been carried out to check the smooth-running of experimental sessions. It was found that there was 89 per cent agreement between both coders. The discrepancies in the coders' judgements were treated by consultation between the coders. Appendix D contains a full guide to the coding procedures in the form of training definitions, guidelines for coders, and a sample of the forms used in coding the protocols.

For each subject the inferences of Type A were enumerated according to their respective categories. (Refer to Figure 1.) The numbers of positive, negative, rejected, and prescriptive inferences made were recorded. These four categories together made up the total number of Type A inferences generated. The numbers of educational, emotional, physiological, and contextual inferences made were recorded, excluding those inferences that were rejected. Educational, emotional, physiological, and contextual inferences (excluding rejected inferences) that were designated positive were counted. Similarly, the number of negative inferences retained in these four



categories were also counted. The prescriptive inferences in each of the three categories, educational, emotional, and physical were counted.

### **Representation of the Case-file and of Subject's Reasoning Processes**

The case-file and subjects' protocols were represented as semantic networks in linear graph form (Sowa, 1984) in preparation for analysis of the reasoning processes involved in the assessment task.

*Linear representation of the case-file.* In order to use the case-file as a basis for comparison between information provided to subjects and subjects' reasoning processes as they interpreted this information, the case-file text was represented according to the system used by Sowa (1984). Sowa's system of representing the internal cognitive structures that are used to represent meanings associated with language, perception, and thought is defined in terms of conceptual graphs and semantic networks. The usual format, called the display form of representation, employs a box and circle notation (as shown in Figure 2 and described below). However, Sowa has shown how the display form can be converted to a linear notation which is easier to type and print using a word-processing program. The resultant representation is both more condensed and easier to survey than the display form, while at the same time the structure of the network is preserved. In preparation for further analysis, Sowa's method of representing conceptual graphs and semantic networks<sup>3</sup> in linear form provided a clear and convenient means of showing the concepts, and the relationships between

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<sup>3</sup> Sowa distinguishes between conceptual graphs and semantic networks: "Each conceptual graph asserts a single proposition. The semantic network is much larger. It includes a defining node for each type of concept, subtype links between the defining nodes, and links to perceptual and motor mechanisms (p. 78)." Many authors use the terms interchangeably. The term "representation" will be preferred here as links were identified between propositions but each subject's set of hypotheses did not form one integrated network. When the term "network" is used it refers to the more general meaning and not to the more specialised meaning given it by Sowa.

concepts, in the text. (The case-file did not contain complex relations between concepts because the original assessor's inferences and comments had been edited out.) It was then possible to establish which of these concepts became linked, and through what kinds of relationships they were linked, when subjects interpreted the text.

An example, adapted from Sowa's book *Conceptual Structures: Information Processing in Mind and Machine*, but using a sample from the case-file examined in the present study, is shown in Figure 2. This example illustrates how the original statement was, first, paraphrased in order to convey more clearly its meaning. (This paraphrasing was not necessary for most of the statements in the file.) Secondly, the statement is represented in display form where rectangles represent concepts and ovals represent the relations between concepts. "CASE" denotes the student described in the file, "PAT" stands for a patient relation, and "ATT" stands for an attribute relation. The representation of the statement forms a tree consisting of two main branches from the concept [CASE], each of which has further sub-branches. Part of the network forms a loop where two sub-branches, one from each of the main branches, are linked to the concept representing the "contents of paragraphs". Thirdly, the same concepts and relations are set out according to Sowa's linear method of representation. The symbol "\*x" indicates that the network contains a loop and signals equivalence between the two instances in which the concept "paragraphs" is mentioned. A double hyphen and comma form a bracketing pair which is necessary to show that a branch in the network is being represented. For instance, the double hyphen immediately following [read aloud] and the comma after [fluently] make up such a pair. They mark the branch to which the concepts [paragraphs], [accurately], and [fluently] are connected. The superscript numbers shown on the linear representation of the case-file were added as references to proposition numbers in the original text.

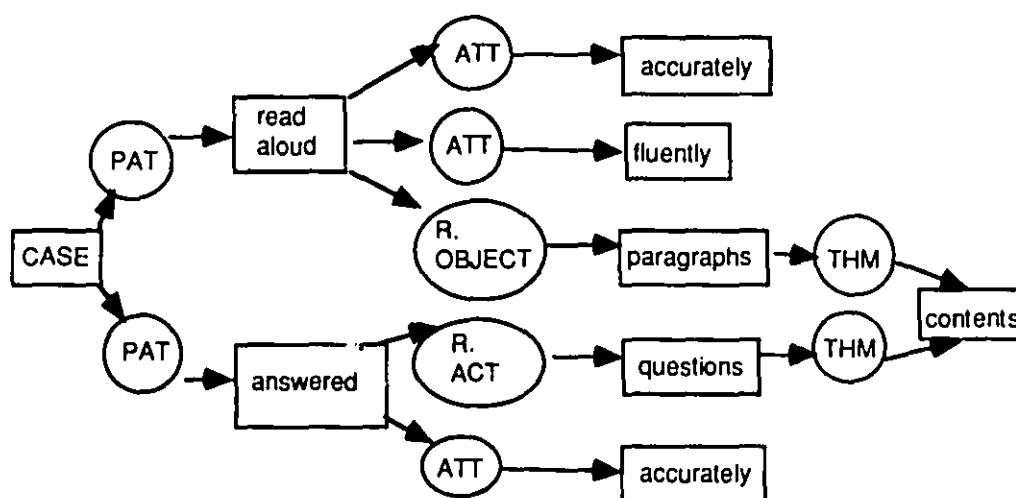
### Sample statement extracted from Paragraph 7 of the case-file.

He read accurately and fluently....Questions about the paragraphs that he had read were answered accurately.

*Implicit meaning.*

The case read aloud paragraphs accurately and fluently....Questions about the paragraphs that the case had read aloud were answered accurately.

*Display form.*



*Linear form.*

```
[CASE]--
  (PAT)→ [read aloud]--
    (R.OBJ)→ [paragraphs:']
    (ATT)→ [accurately]
    (ATT)→ [fluently], 7.21.1

  (PAT)→ [answered]--
    (R.ACT)→ [questions]→ (THM) → [] → (THM)→[paragraphs:'x]
    (ATT)→[accurately], 7.21.2
```

*Note.* Superscripts refer to proposition numbers.

PAT = PATIENT, R. ACT = RELATED ACT, R. OBJ = RELATED OBJECT,  
ATT = ATTRIBUTE, THM = THEME

**Figure 2.** Example of the linearisation of the display form of a representation following the method of Sowa (1984).

In preparation for representation, the presented case-file was divided into eight categories of information entitled Family, Parents' Goals, Current Characteristics, Past Characteristics, Current Events, Past Events, Current Processes, and Past Processes. Since the individual categories imply tense, the linear representation was condensed by eliminating the need for adding tense relationship and tense concept links to every proposition. Further condensation was achieved by allowing the default truth value to be positive, unless indicated as negative. The designation of "current" for events and processes was chosen instead of "present" because the past tense was frequently used where the information provided was still current for the individuals dealing with the child described in the case-file. For example, the psychologist's observations had been made in the recent past and were considered as currently valid by the assessors, as opposed to some of the information in the parents' report that pertained to their son's early childhood. The linearised version of the dossier is set out in Appendix F. "Family", "Parents", and "Case" were extracted as head elements for clarity and efficiency. Superscript numbers refer to numbers in the propositional analysis of the case-file which are cross referenced where necessary.

*Linear representation of subjects' reasoning processes.* The subjects' protocols had been coded against the propositions that made up the case-file. The linearised representation of the case-file facilitated the identification of the links the subject made between case information and their inferences. The proposition numbers were used to stand for the case-file data that subjects incorporated into their inferential reasoning. Adapting Sowa's system of linear representations provided a clear way of showing where and how data and inferences were linked together. The representations of subjects' reasoning were worked out from the protocols so as to show as faithfully as possible the links between case information and inferences. It may appear to the reader that there are instances in which subsystems of hypothesis formulation by a subject

should have been shown as linked but in which they have been shown as separate systems of reasoning. If this is the case, it is because the subject did not make any explicit connection between the hypotheses in question, and every effort was made, both in coding and in analysing the protocols, not to make any inferences beyond those made explicit by the subjects themselves.

For the representations of subjects' reasoning, the links between concepts were labelled to reflect the kinds of reasoning used. The relationships between file information and inferences were of the types: cause (CAU), condition (COND), negative cause (NEG CAU), negative condition (NEG COND), equivalence, "or", and "and".

The definition of causal relations was that used by Frederiksen (1975), citing Simon and Rescher (1966). A causal relation is a relation which expresses one variable (the effect) as a function of another variable (the cause). The direction of the causal relation is given by the asymmetry of the system of functional relations involving the variables. For example, as shown in Figure 3, Subject EH inferred from statements in the text referring to the child having weak math skills (Proposition No. 4.5.0) and needing help in getting his school work organised (Proposition Nos. 4 7.0-2) that a possible cause of poor math skills was the child's inability to be organised without teacher assistance. The subject's actual statement was "If he's having trouble with math ... so this could be related to his difficulty in organising his work". Implied here is a functional relationship between organisation of work and skills in mathematics. Clearly the direction of the causal relation is from "organisation" to "math skills". This definition of a causal relation is a useful one, especially, as is the case in the above example, when reasoning is not verbalised in terms of "event A causes event B", or in terms of "if ..., then ...", or "if, and only if, ..., then ..." statements. This definition thus distinguishes between what the subjects actually said and what was implied by their statements.

## Subject EH

4.5.0, 4.7.0-2→COND→math skills are weak --

OR CAU←lacks organisational skills: \*z

OR CAU←weak in math area

4.8.0 --

OR CAU←dependency

OR CAU←needs direction, needs organisation: \*z

### *Case-file Text*

#### *Proposition number.*

4.5.0	His math skills are weak
4.7.0-2	He needs help in getting his school work organised
4.8.0	He has had to be seated close to his teachers

### *Protocol Text*

#### *Segment number.*

4.5	... The fact that his math skills are weak
4.12	If he's having trouble with math ...
4.14	... so this could be related to his difficulty organising his work
4.17	It could also be ... weak(ness) in that area
4.18	Being seated close to the teachers ... can be ... that ... he's dependent
4.21	Or, he needs to be told where he has to go, and how to get organised

COND = CONDITION, CAU = CAUSE

**Figure 3.** Sample of relations between concepts in representations of subject's reasoning: Subject EH

A similar definition was used for the negative causal relation. However, in this case the subjects stated or implied that the effect was not a function of the variable (or "cause") under discussion. For instance, as shown in Figure 4, Subject NA inferred that the child's behaviour difficulties (Proposition 2.6.1) were not caused by family circumstances (Propositions 3.2.0-3.3.1, stating that the family is intact and that their financial situation is stable and good).

A conditional link is formed when text information or one of the subject's previous inferences is seen by this subject as being supportive of a particular inference. For instance, the excerpt in Figure 5, from the representation of reasoning obtained from the protocol of Subject EE, shows how this subject, taking three concepts from the text, has inferred that the conjunction of these concepts is a condition for the presence of an attention deficit disorder (ADD). The sets of propositions 3.6.0-2, 3.10.0, and 3.14.0-2 contain respectively the information that the child was an active baby who did not like being touched, did not mix well with other children, and was scattered, impulsive, and immature, all of which were regarded as conditions for diagnosing an attention deficit. A negative conditional link is formed when text information or a previous inference provides a condition for a characteristic, event, or process *not* to be true for the case under examination. For instance, Subject EE inferred that the additional information from the case-file text, that the child obtained a high score (a scaled score of 15) in the WISC-R Coding subtest (Proposition 7.16.0), was a condition for the *absence* of an attention deficit. As shown in the figure, the arrow directions indicate the direction of the conditional or negative conditional reasoning.

### Subject NA

2.6.1←NEG CAU←3.2.0-3.3.1

#### Case-file Text

##### Proposition number.

2.6.1	Behaviour difficulties
3.2.0-3.3.1	The family is intact
	Their financial situation is stable and good

#### Protocol Text

##### Segment number.

S9	There are also behavioural problems to be looked at
S11	... family relationship ... that the family's together ...
	they say that the family was stable

NEG = NEGATIVE, CAU = CAUSE

**Figure 4.** Sample of relations between concepts in representations of subject's reasoning: Subject NA

### Subject EE

3.6.0-2, 3.10.0, 3.14.0-2→COND→ADD←NEG COND←7.16.0

#### Case-file Text

##### Proposition number.

3.6.0-2	He was an active baby who did not like being touched
3.10.0-2	He did not mix well with other children
3.14.0-2	He is scattered, impulsive, and immature
7.16.0	Coding - 15

#### Protocol Text

##### Segment number.

3.4	The thought came in to my mind ... in not being touched ...
3.6	And when I see that he did not mix well with other children ...
3.7	... a question of attentional deficit (disorder) (ADD)
3.9	(Reads: ... is scattered, impulsive, and immature) See!
5.5	Attention (deficit) ... I didn't see that in the Coding

COND = CONDITION, NEG = NEGATIVE

**Figure 5.** Sample of relations between concepts in representations of subject's reasoning: Subject EE



Equivalence relations were shown by Sowa's system of cross referencing of letter symbols representing the variables that may be inserted in the concept slot. This system was used when the corresponding display form of a representation could not be drawn as either a line or a tree, for instance, when there were loops in the network. (Refer to Figure 2.) The extract from the linear representation of the protocol generated by Subject EH (Figure 3) illustrates a case where both instances of the discussion concerning the child's difficulty with organisation referred to the same concept. This is signalled by the symbol "\*z".

The disjunction, "or", was shown by either "or cause" (OR CAU) or "or condition" (OR COND), as appropriate, to indicate where subjects explicitly suggested a possible choice of concepts. The excerpt from the representation of reasoning obtained from the protocol of Subject EH (Figure 3) shows that this subject viewed the fact that the child was seated close to his teachers (Proposition 4.8.0) as the result of his dependency on others or of his needs for direction and help with organisation. Similarly, alternative inferences were generated to explain the child's weak math skills; that the child lacked organisational skills or that he was just weak in that area of study. The link "OR COND" was used in a similar fashion when subjects specified alternative conditions in order to support an inference.

The conjunction, "and", was shown by the insertion of commas between the concepts that were considered in conjunction with one another. For instance, as shown in Figure 3, Subject EE initially considered the sets of propositions 3.6.0-2, 3.10.0, and 3.14.0-2 to be *jointly* indicative of an attention deficit. A further example of conjunction occurs where Subject EH postulated that the child's *joint* needs for direction *and* organisation may have caused his teachers to seat him close to them. This conjunction is indicated by the comma between "needs direction " and "needs

organisation". Appendix G contains further, more comprehensive, examples from the linear representations of subjects' reasoning.

From the linearised representations of subjects' inference generation it was possible to compare and contrast the links that subjects formed between propositions and between propositions and inferences. Hence the types of reasoning used could be deduced. Group differences in terms of the presence and frequency of causal reasoning were studied. The linear systems were also used to compare and contrast the numbers of propositions on which the two groups of subjects based their inferences, and from which topics in the case-file inferences were drawn.

The representations were studied to ascertain whether or not subjects' reasoning could be described as well-integrated. The criteria for well-integrated reasoning were that data and inferences (made on the basis of those data) were combined in order to develop complex theories explaining the child's condition, and that these theories consisted of several, interconnected inferences. In contrast, poorly-integrated reasoning was shown when data were linked with inferences in series of distinct linear relationships. Using Sowa's system of cross referencing, indicated by variables, it was possible to judge in which representations inferences were combined into more complex sets of concepts and relations, and in which representations inferences were connected with the data in list-like series. The representations were then examined to determine whether the level of integration was associated with other characteristics of the reasoning process.<sup>4</sup>

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<sup>4</sup> Appendix H contains part of one subject's protocol showing all the analytic procedures applied to it.

## Chapter Five

### Results

#### Synopsis of Measures and Analyses<sup>5</sup>

Subjects' profiles on the Counselor Orientation Scale were analysed in order to test for differences between the expert and novice samples. The use of the Counselor Orientation Scale to divide the sample of 24 subjects into at least two, but not more than three, broad categories of orientation in psychology had been envisaged. However, because of missing data and ambiguous results, orientation was not included as a second grouping factor in repeated measures analyses. Instead, correlation matrices between the mean orientation scores (reflecting subjects' preferences for each of the seven counsellor orientations) and the mean numbers of inferences generated in three sets of coding categories (as in the groupings 1, 2, and 4 set out below) were examined.

The numbers of inferences generated in the various coding categories were analysed according to the following groupings. (See section entitled *Protocol coding categories* in Chapter Four):

1. Negative, positive, rejected, and prescriptive inference categories.
2. Educational, emotional, physiological, and contextual inferences.

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<sup>5</sup> The computer application, SYSTAT, Version 4, (Wilkinson, 1989) was used for all statistical analyses. Summary statistics for the analyses are set out in Appendix I.

3. Negative inferences in the educational, emotional, physiological, and contextual categories.

4. Positive inferences in the educational, emotional, physiological, and contextual categories.

5. Prescriptive inferences in the educational, emotional, and physical categories.

Type A inferences (those concerning the student described in the case-file) only were used for analysis. Type B inferences (those that did not bear directly on the student being evaluated) and comparative (non-inferential) comments were rarely made.

A repeated measures, multivariate analysis of variance was carried out for each of the five sets of inference categories listed above. The numbers of inferences generated in the various coding categories (the dependent variables) were treated as a set of repeated measures, with experience (expert and novice) as the single grouping factor.

Subjects' representations of case-file interpretation were set out following the linear form devised by Sowa (1984) in order to study assessors' reasoning processes. Information concerning the propositions, or sets of propositions in the case-file text to which subjects referred, was available directly from the representations. Selectivity in use of case-file information was analysed by using the numbers of references made to propositions in each of the nine topics in the case-file as a set of repeated measures, with experience as the single grouping factor.

The representations were examined to assess whether subjects had interpreted the case-file text on the basis of one or more theories that they developed about the student, or whether they had generated unrelated explanations for the student's characteristics mentioned in the file. As assessment of the extent to which subjects' inferences were

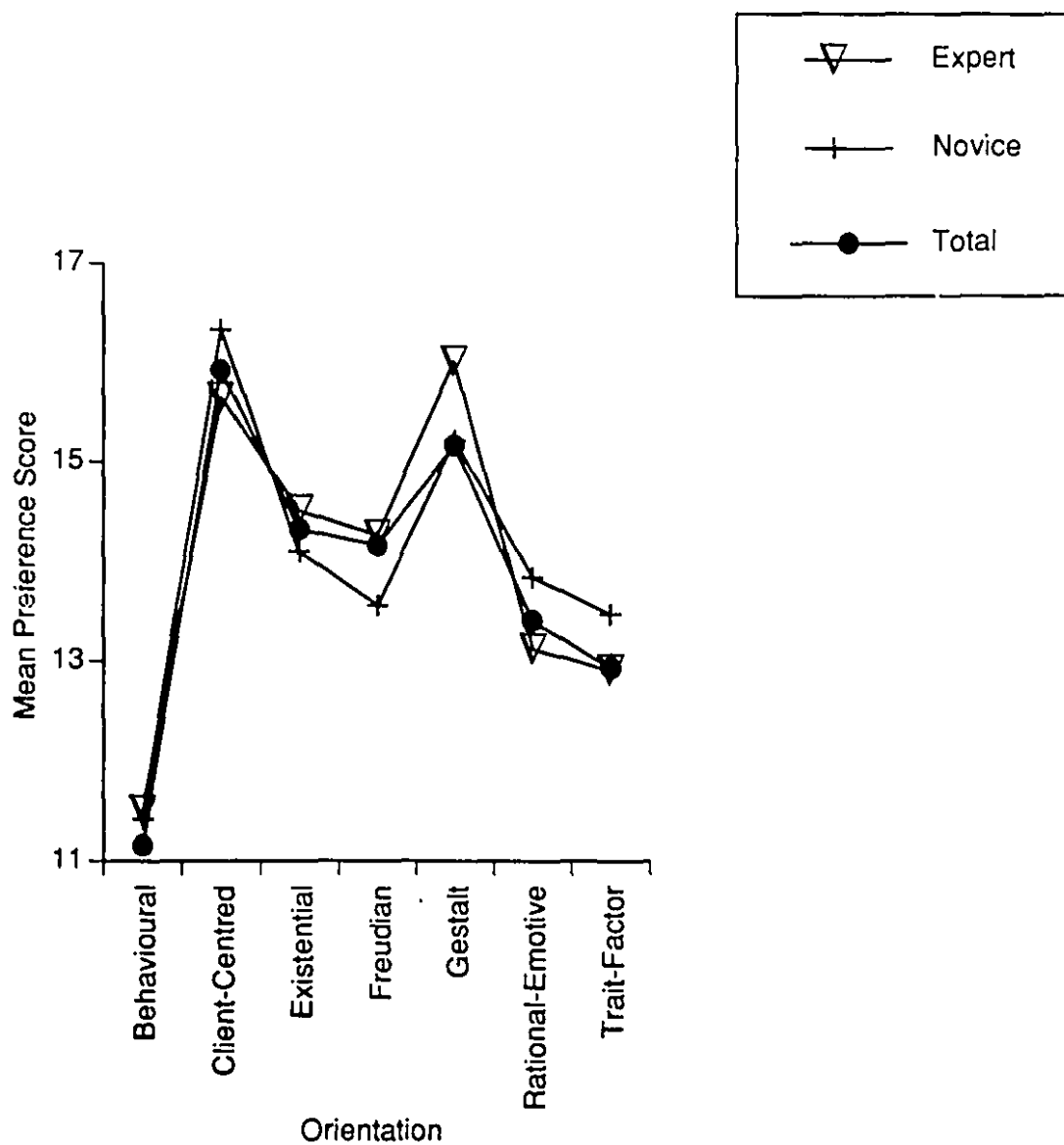
integrated with these theories was made. The representations were then examined for features that might distinguish the better-integrated from the less well-integrated protocols.

An additional descriptive analysis of the representations was carried out concerning the sets of propositions to which subjects commonly referred. Particular attention was given to interpretations of the child's written composition and drawing that had been included in case-file.

### **Analysis of Subjects' Theoretical Orientation**

All of the subjects returned Counselor Orientation Scales. However seven out of the twelve expert subjects and four out of the twelve novice subjects had omitted responses to some of the statements. Comments written next to the statements to which responses were not given indicated that the omissions were intentional; the subjects had not been able to decide on a response.

Figure 6 shows the mean preference scores obtained on the Counselor Orientation Scale for each orientation. The means for the expert group, the novice group, and the total sample are plotted separately. The expert sample showed the greatest preference for the Gestalt orientation, the second greatest preference for the Client-Centred orientation, and the least preference for the Behavioural orientation. For the expert sample the greatest variability in preference was for the Behavioural orientation and the least variability was found for the Existential orientation. The novice sample showed the greatest preference for the Client-Centred orientation, second greatest preference for the Gestalt orientation, and the least preference for the Behavioural orientation. For the novice sample the greatest variability in preference was for the Rational-Emotive orientation and the least variability was found for the Trait-Factor orientation. The total sample showed the greatest preference for the Client-Centred orientation, second



**Figure 6.** Counselor Orientation Scale mean scores: expert, novice, and total sample.

greatest preference for the Gestalt orientation, and the least preference for the Behavioural orientation. The greatest variability in preference was for the Rational-Emotive orientation and the least variability was found for the Trait-Factor orientation. The means and standard deviations of the Counselor Orientation Scale scores for each experience group are shown in Table 1.

A Hotelling's  $T^2$  statistic was calculated using the cases for which the data sets were complete, thirteen in all. No significant difference was found between the experts and the novices with respect to the profiles of their scores on the Counselor Orientation Scale,  $T^2(7,5) = 5.88, p = .90$  (Table 2).

**Table 1**

*Means and Standard Deviations (SD) of Counselor Orientation Scale Scores for the Expert and Novice Groups*

	B	E	F	TF	CC	G	RE
Expert							
<i>N</i>	8	6	8	10	11	9	9
Mean	11.50	14.50	14.25	12.90	15.64	16.00	13.11
<i>SD</i>	2.14	1.05	1.83	1.66	1.57	1.50	1.69
Novice							
<i>N</i>	12	11	11	11	12	10	12
Mean	11.42	14.09	13.55	13.46	16.33	15.20	13.83
<i>SD</i>	1.62	1.58	1.57	1.44	2.06	1.81	2.76

B = Behavioural. E = Existential. F = Freudian. TF = Trait-Factor.

CC = Client-Centred. G = Gestalt. RE = Rational Emotive.

**Table 2**

*Summary of Hotelling's  $T^2$  Test of Group Difference on the Counselor Orientation Scale (COS)*

Factor	$\eta^2$	df	p
COS scores	5.883	7, 5	.879

The correlations between scores obtained on the Counselor Orientation Scale and the numbers of inferences generated belonging to the categories: total number of negative inferences, total number of positive inferences, total number of rejected inferences, and total number of prescriptive inferences were explored by examining the correlation matrix between the Counselor Orientation Scale scores and these variables (Table 3). No pattern was discerned, and none of the correlations were significant.

**Table 3**

*Correlation Matrix for Counsellor Orientations and Negative, Positive, Rejected, and Prescriptive Inference Categories*

Orientation	Inference Categories			
	Negative	Positive	Rejected	Prescriptive
Behavioural	-.23	.00	.16	.26
Existential	-.05	.28	.38	-.10
Freudian	.02	-.09	-.12	.37
Trait-Factor	.32	.15	-.01	-.32
Client-Centred	-.22	-.01	.14	-.26
Gestalt	-.04	-.09	.16	-.25
Rational-Emotive	-.27	-.07	.17	-.20



The correlation matrix between the Counselor Orientation Scale scores and the numbers of inferences generated in the educational, emotional, physiological, and contextual categories was also constructed (Table 4). Examination of this matrix showed a pattern of negative correlations between the scores for each of the orientations, with the exception of the Existential orientation, and the numbers of inferences about educational features of the case; however, none of these correlations were significant.

**Table 4**

*Correlation Matrix for Counsellor Orientations and Educational, Emotional, Physiological, and Contextual Inference Categories*

Orientation	Inference Categories			
	Educational	Emotional	Physiological	Contextual
Behavioural	-.12	.60**	-.31	-.15
Existential	.08	-.09	-.19	.48*
Freudian	-.33	.32	.30	-.14
Trait-Factor	-.04	.32	.40* <sup>a</sup>	.49*
Client-Centred	-.28	-.22	.04	.40 <sup>b</sup>
Gestalt	-.21	-.09	.14	.01
Rational-Emotive	-.19	.00	-.56**	-.02

a = value to 3 significant figures was .404, which equalled the critical value for correlation significant at the .05 level.

b = value to 3 significant figures was .402 and, therefore, was below the critical value.

\* $p < .05$ . \*\* $p < .01$ .

The following significant correlations were found: a positive correlation of .60 between the Behavioural orientation measure and the number of inferences in the emotional category ( $p < .01$ ), a positive correlation of .49 between the Trait-Factor orientation measure and the number of inferences in the contextual category ( $p < .05$ ), a positive correlation of .48 between the Existential orientation measure and the number of inferences in the contextual category ( $p < .05$ ), and a positive correlation of .40 between the Trait-Factor orientation measure and the number of inferences in the physiological category ( $p < .05$ ).

From the correlation matrix of orientations and the three categories of prescriptive inferences, educational, emotional, and physical (Table 5), a pattern of negative correlations between the values obtained for each of the orientations and the numbers of prescriptive inferences pertaining to remediation strategies for physical factors was observed. These correlations were significant for the Freudian orientation ( $r = -.57, p < .01$ ), the Client-Centred orientation ( $r = -.43, p < .05$ ), the Gestalt orientation ( $r = -.51, p < .05$ ), and the Rational-Emotive orientation ( $r = -.49, p < .05$ ).

**Table 5**

*Correlation Matrix for Counsellor Orientations and Prescriptive Inference Categories: Educational, Emotional, and Physical*

Orientation	Inference Categories		
	Educational	Emotional	Physical
Behavioural	-.09	.55**	-.32
Existential	.07	-.10	-.33
Freudian	.26	.54**	-.57**
Trait-Factor	-.27	-.24	-.12
Client-Centred	-.09	-.19	-.43*
Gestalt	-.23	-.04	-.51*
Rational-Emotive	-.27	.05	-.49*

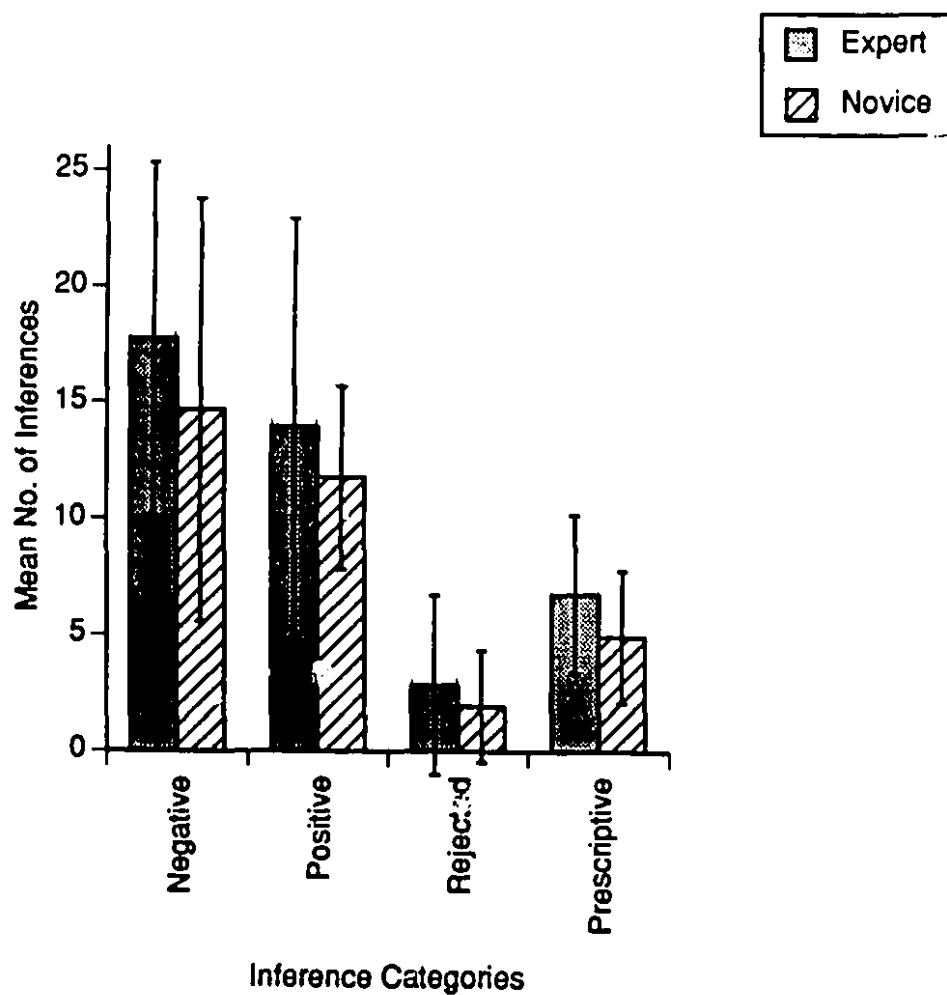
\* $p < .05$ . \*\* $p < .01$ .

Significant positive correlations were found for both the Behavioural and Freudian orientations and prescriptive inferences in the emotional category ( $r = .55, p < .01$  and  $r = .54, p < .01$ , respectively).

### Analysis of Inference Counts

Figure 7 presents the means and standard deviations of the numbers of inferences made by each of the two groups of subjects for the following coding categories; negative inferences, positive inferences, rejected inferences, and prescriptive inferences. The sum of the inferences made in each of these categories equalled the total number of inferences generated. The experts inferred more negative attributes ( $M = 17.75$ ) than did the novices ( $M = 14.67$ ) as well as more positive attributes ( $M = 13.92$ ) than the novices ( $M = 11.75$ ). The experts rejected more of their inferences ( $M = 2.83$ ) than the novices ( $M = 1.92$ ). More prescriptive inferences were made by the expert group ( $M = 6.75$ ) than by the novice group ( $M = 4.92$ ).

Although it appears that the experts generated more inferences in each of the four categories than the novices, group differences were not found to be statistically significant across the four categories, *Mult. F* (3, 20) = 0.31,  $p = .82$ , nor were significant group differences found for the total number of inferences,  $F$  (1, 22) = 1.30,  $p = .27$ . As can be seen in Figure 7, there was considerable variance in the data for each inference category. For the sample as a whole, the largest number of inferences made was in the category of negative inferences ( $M = 16.21$ ), followed by inferences in the positive category ( $M = 12.83$ ). The mean number of prescriptive inferences was 5.83 and the mean number of rejected inferences was 2.38. These within-subjects effects were found to be statistically significant, *Mult. F* (3, 20) = 7.36,  $p < .01$ . These results are summarised in Table 6.



**Figure 7.** Means and standard deviations of the numbers of inferences made by each group: negative, positive, rejected, and prescriptive categories.

**Table 6**

*Results of Tests for Groups x Variables, Between-Groups, and Within-Groups Effects for Inferences in the Negative, Positive, Rejected, and Prescriptive Categories*

Effects	<i>F</i>	<i>df</i>	<i>p</i>
Groups x variables	0.31 <sup>a</sup>	3, 20	.82
Between-groups	1.30	1, 22	.27
Within-groups	7.36 <sup>a</sup>	3, 20	<.01**

<sup>a</sup> = Mult. *F*.

\*\*  $p < .01$ .

Table 7 summarises the tests of contrast effects between pairs of variables in the inference categories; positive, negative, rejected, and prescriptive. The differences between the means of the numbers of inferences in the positive and negative categories were not found to be significant,  $F(2, 22) = 2.63, p = .09$ . Statistical significance was found for the contrast between the number of negative inferences and the number of rejected inferences,  $F(2, 22) = 43.25, p < .01$ , and for the contrast between the mean number of rejected inferences and the mean number of prescriptive inferences,  $F(2, 22) = 10.75, p < .01$ .

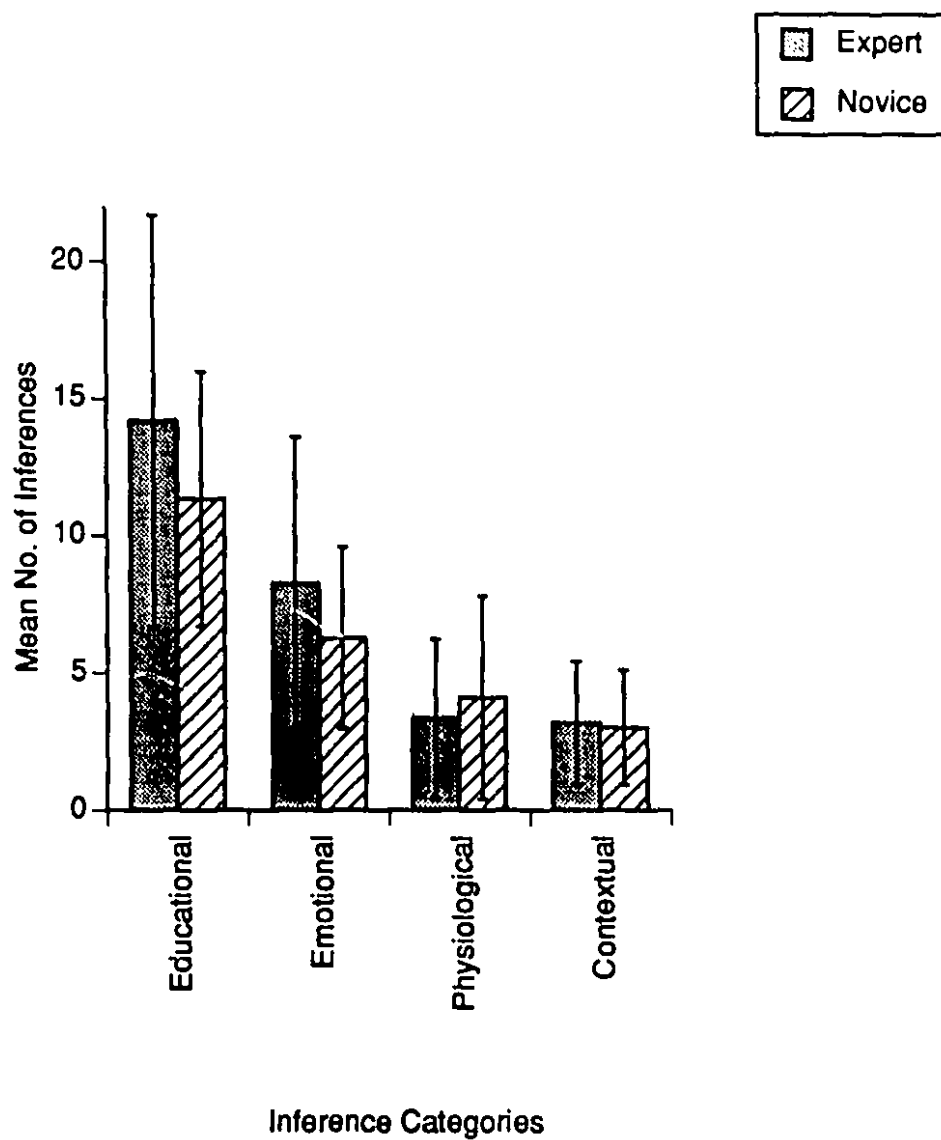
**Table 7**

*Tests for Contrasts Between Variables in the Set of Negative, Positive, Rejected, and Prescriptive Inference Categories*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Total inferences</i>			
Positive vs Negative	2.63	2, 22	.09
Negative vs Rejected	43.25	2, 22	<.01**
Rejected vs Prescrip.	10.75	2, 22	<.01**

\*\*  $p < .01$ .

Figure 8 presents the means and standard deviations of the numbers of inferences generated by each group of subjects in the categories designated educational, emotional, physiological, and contextual. (See definitions of categories on pp.52 and 53). These categories exclude both the rejected and prescriptive inferences. The experts made more inferences about educational characteristics ( $M = 14.17$ ) than the novices ( $M = 11.33$ ), and more inferences about emotional characteristics ( $M = 8.25$ ) than the novices ( $M = 6.25$ ). The experts made fewer inferences pertaining to physiological characteristics ( $M = 3.33$ ) than the novices ( $M = 4.08$ ), but made more inferences concerning contextual features ( $M = 3.17$ ) than did the novices ( $M = 3.00$ ).



**Figure 8.** Means and standard deviations of the numbers of inference retained by each group: educational, emotional, physiological, and contextual categories.

The group differences across these four categories were not found to be statistically significant, *Mult. F* (3,20) = 0.79,  $p = .51$ . The two subject groups were not found to differ significantly from one another in the total number of inferences they generated for this set of inferential categories,  $F$  (1, 22) = 0.79,  $p = .39$ . The numbers of inferences referring to educational, emotional, physiological, and contextual characteristics were examined for both experience groups considered together. The largest mean number of inferences made among these categories was in relation to educational factors ( $M = 12.75$ ), with the mean number made in relation to emotional factors coming next in order of magnitude ( $M = 7.25$ ). The mean numbers of physiological and contextual inferences contributed least to the total for this set of variables, but the mean number for the physiological category ( $M = 3.71$ ) was higher than that for the contextual category ( $M = 3.08$ ). These within-subjects effects were found to be statistically significant, *Mult. F* (3,20) = 5.02,  $p < .01$ . These results are summarised in Table 8. Tests for contrasts, summarised in Table 9, between pairs of values obtained for the inference categories referring to educational, emotional, physiological, and contextual characteristics showed that the difference between the numbers of inferences in the educational and emotional categories was statistically significant,  $F$  (2, 22) = 11.51,  $p < .01$ , as was that between the emotional and physiological categories,  $F$  (2, 22) = 6.95,  $p < .01$ . The difference between the numbers in the physiological and contextual categories was not found to be significant,  $F$  (2, 22) = 0.55,  $p = .59$ .

**Table 8**

*Results of Tests for Groups x Variables, Between-Groups, and Within-Groups Effects for Inferences in the Educational, Emotional, Prescriptive, and Contextual Categories*

Effects	<i>F</i>	<i>df</i>	<i>p</i>
Groups x variables	0.79 <sup>a</sup>	3, 20	.51
Between-groups	0.79	1, 22	.39
Within-groups	5.02 <sup>a</sup>	3, 20	<.01**

<sup>a</sup> = *Mult. F*.

\*\*  $p < .01$ .



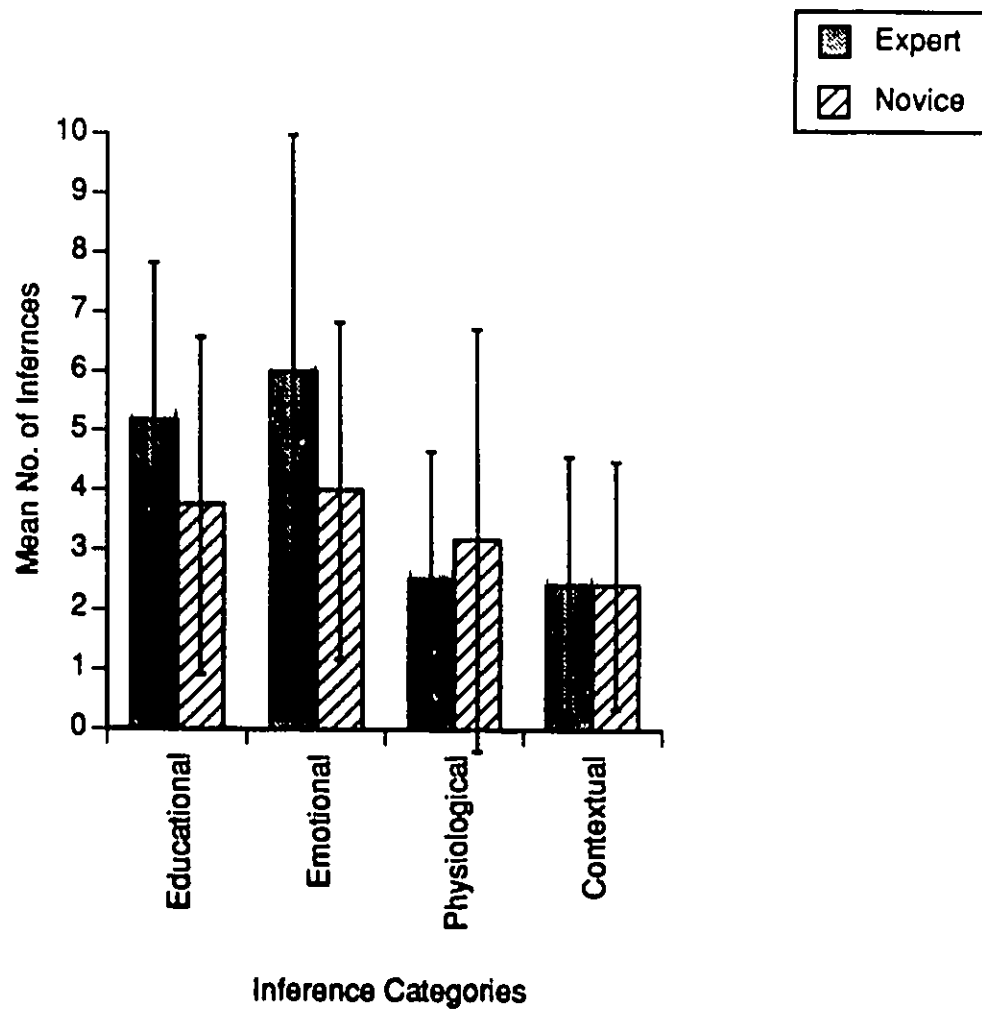
**Table 9**

*Tests for Contrasts Between Variables in the Set of Educational, Emotional, Physiological, and Contextual Inference Categories*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Negative and Positive Inferences</i>			
Educational vs Emotional	11.51	2, 22	<.01*
Emotional vs Physiol.	6.95	2, 22	<.01*
Physiol. vs Contextual	0.55	2, 22	.59

\*\*  $p < .01$ .

The inference categories designated educational, emotional, physiological, and contextual were subdivided according to whether they were negative or positive descriptions of the student, that is, according to whether they belonged to the negative inference category or the positive inference category. The means and standard deviations of the numbers of negative inferences in these four categories generated by each group of subjects is shown in Figure 9. The experts generated more negative inferences than the novices in the educational category ( $M = 5.17$  and  $M = 3.75$ , respectively) and they also generated more negative inferences than the novices in the emotional category ( $M = 6.00$  and  $M = 4.00$ , respectively). The experts made fewer negative inferences than the novices in the physiological category ( $M = 2.50$  and  $M = 3.17$ , respectively). Both experience groups made equal numbers of negative inferences in the contextual category ( $M = 2.42$ ). However, the differences across negative categories were not found to be statistically significant,



**Figure 9.** Means and standard deviations of the numbers of negative inferences retained by each group: educational, emotional, physiological, and contextual categories.

*Mult.  $F(3, 20) = 0.96, p = .43$* , nor were the two groups found to differ significantly with respect to the total number of negative inferences made up of these four categories,  *$F(1, 22) = 11.34, p = .39$* . These results are summarised in Table 10.

**Table 10**

*Results of Tests for Groups x Variables, Between-Groups, and Within-Groups Effects for Negative Inferences in the Educational, Emotional, Physiological, and Contextual Categories*

Effects	<i>F</i>	<i>df</i>	<i>p</i>
Groups x variables	0.96 <sup>a</sup>	3, 20	.43
Between-groups	0.78	1, 22	.39
Within-groups	2.44 <sup>a</sup>	3, 20	.10

<sup>a</sup> = *Mult.  $F$* .

As shown in Figure 9, both the expert and novice groups together generated most inferences in the negative, emotional category ( $M = 5.00$ ) and fewest in the negative, contextual category ( $M = 2.42$ ). Both groups together made more negative, educational inferences ( $M = 4.46$ ) than negative, physiological inferences ( $M = 2.83$ ). However, these within-subjects effects were not found to be statistically significant, *Mult.  $F(3, 20) = 2.44, p = .10$* . (See Table 10.)

The results of tests for contrasts between the values in the following pairs of negative inference categories; educational and emotional, emotional and physiological, and physiological and contextual, are set out in Table 11. As shown in the table, the contrast between the values for the negative emotional and negative physiological

**Table 11**

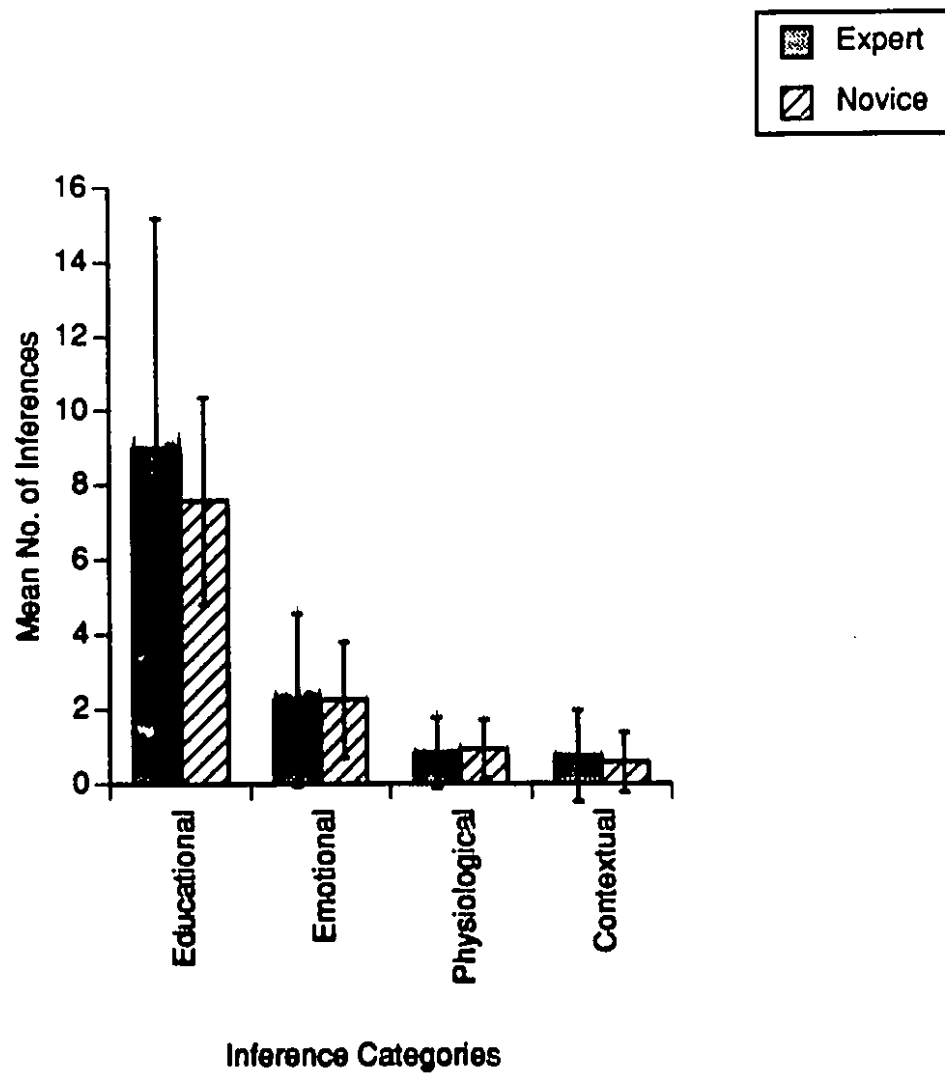
*Tests for Contrasts Between Variables in the Set of Negative Inference Categories:  
Educational, Emotional, Physiological, and Contextual*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Negative inferences</i>			
Educational vs Emotional	0.56	2, 22	.58
Emotional vs Physiolog.	4.56	2, 22	<.05*
Physiolog. vs Contextual	0.31	2, 22	.74

\* $p < .05$ .

categories was found to be statistically significant  $F(2, 22) = 4.56, p < .05$ , whereas the contrasts between the values for negative educational and negative emotional, and between the values for negative physiological and negative contextual were not found to be significant,  $F(2, 22) = 0.56, p = .58$  and  $F(2, 22) = 0.30, p = .74$ , respectively.

Figure 10 sets out the mean values and standard deviations of the numbers of positive inferences made by each of the two subject groups in the educational, emotional, physiological, and contextual categories. More positive inferences of an educational nature were made by the experts ( $M = 9.00$ ) compared to the novices ( $M = 7.58$ ). Both the experts and the novices made the same number of positive inferences in the emotional category ( $M = 2.25$ ). Fewer positive inferences were generated in the physiological category by the experts ( $M = 0.83$ ) than by the novices ( $M = 0.92$ ). For the contextual category, the mean for the experts was higher than that for the novices ( $M = 0.75$  and  $M = 0.58$ , respectively). The pattern of results across these categories was not found to be statistically significant,



**Figure 10.** Means and standard deviations of the numbers of positive inferences retained by each group: educational, emotional, physiological, and contextual categories.

*Mult. F* (3, 20) = 0.33,  $p = .80$ . The two groups also did not differ significantly in the total number of positive inferences generated in the educational, emotional, physiological, and contextual categories, *F* (1, 22) = 0.36,  $p = .56$ , as summarised in Table 12.

**Table 12**

*Results of Tests for Groups x Variables, Between-Groups, and Within-Groups Effects for Positive Inferences in the Educational, Emotional, Physiological, and Contextual Categories*

Effects	<i>F</i>	<i>df</i>	<i>p</i>
Groups x variables	0.33 <sup>a</sup>	3, 20	.80
Between-groups	0.36	1, 22	.56
Within-groups	3.43 <sup>a</sup>	3, 20	<.05*

<sup>a</sup> = *Mult. F*.

\*  $p < .05$ .

For the sample as a whole, as shown in Figure 10, most positive inferences were generated in the educational category ( $M = 8.29$ ), followed by the emotional category ( $M = 2.25$ ). There were fewer positive inferences in the physiological category ( $M = 0.88$ ) and still fewer in the contextual category ( $M = 0.67$ ). Statistical significance was found for these within-groups effects, *Mult. F* (3, 20) = 3.43,  $p < .05$  (Table 12). Tests for contrasts between pairs of these values showed that there was a significant difference between the numbers of positive inferences generated in the educational and emotional categories, *F* (2, 22) = 20.31,  $p < .01$ , and between the

numbers of positive inferences generated in the emotional and physiological categories,  $F(2, 22) = 6.28, p < .01$ . However, statistical significance was not found for the contrast between the positive, physiological and positive, contextual categories,  $F = 0.61, p = .553$ . Table 13 contains a summary of the tests for contrasts on this set of variables.

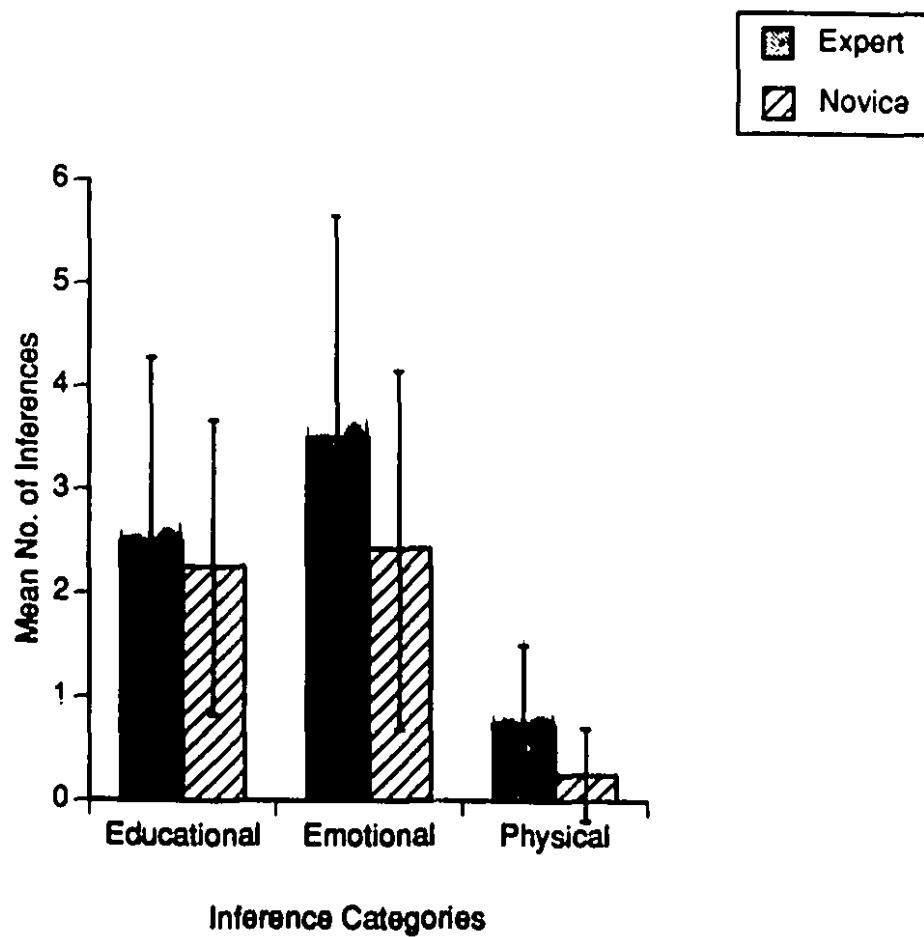
**Table 13**

*Tests for Contrasts Between Variables in the Set of Positive Inference Categories:  
Educational, Emotional, Physiological, and Contextual*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Positive inferences</i>			
Educational vs Emotional	20.31	2, 22	<.01**
Emotional vs Physiolog.	6.28	2, 22	<.01**
Physiolog. vs Contextual	0.61	2, 22	<.55

\*\*  $p < .01$ .

The final set of inferences examined consisted of those in the prescriptive category, subdivided according to recommendations for educational, emotional, and physiological strategies. Figure 11 shows the means and standard deviations of the numbers of inferences in each of the three prescriptive categories made by each group of subjects. These include the prescriptive inferences rejected. However, only two subjects rejected any inferences in the prescriptive category; one subject rejected one prescriptive inference and the other rejected two. The experts recommended educational approaches more frequently ( $M = 2.50$ ) than did the novices ( $M = 2.25$ ).



**Figure 11.** Means and standard deviations of the numbers of prescriptive inferences made by each group: educational, emotional, and physical categories.



They also recommended approaches that were designated emotional more frequently ( $M = 3.50$ ) than the novices ( $M = 2.42$ ). The experts also made more recommendations in the physical, prescriptive category ( $M = 0.75$ ) compared to the novices ( $M = 0.25$ ). However, no significant differences were found when the two groups were compared across the three types of prescriptive inferences, *Mult. F* (2, 21) = 0.64,  $p = .54$  or when they were compared on the total number of inferences in the prescriptive category,  $F$  (1, 22) = 2.04,  $p = .17$ . Overall, most of the prescriptive inferences were made in the emotional category ( $M = 2.51$ ), compared to a mean of 2.38 in the educational category and a mean of 0.50 in the physical category; however, the multivariate within-subjects effect was not significant, *Mult. F* (2, 21) = 2.75,  $p = .09$ . These results are presented in Table 14.

**Table 14**

*Results of Tests for Groups x Variables, Between-Groups, and Within-Groups Effects for Prescriptive Inferences in the Educational, Emotional, and Physical Categories*

Effects	<i>F</i>	<i>df</i>	<i>p</i>
Groups x variables	0.64 <sup>a</sup>	2, 21	.54
Between-groups	2.04	1, 22	.17
Within-groups	2.75 <sup>a</sup>	2, 21	.09

<sup>a</sup> = *Mult. F*.

Tests for contrasts, as summarised in Table 15, showed that there was no significant difference between the number of prescriptive inferences in the educational category

compared to the number in the emotional category,  $F(2, 22) = 1.95, p = .17$ , but that there was a significant difference between the number in the physical category compared to the number in the educational category,  $F(2, 22) = 15.47, p < .01$ .

**Table 15**

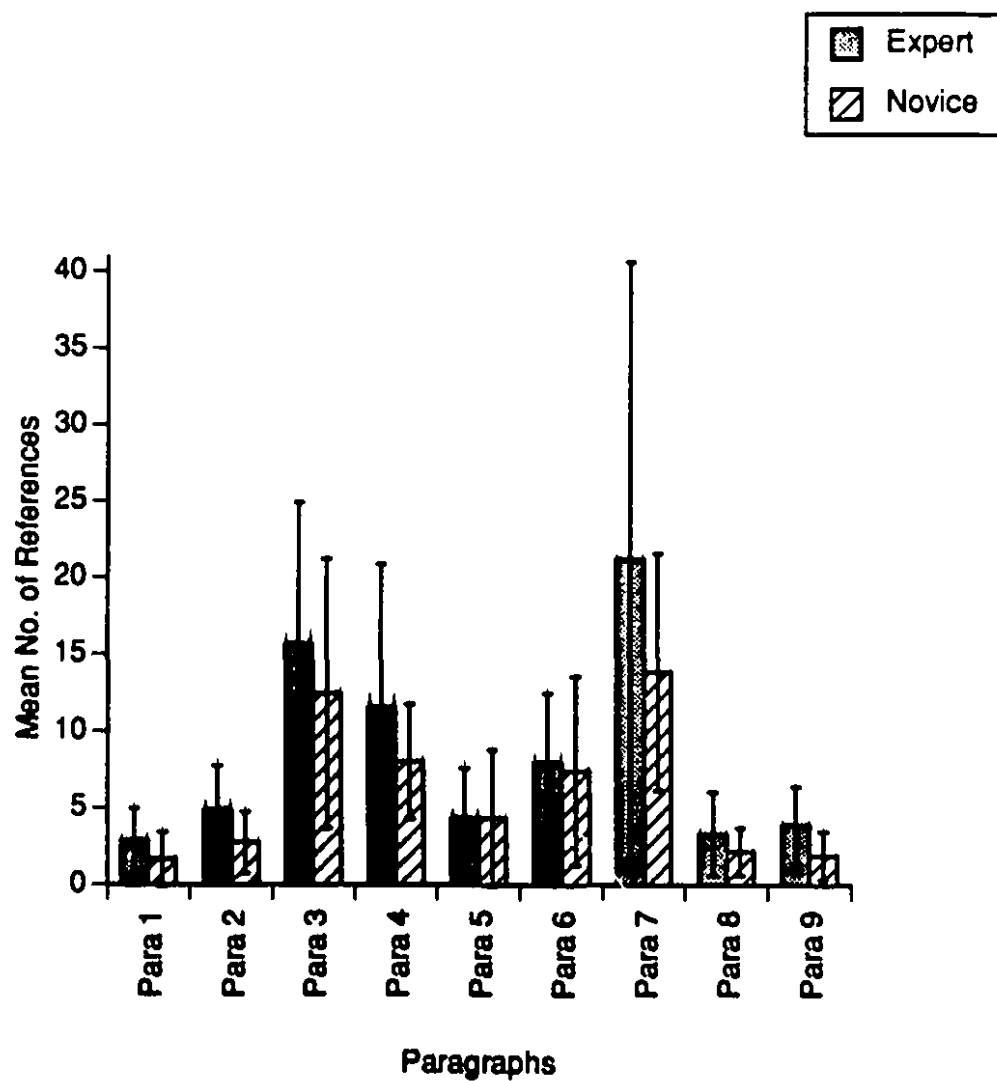
*Tests for Contrasts Between Variables in the Set of Prescriptive Inference Categories:  
Educational, Emotional, and Physical*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Prescriptive inferences</i>			
Educational vs Emotional	15.48	2, 22	<.01**
Educational vs Physical	.95	2, 22	.17

\*\*  $p < .01$ .

### **Analysis of the Representations of Subjects' Reasoning**

*Selectivity in use of case-file data.* The linearised representations contained the information in the case-file text to which subjects referred. In setting out the representations, the proposition numbers from the presented case-file were used to stand for this information. These proposition numbers were then used to establish how many times each subject referred to the case-file text and from which topics in the text these references came. Thus a measure of selectivity in the use of case-file data was obtained from enumeration of the references made to each of the nine topics in the text. Figure 12 shows the mean number of references made by the two experience groups to each case-file topic and the corresponding standard deviations.



**Figure 12.** Means and standard deviations of the numbers of references to each case-file paragraph made by the experts and the novices.

The experts referred to each topic more frequently than the novices, with the exception of Topic 5, the child's birth and medical history, which was referred to equally often by both experts and novices (see Figure 12). The multivariate analysis of the numbers of references made to each topic showed that there was no statistically significant difference in the pattern of inferences made by each group across the nine topics, *Mult. F* (8, 15) = 0.74, *p* = .65. The mean number of references made to the text by the experts was 75.75, which was greater than the mean number of references made to the text by the novices (*M* = 54.50). However, this group difference in the total number of references made to the case-file text also was not found to be statistically significant, *F* (1, 22) = 1.92, *p* = .18. (Figure 12 indicates that there was considerable variance in the data.) The results of the multivariate analysis are summarised in Table 16.

**Table 16**

*Results of Tests for Groups x Variables, Between-Groups, and Within-Groups Effects for References Made to Topics in the Case-file Text*

Effects	<i>F</i>	<i>df</i>	<i>p</i>
Groups x variables	0.74 <sup>a</sup>	8, 15	.65
Between-groups	1.92	1, 22	.18
Within-groups	5.29 <sup>a</sup>	8, 15	<.01**

<sup>a</sup> = *Mult. F.*

\*\* *p* < .01.

Figure 12 presents the numbers of references made to each topic and the corresponding standard deviations, with the topics ordered according to decreasing frequency in the number of references made per topic. As shown in the figure, the majority of subjects made most reference to Topic 7, the test results, ( $M = 17.50$ ) and to Topic 3, the parents' report ( $M = 14.04$ ). An examination of the results obtained for each subject showed that, for all but three subjects (EC, EH, and NK), either Topic 7 or Topic 3 ranked first in terms of the number of references made to each of these two topics. For all subjects, Topic 4, the school's comments ranked third in regard to the number of occasions subjects drew upon case-file information ( $M = 9.75$ ). Topic 6, the psychologist's observations, ranked fourth ( $M = 7.71$ ). Topic 5, the birth and medical history, ranked fifth ( $M = 4.33$ ). Topic 2, the description of the presenting problem, ranked sixth ( $M = 3.83$ ). Topic 9, the child's drawing, ranked seventh ( $M = 2.92$ ). Topic 8, the child's composition, ranked eighth ( $M = 2.75$ ). Topic 1, the basic referral data ranked ninth ( $M = 2.29$ ).

A significant difference was found to exist between the numbers of references made to each of the topics when both subject groups were considered together,  $Multi. F(8,15) = 5.29, p < .01$ . (Refer to Table 16.) The results of tests for contrasts between the numbers of references made to the topics are summarised in Table 17. As set out in the table, a significant contrast effect was found between Topics 6 and 5 (the psychologist's observations and the child's birth and medical history). No other significant contrast effects were found.

Table 17

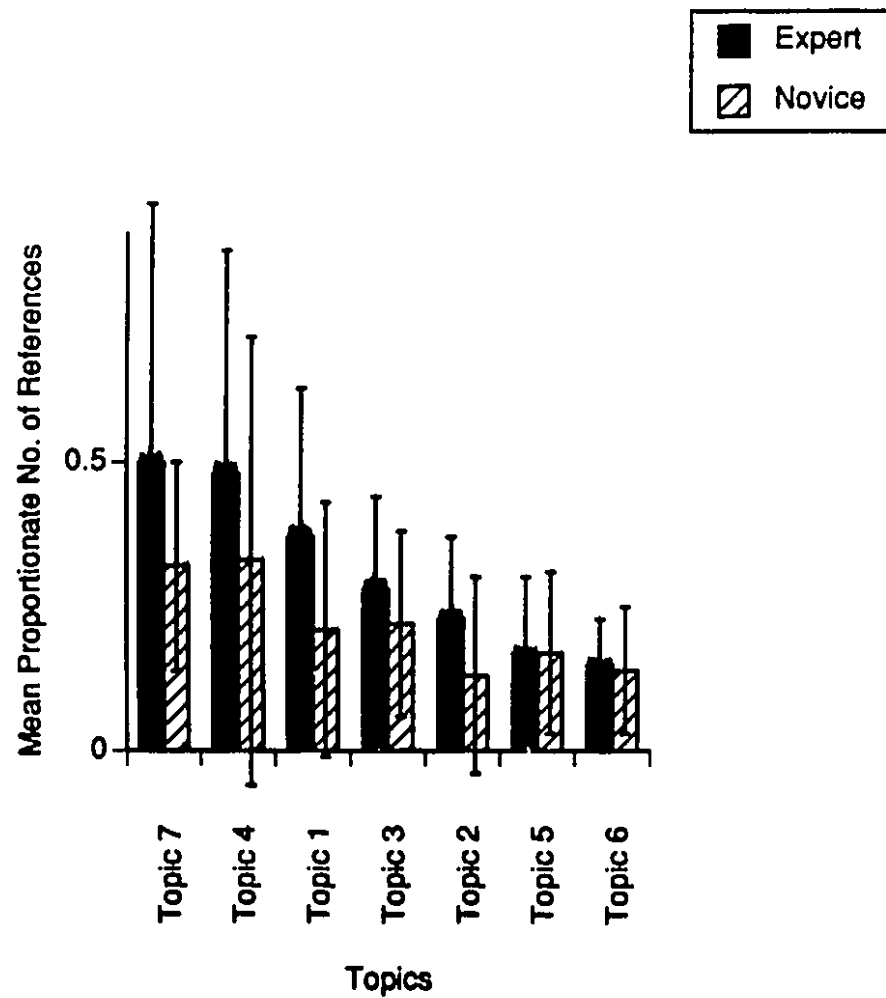
*Tests for Contrasts Between the Numbers of References Made to Topics in the Case-file Text*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Topics</i>			
7 vs 3	1.21	2, 22	.32
3 vs 4	3.42	2, 22	.05 <sup>a</sup>
4 vs 6	2.26	2, 22	.13
6 vs 5	4.72	2, 22	<.05*
5 vs 2	1.33	2, 22	.28
2 vs 9	1.97	2, 22	.16
9 vs 8	0.37	2, 22	.70
8 vs 1	0.38	2, 22	.69

<sup>a</sup> = greater than .05 (value to 3 significant figures was .051).

\**p* < .05.

Figure 13 shows the mean numbers of references made to each topic as proportions, with the number of propositions per topic used as the base. (Topics 1 through 7 contained 8, 21, 56, 24, 26, 54, and 43 propositions respectively, as set out in Appendix E.) Standard deviations are also shown in Figure 13, corresponding in magnitude to those for the absolute numbers of references (Figure 12), and, once again, the considerable variance in the data can be seen. The number of references made to Topic 8, the child's composition, and to Topic 9, the child's drawing, were not considered as proportions since these sections had not been subjected to a propositional analysis. Figure 13 reflects descending order in the proportionate number of references per topic.



**Figure 13.** Means and standard deviations of the numbers of references made to each case-file topic, considered in proportion to the number of propositions presented in each topic.

Taking into account the amount of information presented under each topic, as measured by the number of propositions per topic, the majority of subjects made most reference to Topic 7, the test results, ( $M = 0.41$ ) and to Topic 4, the school's comments, ( $M = 0.41$ ). (The values for these means to three decimal places were  $M = 0.407$  for Topic 7, and  $M = 0.406$  for Topic 4.) Topic 1, the basic referral data ranked third in this regard ( $M = 0.29$ ), and Topic 3, the parents' report, ranked fourth ( $M = 0.25$ ). Topic 2, the description of the presenting problem, ranked fifth ( $M = 0.18$ ). Topic 5, the birth and medical history, ranked sixth ( $M = 0.17$ ). Topic 6, the psychologists observations, ranked seventh ( $M = 0.14$ ). Within-subjects effects were significant, *Mult. F* (6, 17) = 6.97,  $p < .01$ .

The results of tests for contrasts between the numbers of references made to the topics are summarised in Table 18.

**Table 18**

*Tests for Contrasts Between the Proportionate Numbers of References Made to Topics in the Case-file Text*

Contrast	<i>F</i>	<i>df</i>	<i>p</i>
<i>Topics</i>			
7 vs 4	0.05	2, 22	.96
4 vs 1	1.65	2, 22	.22
1 vs 3	0.77	2, 22	.48
3 vs 2	5.97	2, 22	<.01**
2 vs 5	1.69	2, 22	.72

\*\*  $p < .01$ .



As shown in Table 18, a significant contrast effect was found between Topics 3 and 2 (the parents' report and the description of the presenting problem). No further contrast effects were found.

*Causal links.* The linearised representations of subjects' interpretations of the case-file enabled the causal links between case-file data and inferences to be enumerated, both in total and subdivided according to direction.

The mean number of causal links in the representations of the expert group was 10.08, which was lower than the corresponding mean value for the novice group at 11.67. Fewer causal links in a forward direction were counted for the expert group ( $M = 4.08$ ) than for the novice group ( $M = 4.50$ ), and there were also fewer backward causal links in the experts' representations ( $M = 6.00$ ) compared to those in the novices' representations ( $M = 7.17$ ). The difference between the experts and the novices with respect to the total number of causal links formed was not found to be statistically significant,  $t(22) = -0.44$ ,  $p = .66$ . The group differences with respect to forward causal links and backward causal links were also not significant,  $t(22) = -0.296$ ,  $p = .770$  and  $t(22) = -0.448$ ,  $p = .658$ , respectively. Table 19 contains a summary of the mean numbers of causal links and the results of the statistical tests.

**Table 19**

*Numbers of Causal Links Identified in the Experts' and Novices' Protocols and Summary of t-Tests for Group Differences*

Group	Mean number of links		
	Total causal	Forward causal	Backward Causal
Expert	10.08	4.08	6.00
Novice	11.67	4.50	7.17
	$t(22) = -0.44$	$t(22) = -0.30$	$t(22) = -0.45$
	$p = .66$	$p = .77$	$p = .66$

### Characteristics of Subjects' Reasoning Processes

*Integration of information.* The linear forms of the representations of subjects' reasoning processes were examined to determine to what extent subjects had combined concepts derived directly or inferred from the case-file. A representation containing well-integrated reasoning was defined as one containing concepts which were cross-referenced to one another, in accordance with Sowa's system of letter symbols standing for equivalence relations. A representation which was not well-integrated was defined as one consisting of separate explanations for a few features mentioned in the case-file, with few or no cross-references between concepts.

Extracts from two linearised representations (Subjects EG and ND), one of which contains cross referencing and was judged to contain some degree of integration of information (EG), and the other of which contains no cross referencing and was judged to be poorly integrated (ND), are presented in Figures 14 and 15. (These linear representations are set out in full in Appendix G.) In both examples, the subjects have generated inferences based on case-file text from Topics 3 and 4 (the parents' report and the school's comments), although they selected different sets of propositions as cues.

The example from the linear representation derived from the protocol of subject EG (Figure 14) shows how this subject, on reading that the student had been an active baby who did not like being touched (Propositions 3.6.0 - 3.6.2), inferred that the child had a fragile nervous system. This inference was then used as a condition for an inferred rigidity in new learning and also as a cause of the inferred difficulty in being a success at school. In the linear representation of Subject EG's reasoning, it was, therefore, necessary to mark use of the "nervous system problem" hypothesis with the cross reference symbol "\*v". In contrast, the example from the linear representation derived from the protocol of Subject ND (Figure 15), shows how this subject, has, at this stage in the reading of the case-file, not referred back to any of the inferences already made

in order to tie in new hypotheses with the previous theories about the student's problems. Some new information, acquired after reading more of the case-file, was used to support or modify earlier theories. However, the representation is list-like in that this subject generated separate explanations for the features described in the case-file. None of the inferences generated were linked in any way. For instance, Proposition 3.9.0-1, stating that at nursery school the child had been observed to have poor coordination, was selected by the subject as an indication of motor coordination problems. Although this subject, based on reading the whole of Topic 3, the parents' report, inferred that the student had many problems, the specific motor coordination problem was not mentioned at this stage. It was referred to once again when the subject read Proposition 7.16.0, the WISC-R Coding subtest score of 15, which provided evidence contrary to this hypothesis, but it was not linked to other data or to other inferences.

Some separate, that is, unlinked, explanatory inferences in response to distinct features mentioned in the case-file were characteristic of all the protocols, but several subjects also generated hypotheses that were subsequently used to help elaborate other hypotheses. Eight linear representations were judged to include more highly integrated reasoning compared to the other 16 protocols. Four of the eight were from the expert group (Subjects EC, EG, EH, and EJ) and four were from the novice group (Subjects NA, NE, NG, and NI). Compared to other protocols, these contained more inferences that were put to use in explaining further inferences. In addition, these inferences were more frequently linked with later inferences. For instance, in the example given in Figure 14, Subject EG has linked the inference about the student's nervous system problem, marked "\*v", to two other inferred difficulties. The full representation of this subject's protocol contains additional instances of cross-referencing. (See Appendix G.) No such linkage is present between the inferences generated by Subject ND (Figure 15).

## Subject EG

3.6.0-3.6.2→COND→child has fragile nervous system,  
sensitive nervous system:\*v

2.6.0-2,

3.6.0-2,

3.4.0-1→COND→rigidity in new learning --

COND← \*v

COND←7.12.0, 7.13.0, 7.15.0

CAU→not fully utilising abilities

TOPIC 4.1.0 (School's comments) --

COND→difficulty becoming a teenager

COND→difficulty finding himself

COND→difficulty relating to school environment

COND→difficulty being

a success←CAU←immaturities in CNS:\*v,

immature ways of

reacting←COND←PARA 3.1.0

(Parents' report)

COND→discrepant academic functioning

### *Case-file Text*

#### *Proposition number.*

2.6.0-2      He (Edgar) is now manifesting behaviour difficulties

3.4.0-1      There is a family history of learning difficulties

3.6.0-2      He was an active baby who did not like being touched

7.12.0       WISC-R Picture Completion scaled score - 8

7.13.0       WISC-R Picture Arrangement scaled score - 8

7.15.0       WISC-R Object Assembly scaled score - 8

COND = CONDITION, CAU = CAUSE

**Figure 14.** Extract from a well-integrated protocol.

## Subject ND

3.5.0-3.5.1→COND→child's problems stem  
from birth of siblings→CAU→4.12.0-4.12.1

3.9.0-1→COND→motor coordination problems←NEG COND←7.16.0

3.20.9, 4.3.0-2→COND→general agreement about  
attention span weakness←CAU←2.2.0

TOPIC 3.1.0 (Parents' report) --

COND→child has many problems

NEG COND→placement in regular class (subject expected  
placement in a special education class)

NEG COND→parents are supportive (subject guesses that this is the case,  
despite their report)

4.9.0→COND→teachers provide support

4.12.0-4.12.1←CAU←emotional problems stemming from home

### *Case-file Text*

#### *Proposition number.*

3.5.0-3.5.1	Edgar is the eldest of three boys
3.9.0-1	At nursery school he was observed as being poorly coordinated
3.20.9	... problem ... is attention span
4.3.0-2	There are gaps in his basic level skills of attention, attitude, and concentration
4.9.0	His teachers have tried to be supportive
4.12.0-4.12.1	There have been crises in every school year
7.16.0	WISC-R Coding scaled score - 15

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COND = CONDITION, CAU = CAUSE, NEG = NEGATIVE

**Figure 15.** Extract from a poorly integrated representation.

*Qualitative differences between the protocols.* The eight best-integrated representations were studied for any characteristics they might have had in common or that would distinguish them from the other subjects in the sample. No common or distinguishing features were seen in these subjects' Counselor Orientation Scale responses or in the inference categories coded in their protocols. Comparison across the numbers and directions of causal links in their representations did not reveal any common patterns of reasoning, nor could these subjects be classified according to how much of the case-file data they drew upon for their complete sets of interpretations.

However, there were qualitative differences in the interpretations of the case-file data made by the experts EC, EG, EH, and EJ that distinguished them from other members of the expert group. Subjects EC and EH were outliers in that, unlike the other 10 experts, they did not draw most of their inferences from either Topic 3, the parents' report, or Topic 7, the test results. The absolute numbers of references made to each of the nine topics were used for the study of qualitative differences between case-file interpretations, rather than the proportional numbers, so that Topics 8 and 9, the child's composition and drawing, could be included in this analysis. (See earlier analysis entitled *Selectivity in use of case-file data.*) EC referred to Topics 8 and 9 (the composition and the drawing) more than to any other topic, and EH referred to Topic 4 (the school's comments) most frequently. EG, EJ, and also EC stood out because of the kinds of interpretations they made. Their conclusions about the nature of the student's problem were unlike those of the other subjects, both in regard to the diagnoses made and to the specificity of the conclusions drawn. These three subjects described the student's problems in specific terms. For instance, in the examples given in Figures 14 and 15, Subject EG hypothesised that the student's nervous system was immature while, in contrast, Subject ND referred to problems in general. The majority of subjects were similar to Subject ND in that they discussed the student's problems in general

terms. The eight protocols which contained the most highly integrated reasoning are described below. The linear representations appear in full in Appendix G.

Subject EC presented a very succinct interpretation. Unlike most other subjects, relatively fewer references were made to Topics 3 and 7, the parents' report and the test results, (3 per cent and 15 per cent respectively). This subject drew extensively on Topic 8, the child's composition, (21 per cent) and Topic 9, the child's drawing, (21 per cent) which together provided 42 per cent of cues. For comparison, Table 20 provides the mean percentage of references made to each topic in the case-file and corresponding values for standard deviation for the sample as a whole. The most highly integrated section of Subject EC's protocol dealt with projective interpretation of the composition and drawing, and, together with Topic 5, the child's birth and medical history, this led to discussion and recommendations concerning a specific personality disorder.

**Table 20**

*Mean Percentages of References Made to Each Topic in the Case-file and Corresponding Values for Standard Deviation (SD)*

Topic No.	1	2	3	4	5
Mean percentage	3.81	6.12	21.61	15.12	7.94
SD	3.31	3.72	7.41	6.61	7.80
Topic No.	6	7	8	9	
Mean percentage	11.93	25.48	4.48	4.90	
SD	5.40	9.72	4.01	4.19	

Subject EH drew most extensively on Topic 4 the school's comments, (25 per cent of references) and slightly less extensively on Topic 7, the test results (22 per cent). The most highly integrated part of the protocol discussed evidence for the child's having poor organisational abilities and his requiring assistance in becoming better organised with his school work. This inference followed directly from statements that appeared in the case-file and hence this subject's inferential reasoning did not depart from the more common pattern observed for other subjects. The inferences that the child lacked motivation and was impulsive were also relevant to this subject's argument.

Subject EG was not unusual in that the parents' report and the test results provided the most frequently used information sources (31 and 26 per cent of references respectively). The unusual aspect of this subject's interpretation in comparison to most others was the confidence with which a hypothesis about the child's having a fragile, sensitive nervous system, generated after reading the parents' report, was maintained with subsequent explanations made in support of this. Before reading the WISC-R results, and without realising that these test results would be presented, this subject predicted that the student would obtain higher scores in cognitive tasks than in most visual-motor tasks, and was the only subject to make a correct prediction about test results before reading about them in the section containing the test scores.

Subject EJ also maintained a single, underlying hypothesis, generated after reading the parents' report. His hypothesis about the existence of cerebral dysfunction determined the interpretation of all subsequent information. The representation for this subject shows a high degree of integration of information with the cerebral dysfunction inference. This subject relied most heavily on the parents' report and the test results as information sources (27 per cent and 24 per cent of all references respectively).



The novice subjects, NA, NE, NG, and NI, could not, beyond the integration factor, be contrasted with the other subjects, either by their reliance on different sets of cues or by any qualitative differences in their interpretations. All four used either the parents' report or the test results more extensively than other topics, although Subject NG made equal numbers of references to the parents' report, the test results, and the school's comments. Subjects NA and NE both integrated a large part of their interpretations of the case-file data within an inference about the child's being under pressure to perform well at school. Subject NE also paid attention to physiological factors that might have contributed to the child's difficulties. Subjects NG and NI dealt with inferences concerning the child's ability or inability to pay attention and to concentrate, although they drew opposite conclusions. NG characterised the child as distractible and impulsive as suggested in the reports, whereas NI disputed the case-file information that the child could not concentrate well. The representations for NA, NE, NG, and NI are shown in Appendix G.

In summary, the distinguishing factor for the four expert subjects whose interpretations of the given data were the best integrated arose from less conventional approaches on their part in comparison to the other subjects in this study. The four novice protocols did not appear to have features in common beyond the higher level of integration nor were they otherwise distinguishable from the other subjects.

Three additional expert protocols and one other novice protocol included sections that showed integration of information and hypotheses to a lesser degree than the eight protocols listed above, but that were not purely the "explanatory lists" that were typical of the remaining twelve protocols. As in the eight best-integrated protocols, these four also contained inferences that were then linked with other inferences. However, compared to the eight protocols described above, these inferences were not linked to other hypotheses as frequently. The three experts, EA, EE, and EI, did not differ from

the majority of the subjects in the frequency of use of the parents' report and the test results. In comparison to the experts, EC, EG, EH, and EJ, the best integrated parts of their discussions centred on hypotheses of a more general nature. Whereas the former were specific in their conclusions, Subject EA concluded that the child's difficulties were due to emotional problems rather than academic difficulties, EE's discussion was concerned with inconsistencies in the report which required further investigation of the sources of the child's difficulties, and EI considered stress as an important contributor to the educational and behavioural characteristics described in the case-file. The novice subject, NK, differed from the others in the novice group and from most of the expert group in that more reference was made to Topic 5, the medical history, (21 per cent of references) than to any other topic. The more central hypothesis generated by this subject was that the child engaged in attention-seeking behaviour a cause of which had been his early childhood illnesses.

The hypotheses generated by EA, EE, EI, and NK were embedded amongst alternative hypotheses and did not stand out as distinctly as the main conclusions drawn by those subjects whose protocols were better integrated. Moreover, fewer of the interpretations made by subjects in the group whose hypotheses were less well integrated were influenced by a determinative stance on decisive factors in the case. Their protocols were less clear as to what they regarded as the most salient features of the case. These subjects' (EA, EE, EI, and NK) representations appear in Appendix G.

The representation constructed for the remaining five experts and seven novices were list-like in that propositions and sets of propositions were explained as being the outcomes of inferences about events and characteristics, or they served as explanatory information for other sets of propositions and inferences. But each line of reasoning formed a separate system with little or no linkage to other systems. The representations for Subjects EK and ND, shown in Appendix G, are examples of explanatory listings.

### **Additional Observations**

*Differential use of case-file data.* Different subjects used the same sets of propositions but drew opposite or dissimilar conclusions from them. Specific examples are given in Table 21. Table 21 shows the proposition numbers, the information given in these propositions, and the alternative types of inferences made that were based on this information. Details of the numbers of subjects, by experience group, and in total, who made inferences of the types listed are also included in the table.

*Interpretation of the student's written composition and drawing.* Seven out of 12 experts rated the student's written composition for the level of cognitive maturity it reflected. (The composition, designated Topic 8, is included in Appendix A.) Of these seven, three rated it as appropriate for the child's age and four rated it as immature. Two of the seven stated that the composition reflected poorly organised thoughts. A third expert subject (one who had not made any comments regarding the cognitive maturity reflected) expressed uncertainty as to whether the child had been unable to organise his thoughts properly or whether the faults in punctuation made it confusing for the reader. All of the seven subjects who gave the composition a rating according to the child's level of maturity also made general comments about the grammar, spelling, or punctuation. Even those who found it to be generally mature recognised the faults in punctuation. Two additional expert subjects criticised the grammar without commenting on whether or not the composition reflected an appropriate intellectual maturity. All comments made about the spelling were favourable. (The composition did not contain any spelling errors.) Two expert subjects attempted to interpret the composition for projective content, but both stated that it did not yield any information.

**Table 21***Examples of Opposite Conclusions Drawn from the Same Data Set*

Prop. No.	Information	Inference	Numbers of Subjects		
			E	N	Total
1.4.0	Age: 12yrs.5mo.	Child has repeated a school year.	2	3	5
1.5.0	Grade: 6.	Child is in right grade for his age.	2	2	4
2.2.0	Edgar has had long-standing learning difficulties.	Child is learning disabled.	2	3	5
Topic 7	Test results are in normal range.	Child is not learning disabled.	2	0	2
3.9.0-1	At nursery school he was observed as being poorly coordinated.	Child is poorly coordinated.	3	0	3
Topic 9	Drawing done by child.	Child is not poorly coordinated.	0	1	1
3.18.0	He teases his two younger brothers.	Abnormal behaviour.	3	2	5
		Normal behaviour.	2	1	3
4.2.0-2	Edgar is enrolled in a bilingual programme	Programme is inappropriate.	6	10	16
		Programme is appropriate.	1	0	1
4.5.0	His math skills are weak.	Math difficulty is separate from other problems.	4	5	9
7.6.0	WISC-R Arithmetic subtest score 10	Math difficulty is a manifestation of the other problems.	6	4	10
7.28.0-7.32.0	WRAT results; cannot do fractions; WRAT Arithmetic subtest score Grade 4.9.				
6.17.0-1	He likes movies with violence and horror in them.	Interest in violence is a cause for concern.	4	2	6
		Liking movies of this type is normal.	0	3	3

Three novice subjects rated the composition for level of cognitive maturity. One of these judged it as age-appropriate, without commenting on grammar, spelling, or punctuation, and one judged it as age-appropriate despite poor grammar. The third judged it as below age level. A total of 10 novice subjects commented on grammar, spelling, or punctuation. Three novice subjects interpreted the composition in a projective manner. Two of these, including one subject who had also rated it as cognitively mature, read expressions of loneliness in the child's story. The third read the request given by the mother to the child in the story as a command, and, therefore, was of the opinion that Edgar was projecting his own mother's strictness into his story.

All of the subjects who participated in the study made some comment on the drawing of a person that was included in the case-file. A copy of this drawing, designated Topic 9, is included in Appendix A. Six of the twelve experts rated Edgar's drawing as cognitively immature, the remainder rated it as reflecting the appropriate level of cognitive development for a twelve-year-old. Two of the novices rated it as cognitively immature, four made no comments about its age-appropriateness, two of these four because they said they did not have the knowledge to do so. The remaining six novices judged the drawing as reflecting the appropriate level of cognitive development for a twelve-year-old. Three experts made direct reference to the need to have the scoring norms available as did two novices.

Eight experts used the drawing in a projective manner and three of these eight judged Edgar in a favourable light. Three experts made specific reference to Edgar's drawing as reflecting his self-image. Two of these judged his drawing as evidence of a

poor self-image while the third thought that the drawing reflected good self-awareness. None of the novices made direct references to the drawing as representative of Edgar's image of himself. Seven of the novices made comments about Edgar's mental health or personality based on the drawing, although two of the seven queried the relevance of such comments as being "too projective". Four of these seven projective judgements were favourable, including the two queried judgements. Isomorphic signs were assigned meaning by three subjects, one expert and two novices, although one of the novices was a subject who admitted the possibility of being too projective. Isomorphic signs is the term used by Harris (1963) referring to the projective use of drawings in the study of personality in which the interpreter reasons by analogy. For example, a drawing done at the side of the page or with a line underneath indicates the child's need for support. The squared off shoulders in Edgar's drawing were taken as a sign of a rigid personality. Subject EJ also referred to the drawing of the mouth as a further sign of rigidity because, to him, it looked fixed.

Edgar's drawing, when scored according to the guidelines set out by Harris (1963) for drawings of a man by boys, places Edgar above the 53rd percentile, with a standard score of 101. Therefore, according to Harris's criteria, Edgar's drawing was entirely age-appropriate, although it was rated by 50 per cent of the experts as immature. Of the eight novices who gave the drawing a rating on maturity or age appropriateness, only two judged it to be below what they would have expected for a child his age.

Comparing subjects' judgements of the composition with those of the drawing, five expert subjects were consistent in that they judged both the composition and the drawing to be at the same level of cognitive maturity. Two judged both the composition and the drawing as reflecting maturity, and three judged both as reflecting

immaturity. Two experts judged the composition and drawing as reflecting opposite sides of the maturity-immaturity continuum. One of these rated the composition as immature and the drawing as mature, and the other rated the composition as mature and the drawing as immature. Of the three novice subjects who gave the composition a rating on level of cognitive maturity, one did not rate the drawing in this respect, one rated both the composition and the drawing as immature, and one rated the composition as mature and the drawing as immature.

More projective use was made of the drawing than of the composition. All of the subjects who used the composition in a projective manner also did so for the drawing.

## Chapter Six

### Discussion

The study examined the reasoning processes whereby decisions about a child referred for assessment were reached. In order to study how assessors actually deal with the task of reviewing and interpreting a case-file, the experimental procedure replicated as closely as possible this part of the assessment process. The study was conceived, in part, to explore some of the issues raised by critics of the psychoeducational assessment process. It is during the interpretation process that far-reaching decisions concerning the child are made, but this process is perceived as being the most susceptible to inconsistencies resulting from individual differences in assessors. The study was designed to explore putative sources of these individual differences; and also to search for consistencies in the decision-making strategies used by assessors. The types of inferences made from the case-file data, and the use of these inferences to reach diagnostic decisions and to make recommendations concerning future programmes for the child were examined. It was assumed that the reasoning used by experienced school psychologists would be characterised by features similar to those found in other professions in which expertise is associated with efficient problem-solving skills that produce accurate solutions. Interpretation of the information contained in a child's case-file to draw conclusions about the child's abilities and difficulties was viewed as a problem-solving task. However, based on findings, mainly



from the domain of psychotherapy (e.g., Wills, 1978), it was also expected that psychoeducational assessors' decisions would be biased by their theoretical orientations in psychology and by their preferred conceptualisations of educational exceptionality, and that this would, in part, account for some of the variability in assessment outcomes.

In order to investigate these influences, assessors' think-aloud protocols were recorded as they interpreted a dossier containing information typically collected as part of the referral procedure. From these protocols the types of inferences made could be studied, and the way in which the problem task was represented by each of the assessors could be set out formally. Experienced assessors were compared with assessors in training to determine which, if any, influences on case-file interpretation were active for experienced assessors and which were active for trainees, and to what extent these influences facilitated or constrained decision-making. The study aimed at fostering awareness among assessors of the factors influencing their decisions and making explicit processes that assessors themselves often describe as intuitive. A further aim was to show how consistencies in the reasoning strategies used by experienced assessors, if indeed such consistencies were observed, might be used in the construction of a model of expertise for psychoeducational assessment.

### **Overview of Results**

The results of the present study did not indicate any expert-novice differences with respect to the variables analysed: the measures of theoretical orientation in

psychology, the numbers of inferences made in the categories specified, the number of causal links identified from representations of subjects' reasoning, and the numbers of references made to case-file text propositions. However, within-subjects differences were found for three sets of inference categories and tests for contrasts between categories revealed that, for all subjects, specific types of inferences predominated over others. The significant within-subjects effect for the numbers of references made to topics in the case-file and the associated contrast effects showed that the use of text file information followed a similar pattern for all subjects. Differences across individual subjects emerged from a detailed, qualitative analysis of the representations of subjects' reasoning, from which it was possible to describe characteristics of well-integrated reasoning and to identify sources of the variability in assessment outcomes. This descriptive analysis revealed that the well-integrated expert protocols possessed common features that were not present in the well-integrated novice protocols

The first set of results reported in Chapter 5 was associated with subjects' theoretical orientation in psychology as assessed by the Counselor Orientation Scale. No statistically significant group differences were found with respect to counsellor orientation. Both the experts and the novices showed greater preferences for the Gestalt and Client-Centred orientations and least preference for the Behavioural orientation compared to the other orientations listed in the scale. The examination of the correlation matrices constructed between preference scores on the scale and the numbers of inferences made in specified coding categories revealed significant negative relationships between some of the counsellor orientations and inferences

relating to physiological factors. No other readily interpretable relationships were perceived.

Analysis of the numbers of inferences generated was carried out for the following category sets: a) negative, positive, rejected, and prescriptive inferences, b) educational, emotional, physiological, and contextual inferences, c) educational, emotional, physiological, and contextual inferences within the *negative* category, d) educational, emotional, physiological, and contextual inferences within the *positive* category, and e) educational, emotional, and physical inferences within the prescriptive category. No significant group differences between the experts and the novices were found across the inference categories analysed, nor were there significant differences for the total number of inferences generated in each set. It was noted that there was a great deal of variability between individual subjects in both groups in regard to the numbers of inferences made in all the categories. Within-subjects effects were found to be statistically significant for three out of the five sets of inference categories considered. The tests for contrasts between the numbers of inferences made in the various categories showed that, for all subjects, the retained negative and positive inferences that were non-prescriptive together accounted for most of the inferences made, and that all subjects discussed the case-file largely in terms of educational and emotional factors rather than physiological and contextual factors.

From the analyses of the data obtained directly from the linear forms of representations of subjects' reasoning, it was found that the experts and novices did not differ significantly with respect to either the extent or the directions (forward and

backward) of the causal reasoning in which they engaged. The experts and novices could not be differentiated according to their selectivity in use of case-file data. In regard to selectivity, a large majority of subjects referred to the same three topics in the case-file more often than to the other six topics (in terms of absolute numbers of references made). These three topics were also among the most frequently used topics when the amount of information presented in each topic was taken into consideration. An additional descriptive analysis was carried out of the propositions in the case-file text that were commonly used as inference cues. It was observed that there were considerable differences in interpretations of similar information and that subjects drew opposite conclusions from the case-file data. This was particularly true of the interpretation of the child's drawing included in the case-file.

The representations of subjects' reasoning, set out in the linear form, showed that there was a higher level of integration, that is, the combining of inferences based on case-file information with one or more theories about the student being assessed, in some of the protocols than in others. This was neither related to level of expertise nor to orientation. A search was made to find qualitative characteristics that would distinguish the better-integrated representations from the less well-integrated or poorly integrated representations. It was found that the well-integrated representations derived from experts' protocols contained specific diagnostic theories about the student's problems. These theories contrasted with the more general diagnoses made by most subjects. When specific diagnostic theories were postulated, the information in the case-file was more likely to be interpreted on the basis of these theories. In

contrast, the well-integrated representations derived from novices' protocols did not contain features that distinguished them from the less well-integrated or poorly integrated representations.

### **Summary of Research Hypotheses.**

A number of specific research hypotheses were proposed. The first four research hypotheses dealt with differences between expert and novice psychoeducational assessors with respect to the numbers of inferences generated in response to reading and reviewing a case-file. These inferences were divided into categories to facilitate exploration of group differences. Two research hypotheses were related to information obtained from subjects' responses to the Counselor Orientation Scale. A further four hypotheses dealt with the representations of subjects' reasoning and differences between the reasoning strategies used by experts and novices. The research hypotheses are reiterated below:

1. The experts will make fewer inferences from the case-file than will the novices.
2. The experts will identify more negative attributes of a student than the novices.
3. The experts will identify fewer positive attributes of a student than the novices.

4. Although the experts will generate fewer inferences than the novices, they will retain more of their inferences than the novices. In other words, the experts will reject fewer inferences than the novices..

5. The Counselor Orientation Scale will show that experts are more closely aligned with a particular theoretical orientation than are the novices.

6. For all subjects, theoretical orientation will correlate with the types of hypotheses retained.

7. The expert assessors will use more causal links than novices to generate inferences about the student. The novices will use comparatively fewer causal links than the experts.

8. The experts will link their inferences to a selectively narrow body of information, whereas the novices will use a wider range of data from the case-file as inferential cues.

9. The representations of the experts' interpretations of the case-file will include the standardised test scores among the critical cues and the experts will refer to this body of information more often than to any other. In contrast, the novices will refer

less frequently to the test data which will, therefore, not feature so prominently in their selection of cues.

10. The reasoning processes used by experts will be represented by more highly integrated networks than those of the novices.

### **Discussion and Implications of Findings**

In the remainder of this chapter, the order of the discussion of the research results and their implications follows the sequence of presentation of the research hypotheses in the above summary. The implications of the findings related to the use of educational and emotional factors in interpreting the case-file and the contribution of the referral information to interpretation are considered following the discussion of Hypotheses 1–4. The results derived from the Counselor Orientation Scale are then discussed with reference to Hypotheses 5 and 6, and the correlational analysis performed. The results obtained from analysis of the linear representations are discussed next. This discussion includes the use of causal reasoning (Hypothesis 7) and suggestions for alternatives to the causal model, selectivity in use of information (Hypothesis 8), the relative importance of the standardised-test results (Hypothesis 9) and other case-file data, and the characteristics of integrated reasoning (Hypothesis 10).

The additional findings relating to the differing interpretations made of similar case-file data are considered after the discussions arising from all 10 research hypotheses.

*The numbers and categories of inferences made (Hypotheses 1–4).* The first hypothesis was not supported by the results. The experts generated globally more inferences than the novices, although this difference was not found to be statistically significant. (Figure 7 and Table 6 show the results of this study that are pertinent to Hypotheses 1–4.) There was no indication in the present study that the experts and novices could be differentiated according to ability to limit the number of inferences made. The study of medical practitioners (Joseph & Patel, 1987) showed that high domain-knowledge specialists organised information so as to limit the generation of multiple hypotheses. However, when there are a number of ways in which to solve a problem, a flexible approach which allows for choice between multiple hypotheses, may be advantageous. In the domain of psychoeducational assessment there are no efficiency criteria to guide problem solving and, therefore, as Wills (1978) has suggested, a reasoning strategy of review and revision might be best. If the generation of a large number of inferences from a body of data is taken as an indicator of willingness to consider alternative ideas for review, it would be desirable for practising assessors to maintain such an approach. However, it is impossible to say, from the enumeration of inferences alone, whether the assessors in the present study were comprehensive in their consideration of hypotheses. Generating any number of



hypotheses does not necessarily imply that systematic strategies of review and revision are being carried out..

Hypothesis 2 was not supported in that there was no significant difference between the number of negative attributes inferred by the experts compared to the number inferred by the novices. Contrary to Hypothesis 3, no significant difference was found between the experts and the novices for the number of positive inferences generated. These results fail to support the contention that experience in psychoeducational assessment leads to increased attention to pathology. This does not necessarily contradict the results obtained by Wills (1978), that experienced therapists attend to more negative client attributes than do those with less experience, but indicates that practitioners of psychoeducational assessment may be dissimilar to practitioners of psychotherapy. It should not be assumed that experience in different branches of psychology leads to the same perceptions of clients' functioning. The client populations dealt with may also differ considerably from one subdiscipline to another. Therefore, practitioners in psychoeducational assessment and practitioners in psychotherapy undergo widely divergent work experiences which, in turn, lead to differences in professional outlook.

With reference to Hypothesis 4, group differences in the numbers of inferences that were retained in any category were also found to be non-significant. This was true whichever way the inferences were subdivided, whether according to educational, physiological, and contextual topics, according to whether the inferences were negative or positive, or according to whether they dealt with subjects' recommendations.

Neither group rejected many of their initial inferences. The experts rejected slightly more of their inferences than did the novices but the difference was not significant. The results did not indicate that subjects in either group were willing to reject completely very many of their statements.

It was suggested that the constraints imposed by adherence to a theoretical orientation in psychology would lead to reluctance to revise the statements made about the child being assessed, even when disconfirmatory evidence was available. It was also suggested that the experts would adhere more strongly than the novices to preferred orientations and, therefore, would show less inclination to withdraw any inferences. Based only on the evidence of the numbers of inferences rejected, it might be concluded that both the experts and the novices were similarly constrained. However, as will be discussed later in this chapter, there was no clear evidence that the assessors sampled worked within any particular theoretical framework

*Factors in case-file interpretation* No significant differences between the groups were obtained from the analysis of the numbers of inferences made in the various sets of categories. However, significant within-subjects effects were found for the set of negative, positive, rejected, and prescriptive inference categories (see Table 6). As can be seen in Figure 7, most of the inferences made were in the negative and positive categories, and there were more negative than positive inferences. This appeared to be evidence for greater emphasis by all subjects on negative aspects of the case than on positive attributes. That there were fewer prescriptive inferences than positive or

negative ones might have been predicted. Not all interpretations of case-file information lead directly to recommendations for further action. It might also be expected that assessors put forward recommendations that take into account more than one feature of the case and, therefore, some form of summarisation takes place. While it was also to be expected that there would be fewer rejected inferences than posited ones (if any final diagnostic theories were to be postulated), Figure 7 shows that, in fact, the rejection of inferences was a relatively infrequent occurrence.

From the results of tests for contrasts between the negative, positive, rejected, and prescriptive inferences (Table 7), it was observed that, of the total number of inferences generated, retained positive and negative (non-prescriptive) inferences together accounted for a significantly larger part of the subjects' interpretations than prescriptive inferences. There was no significant difference between the relative contributions of the positive and negative inferences to this set of categories. Therefore, subjects could not be said to emphasise selectively the child's negative characteristics. Prescriptive inferences accounted for a significantly larger part than the rejected inferences, which confirmed that the rejection of inferences contributed relatively little to subjects' discussions of the case. Rather than rejecting explicitly any of their inferences, it appeared that subjects continued to generate additional explanations as they accumulated more information about the case. In the presence of uncertainty, they preferred to retain alternative hypotheses for consideration.

Significant within-subjects effects were found for the set of educational, emotional, physiological, and contextual inference categories (see Table 8). Figure 8 shows that

inferences in the educational and emotional categories occurred most frequently within the set of combined negative and positive inferences, with the educational category predominating. When tests for contrasts were carried out, it was found that inferences in the educational category were indeed significantly more frequent than inferences in the other three categories. Inferences in the emotional category were found to occur significantly more frequently than inferences in the physiological and contextual categories. However, the physiological and contextual categories did not differ significantly with respect to the number of inferences made from them. (See Table 9.) The physiological category was the only instance in which the experts made fewer inferences than the novices, in spite of the fact that the experts generated more inferences overall. However, neither the group difference in the number of inferences made in the physiological category, nor the between-subjects difference in the total number of inferences generated was found to be statistically significant.

Thus far, there appeared to have been most emphasis placed first, on educational factors and, secondly, on emotional factors, with comparable emphasis on negative and positive attributes. The educational, emotional, physiological, and contextual categories were divided according to whether they were made up of negative or positive inferences. Hence the distribution of negative and positive inferences among the educational, emotional, physiological, and contextual categories could be examined. Figure 9 shows that more inferences were made in the negative emotional category than in the negative educational category, and shows that more inferences were made in the negative educational category than in the negative physiological or

negative contextual categories. Figure 10 shows a preponderance of inferences in the positive educational category and more inferences in the positive emotional category than in the positive physiological or positive contextual categories. Comparing Figures 8, 9, and 10, it can be seen that for the educational and emotional inference categories, there were proportionately more positive inferences than negative ones. Thus there appeared to be differences in the way in which all assessors had assigned the negative and positive attributes to the student, particularly with regard to the educational and emotional inference categories. This may reflect the characteristics of the case-file used or, as will be discussed below, may be representative of a general approach to assessment. However, although significant within-subjects effects were obtained for positive inferences made in the educational, emotional, physiological, and contextual categories, the effects for the corresponding set of negative inferences were not significant (see Tables 10 and 12). Therefore, the negative inferences were more evenly distributed among categories than the positive inferences.

Since there were significantly more inferences made in the educational and emotional categories than in the physiological and contextual categories, it was not unexpected that most inferences would be found in the educational and emotional categories when negative and positive attributes were considered separately. The tests for contrasts (Tables 11 and 13) showed that this was, in fact, the case. However, for the *negative* inferences, no significant difference was found between the numbers of inferences generated in the educational and emotional categories. In contrast, there were significantly more inferences in the educational category than in the emotional

category when the set of *positive* inferences was considered. For both the negative and positive sets of inferences, no significant differences were found between the physiological and contextual categories. The implications of an apparent emphasis on educational aspects of the case, especially with regard to positive factors, and less differentiation between educational and emotional features with regard to negative factors are discussed below.

Figure 11 shows that for the prescriptive inference categories, most inferences were made in the emotional category, and least in the physical category. (The prescriptive inferences were divided into three categories only, namely: educational, emotional, and physiological.) However, within-subjects effects were not significant (see Table 14). The contrasts analysis of the prescriptive inference categories indicated that significantly more inferences were made in the educational and emotional categories than in the physical category. There was no significant contrast between the numbers of prescriptive inferences generated in the educational and emotional categories. (See Table 15.) Thus, most of the recommendations that were made concerned attending to the child's emotional and educational needs.

The pattern that emerged from the contrasts analyses performed indicated that all subjects paid most attention to educational and emotional factors in their interpretations of the case-file. However, whereas both educational and emotional attributes dominated the *negative* set of inferences, with little difference in their respective contributions to interpretation, educational attributes alone dominated the *positive* set of inferences. Subject's recommendations concerning remedial strategies

were also primarily related to improved educational functioning and emotional well-being, although these included contextual factors as well. Overall, positive educational inferences made up the largest single subcategory.

These results show that assessors not only seek out positive attributes with which to describe a student, but also find most of these within the realm of academic functioning. This makes sense in terms of what psychoeducational assessment is intended to achieve. In order to encourage and help improve children's progress at school, it is necessary to discover in what areas they function best and what conditions lead to successful learning. It is then possible to design individualised programmes based on these conditions. When assessment is carried out specifically for schools, it is not surprising that the emphasis is on educational considerations. Drawing attention to children's academic strengths can also contribute to improvements in affective functioning. For example, self-confidence is increased when children are made aware of what they *can* do, as opposed to being reprimanded for what they cannot do. That both the experts and the novices in the present study showed similar tendencies in this regard may reflect the fact that this type of approach is common to both the teaching and practice of psychoeducational assessment.

It was also observed that, for both the experts and the novices, there were more inferences in the negative, emotional category than in the positive emotional category, whereas there were fewer inferences in the negative educational category than in the positive educational category. (Compare Figures 8 and 9.) This suggests that the student's *problems* were attributed to emotional factors more frequently than to

educational factors. In contrast, as discussed above, more positive signs of adaptive academic functioning were inferred from the case-file. The emphasis on emotional factors in explaining the child's problems and on educational factors in explaining the child's successes is an interesting outcome of this research. A possible reason for these findings was suggested in the preceding paragraph i.e., that attention is drawn to academic successes as one way of promoting higher self-regard in the children concerned. In addition, these children are likely to rise in the estimation of others when their abilities are pointed out.

No specific research hypotheses were put forward in regard to the differential emphasis on education and emotional factors in assessment, but it is possible that this reflects a general tendency among assessors. Alternatively, the assessors in this study may have been in agreement, that, in general, Edgar's problems stemmed from emotional factors rather more than from learning disabilities. Further investigation is necessary before such generalisations can be made with any certainty, and it would be necessary to study interpretations of a number of case-files describing students with dissimilar characteristics.

*The influence of referral information on case-file interpretation.* The reasons for referral given in the case-file used in the present study no doubt exercised some influence on the assessors' interpretations of the data. The reasons for referral were that advice was sought by the parents before they made a decision about the child's high school programme, and that they also needed help in dealing with his difficult



behaviour. Thus the subjects were asked to attend to both educational and (presumably) emotional factors. A child is likely to be classified as emotionally disturbed when the referral is for behavioural problems (Ysseldyke & Algozzine, 1981). Therefore, it is not surprising, if Tidwell (1976), Ysseldyke and Algozzine (1981), and O'Reilly et al. (1989) are right (referral information influences assessment outcomes) rather than Huebner and Cummings (1986), and Ritchie (1986) (referral information does not influence assessment outcomes), that educational and emotional factors featured most prominently in the discussions, with less emphasis on physiological and contextual information. The discrepancy between one set of findings, that referral information is a source of bias in psychoeducational assessment, and the other set of findings, that it does not influence assessment unduly, is explained in part by differences in the populations of assessors sampled. The subjects who participated in the study carried out by Ysseldyke and Algozzine (1981) included special education teachers, teacher support personnel, and school administrators, as well as school psychologists. The subjects in the study carried out by Tidwell (1978) were graduate students enrolled in a school psychology internship, and the subjects in the study by Ritchie (1986) were full-time guidance counsellors. O'Reilly et al. (1989) sampled school psychologists. The subjects who participated in the present study were experienced school psychologists and graduate students who had recently completed a course in assessment. Thus, the various studies that dealt with the influence of referral information on assessment were not uniform with regard to either the type or the duration of experience in assessment undergone by their subjects.

Another reason for the discrepant findings is that referral data are neither ignored completely, nor are they the most important influence. Although the influence of the referral information on assessors' interpretations of Edgar's case-file may have been minimal (given the typical array of data presented in the case-file), it probably predisposed them to search for suitable responses to the parents' requests. Consequently, the referral data created a framework for interpretation of the subsequent information. In the present study no significant differences between the experienced and trainee assessors were found with respect to the categories of inferences made. The referral information was, therefore, equally influential regardless of experience.

*Theoretical orientation (Hypotheses 5-6).* The results obtained from the subjects' responses to the Counselor Orientation Scale were inconclusive. Only thirteen out of the twenty-four response sheets were complete. The remainder contained statements to which responses were omitted. From the comments that had been written on the forms, it can be concluded that these omissions were intentional.

For both the expert and novice groups preferences were shown for the Client-Centred and Gestalt orientations. The Behavioural orientation was the least preferred. (See Figure 6.) That the total sample showed greatest preference for the Client-Centred orientation and least preference for the Behavioural orientation is in agreement with the findings reported by Loesch and McDavis (1978) in their field test of the scale. The present findings differed from those of Loesch and McDavis in that the

authors of the scale found greatest variability in the spread of scores that indicated preference for the Existential orientation, while the present study found greatest variability in the expert group for the Behavioural orientation, greatest variability in the novice group for the Client-Centred orientation, and greatest variability in the entire sample for the Rational-Emotive orientation. Least variability among the expert group was found for the Existential orientation although, for both the novice group and for the sample as a whole, least variability was found for the Trait-Factor orientation. This accords more closely with the field test findings, in which least variability was also found for the Trait-Factor orientation. (Table 1 contains the standard deviations for preference scores on each of the counsellor orientations.).

Neither the expert nor the novice group showed affinity to one orientation to the exclusion of the others and there was no significant difference between the profiles of scores obtained by the two groups, as shown in Table 2. Both groups showed a favourable inclination toward the Client-Centred and Gestalt orientations, but not exclusively so. If anything, the scale showed that all of the subjects were eclectic in their outlook. Barnett (1988) claimed that professional practices are founded on "lore" or opinion. Subjects' preferences for the Client-Centred and Gestalt orientations could be the product of a prevalent predilection for Client-Centred and Gestalt approaches to client treatment, at least in the branch of psychology that deals with psychoeducational assessment. As discussed by Barnett, accepted theories of practice are passed on during training, and are perpetuated when the trainees continue on to professional

practice. Both the experienced school psychologists and the trainees in this study may have been influenced by the same theoretical orientations during their education which would account for their similar patterns of orientation preferences.

In connection with Research Hypothesis 6, which predicted the existence of relationships between theoretical orientations in psychology and the types of hypotheses retained by all subjects, the correlations between scores on the Counselor Orientation Scale and numbers of inferences retained in the various categories were examined<sup>6</sup>. (Tables 3–5 contain the correlation matrices constructed.) That both the Client-Centred and the Gestalt orientations, the two preferred orientations, had a relatively high negative correlation with prescriptive inferences about physical remedies reflects the low incidence of inferences in the physical category of prescriptive inferences. The Rational-Emotive orientation measure also had a significant negative correlation with the number of prescriptive inferences designated as physical, as well as with the number of inferences in the physiological category. In addition, a significant negative correlation was found between the Freudian orientation and prescriptive inferences related to physical remedies. Thus significant negative correlations were found for four (the Client-Centred, the Gestalt, the Rational-Emotive, and the Freudian) orientations out of a total of seven and for inferences in the physical prescriptive category. The other three orientations measures were also negatively

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<sup>6</sup> Although nine bivariate correlations were found to be statistically significant, the fact that there were seven factors for theoretical orientation leads to an increased likelihood of Type I error. Therefore, one may wish to be more conservative regarding statistical significance. A further reason for considering the correlations with caution is that the subscales for each of the orientations are not independent.

correlated with the number of inferences in this category, although not at levels of statistical significance.

The conclusions that might be drawn from this are that there is a lack of knowledge about remediation strategies of a medical nature and/or that there is a general reluctance to make referrals to physicians. However, evidence based only on the Counselor Orientation Scales forms a tentative empirical basis for these conclusions. Moreover, none of the orientations in the scale related specifically to medical factors (see Appendix B). If psychoeducational assessors do indeed pay little attention to possible physiological correlates of schoolchildren's difficulties, this is a serious omission on their part. For instance, there are children for whom illness, although not necessarily severe, is a contributor to academic failure. Or, it may be the case that a child's "perceptual problem" is the result of a need for eyeglasses. If the training of school psychologists does not include awareness of medical factors in assessment, this must be remedied.

The other significant correlations did not conform to any pattern, nor were they meaningful in themselves. Although the Behavioural orientation was the least preferred, it was significantly correlated with the number of inferences in the emotional category (one of the principal categories used) and with the number of inferences relating to recommendations for further investigation and treatment of affective disorders. This is unexpected because a Behavioural orientation is usually associated with contextual factors. That a relatively high positive correlation was found for the Freudian orientation and prescriptive inferences related to emotional factors is not

surprising, given that a Freudian orientation is usually associated with attention to affective disorders. But this is not particularly informative in the present context. Similarly, the significant positive correlation for the Trait-Factor orientation and contextual inferences is not unexpected, given that the relevant Counselor Orientation Scale items deal with an individual's adaptation to environmental factors. However, the meaning of the significant positive correlation for the Trait-Factor orientation and physiological inferences is ambiguous because there is no apparent physiological content in Trait-Factor theory. As for the significant positive correlation obtained for the Existential orientation and contextual inferences, this is contrary to expectation. The scale items that are representative of the Trait-Factor orientation have more relevance to contextual considerations than do the items corresponding to the Existential orientation.

*Causal Reasoning (Hypothesis 7).* Hypothesis 7 dealt with differences between the expert and novice groups that were expected to emerge from the analysis of the type of reasoning they used as they interpreted the case-file. It was hypothesised that the experts would use more causal reasoning and, hence, more causal links would be identified in the experts' representations compared to those of the novices.

No significant group difference was found for the total number of causal links formed, as shown in Table 18. Hypothesis 7 was, therefore, not supported. All of the subjects, irrespective of group membership, used causal explanations in both forward and backward directions to some extent. That is, they identified characteristics, events,

and processes described in the case-file as causal explanations for their inferences concerning the student (forward reasoning from data to theory), and they also generated inferences that provided causal explanations for the information that they read in the file (backward reasoning from theory to data). No significant group differences were found when separate consideration was given to forward-causal and backward-causal links (see Table 18). The implication here is that, if the experts' assessments are assumed to be more accurate than those of the novices, experts in the domain of psychoeducational assessment cannot be distinguished from novices in this field by applying the rule system identified by Patel and Groen (1986) for the domain of medicine. In modelling diagnostic explanations in terms of causal reasoning, Patel and Groen found that accurate medical diagnosis was associated with forward reasoning and inaccurate diagnosis was associated with backward reasoning.

There are two possible explanations for the difference in outcomes of the study carried out by Patel and Groen and the present study. One explanation is that the causal model is applicable to the domain of medicine but not to the domain of psychoeducational assessment. In dealing with the problems for which schoolchildren are referred for assessment, the identification of the problem in more specific terms and the planning of remedial strategies may take precedence over the identification of underlying causes. Unlike in medical practice, the "cure" need not be directly connected to the cause. For instance, a reading disability requires a child to learn strategies to overcome the disability but the actual disability does not diminish. The other reason for the difference in research outcomes is that the assumption that the

experts were more accurate than the novices may be false. Both the experts and the novices who participated in the present study may have interpreted the given data equally accurately (or inaccurately). The problem in the domain of psychoeducational assessment is that there are no accepted criteria against which to match the solutions offered and, therefore, their accuracy cannot be gauged. Consequently, the associations between forward reasoning and accuracy, and between backward reasoning and inaccuracy cannot be made. Therefore, the construction of a model of expertise needs to be based on other considerations. In addition, psychoeducational assessors themselves have not been afforded the opportunity of forming an association (either tacit or explicit) between their reasoning strategies and the accuracy or inaccuracy of their diagnoses. Presumably, achieving accurate diagnoses reinforces the method of reasoning through which they were achieved, even though formal training in particular methods of diagnostic reasoning is not a usually given. In the absence of standards of accuracy for psychoeducational assessment, such reinforcement cannot be experienced.

If it is true that a causal model is inappropriate for the domain of psychoeducational assessment, a better model that might be provided is one that incorporates conditional reasoning. Frederiksen (1990) has suggested that reasoning can be analysed to reflect whether all the necessary and/or sufficient conditions for the hypotheses generated have been considered in order to draw scientifically valid conclusions. Because this requires an explicit articulation of every step of the reasoning process it enables one to test whether all relevant information has been used. Platt (1964) argued in favour of



testing multiple, plausible, competing hypotheses using the method of strong inference. Decision points regarding the retention or rejection of hypotheses can be represented thereby in the form of forks in a conditional inductive tree. This also suggests the form of a possible model of complete and explicit reasoning with which subjects' representations might be compared and how analysis of an individual's conditional reasoning to assess the rigour of an argument in favour of a theory could be carried out. It would then be possible to ascertain to what extent review and revision are characteristic of the domain in question and whether groups classified by type and duration of experience can be differentiated according to their willingness to modify theories on the basis of new information. Bus and Kruizenga (1989) found that the diagnostic problem-solving behaviour of expert practitioners in the field of learning disabilities did not follow the scientific method of hypothesis testing. That is, expert practitioners did not test systematically whether the data provided validated or invalidated their hypotheses. The use of representational models of reasoning would clarify these findings. The comparison of practitioners at different levels of expertise (Bus and Kruizenga studied experts only) is also necessary in order to investigate further the association between different types of reasoning strategies and experience in the domain of psychoeducational assessment.

*Selectivity of cues (Hypothesis 8).* Hypothesis 8, which stated that the experts would be more selective in their use of information, was not supported. The experts drew inferences based on a larger number of propositions from each paragraph than the

novices, with the exception of Paragraph 5 (the child's birth and medical history) from which both the experts and the novices used an equal number of cues. However, neither the difference between the two groups across the references made to each paragraph nor the difference between the two groups with respect to the total number of references made to the entire case-file were found to be statistically significant. (See Table 16.)

The results do not indicate that the experts were any different from novices in their use of information. That is, they did not use a restricted body of information to a greater extent than the novices. This finding in the domain of psychoeducational assessment differs from that of Joseph and Patel (1987) in the domain of medicine. In their study of expertise as a function of domain-knowledge, Joseph and Patel found that experienced practitioners used the patient data that was critical in the formulation of an accurate diagnosis to a greater extent than the less-experienced practitioners.

McDermott's study (1975) of decision-making behaviours among groups of school psychologists at successive levels of training and experience also showed that one group of school psychologist trainees did not differ appreciably from experienced school psychologists in the number of units of information used. However, this trainee group consisted of prepracticum trainees. Postpracticum trainees were found to use more diagnostic units than both the experienced school psychologists and the prepracticum trainees. All the novices who participated in the present study had some practical experience as part of their training, but it is not known whether the extent and type of practice is comparable to those of the postpracticum trainees in McDermott's

study. Therefore, it is not possible to compare the present set of results with those of McDermott, although his results suggest that similarity between experts and novices with respect to the amount of information used is not an unusual finding. McDermott did not investigate differential use of the contents of the units of information provided to the subjects who participated in his study.

The reasons for the similar selection of cues for file interpretation on the part of both the experts and the novices, as well as explanations for the apparently greater salience of some topics over others, are discussed in the next section which deals with the interpretation of information from the case-file topics.

*Interpretation of information from the case-file topics (Hypothesis 9).* The topic from the student case-file used in the present study to which most references were made was Topic 7. This part of the file contained the results of standardised tests (see Appendix A), but, contrary to the expectation expressed in Hypothesis 9, the expert group did not refer to the test information more often than the novice group. For the absolute numbers of references made to the various topics (see Figure 12), Topic 3, the parents' report, ranked second in terms of frequency of references, Topic 4, the school's comments ranked third, and Topic 6, the psychologist's observations ranked fourth. When the references made to the topics were considered in proportion to the amount of information given in each topic (see Figure 13), the parents' report and the school's comments also ranked among the four most frequently used sections of the case-file. However, there was a reversal, as well as a change in their rankings. The school's

comments ranked second, and the parents' report ranked fourth. Topic 1, the basic data, ranked third when the number of propositions in each topic was taken into account, whereas analysis of the absolute numbers of references had assigned it ninth ranking. The psychologist's observations received the least amount of attention among the seven topics that could be analysed according to the number of propositions they contained.

The analysis of the absolute numbers of references placed Topic 5, the child's birth and medical history in, in fifth position and Topic 2, the description of the presenting problem, in sixth position, whereas the analysis of the proportional numbers of references per topic reversed this order. According to the proportional analysis, "Presenting Problem" ranked fifth and "Birth and Medical History" ranked sixth. Thus, both analyses showed that these two topics received relatively little, although not least, amounts of attention from the assessors. The numbers of references made to the composition and the drawing could only be considered in absolute terms as these topics were not subjected to propositional analysis. With rankings of seventh for the drawing and eighth for the composition, they appear to have been considered as among the least pertinent topics for the assessment. Because of their qualitative difference from the other topics, both with respect to their content and the projective nature of the inferences that some subjects derived from them, the composition and drawing are discussed separately (see the section of this chapter entitled "*Additional findings*" below).

The contrasts analysis for both the absolute numbers of references made to the topics in the case-file and the proportional numbers of references made to the topics showed general patterns of information use that were common to all subjects (see Tables 17 and 18). Both analyses showed that there was no statistically significant difference between the numbers of references made to the four most frequently used topics. Using absolute numbers, the four most frequently used topics were Topics 7, 3, 4, and 6, i.e., the test results, the parents' report, the school's comments, and the psychologist's observations. Using proportional numbers, the four most frequently used topics were Topics 7, 4, 1, and 3, i.e., the test results, the school's comments, the basic data, and the parents' report. However, a statistically significant difference was found between the absolute numbers of references made to Topic 6, the psychologist's observations, and Topic 5, the birth and medical history, and a statistically significant difference was found between the proportional numbers of references made to Topic 3, the parents' report and Topic 2, the presenting problem. No statistically significant difference was found between the absolute numbers of references made to Topics 5, 2, 9, 8, and 1, i.e., the birth and medical history, the presenting problem, the drawing, the composition, and the basic data. There was also no statistically significant difference between the proportional numbers of references made to Topics 2, 5, and 6, i.e., the presenting problem, the birth and medical history, and the psychologist's observations. It therefore appeared that for both types of analyses, topics fell into two categories in terms of frequency of use: a high frequency group and a low frequency group. Common to both high frequency groups were the parent's report, the school's

comments and the test results. Common to both low frequency groups were the presenting problem, and the birth and medical history.

The extensive use by both groups of subjects of Paragraph 7 implies that standardised tests have a major function in assessment. Some maintain that their popularity is out of proportion to their validity, e.g., Meehl, 1978; Haney, 1981. The novices, having come through a school and university system in which standardised tests are widely used as measures of ability and as selection criteria, are likely to regard test use as the norm. Standardised tests are seen as social artifacts, just as much as they are viewed as scientific instruments (Haney, 1981; Ungerleider, 1985). The preference on the part of professionals for using standardised tests as a means of classification and selection has had a pervasive effect on society. Individuals are still labelled and classified according to their standings in tests that purport to measure academic achievement and academic potential (Smith & Knoff, 1981; Meyers, Pfeffer, & Erlbaum, 1988). Moreover, it is difficult for any individual to have his or her classification or label changed.

Topics 3 and 4, the parents' report and the school's comments were also referred to frequently both in terms of the absolute numbers of references made and in terms of the numbers of references made in proportion to the amount of information these two topics contained. The parents' report contained a description of the child's past and current problems as perceived by his parents. The problems discussed included dissatisfaction with his behaviour at home and reasons why he was not doing as well as expected at school. The school's comments contained a summary of the child's past

and current difficulties at school. This topic had been composed from teachers' reports. The child's problems outlined in both of these topics could have arisen from affective or academic difficulties, or from both. (Appendix A contains the full text of the case-file.) One reason for the apparent salience of the information contained in the parents' report and the school's comments is the framework created by the description of Edgar's previous and current difficulties and the specific requests for advice and assistance made by his parents.

In the case-file used in the present study, the contents of the section entitled "Presenting Problem" (Topic 2) contained the information that introduced the assessors to Edgar's situation. Subjects read that Edgar had had longstanding learning difficulties, had been assessed previously and had received remedial help with his school work. This section of the file also informed them that Edgar was in Grade 6 at the time of the present assessment, and that he was manifesting behaviour difficulties. They were told that his parents had requested a re-evaluation in order to help them plan for his highschool entry the following year and wanted help in dealing with his difficult behaviour. As discussed earlier in this chapter under the heading "*The influence of referral information on case-file interpretation*" this information, which is typical of introductory referral information, may have prompted the assessors to attend to data which would assist them in giving the advice sought. Topic 2 did not rank highly in terms of either absolute or proportional frequency of use. Nevertheless, it is suggested that the nature of the information it provided exerted a strong, tacit influence on the interpretations of the case-file.

Topic 5, the child's birth and medical history, was also among the topics that were referred to less frequently. The discussion of subjects' theoretical orientation earlier in this chapter considered that assessors might not pay sufficient attention to physiological factors in assessment. The relatively little attention assigned to this topic, especially in proportion to the amount of information given, provides some further evidence in this regard.

Topic 1, the briefest section of the case file (8 propositions), containing only basic data about the child, ranked as an infrequently used topic according to the analysis of absolute numbers of references, but as a frequently used topic in proportion to the quantity of information it contained. There is a practical reason for this proportional frequency of use. The information presented in this section can be described as neutral in that no diagnostic decisions could have been made based on this section alone. However, it is necessary for assessors to know a child's sex, age, and grade in order to judge the appropriateness of academic level and behaviour. This would account for this topic's prominence in helping to interpret the parents' report and the school's comments. Knowledge of a child's school grade is also useful in interpreting the results of standardised tests, such as in judging whether or not the child has been assigned to an appropriate class at school. (Age and sex are taken into consideration in the norming of standardised tests.) An examination of the think-aloud protocols obtained in the present study confirmed that subjects used Topic 1 data in this manner. The fact that the child was referred for assessment by his parents and not by his school teachers was regarded as pertinent by one subject only.



When the amount of information provided under the heading "Psychologist's Observations" was taken into consideration, this topic was seen to have been used relatively infrequently. The reason for this finding may be that, in the present study, it was not possible for the assessors to make their own observations of the child's behaviour, nor were they able to interview the child. Consequently, the importance they attached to the information in this section may not reflect the attention given to this kind of material in an actual assessment. This type of information might be regarded as highly salient when it reports on the results of an assessor's own investigations.

*Integration of information (Hypothesis 10).* The review of subjects' representations did not indicate that experts' interpretations were better integrated than those of the novices. Four representations from among the expert group were identified as well-integrated and four from among the novice group were identified likewise. Of the four representations that were identified as somewhat integrated, three were from the expert group and one was from the novice group. These numbers do not provide unequivocal support for Hypothesis 10 which stated that experts' reasoning would be represented by the more highly integrated networks. Descriptions of the features of the best integrated networks showed that the representations constructed for the experts, but not the representations constructed for the novices, appeared to have in common a less conventional approach to interpretation compared to the other expert and novice subjects in this study. The four experts in question either relied less on the two topics

in the case-file that had proved most salient for the other subjects, or they held theories about the student's functioning that were qualitatively different from those held by most of the other subjects. These qualitative differences were due to a single prevailing theory about the child in question being maintained throughout the protocol, to the theory's describing the student's problem in specific, rather than general terms, and to the theory's being unique to the respective subjects.

The small number of expert subjects involved here makes it impossible to draw firm conclusions. But the fact that a specific diagnosis was associated with an integrated network implies that, for these subjects, information is indeed interpreted in conformity with theories about the child postulated early on in assessment. In the study carried out by Snyder and Swann (1976) it was shown that bias in interpretation of information could be evoked by prior suggestion of a theory *by the experimenter*. In the present study, the subjects in question postulated theories about the student being assessed at a very early stage of the interpretation of the case-file. That these theories were suggested *by the subjects themselves* may be a reason for the strong adherence to them. Their diagnostic formulations may have arisen from preferred notions regarding the nature of psychoeducational problems which would explain both their emergence early on in interpretation of the case-file as well as the strong adherence to them. Although some of the novices' protocols were well-integrated, these did not reflect such rigidly held diagnostic theories concerning the child's difficulties. It would appear that the tendency to adhere to initial diagnoses is more characteristic of experienced professionals than of professionals in training.

What is not clear from the assessment outcomes of only one case, however typical, is whether a particular conceptualisation of educational exceptionality is part of an assessors' theoretical approach that is consistently followed for all referrals, or whether the conceptualisation is specific to each child. For instance, it is the author's experience that a programme of behaviour modification might be recommended as the remediation strategy appropriate for one child, while a counselling approach that is essentially Client-Centred might be recommended for another child. Both children may have manifested similar behaviour but differ with respect to, for example, personality and home environment. The different recommendations arise, not from the assessor's theoretical orientation in psychology, but from consideration of the individual needs of the children (and families) concerned. McDermott (1981) listed discrepant diagnoses resulting from application of principles drawn from antithetical theories as a source of error in the assessment of children. Provided that these are not applied to the *same* case, it cannot be said that an error has been committed. A full investigation of whether assessors' conclusions and recommendations arise from consistently held theories and related conceptualisations of childhood exceptionality, or whether different cases elicit different approaches requires a study using several case-files.

In the domain of psychoeducational assessment, the association between expertise and well-integrated reasoning is problematic. In many problem-solving situations, both in well-structured and ill-structured domains, a single correct solution or a limited set of correct solutions can be shown to exist. For these situations well-integrated

reasoning is associated with competence (Greeno, 1978). For example, evidence from the medical domain shows that expert practitioners are better at organising information so as to limit the generation of multiple hypotheses (Joseph & Patel, 1987). In psychoeducational assessment, a clearly defined set of solutions to the referral problem cannot be assumed. Very often multiple hypotheses about the nature of the problem need to be considered, which, although likely, are not all valid. Limiting the number of hypotheses may, therefore, not be a priority in assessment. It may, in fact, be detrimental, if flexibility is important. Therefore, the relevance of combining hypotheses with critical cues into a well-integrated representation of the problem-space (Greeno, 1978) for problems that do not have clearly delineated solutions may be questioned.

It has been suggested that strategies of review and revision are conducive to flexibility and, as such, are appropriate to psychoeducational assessment. That the most highly integrated networks from among the expert assessors who took part in the present study were associated with the most specific and consistently held theories about the student, suggests that these experts did not subject their theories to much revision. Nor did they appear to test alternative theories. It is possible that these assessors were the most bound by preconceived notions and interpreted the case-file information in accordance with these notions. Arkes (1981) has surveyed research, including the classic study by Chapman and Chapman (1967), that has demonstrated the pervasive and powerful influence of preconceived notions. There is support from the present study that strongly held notions about the nature of children's learning

abilities and their social and emotional functioning limits the range of diagnosis which, in turn leads to the search for confirmatory evidence and either disregard for conflicting evidence or interpretation of information to conform to prior convictions.

*Additional findings.* There was disagreement among subjects over the specific etiology and nature of the child's problems. One source of the difference in opinions was the diametrically opposite interpretations that were made from the same data sets. (Refer to Table 20.) Thus, even when the same cues were regarded as salient, the inferences made differed considerably. For example, error Number 3 on McDermott's list, the inconsistent weighting of diagnostic cues, was a striking phenomenon in this study. These findings agree with those of Bus (1989), that with the same case and similar information sources, diagnostic statements, as well as remedial prescriptions, differ. Bus and Kruizenga (1989) showed that there is a great deal of assessment information that is not interpreted, which suggests arbitrariness in drawing up statements about a case. However, providing assessors with the same information would not guarantee similar interpretation. Barnett (1988) provides an illustration of how the aggressive behaviours of a child can be interpreted differently depending on assessors' "explicit theoretical orientations and implicit covert processes" (p. 661).

The comparison of subjects' inferences made on the basis of the child's composition and drawing provides further evidence that the same information prompts dissimilar conclusions. There were differences in opinion among the seven experts who rated the composition for its level of cognitive maturity. Three judged it as mature, that is, age

appropriate, and four judged it to be immature. Similarly, although only three novices rated the composition on this dimension, two judged it as mature and one as immature. The differences in opinion concerning the cognitive maturity of the drawing were more striking. Six experts rated the drawing as mature, and six rated it as immature, although, according to the criteria set out by Harris (1963), the drawing was age appropriate. In contrast, of the eight novices who rated the drawing for its cognitive maturity, only two were incorrect. The other six novices were correct according to the Harris guidelines. Of the four novices who made no comments in this respect, two explicitly stated that they refrained from judgement of the drawing because of lack of knowledge. Thus, in the one instance where there were criteria against which accuracy could be gauged, not only were opposite conclusions drawn from the same data, but also half of the experts were shown to be incorrect. The novices fared better in comparison to the experts and, although the number of subjects concerned was small, there was some indication of willingness to admit lack of knowledge. There is little justification for confidence in the judgement of experienced assessors if the evidence provided by their ratings of the drawing is taken on its own. However, not all the blame for inaccuracy should be placed on assessors. The validity of children's drawings to estimate cognitive ability has also been called into question (Naglieri, 1988). It should also be borne in mind that the assessors in this study did not use Edgar's drawing as the sole index of his intellectual maturity. Insofar as could be determined from the analysis of the absolute numbers of references that the assessors made to the case-file text, the drawing ranked among the less frequently used topics.

Only one of the assessors, Subject EC, relied heavily on it when formulating a diagnosis.

The differences in opinion that arose from projective use of the drawing (the composition was not subjected to this type of interpretation as much as the drawing) do not necessarily reflect arbitrary judgements on the part of these assessors. Instead, the relevance of the use to which the data were put can be questioned. Reservations about the validity of the projective use of children's drawing and stories have been documented e.g., Bersoff, 1973; McDermott, 1975. Bersoff attributed as much validity to projective testing as he did to the sixteenth century practice of ascertaining the guilt of a witch. However, in spite of the literature that is critical of projective tests, eight out of twelve expert subjects in this study, and seven out of twelve novice subjects interpreted the drawing for its projective content. It appears that the use of projective material is still a popular, although unscientific means of personality assessment. In view of proposals for encouraging systematic hypothesis testing among assessors, consideration needs to be given to the validity of the data that are used in support of assessors' hypotheses.

A similar case can be made for the observed differences in the opinions made on the basis of the test results given in Edgar's case-file. Errors in professional judgement have been linked to the technical inadequacy of testing procedures. Test authors and researchers report that validity coefficients of, for example, .30 to .70 are acceptable and support professional practices associated with the scales. But, if used as the primary basis for professional decisions about individual cases, practitioners must

face magnitudes of errors that are difficult to defend (Barnett, 1988). It is necessary for assessors to consider carefully whether the validity of the data they are using justifies the importance they assign to them.

### **Summary of Findings and Implications**

The specific research hypotheses that differences between the experienced and trainee assessors would be observed when the two subject groups were compared across the numbers of inferences made in the predetermined categories (Hypotheses 1-4), and across preference scores for theoretical orientations (Hypothesis 5) were not supported. The research hypotheses concerning group differences in the numbers of causal links identified in the subject-generated protocols (Hypothesis 7), selectivity in use of case-file data (Hypothesis 8), extent of use of standardised test data (Hypothesis 9), and the integration of case-file data and inferences about the child described in the case-file (Hypothesis 10) were also not supported. A number of reasons for finding similarities between experienced assessors and trainees where differences were expected were proffered. Not all of the significant correlations obtained for theoretical orientation scores and numbers of inferences in specified categories were readily interpretable, although some of them were indicative of a neglect of physiological factors on the part of all the assessors. However, caution was necessary in interpreting the correlations so that the predicted relationship between theoretical orientations and types of inferences generated (Hypothesis 6) could not be refuted or supported conclusively.



With respect to the total numbers of inferences made by each subject group, there was no evidence that experienced assessors were more parsimonious in generating inferences than were the novices. Although research in other domains has associated expertise with the ability to limit the generation of multiple hypotheses, this association did not hold for the psychoeducational assessors sampled. It was suggested that, in the domain under study, it is advantageous to generate multiple hypotheses in order that hypotheses may be reviewed and, if necessary, revised. In this way, school psychologists retain a flexible approach to assessment and are not constrained by preferred hypotheses. However, the enumeration of inferences alone provided insufficient data with which to determine whether subjects did, in fact, test their hypotheses in a systematic manner.

There was no evidence that experienced assessors perceived the student's functioning in negative terms any more than did the trainees. All the assessors sampled identified adaptive as well as maladaptive characteristics of the student described in the case-file. McDermott (1981) considered one of the sources of error in assessment to be the diagnosis of a problem within the child even when the presence of problems was doubtful. Although all subjects identified some problems within the child, they also acknowledged that he possessed good abilities and had achieved successes at school that offered encouragement for his future progress. Thus their outlook was not entirely pessimistic. This did not accord with the findings of Wills (1978) that experienced psychotherapists perceive their clients primarily in terms of negative characteristics. To account for the divergent findings, it was suggested that the psychoeducational

assessors sampled in this study and the psychotherapists sampled by Wills had evolved their respective professional practices in response to dissimilar client demands.

That no expert-novice differences were found for the numbers of inferences rejected (or retained), and that relatively few inferences were rejected was taken as evidence that none of the assessors sampled were willing to reject completely many of their inferences. The specific research hypothesis that the expert assessors would be more reluctant than the novices to reject their inferences was formulated in connection with Hypothesis 5, which stated that the experts would be more closely aligned with a particular theoretical orientation in psychology than the novices. This expected alignment with theory on the part of experts was thought to constrain inference generation and lead to the interpretation of case-file information strictly in accordance with the preferred theoretical orientation. However, there was no decisive evidence that the experienced assessors worked within a theoretical framework in psychology any more than did the novices. All subjects showed preferences for the Client-Centred and Gestalt orientations but were generally eclectic in orientation. The similarities in orientation preferences shown by the experts and the novices were thought to result from similarities in their educational backgrounds. Therefore, although all the assessors retained most of the inferences they had made, or, in other words, rejected very few, no direct links between their theoretical orientations in psychology and their apparent reluctance to discard ideas about the child being assessed could be established.

Subjects in both groups were consistent in that they generated more inferences in the educational and emotional categories than in the other categories. An interesting tendency on the part of assessors to interpret the descriptions of the child's academic functioning in a more positive manner than the descriptions of his affective functioning was observed. It was suggested that school psychologists do, in fact, work in this way. They seek out areas of relatively high academic achievement (for each child being assessed) in order to use these as bases on which to build individualised remediation programmes.

The consistencies among all subjects that were found with respect to both the predominance of inferences in the educational and emotional categories, together with the selection of case-file data that they regarded as most pertinent to the case, suggested that all the assessors directed their enquiries so as to respond to the requests for assistance implicit in the introductory referral data. The sections of Edgar's file referred to most frequently included the parents' report and the school's comments. These two topics contained information that was regarded as salient to the child's problems as presented. The high frequency of use of the results of the standardised tests that had been administered to the child was seen as evidence that such tests are still considered as major components of assessment, despite current criticism of their reliability and validity. It was felt that insufficient attention was paid to the child's medical history and that assessors should take physiological factors into greater account than they do at present. The latter finding provided further evidence to support the conclusions drawn from the correlations between the Counselor Orientation Scale

scores and the numbers of inferences generated in the various categories, namely that assessors lack knowledge of medical correlates of learning difficulties and/or are unwilling to consider remediation strategies requiring medical intervention.

The assessors who participated in the present study did not demonstrate exclusive preferences for particular theoretical orientations in psychology. Nor could it be concluded that adherence to diagnostic formulations concerning the child they were assessing reflected preference for any particular theory in psychology. It was proposed instead that diagnoses are made in response to the characteristics of each child referred for assessment. Some of the expert subjects in this study proffered theories about Edgar's difficulties early on in their reading of his file. It was suggested that these theories might also be more influenced by case-characteristics than by conceptualisations of learning problems derived from a single preferred theory in psychology. Moreover, although experience may lead to strong adherence to theories, this applies only to those diagnostic theories postulated by assessors within the context of each referral situation. Selective use of the contents of the case-file provided evidence that introductory referral information directs assessors' attention to those sections of the file that will help them respond to whatever queries and requests are made in the referral statement. Thus, taking into account the joint influence of case-characteristics and referral information, the conclusion can be drawn that assessors' interpretations are case-specific and are not guided by any global theory of child psychology.

Further research is necessary in order to establish with certainty whether school psychologists take a case-specific approach to assessment as opposed to a theory-driven approach. That assessment outcomes are influenced by a theoretical orientation in psychology or from an adaptation of a theory in psychology (Barnett, 1988) cannot be ruled out. A further question can be raised in connection with the postulated case-specific approach. This question arises from consideration of the protocols obtained from the four experts assessors in this study who diagnosed the child's problems with such confidence. How is it that psychologists would be able to vary their approaches to assessment from one child to the next and yet hold fixed ideas for one child? Obtaining answers to this question is a necessary part of further research on case-specific methods of psychoeducational assessment.

Strong adherence to a theory about a particular child, whether case-specific or associated with a theoretical orientation in psychology, is likely to produce a search for confirmatory evidence for the theory. The association between adherence to a theory and the interpretation of information in conformity with the theory was confirmed in the present study. The assessors who described Edgar's problems in precise terms after reading the early portion of his file perceived subsequent data as supportive of their initial conceptualisations. Considering the tendency to seek out confirmatory data once an idea or hypothesis has been formulated, Kleinmuntz (1990) advocated systematically searching for evidence that may disconfirm such a formulation. In view of the present findings that this tendency is present among experienced assessors, this recommendation is a valid one.

If school psychologists do, in fact, adopt a case-specific approach to assessment, it is necessary for them to consider that the child's difficulties may be other than those stated, and that the perceptions of difficulties as existing within the child may be erroneous (Quay, 1973). They should also consider that the perceived difficulties may not be more serious than those experienced by the majority of schoolchildren but that the real reason for referral is that the child has not met parents', guardians', or teachers' expectations. It is necessary for assessors to be cognisant of what constitutes normality (while also acknowledging individual differences), as well as exceptionality..

From a perusal of the standard deviations for the numbers of inferences generated in each of the coding categories (Figures 7, 8, 9, 10, and 11), the standard deviations for the numbers of references made to each topic in the case-file text (Figures 12 and 13), and the different implications drawn from the same case-file data (Table 21 and the interpretations of the child's written composition and drawing), it is evident that the case-file was interpreted in very many different ways. There was as much diversity among the experienced assessors as among the trainees. A major concern in the domain of psychoeducational assessment has been the variability among assessors (e.g., McDermott, 1981). Barnett (1988) discussed the influence of personal models of professional practice on the decisions made by school psychologists. These models evolve from "explicit theoretical orientations and implicit covert processes" (p.661), and remain largely unspecified. The use of such individually constructed models would account for the variability observed in this study. Moreover, if, as has been discussed, each referral situation is considered as unique, individual assessors will not

necessarily be consistent in the strategies they use across case studies. McDermott (1981) described "inconstancy of diagnostic style" (p. 38) as a source of error in assessment when decision-making strategies are changed within one case study or across intrinsically similar case studies. However, it can be argued that, when cases are dissimilar, it is appropriate for assessors to alter their approach.

At least for some of the data that are commonly collected as part of an assessment, the lack of validity of the instruments used to compile the data may be responsible for the variability in their interpretation. Lidz (1981) documented that school psychologists have expressed dissatisfaction with test instruments and are in agreement with the criticisms of standardised tests found in the psychoeducational assessment literature. That tests of dubious reliability and validity continue in widespread use may be because alternatives, such as cognitive diagnostic methods (e.g., Glaser, 1981) are not made available to them. Silverman (1989), among others, argued for the abandonment of standardised tests in favour of continuous assessment of students on school tasks by teachers, as well as by school psychologists. He opposed the use of highly structured test situations in which the tasks set bear no relation to school work. The introduction of alternative tests and/or strategies for assessment requires policy changes on the part of school boards, and also additional training for school personnel. Although assessors cannot initiate these changes by themselves, they can act as proponents for change.

The generation of multiple hypotheses was regarded as advantageous to solving problems for which there are several possible solutions. The fact that all the assessors

in this study generated multiple hypotheses was not, however, a sufficient indicator that these hypotheses were tested systematically. The present study provided some evidence that psychoeducational assessors do *not* engage in a systematic review and revision of their theories about a student. One source of evidence was the apparent lack of willingness to reject hypotheses completely. Although most of the assessors in the present study preferred to generate new inferences without discarding earlier ones, there was no indication from their protocols that they subjected their various ideas about Edgar to systematic review. It appeared that they retained alternative hypotheses but did not test each one against new evidence. Another source of evidence was the interpretation of data by some of the expert subjects in conformity with their original theories about Edgar. These subjects did not consider alternative diagnoses, nor did they test systematically the soundness of their diagnoses. It was suggested that the construction of a model of reasoning that epitomises systematic hypothesis-testing would need to be in terms of conditional links instead of, or as well as, causal links. It was argued that, in the absence of agreed criteria for gauging the accuracy of assessors' conclusions about a child, it would be impractical to construct a model in purely causal terms. It was also argued that a causal model does not reflect completely the reasoning strategies appropriate for psychoeducational assessment. A further advantage of a model that included conditional links would be its capability of representing the generation of multiple hypotheses. Such a model might reveal the extent to which strategies of review and revision of theories about the cases referred are employed by



assessors and make it possible to fully investigate the comprehensiveness of an assessment.

If assessors do not engage in rigorous, scientific reasoning, it is essential to impart improved decision-making strategies to them. This is especially necessary because of the apparent lack of consistency in assessment. It was suggested that the method of strong inference proposed by Platt (1964) is analogous to a strategy of review and revision of hypotheses, and that this would provide an appropriate reasoning model for psychoeducational assessment. Platt claimed that testing multiple theories using the method of strong inference can, first of all, be taught and learned. Secondly, it is necessary to be "explicit, formal, and regular about it" (p.146). For the purposes of both teaching and practice, decision support systems in the form of expert systems applications would be useful in attaining the conditions of explicitness, formality, and regularity. An obstacle to the design of an expert system for psychoeducational assessment is the lack of agreement among experts. However, the decisions that are based on assessments are too important and immediate to await the development of comprehensive systems that have proven validity and reliability. The absence of universally recognised guidelines, whether or not in the form of expert systems applications, can be compensated for, in part, by the "conferencing" of cases by a team that includes more than one school psychologist in order that the child, the parents or guardians, and the teachers involved are given the benefit of less subjective assessments. At the very least, the initial assessment reports need to include the alternative hypotheses which longer-term monitoring of the student, as recommended

by advocates of process assessment, will either support or disconfirm. It is more likely, then, that alternative hypothesis sets will be deliberately considered. At the same time it should be possible for assessors consulting together to foster mutual awareness of how and why certain decisions are reached. Although professionals may try their best to assess a child's most important needs, they are not always correct. They must make predictions from inadequate evidence, but the more they are aware of this, the more likely they are to listen to others who can contribute further evidence. "Real assessment does not lie in deluding ourselves that we have discovered the true nature of the child's needs, but in putting our fallible opinions to the test and in our readiness to modify them when events show them to be at fault" (Bookbinder, 1986, p. 7).

### **Limitations of the Present Study**

The full scope of this investigation into the psychoeducational assessment process is recognised as being subject to limitations imposed by the artificiality of the research situation.

1. The initial stages of assessment involve making decisions about what kind of information to collect and from whom to request the information. The study did not involve these stages, but focussed only on the interpretation of information that had already been gathered. The dossier provided to the subjects who participated in the present study contained case information that had been collected by an experienced

assessor. As such, expert versus novice differences that might occur at these earlier decision points were not investigated.

2. Assessors, in practice, have access to the individuals who are involved in the case for interviews, testing, and observation. This could not be part of a research study. The skills necessary for conducting and understanding interviews, for using and scoring test instruments, and for observing and interpreting the behaviour of individuals in naturalistic and complex social interactions are essential components of expertise in the field. It is likely that experienced and trainee assessors could be differentiated according to levels of skills in these areas.

3. The collection of information by assessors is a multi-staged procedure. Questions arise from preliminary data interpretation that can be answered only by conducting further interviews, tests, or observations. Requests for further information, beyond that provided to subjects in the on-line presentation, could not be satisfied.

### **Recommendations for Further Research**

There are several avenues of further research into the interpretation of psychoeducational assessment data which could contribute to a more complete understanding of the process and lead to greater systematisation of procedure.

The influences of formal theories in psychology, notions currently prevalent in the field, and personal theories, which have become part of an assessor's internalised

knowledge, need further study. To this end, better objective scales and/or self-rating methods for assessing the theoretical professional, and personal orientations that contribute to professional judgement require further development and field testing. Further attention needs to be given to the acquisition of notions and orientations. Are they acquired during training, or even earlier? Or are they acquired during professional practice?

The influence of referral information on judgement by school psychologists and other school personnel has been the subject of research but the findings in this regard are equivocal. Further research is necessary to help resolve the issue of the weighting of referral information relative to other data, and to find out whether experience is a modifying factor. It is also necessary to select and classify subject samples in a uniform manner so that research results are comparable.

This study involved the use of only one case-file. The use of several, dissimilar case-files is required for further study of the interpretation phase of psychoeducational assessment. In particular, it is important to investigate whether school psychologists are guided by case-characteristics during an assessment more than they are influenced by preferred theories in psychology (either in original or adapted form), as the present research findings seemed to suggest.

Further work on the modelling of reasoning in assessment needs to be carried out. The present study was exploratory in this respect. Although the development of a suitable template of expert reasoning is difficult in a field where there is little agreement among professionals, it is a useful research goal. The comparison of the

reasoning processes used by individuals at different levels of expertise would then be facilitated. Models of reasoning in the domain of psychoeducational assessment would need to represent different types of conditional reasoning, as well as causal reasoning, and would need to represent the direction of reasoning. They would also need to account for the generation of multiple theories. Platt (1964) made an analogy between hypothesis testing using the method of strong inference and a tree structure in which the decision points are represented as forks. This is similar to the concept of informational equivalence between mental representations and the representational models constructed in cognitive science. Because of the complexity of a model that includes several lines of reasoning, Sowa's method of linear representation is an alternative to the display form of representation and could be applied to the conditional, inductive tree described by Platt.

Similar considerations relating to factors which influence judgement need to be given to the information search phase of psychoeducational assessment. This phase itself comprises several stages, beginning with the decisions concerning an overall strategy for assessment. Important decisions about what to include in the data gathering phase must be made early on in the referral process. The data gathered may include several of the following: interviews with parents or guardians, with school teachers and other professionals who have worked with the child, reviews of the child's previous history and written schoolwork, observations of the child at school and at home, and the selection of test instruments followed by administration, scoring, and interpretation of them. The information collected must then be compiled before the

"diagnostic" interpretation can begin. However, theories concerning the child's functioning are often proposed at several stages of the assessment process, so that part of the data collection may be for corroboration or refutation of these theories. Ideally, models of reasoning for the entire assessment process need to be developed. This is a highly complex task and presents a challenge for future research.

## REFERENCES

- American Psychological Association (1985). *Standards for educational and psychological testing*. Washington, DC: Author.
- Arkes, H. R. (1981). Impediments to accurate clinical judgment and possible ways to minimize their impact. *Journal of Consulting and Clinical Psychology*, 49, 323-330.
- Ballstaedt, S.-P., & Mandl, H. (1984). Elaborations: Assessment and Analysis. In H. Mandl, N. L. Stein, & T. Trabasso (Eds.), *Learning and comprehension of text*. Hillsdale, NJ: Erlbaum.
- Barnett, D. W. (1988). Professional judgment: A critical appraisal. *School Psychology Review*, 17, 658-672.
- Bersoff, D. N. (1973). Silk purses into sows' ears: The decline of psychological testing and a suggestion for its redemption. *American Psychologist*, 28, 892-899.
- Bookbinder, G. (1986). Professionals and wrong predictions. *British Journal of Special Education*, 13, 1-7.
- Breuleux, A. (1990). *L'élaboration et l'exécution de plans dans une tâche de rédaction*. Unpublished doctoral dissertation, Université de Montréal, Montreal.
- Bus, A. G. (1989). How are recommendations concerning reading and spelling disabilities arrived at and why do experts disagree? *Psychology in the Schools*, 26, 54-61.
- Bus, A. G., & Kruizenga, T. H. (1989). Diagnostic problem-solving behavior of expert practitioners in the field of learning disabilities. *Journal of School Psychology*, 27, 277-287.
- Carlson, S. B., & Ward, W. C. (1988). *A new look at formulating hypotheses items*. (GRE Board Report No. 85-14P.) Princeton, NJ: Educational Testing Service.
- Chafe, W. L. (1980). The deployment of consciousness in the production of a narrative. In R. O. Freedle (Ed.), *Advances in discourse processes: Vol. 3. The pear stories: Cognitive, cultural, and linguistic aspects of narrative production*. Norwood, NJ: Ablex.
- Chapman, L., & Chapman, J. (1967). Genesis of popular but erroneous psychodiagnostic observations. *Journal of Abnormal Psychology*, 72, 193-204.
- Chase, W. J., & Simon, H. A. (1973). Perception in chess. *Cognitive Psychology*, 1, 55-81.

- Cooper, L. A., & Regan, D. T. (1982). Attention, perception, and intelligence. In R. J. Sternberg (Ed.), *Handbook of human intelligence* (Chapter 3). Cambridge: Cambridge University Press.
- Dawes, R. M., Faust, D., & Meehl, P. E. (1989). Clinical versus actuarial judgment. *Science*, 243, 1668-1673.
- Donin, J., Denhière, G., & Frederiksen, C. H. (1988). Semantic processing in the production of written text to transmit procedural knowledge. In P. Boscolo (Ed.), *Writing: Trends in European research. Proceedings of the International Workshop on Writing*. Padova, Italy: Upsel Editore.
- Dowling, E., & Osborne, E. (1985). *The family and the school: A joint systems approach to problems with children*. London: Routledge & Kegan Paul.
- Dumont, F. (1987). *A research proposal: Inferential processes in clinical diagnosis*. Unpublished manuscript. McGill University, Department of Educational Psychology and Counselling, Montreal.
- Dumont, F. (1989). School psychology in Canada: Views on its status. In P. A. Saigh & T. Oakland (Eds.), *Psychology in the schools: International perspective* (pp. 211-222). Hillsdale, NJ: Erlbaum.
- Dumont, F., & Lecomte, C. (1987). Inferential processes in counseling and psychotherapy: An inquiry into the logical errors that affect assessment and treatment. *Professional Psychology: Research and Practice*, 18, 433-438.
- Ericsson, K. A., & Simon, H. A. (1984). *Protocol analysis: Verbal reports as data*. Cambridge, MA: MIT Press.
- Fagan, T. K. (1989). School psychology: Where next? *Canadian Journal of School Psychology*, 5, 1-7.
- Frankenberger W., & Harper, J. (1987). States' criteria and procedures for identifying learning disabled children: A comparison of 1981/82 and 1985/86 guidelines. *Journal of Learning Disabilities*, 20, 118-121.
- Frederiksen, C. H. (1975). Representing logical and semantic structure of knowledge acquired from discourse. *Cognitive Psychology*, 7, 371-485.
- Frederiksen, C. H. (1986). Cognitive models and discourse analysis. In C.R. Cooper & S. Greenbaum (Eds.), *Written communication annual: An international survey of research and theory, Vol. I: Studying writing: Linguistic approaches*. Beverly Hills, CA: Sage.
- Frederiksen, C. H., & Breuleux, A. (1989). *Monitoring cognitive processing in semantically complex domains*. (Technical report No. 88.1). Montreal: McGill University, Laboratory of Applied Cognitive Science.



- Frederiksen, C. H., Breuleux, A., Renaud, A., & Perrault, R. (September, 1988). *A Guide to Using CODA on the Macintosh (Version 3.0)*. Documentation Report, Laboratory of Applied Cognitive Science, McGill University, Montreal, Canada.
- Frederiksen, C. H., Perrault, R., Breuleux, A., Donin, J. S., Bracewell, R. J., Renaud, A., & Bedard, D. (September, 1988). *On-line User's Guide and Technical Documentation (Version 5.0)*. Documentation Report, Laboratory of Applied Cognitive Science, McGill University, Montreal, Canada.
- Gingerich, W. J. (1990a). Expert systems: New tools for professional decision-making. *Computer Literacy in Human Services*, 6, 219-229.
- Gingerich, W. J. (1990b). Developing expert systems. *Computer Literacy in Human Services*, 6, 251-263.
- Glaser, R. (1981). The future of testing: A research agenda for cognitive psychology and psychometrics. *American Psychologist*, 36, 923-936.
- Glutting, J. J. (1986). The McDermott multidimensional assessment of children: Applications to the classification of childhood exceptionality. *Journal of Learning Disabilities*, 19, 331-335.
- Glutting, J. J. (1987). The McDermott multidimensional assessment of children: Contribution to the development of individualized educational programs. *Journal of Special Education*, 20, 431-445.
- Graden, J., Kaufman, N., Christenson, S., Ysseldyke, J., & Meyers, J. (1984). A national survey of students' and practitioners' perceptions of training. *School Psychology Review*, 13, 397-405.
- Greeno, J. G. (1978). Natures of problem-solving abilities. In W. K. Estes (Ed.), *Handbook of learning and cognitive processes: Volume 5. Human information processing*. NY: Erlbaum.
- Greeno, J. G., & Simon, H. A. (1984). Problem solving and reasoning. In R. C. Atkinson, R. Herstein, G. Lindzey, & R. D. Luce (Eds.), *Steven's handbook of experimental psychology*. New York: Wiley.
- Grossman, F. M. (1985). Interpreting clinically derived WISC-R subtest groupings: A statistical approach. *Journal of Psychoeducational Assessment*, 3, 89-96.
- Haney, W. (1981). Validity, vaudeville, and values: A short history of social concerns over standardized testing. *American Psychologist*, 36, 1021-1034.
- Hansen, R. D. (1980). Commonsense attribution. *Journal of Personality and Social Psychology*, 39, 996-1009.
- Harris, D. B. (1963). *Children's drawings as measures of intellectual maturity: A revision and extension of the Goodenough Draw-a-Man Test*. New York: Harcourt, Brace & World.

- Hasselbring, T. S. (1986). Specialized services and expert systems: An examination of the potential and reality. *Computers in the Schools*, 3, 173-183.
- Huba, G. J. (1985). How unusual is a profile of test scores? *Journal of Psychoeducational Assessment*, 4, 321-325.
- Huebner, E. S., & Cummings, J. A. (1986). A naturalistic study of school psychologists use of diagnostic test data in making decisions. *Journal of Psychoeducational Assessment*, 4, 183-190.
- Joseph, G.-M., & Patel, V. L. (1986). Specificity of expertise in clinical reasoning. *Proceedings of the Eighth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Erlbaum, 331-343.
- Joseph, G.-M., & Patel, V. L. (1987). Problem representation and hypothesis generation in diagnostic reasoning. *Proceedings of the Ninth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Erlbaum, 243-257.
- Kaplan, C. A., & Simon, H. A. (1990). In search of insight. *Cognitive Psychology*, 22, 374-419.
- Kleinmuntz, B. (1990). Why we still use our heads instead of formulas: Toward an integrative approach. *Psychological Bulletin*, 107, 296-310.
- Kubes, M. (1988). *The use of prior knowledge in integration*. Unpublished doctoral dissertation. McGill University, Montreal.
- Levinson, E. M. (1990). Actual/desired role functioning, perceived control over role functioning, and job satisfaction among school psychologists. *Psychology in the Schools*, 27, 640-74.
- Lidz, C. S. (1981). *Improving assessment of schoolchildren*. London: Jossey-Bass.
- Loesch, L. C., & McDavis, R. J. (1978). A scale for assessing counseling orientation preferences. *Counselor Education and Supervision*, 17, 262-271.
- Massaro, D. W., & Friedman, D. (1990). Models of integration given multiple sources of information. *Psychological Review*, 97, 225-252.
- McDermott, P. A. (1975). *Characteristics of diagnostic decision-making behaviors among groups of pre- and post-practicum trainee and experienced school psychologists*. Unpublished doctoral dissertation, Temple University, Michigan.
- McDermott, P. A. (1981). Sources of error in the psychoeducational diagnosis of children. *Journal of School Psychology*, 19, 31-43.
- Meehl, P. E. (1954). *Clinical versus statistical prediction: A theoretical analysis and a review of the evidence*. Minneapolis: University of Minnesota Press.
- Meehl, P. E. (1960). The cognitive activity of the clinician. *American Psychologist*, 15, 19-27.

- Mercer, C. D., King-Sears, P., & Mercer, A. R. (1990). Learning disabilities definitions and criteria used by state education departments. *Learning Disability Quarterly*, 13, 141-152.
- Mercer, J. R. (1986). Scientific revolutions and the psychomedical paradigm: The growing crisis in measurement psychology. *Canadian Journal of School Psychology*, 4, 1-16.
- Meyers, J., Pfeffer, J., & Erlbaum, V. (1985). Process assessment: A model for broadening assessment. *Journal of Special Education*, 19, 73-89.
- Ministère de l'Éducation du Québec. (1976). *Rapport COPEX, Sections 7-2-3 et 7-4-2-3, Tome 11*. Québec: Ministère de l'Éducation.
- Ministère de l'Éducation du Québec. (1981). *Organisation des services éducatifs aux élèves en difficulté d'adaptation et d'apprentissage*. (Instruction (AE-15-81-01), Loi sur l'instruction publique, Article 33-34-189-480-482 et 483 - école québécoise, énoncé de politique et plan d'action.) Québec: Ministère de l'Éducation.
- Ministère de l'Éducation du Québec. (1988). *Planification et Développement Pédagogique*. Québec: Ministère de l'Éducation.
- Naglieri, J. A. (1988). *Draw a person: A quantitative scoring system*. New York: Psychological Corporation.
- Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.
- Nisbett, R., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NJ: Prentice-Hall.
- O'Leary, K. D. & Johnson, S. B. (1979). Psychological assessment. In H. C. Quay & J. S. Werry (Eds.), *Psychopathological disorders of childhood*, 2nd edition. New York: Wiley.
- O'Reilly, C., Northcraft, G. B., & Sabers, D. (1989). The confirmation bias in special education eligibility decisions. *School Psychology Review*, 18, 126-135.
- Palmer, S. (1978). Fundamental aspects of cognitive representation. In E. Rosch (Ed.), *Cognition and categorization*. Hillsdale, N.J.: Erlbaum.
- Patel, V. L. & Groen, G. J. (1986). Knowledge based solution strategies in medical reasoning. *Cognitive Science*, 10, 91-116.
- Platt, J. R. (1964). Strong inference. *Science*, 146, 347-353.
- Portsmouth, R., & Caswell, J. (1988). The myth about "achieving potential". *British Journal of Special Education*, 15, p. 14.

- Quay, H. C. (1975). Special education: Assumptions, techniques, and evaluative criteria. *Exceptional Children*, 40, 165-170.
- Ritchie, M. H. (1986). The influence of referral information on the diagnostic classification of exceptional children. *The Exceptional Child*, 33, 181-186.
- Rosenhan, D. L. (1973). On being sane in insane places. *Science*, 179, 250-258.
- Salvia, J., & Ysseldyke, J. E. (1985). *Assessment in special and remedial education* (3rd ed.). Boston: Houghton Mifflin.
- Sarason, S. B., & Doris, J. (1979). *Educational handicap, public policy, and social history: A broadened perspective on mental retardation*. New York: Free Press.
- Schoech, D., Jennings, H., Schkade, L. L., & Hooper-Russell, C. (1985). Expert systems: Artificial intelligence for professional decisions. *Computers in Human Services*, 1, 81-115.
- Shertzer, B., & Stone, S. C. (1974). *Fundamentals of counseling* (2nd ed.). Boston: Houghton Mifflin.
- Siegel, L. S. (1989). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities*, 22, 469-478.
- Siegler, R. S. (1989). Mechanisms of cognitive development. *Annual Review of Psychology*, 40, 353-379.
- Siegler, R. S. & Richards, D. D. (1982). The development of intelligence. In R. J. Sternberg (Ed.), *Handbook of human intelligence* (Chapter 14). Cambridge: Cambridge University Press.
- Silverman, S. (1988). Psychological tests in education: Some concerns. *Archtype*, 7, 5-7.
- Silverman, S. (July, 1989). Personal communication (Course given at McGill University, Montreal, Canada: Summer Institute in Integrated Education).
- Silverstein, A. B. (1984). New formulas for evaluating the abnormality of test score differences. *Journal of Psychoeducational Assessment*, 2, 79-82.
- Simon, H. A., & Rescher, N. (1966). Cause and counterfactual. *Philosophy of Science*, 33, 323-340.
- Smith, C. R. (1980). Assessment alternatives: Non-standardized procedures. *School Psychology Review*, 9, 46-57.
- Smith, C. R., & Knoff, H. M. (1981). School psychology and special education students' placement decisions: IQ still tips the scale. *Journal of Special Education*, 15, 55-64.

- Smith, D. K. (1984). Practicing school psychologists: Their characteristics, activities, and populations served. *Professional Psychology: Research and Practice*, 15, 798-810.
- Snyder, M. & Swann, W. B. (1978). Behavioral confirmation in social interaction: From social perception to social reality. *Journal of Experimental Social Psychology*, 14, 148-162.
- Sowa, J. F. (1984). *Conceptual structures: Information processing in mind and machine*. Don Mills, Ontario: Addison-Wesley.
- Stanovich, K. E. (1989). Has the learning disabilities field lost its intelligence? *Journal of Learning Disabilities*, 22, 487-492.
- Tidwell, R. (1976). Expectancy effects and their relationship to psychological case report writing. *Psychology in the Schools*, 13, 275-278.
- U.S. Office of Education. (1977). *Procedures for evaluating specific learning disabilities*. (Federal Register, 42), 65082-65085.
- Ungerleider, C. S. (1985). The social and educational consequences of standardized testing: A point of view. *McGill Journal of Education*, 20, 281-292.
- van Dijk, T. & Kintsch, W. (1984). *Strategies of discourse comprehension*. New York: Academic.
- Ward, W. C., Frederiksen, N., & Carlson, S. B. (1980). Construct validity of free-response and machine-scorable forms of a test. *Journal of Educational Measurement*, 17, 11-29.
- Wiggins, J. S. (1981). Clinical and statistical prediction: Where are we and where do we go from here? *Clinical Psychology Review*, 1, 3-18.
- Wilkinson, L. (1988). *Sygraph*. Evanston, IL: Systat.
- Wilkinson, L. (1989). *Systat: The system for statistics*. Evanston, IL: Systat.
- Wills, T. A. (1978). Perceptions of clients by professional helpers. *Psychological Bulletin*, 85, 968-1000.
- Ysseldyke, J., & Algozzine, B. (1981). Diagnostic classification decisions as a function of referral information. *Journal of Special Education*, 15, 429-435.
- Ysseldyke, J., & Algozzine, B. (1983). LD or not LD: That's not the question! *Journal of Learning Disabilities*, 16, 29-31.

## APPENDIX A

### INSTRUCTIONS TO SUBJECTS, PRACTICE TASKS, AND CASE-FILE

#### INSTRUCTIONS

We are interested in your assessment of the following case-file that contains information about a student who was referred for psychoeducational assessment. I should like you to assess the case in the same way as you would assess a student who was referred to you in your work. I am going to ask you to THINK ALOUD as you work through the file. I should like you to tell me everything that you are thinking, just as the thoughts occur to you. I should also like you to read the material that is presented to you on the computer screen OUT LOUD. You can refer back to any portion of the file whenever and however often you wish to do so. Please continue to read and think out loud even when you go back over information that you have already read.

All the information will be presented on the computer screen. Pressing the keyboard space bar continues the presentation. Whenever you stop reading the file and think out loud, please press the ENTER key. Press the ENTER key again when you return to reading. When you want to go back in the file and forward again, use the mouse to click the arrows at the right side of the reading screen. This allows you to scroll the text up or down. Please indicate when you have completed your assessment of the case.

Before we begin with the main file, here is some practice material.

Thank you.

## PRACTICE TASKS

PLEASE READ THE TASKS OUT LOUD AND DO YOUR THINKING OUT LOUD

How many windows are there in your own home?  
Describe your thought processes in counting them.#<sup>1</sup>

Add the following numbers together:  
Three hundred and forty-six plus four hundred and fifty-eight.  
Describe how you go about doing the addition.#

Please read the following paragraph and verbalise all you thoughts about it. Press the ENTER key whenever you stop reading from the screen and press the ENTER key again whenever you start reading again. Practice scrolling the text up and down using the mouse to click on the arrows at the right side of the screen.#

### SCHOOL LUNCHES

"...Among the settlement workers at the turn of the century there was some agitation about introducing a program of school lunches for poor children. The special education teachers within the school system were particularly anxious for this innovation for they frequently expressed concern about the poor state of nutrition for their charges. Some school administrators...were of the opinion that the problem was not that the parents could not afford to supply their children with proper food but that parental carelessness and ignorance resulted in the improper nourishment of the children<sup>2</sup>."#

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<sup>1</sup> The symbol "#" denotes each section of the task as displayed to the subjects on the computer screen. The symbol did not actually appear in the texts presented to the subjects.

<sup>2</sup> Sarason, S. B., & Doris J., (1979). *Educational handicap, public policy, and social history: A broadened perspective on mental retardation*. New York: Macmillan.

Here is a further practice task before we begin with the main file.#

### **PSYCHOEDUCATIONAL ASSESSMENT**

Name: Kathy  
Age: 4 yrs. 3 mo.#

### **PRESENTING PROBLEM**

Reason for referral was concern that Kathy, who had made considerable progress at her present nursery school this year, might be set back by a transfer to a new school for the Kindergarten grade.#

### **PARENT'S COMMENTS**

Kathy had started to speak at age 3 years so that her present progress was encouraging.#

### **PSYCHOLOGIST'S OBSERVATIONS**

Kathy is a lively, alert child. She was wary of the examiner initially but quickly became friendly. Testing was begun with her mother present. After about ten minutes she was comfortable enough for her mother to leave and she worked happily throughout the session.#

### **TEST RESULTS AND SCORES**

**BENDER VISUAL MOTOR GESTALT TEST**  
Score at age level

**KAUFMAN ASSESSMENT BATTERY FOR CHILDREN**  
**GLOBAL SCALE STANDARD SCORES**

(Mean = 100, standard deviation = 15)

Sequential Processing	89
Simultaneous Processing	80
Mental Processing Composite	82
Achievement	85
Nonverbal	82#



### **ADDITIONAL INSTRUCTIONS**

The case-file of the student who you are being asked to assess will now be presented to you. Please read the case file OUT LOUD. You may pause in your reading to THINK ALOUD whenever you wish to do so. You may also go back to any part of the file at any time, always reading and thinking out loud.

Just to remind you. Pressing the keyboard space bar continues the presentation. Whenever you stop reading to think out loud, press the ENTER key. Press the ENTER key again when you return to reading. Use the mouse to click on the arrows to the right of the screen when you want to scroll the text up or down. Please indicate when you have completed your assessment. Thank you.

## REFERRAL FOR PSYCHOEDUCATIONAL ASSESSMENT

Name: Edgar R.                      Sex:            male  
Age: 12 yrs. 5 mo.                Grade:           6  
Test date: Jan., 1988  
Referred by parents.#

### PRESENTING PROBLEM

Edgar has had long-standing learning difficulties. There have been previous investigations and he has received remedial help with school work. He is now in Grade 6 and is manifesting behaviour difficulties. His parents want him re-evaluated for help in planning next year's schooling when he will enter high school and they would like advice about how to deal with his difficult behaviour.#

### PARENTS' REPORT

The family is intact. Their financial situation is stable and good. There is a family history of learning difficulties. Edgar is the eldest of three boys. He was an active baby who did not like being touched. Crawling, walking, and talking all occurred at normal times. There were no problems with toilet training. At nursery school he was observed as being poorly coordinated and he did not mix well with other children. He now tries hard with friends and is well liked at school. He is a demanding child. He is scattered, impulsive, and immature. He engages in repetitive behaviours. He has a quick temper and is easily frustrated. He teases his two younger brothers. He is a worry. Edgar's parents list the following problem areas: following teachers in class, sequencing, problem-solving, following directions, attention span, making inferences and abstracting, remembering what he is told, and needs constant supervision and structure.#

### SCHOOL'S COMMENTS

Edgar is enrolled in a bilingual programme. There are gaps in his basic level skills of attention, attitude, and concentration. He is not committed to his school work. His math skills are weak and his understanding of this subject is limited. He needs help in getting his school work organised. He has had to be seated close to teachers and his teachers have tried to be supportive. Grade 4 was a particularly bad year although Edgar improved subsequently. But there have been crises in every school year.

### BIRTH AND MEDICAL HISTORY

The baby received inadequate nourishment during the last two months of gestation because of placental insufficiency. Delivery was normal. Birth weight was below 5 lb. and there was a brief incubation period. The baby was hospitalised for one month after birth. Parents visited daily. Edgar has persistent diarrhea during his first two years of life. He was a poor eater. He had several illnesses (mononucleosis; hepatitis) until the age of five years. He still suffers from chronic colds, allergies and frequent ear aches.#

### PSYCHOLOGIST'S OBSERVATIONS

Edgar has a pleasant appearance with dark hair and brown eyes. He appears to be well oriented, alert, and quick to notice things in the environment. He appears to be sensitive to social cues. He tackled writing and drawing tasks with skill and speed and held a pencil well. He is right-handed. He speaks quickly and sometimes impulsively. He seemed troubled or preoccupied some of the time and seldom smiled. He was not as cheerful and lighthearted as most children his age. Nevertheless, he talked openly about himself and his interests. He also talked about what he saw as his failings, like his bad temper. He said that he did not read much, only rock magazines. He likes music, and watches lots of T.V. He likes movies with violence and horror in them. During the testing session there were several occasions when he would not listen through to the end of a question or when he was too impatient to think a response through. When a problem had too many variables he gave up.#

### TEST RESULTS AND SCORES

#### WECHSLER INTELLIGENCE SCALE FOR CHILDREN - REVISED (WISC-R) SCORES

VERBAL TESTS	scaled score		
Information	8		
Similarities	9		
Arithmetic	10		
Comprehension	10	Verbal IQ	98
Digit Span	(10)		

#### PERFORMANCE TESTS

Picture Completion	8		
Picture Arrangement	8		
Block Design	9		
Object Assembly	8		
Coding	15	Performance IQ	96
		Full Scale IQ	95

#### PEABODY INDIVIDUAL ACHIEVEMENT TEST (PIAT)

Reading and spelling ability are at his grade level. He read accurately and fluently. His intonation was appropriate. Questions about the paragraphs that he had read were answered accurately. His spelling to dictation was accurate (at the high Grade 6 level) and neatly written in cursive writing.

PIAT SCORE, GENERAL INFORMATION SUBTEST - GRADE 6.3

**DURREL ANALYSIS OF READING DIFFICULTY  
ORAL READING SUBTEST SCORE - GRADE 6, HIGH  
WIDE RANGE ACHIEVEMENT TEST (WRAT)**

Arithmetic knowledge rated at the Grade 4.9 level according to the WRAT. He understands all of the operations, is reasonably active in his computation, but does not appear to know how to do operations on fractions.

**WRAT SCORE, ARITHMETIC SUBTEST - GRADE 4.9.#**

**COMPOSITION**

Edgar was asked to write a story about a photograph that he was shown. (See copy.)  
No time limit was set.

(Spelling and punctuation are as in the original.)

I didn't have school today so I decided to stay home and play with my toys. I went to the corner of my room, and took out my playland set. I opened the box and took it out, I put it on my table to play with. I pretended they woke up and ate breakfast. After breakfast Jim went to spot his dog for a walk. Carl was playing with his baby Martha was sleeping at the table Steven went to wake her up. Then my mother said to come downstairs and to put away my playland set and come down for supper.#

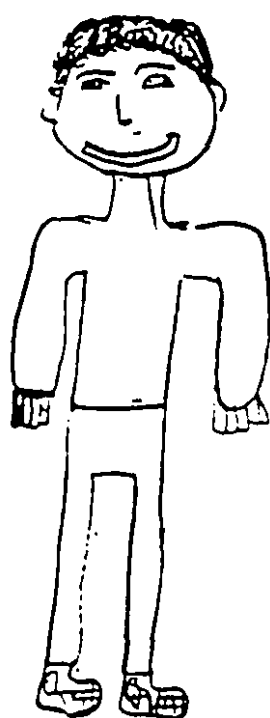
**GOODENOUGH-HARRIS DRAWING TEST**

Instructions to Edgar:

I'd like you to draw a person. Draw the best one you can.

(See drawing.)#





## APPENDIX B

### THE COUNSELOR ORIENTATION SCALE (COS)

The source pool for the Counselor Orientation Scale (COS) component items was a counselling-approach (orientation) comparison grid that appeared in Shertzer and Stone's *Fundamentals of Counseling* (1974, pp. 242-243)<sup>1</sup>. This grid compares nine counselling orientation across 10 characteristics (components) for each orientation. The 35 COS items were chosen to reflect 5 of the characteristics:

Nature of man - NM  
Nature of anxiety - N  
Counselling techniques - CT  
Personality constructs - PC  
Counselling goals - CG

for seven of the counseling orientations:

Behavioural - B  
Existential - E  
Freudian - F  
Trait-Factor - TF  
Client-Centred - CC  
Gestalt - G  
Rational-Emotive - RE

The COS respondent is asked to select one of four response choices: strongly agree (SA), agree (A), disagree (D), or strongly disagree (SD). These response choices are weighted such that SA = 4, A = 3, D = 2, and SD = 1. The score a respondent receives on each scale is the sum of the weightings of the five items for that scale (e.g., the Behavioural score is the sum of the weightings on items 1, 8, 15, 22 and 29). The score range for each of the seven orientation scales is 5 to 20.

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<sup>1</sup> Shertzer, B. & Stone, S. B. (1974). *Fundamentals of Counseling* (2nd ed.) (pp. 242-243). Boston: Houghton Mifflin.

The COS scale items (by number) with orientation and characteristic designations:

- |           |           |
|-----------|-----------|
| 1. B-NA   | 19. F-PC  |
| 2. CC-PC  | 20. RE-CG |
| 3. E-CG   | 21. TF-NA |
| 4. G-CT   | 22. B-CT  |
| 5. F-NA   | 23. CC-NA |
| 6. RE-NM  | 24. E-NM  |
| 7. TF-CG  | 25. G-PC  |
| 8. B-PC   | 26. F-CG  |
| 9. CC-CG  | 27. RE-CT |
| 10. E-CT  | 28. TF-NM |
| 11. G-NA  | 29. B-NA  |
| 12. F-NM  | 30. CC-NM |
| 13. RE-PC | 31. E-PC  |
| 14. TF-CT | 32. G-CG  |
| 15. B-CG  | 33. F-CT  |
| 16. CC-CT | 34. RE-NA |
| 17. E-NA  | 35. TF-PC |
| 18. G-NM  |           |



### THE COUNSELOR ORIENTATION SCALE ITEMS

Please circle one of the following four responses to each of the 35 questions below.

SA - strongly agree, A - agree, D - disagree, SD - strongly disagree

- 
- |     |   |    |   |   |    |
|-----|---|----|---|---|----|
| 1.  | People are mechanistic in that they are merely responsive to environments over which they have little control.  | SA | A | D | SD |
| 2.  | People are guided by their perceptions of themselves and their environment.   | SA | A | D | SD |
| 3.  | People are well adjusted when they experience existence in order to develop commitments and act on potentialities.  | SA | A | D | SD |
| 4.  | The best way to help people is to provide situations in which they can get closely and intensely in touch with themselves.                                    | SA | A | D | SD |
| 5.  | Anxiety is caused by unconscious conflicts in the mind.   | SA | A | D | SD |
| 6.  | People have the potential to be rational and can rid themselves of emotional difficulties through thinking.   | SA | A | D | SD |
| 7.  | People may be considered well adjusted when their characteristics and their environments are appropriately matched.   | SA | A | D | SD |
| 8.  | People's behaviours are determined by the antecedent conditions in operation at any given point in time.  | SA | A | D | SD |
| 9.  | The well-adjusted person is mature, self-directed, congruent, and open to new experiences.  | SA | A | D | SD |
| 10. | The best way to help people is to aid them in finding the meanings of their lives.  | SA | A | D | SD |
| 11. | Anxiety is the result of unresolved feelings about previous events.   | SA | A | D | SD |
| 12. | People are shaped by their needs, instincts, and drives.  | SA | A | D | SD |
| 13. | Psychological states are the result of either logical or illogical thought processes.   | SA | A | D | SD |
| 14. | The best way to help people is to match them to appropriate environments and show them how their skills and attitudes are appropriate for those environments. | SA | A | D | SD |

- |   |    |   |   |    |
|---|----|---|---|----|
| 15. Being well-adjusted means having learned behaviours that don't cause problems.  | SA | A | D | SD |
| 16. The best way to help people is to be open, accepting, and understanding of whatever they wish to communicate.                                   | SA | A | D | SD |
| 17. People become anxious when they lose sight of the purposes of their lives.  | SA | A | D | SD |
| 18. People are more than the sums of their parts; they are a coordination of the parts working as a whole.  | SA | A | D | SD |
| 19. Peoples's personalities are the composite results of all that has happened previously in their lives.   | SA | A | D | SD |
| 20. People will be well-adjusted when the vast majority of their behaviours are rational.   | SA | A | D | SD |
| 21. Uncertainty about the use of personal potential in appropriate situations results in anxiety.   | SA | A | D | SD |
| 22. The best way to help people is to aid them in learning behaviours that bring about desired reactions.   | SA | A | D | SD |
| 23. Incongruence between self-concept and personal experience leads to anxiety.   | SA | A | D | SD |
| 24. People are responsible only to themselves and must define their own meanings for their lives.   | SA | A | D | SD |
| 25. A person is a self-regulating system trying to balance between doing and thinking components.   | SA | A | D | SD |
| 26. In order to achieve maximum adjustment, people must reconstruct parts of their personalities.   | SA | A | D | SD |
| 27. The best way to help people is to use teaching and persuasion to help them eliminate irrational ideas from their lives.                         | SA | A | D | SD |
| 28. People are not capable of developing autonomously and need the assistance of others effectively to match their potential to their environments. | SA | A | D | SD |
| 29. People are anxious because they have learned inappropriate reactions to certain stimuli.  | SA | A | D | SD |
| 30. A person is in a constant state of movement toward self-actualisation.  | SA | A | D | SD |

- |     |   |    |   |   |    |
|-----|---|----|---|---|----|
| 31. | What people are or do is determined by the individual meanings in their lives.  | SA | A | D | SD |
| 32. | People are well-adjusted when they take responsibilities for their own lives and are in touch with themselves and the world.            | SA | A | D | SD |
| 33. | The best way to help people is to let them verbalise the source(s) of their problems.   | SA | A | D | SD |
| 34. | Anxiety is the result of overgeneralising the potentially negative effects of an event.   | SA | A | D | SD |
| 35. | People seek to organise and maintain their lives by matching their unique patterns of capabilities and potential to their environments. | SA | A | D | SD |

## RESEARCH PROJECT QUESTIONNAIRE

CITY PROVINCE POSTAL CODE

TELEPHONE BUSINESS----- HOME -----

DATE OF BIRTH -----  
D M Y

Subject Code \_\_\_\_\_

## EDUCATION

1. SECONDARY	DATE FROM	TO	COURSE OF STUDY	DIPLOMA OR DEGREE
.....	.....	.....	.....	.....








## 2. CGEP/ COMMUNITY COLLEGE

[illegible]

### 3. UNIVERSITY

[illegible]

#### 4. PROFESSIONAL

<p>  </p>	<p>  </p>	<p>  </p>	<p>  </p>	<p>  </p>
<p>  </p>	<p>  </p>	<p>  </p>	<p>  </p>	<p>  </p>

This image shows a full page of primary-ruled paper. It consists of multiple sets of three horizontal lines each: a solid top line, a dashed middle line, and a solid bottom line. These sets are repeated vertically down the entire page, providing a guide for letter height and placement in handwriting practice. The paper is otherwise blank, with no margins or additional markings.

**WORK EXPERIENCE.**

Beginning with present employment, describe the positions you have held. If you wish to provide more details on your experience, please use a separate sheet.

1. FROM/TO NAME AND ADDRESS OF ORGANISATION

-----  
-----  
-----

POSITION HELD

DUTIES AND RESPONSIBILITIES

-----  
-----  
-----

2. FROM/TO NAME AND ADDRESS OF ORGANISATION

-----  
-----  
-----

POSITION HELD

DUTIES AND RESPONSIBILITIES

-----  
-----  
-----

3. FROM/TO NAME AND ADDRESS OF ORGANISATION

-----  
-----  
-----

POSITION HELD

DUTIES AND RESPONSIBILITIES

-----  
-----  
-----

If you were conducting an assessment independently, what information would you seek? Specify the tests, assessment tools and techniques that you would use.

What kind of situations, with regard to the students you are asked to assess, do you encounter most frequently?

## **ADDITIONAL INFORMATION**

192



## APPENDIX D

### CODING PROCEDURES: GUIDELINES FOR CODERS

#### Coding Categories

Each segment of the subjects' protocols is coded according to the following categories (refer to the chart of protocol coding categories) and entered by segment number in the appropriate column on the coding forms alongside the proposition number(s) to which it refers. (See coding forms.)

1. **Quote**

The subject reads or quotes directly from the text, repeating the terms used in the original text of the case-file.

2. **Restatement (Paraphrase)**

The subject repeats information contained in the text using his or her own words, e.g., synonyms or substitution.

3. **Inference**

A transformation of information that goes beyond the text. For example, the subject draws a conclusion from the information contained in the file but that conclusion is nowhere explicitly stated in the file. Alternatively, the subject elaborates on the original text, that is, he or she adds to the basic information contained in the text.

3.1. **Inference Type A**

These are inferences that bear on the individual described in the case-file. These inferences are working definitions of subject-generated hypotheses or theories. Type A inferences are further subdivided into the following coding categories (3.1.1. to 3.1.5.).

3.1.1. **Educational**

The child is seen as experiencing learning difficulties that are related to problems that are usually classified as learning disabilities, e.g., attention deficits, perceptual problems, and dyslexias or disgraphias. Alternatively, the child is seen as doing well in all or some areas of school work.

3.1.2. **Emotional**

The child is seen as experiencing difficulties at home and/or at school that arise from emotional problems. This category includes socialisation difficulties. It excludes inferences that comment on the influence of significant others in the child's life, which are included under the category of contextual inferences.

3.1.3. Physiological

Inferences that pertain to the child's physical health, e.g., a statement that poor health interferes with learning, and inferences that relate to brain physiology, e.g., a statement that prenatal difficulties caused brain damage.

3.1.4. Contextual

Inferences that are descriptions of environmental influences that act upon the child, e.g., statements that are comments about how the parents deal with the child or statements about the child having some *behavioural* reaction to food additives.

3.1.5. Prescriptive

Inferences that are prescriptive, i.e. recommendations for remediation of perceived difficulties. These are subdivided according to whether the recommendations address a) educational, b) emotional, or c) physical factors.

a) Educational

Recommendations that the child's educational programme be modified in some way, e.g., that he be given extra tuition or that he should attend a certain type of high school or that further assessment of his abilities should be carried out.

b) Emotional

Recommendations that the child undergo psychotherapy, either alone or with members of his family. For example, therapy in which he could learn better stress management. Recommendations for further assessment of emotional and/or social functioning are also included in this subcategory.

c) Physical

Recommendations that the child should undergo medical or neurological examination and/or treatment.

Type A inferences belonging to the Educational, Emotional, Physiological, and Contextual categories (Sections 3.1.1-3.1.4) are given either a positive or a negative designation, depending on whether the subject has stated something positive or negative about the student, Edgar, or about his environment.

### 3.2. Inference Type B

Inferences that do not bear directly on the person being evaluated are coded under this category, e.g., a general statement that mathematics involves concentration. These are termed general statements.

### 4. Assessors' data requests

Assessors' requests for further information about the child and assessors' comments concerning data they would have liked to see included in the case-file.

### 5. Comparative (non-inferential) comments

Comments in which the child described in the case-file is compared to an individual or individuals that have been encountered in that assessor's previous professional or personal experience.

## Counting the Inferences

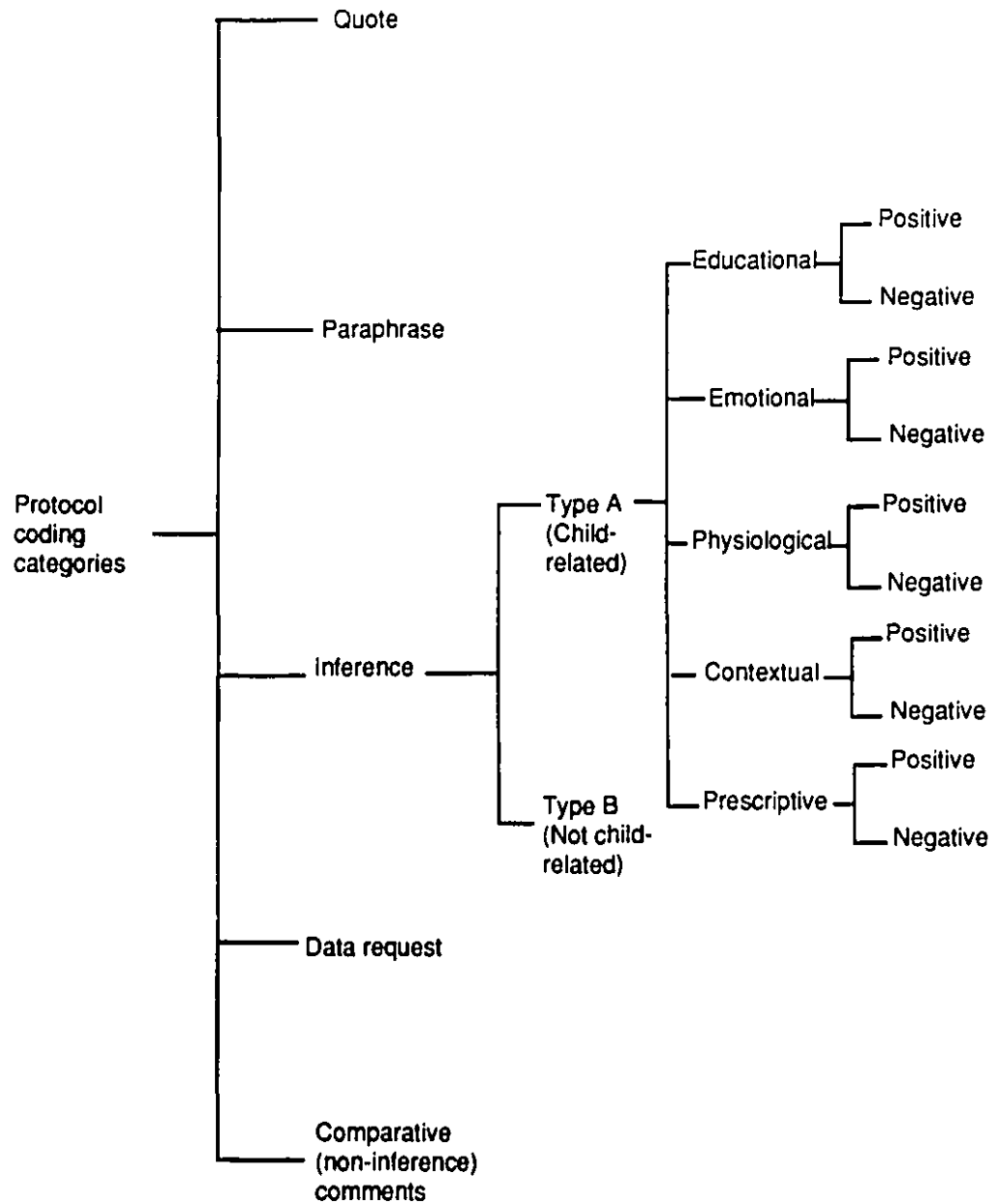
For each subject the inferences in each column of the coding form that contains the break-down of Inferences Type A inferences are counted. Initially only the inferences generated during the subjects' read through and/or reviews of the case-file are counted and not those generated during their summaries. Repetitions of inferences, based on the same text information (propositions), are not counted as new inferences. But, when subjects confirm previous inferences based on additional information (propositions), these are counted as new inferences.

The summaries are helpful in ascertaining whether or not inferences are retained or rejected. They are compared carefully with the protocols generated from the initial reading of the case-file so that repeated inferences are not counted more than once. Inferences mentioned in the summaries are only counted if they are new ones, in which case they are added to the inferences already tallied. Summaries are re-read in conjunction with the initial parts of the protocols to decide whether inferences are retained or rejected by the end of the subject's discussion of the case-file. Proposition numbers serve as guides to sections of the case-file that a subject reconsiders.

## Criteria for Rejection/Retention of Inferences

- a) Inferences that are explicitly rejected by subjects are counted as rejected.
- b) Inferences associated with explicitly rejected inferences that are not also associated with retained inferences are counted as rejected.
- c) Inferences, even when not mentioned in the summaries, are counted as retained when there is no discussion of contrary evidence anywhere in the protocol.

Chart of protocol coding categories





PAGE NO:  
SUBJECT CODE:

### CODING CATEGORIES (Cont.)

PROP NO	EDUCATIONAL	EMOTIONAL	PHYSIOLOGICAL	CONTEXTUAL	PRESCRIPTIVE
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+V0    -V0    +V0    -V0    +V0    -V0    +V0    -V0    PHYSICAL   EDUCATIONAL   EMOTIONAL

A full-page sheet of white graph paper with a black grid. The grid consists of small squares, approximately 10 units wide by 10 units high. There are no margins or additional markings on the page.

## APPENDIX E

### PROPOSITIONAL ANALYSIS OF CASE-FILE<sup>1</sup>

#### TOPIC 1

- 1.1.0      PROCESS: referral GOAL: 1.1.1 POS<sup>2</sup>  
 1.1.1      ACT: assessment ATT: psychoeducational POS  
 1.2.0      IDENTITY REL. ARG: name ARG: Edgar POS  
 1.3.0      IDENTITY REL. ARG: sex ARG: male POS  
 1.4.0      ALGEBRAIC REL. EQUIV. TEM: age  
             TEM: 12 yrs. 5 mo. POS  
 1.5.0      ALGEBRAIC REL. EQUIV. DUR: grade DUR: 6 POS

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<sup>1</sup> Abbreviated relation labels are expanded as follows:

ARG: ARGUMENT	OBJ: OBJECT
ATT: ATTRIBUTE	OR-ALT: OR ALTERNATIVE
CAT: CATEGORY	ORD: ORDER
CONT: CONTINUOUS	PAT: PATIENT
DEF. NUM: DEFINITE NUMBER	PL: PLURAL
DEG: DEGREE	POS: POSITIVE
DET: DETERMINED	PRES: PRESENT
DUR: DURATION	PROX: PROXIMITY
EQUIV: EQUIVALENCE	QUAL: QUALIFYING
FUT: FUTURE	QUES: QUESTION
ITER: ITERATIVE	R. ACT: RELATED ACT
LOC: LOCATION	SING: SINGULAR
MULT: MULTIPLE	SUP: SUPERORDINATE
NEG: NEGATIVE	TOK: TOKEN
NUM: NUMBER	PRT: PART

<sup>2</sup> Upper case indicates a relationship and lower case indicates a concept.

1.6.0 ALGEBRAIC REL. EQUIV. TEM: date  
TEM: Jan. 1988 POS

1.7.0 ACT: referred AGENT: parents PAST POS

## TOPIC 2

2.1.0 PROCESS: problem DUR: presenting PRES.POS

2.2.0 PROCESS: learning difficulties PAT: Edgar  
DUR: longstanding PAST CONT. POS

2.3.0 ACT: investigation TEM: previous PAST ITER.(s) POS

2.4.0 ACT: help RECIPIENT: he THEME: 2.4.1 ATT: remedial  
PAST POS

2.4.1 ACT: work ATT: school POS

2.5.0 OBJECT: he LOC: Grade 6 TEM: now POS

2.6.0 ACT: manifesting AGENT: he R.ACT: 2.6.1 (difficulties)  
PRES. CONT. POS

2.6.1 PROCESS: difficulties ATT: behaviour POS

2.7.0 ACT: want PAT: parents GOAL: 2.7.2 PRES. POS

2.7.1 \*POSSESSION\* PAT: his OBJ: parents  
DEF. NUM. PLURAL POS

2.7.2 ACT: reevaluated OBJ: him GOAL: 2.7.3 POS

2.7.3 ACT: help THEME: 2.7.4 POS

2.7.4 ACT: plan ACT: 2.7.5 POS

2.7.5 ACT: schooling TEM: next year POS

2.7.6 ACT: enter AGENT he RESULT: 2.7.7  
TEM: when FUT. POS

2.7.7 OBJECT: he LOC: high school POS

2.7.8 ALGEBRAIC REL. EQUIV. TEM: 2.7.5  
EQUIV. TEM: 2.7.6 POS



2.8.0 ACT: would like PAT: they THEME: 2.8.1 PRES. POS  
 2.8.1 PROCESS: advice THEME: 2.8.2 (about) PRES. POS  
 2.8.2 PROCESS: deal AGENT: they THEME: 2.8.3 (behaviour)  
 QUES: how POS  
 2.8.3 PROCESS: behaviour ATT: difficult POS (PAT: Edgar  
 OBJ: behaviour)

### TOPIC 3

3.1.0 PROCESS: report AGENT: parents POS  
 3.2.0 OBJECT: family ATT: intact PRES. POS  
 3.3.0 PROCESS: situation PAT: their  
 ATT: financial PRES. POS  
 3.3.1 PROCESS: situation ATT: stable ATT: good  
 3.4.0 PROCESS: history PAT: family THEME: 3.4.1 PRES. POS  
 3.4.1 PROCESS: difficulties ATT: learning PAST CONT. POS  
 3.5.0 ALGEBRAIC REL. ORDER. SUP. ATT: 3.5.1  
 ATT: 3.5.2 PRES. POS  
 3.5.1 OBJECT: Edgar ATT: (age) POS  
 3.5.2 OBJECT: boys DEF. NUM: two ATT: (age) POS  
 3.5.3 OBJECT: Edgar ATT: eldest POS  
 3.6.0 IDENTITY REL. ARG: he ARG: baby  
 ATT: active DEF. NUM. SING. PAST POS  
 3.6.1 PROCESS: like PAT: who \*baby\*  
 THEME: 3.6.2 PAST NEG  
 3.6.2 ACT: touch OBJ: who \*baby\* ITER. MULT. (being) POS  
 3.7.0 ACT: all PART REL. ACT: crawling  
 PART REL. ACT: walking  
 PART REL. ACT: talking TEM: normal times  
 PAST POS

- 3.8.0 PROCESS: problems THEME: 3.8.1 PAST NEG  
 3.8.1 PROCESS: training ATT: toilet POS
- 3.9.0 ACT: observed OBJ: he THEME: 3.9.1  
 LOC: nursery school PAST POS  
 3.9.1 OBJECT: he ATT: coordinated  
 DEGREE: poorly POS
- 3.10.0 ACT: mix with AGENT: he OBJ: children DET. TOK.  
 NUM. PL. PAST NEG  
 3.10.1 OBJECT: children CATEGORY: other POS
- 3.11.0 ACT: tries PAT: he DEG: hard  
 RECIPIENT: friends PRES. POS
- 3.12.0 PROCESS: like OBJ: he ATT: liked  
 DEGREE: well LOC: school PRES. POS
- 3.13.0 OBJECT: he IS A: child PRES. POS  
 3.13.1 OBJECT: he ATT: demanding PRES. POS
- 3.14.0 OBJECT: he ATT: scattered PRES. POS  
 3.14.1 OBJECT: he ATT: impulsive PRES. POS  
 3.14.2 OBJECT: he ATT: immature PRES. POS
- 3.15.0 ACT: engages PAT: he ACT: 3.15.1 PRES. ITER. POS  
 3.15.1 PROCESS: behaviours ATT: repetitive POS
- 3.16.0 ACT: has PAT: he PROCESS: temper PRES. POS  
 3.16.1 PROCESS: temper ATT: quick
- 3.17.0 ACT: frustrated OBJ: he ATT: easily PRES. POS
- 3.18.0 ACT: teases AGENT: he PRES. CONT. POS  
 3.18.1 OBJECT: brothers NUM: two ATT: (age) POS  
 3.18.2 OBJECT: he ATT: (age) POS  
 3.18.3 ALGEBRAIC REL. ORD: younger ATT: 3.18.1 ATT: 3.19.2  
 POS  
 3.18.4 PROCESS: (EMPTY) PAT: his OBJ: brothers

DEF. NUM: two POS

- 3.19.0 OBJECT: he IS A: worry PRES. POS
- 3.20.0 ACT: list AGENT: parents OBJ: areas PRES. POS
- 3.20.1 OBJECT: areas ATT: following POS
- 3.20.2 OBJECT: areas ATT: problem POS
- 3.20.3 \*POSSESSION\* PAT: Edgar OBJ: parents POS
- 3.20.4 IDENTITY REL.: areas IS A: 3.20.5 POS
- 3.20.5 ACT: following OBJ: teachers LOC: class POS
- 3.20.6 IDENTITY REL.: areas IS A: sequencing POS
- 3.20.7 IDENTITY REL.: areas IS A: problem solving POS
- 3.20.8 IDENTITY REL.: areas IS A: following directions POS
- 3.20.9 IDENTITY REL.: areas IS A: attention span POS
- 3.20.10 IDENTITY REL.: areas IS A: making-inferences POS
- 3.20.11 IDENTITY REL.: areas IS A: abstracting POS
- 3.20.12 IDENTITY REL.: areas IS A: 3.20.13 POS
- 3.20.13 PROCESS: remembering THEME: 3.20.14 (what) POS
- 3.20.14 ACT: told AGENT: (EMPTY) RECIPIENT: he PRES.  
ITER. MULT. POS
- 3.20.15 IDENTITY REL.: areas IS A: 3.20.16, 3.20.17 POS
- 3.20.16 PROCESS: needs PAT: he ACT: supervision PRES. CONT.  
POS
- 3.20.17 PROCESS: needs PAT: he ACT: structure PRES. ITER.  
MULT.POS

#### TOPIC 4

- 4.1.0 PROCESS: comments AGENT: school POS
- 4.2.0 PROCESS: enrolled OBJ: Edgar  
RESULT: 4.2.1 PRES. POS
- 4.2.1 OBJECT: Edgar LOC: programme POS
- 4.2.2 OBJECT: programme ATT: bilingual POS
- 4.3.0 PROCESS: skills ATT: basic-level POS
- 4.3.1 PROCESS: skills CATEGORY: attention, attitude,  
concentration POS

- 4.3.2 PROCESS: skills PART. REL. gaps PRES. POS
- 4.4.0 PROCESS: committed PAT: he THEME: 4.4.1 PRES. NEG  
4.4.1 PROCESS: work PAT: he ATT: school POS
- 4.5.0 PROCESS: skills PAT: his CATEGORY: math ATT: weak  
PRES. POS
- 4.6.0 PROCESS: understanding PAT: his  
THEME: 4.6.1 ATT: limited PRES. POS  
4.6.1 OBJECT: subject DEF. NUM. SNG. (this) POS
- 4.7.0 PROCESS: needs PAT: he ACT: 4.7.1 PRES. POS  
4.7.1 ACT: organised ACT: 4.7.2 FUT. (getting) POS  
4.7.2 ACT: work OBJ: his ATT: school POS
- 4.8.0 ACT: seat OBJ: he RESULT: 4.8.1 PAST ROOT (had)  
POS  
4.8.1 ALGEBRAIC REL. PROX. OBJ: he  
LOC. OBJ: teacher TOK. NUM. PL. POS
- 4.9.0 PROCESS: tried PAT: his AGENT: teachers  
ACT: supportive PAST. POS
- 4.10.0 IDENTITY REL.: Grade 4 ARG: 4.10.1  
4.10.1 PROCESS: year ATT: bad  
DEG: particularly POS
- 4.11.0 PROCESS: improved PAT: Edgar PAST. POS  
4.11.1 PROCESS: improved ORD. TEM: subsequently POS
- 4.12.0 OBJECT: crises TEM: 4.12.1 PAST ITER. (every) POS  
4.12.1 OBJECT: year ATT: every POS

## TOPIC 5

- 5.1.00 PROCESS: history ATT: medical  
5.1.0 ACT: nourishment RECIPIENT: baby

ATT: inadequate PAST POS

- 5.1.1 PROCESS: gestation PART REL: last  
TEM. MEASURE: two months POS
- 5.1.2 ALGEBRAIC REL. EQUIV. TEM: 5.1.0  
EQUIV. TEM: 5.1.1 POS
- 5.1.3 CAUSE DEPENDENT. ARG: 5.1.4  
DEPENDENT. ARG: 5.1.0 POS
- 5.1.4 PROCESS: insufficiency PAT: placental POS
- 5.2.0 ACT: delivery ATT: normal PAST POS
- 5.3.0 OBJECT: (EMPTY) ATT: weight TEM: birth POS
- 5.3.1 OBJECT: (EMPTY) ATT: weight  
DEGREE. MEASURE: 5 pounds POS
- 5.3.2 ALGEBRAIC REL. ORDER: 5.3.1 ATT: 5.3.0 (below) POS
- 5.4.0 PROCESS: period DUR: brief  
ATT: incubation PAST POS
- 5.5.0 ACT: hospitalise OBJ: baby DUR: one month PAST POS
- 5.5.1 ACT: birth POS
- 5.5.2 ALGEBRAIC REL. ORD. TEM: 5.5.1 TEM: 5.5.0 (after)  
POS
- 5.6.0 ACT: visited AGENT: parents TEM: daily PAST ITER.  
MULT. POS
- 5.7.0 PROCESS: diarrhea PAT: Edgar  
ATT: persistent PAST ITER. MULT. POS
- 5.7.1 PROCESS: life PAT: his  
PART. REL. PROCESS: first  
TEM. MEASURE: two years POS
- 5.7.2 ALGEBRAIC REL. EQUIV. TEM: 5.7.0  
TEM: 5.7.1 POS
- 5.8.0 ACT: eat AGENT: he ATT: poor PAST POS
- 5.9.0 PROCESS: illnesses PAT: he

PAST ITER. MULT: several POS

- 5.9.1 PROCESS: illnesses IS A. PART REL.  
PROCESS: mononucleosis  
PART REL. PROCESS: hepatitis POS
- 5.9.2 OBJECT: (EMPTY) ATT: age  
DEG. MEASURE: 5 years TEM: (EMPTY) POS
- 5.9.3 ALGEBRAIC REL. ORD. TEM: 5.9.0 TEM: 5.9.2 POS
- 5.10.0 PROCESS: suffers PAT: he  
THEME: allergies, 5.10.1, 5.10.2 PRES CONT POS
- 5.10.1 PROCESS: colds ATT: chronic POS
- 5.10.2 PROCESS: aches LOC: ear ATT: frequent POS

#### TOPIC 6

- 6.1.0 PROCESS: Observations PAT: Psychologist POS
- 6.2.0 OBJECT: Edgar ATT: appearance  
ATT: pleasant PRES. POS
- 6.2.1 OBJECT: Edgar PART REL: eyes PLUR.  
PART REL: hair PRES. POS
- 6.2.2 OBJECT: hair ATT: dark POS
- 6.2.3 OBJECT: eyes PLUR. ATT: brown POS
- 6.3.0 PROCESS: appear THEME: 6.3.1, 6.3.2, 6.3.3 PRES. POS
- 6.3.1 OBJECT: he ATT: well-oriented POS
- 6.3.2 OBJECT: he ATT: alert POS
- 6.3.3 ACT: notice AGENT: he OBJECT: things ATT: quick  
POS
- 6.3.4 OBJECT: things LOC: environment POS
- 6.4.0 PROCESS: appears THEME: 6.4.1 PRES. POS
- 6.4.1 PROCESS: sensitive to PAT: he  
THEME: 6.4.2 POS
- 6.4.2 ACT: cue ATT: social ITER. MULT (s) POS

- 6.5.0 ACT: tackled AGENT: he ACT: 6.5.1, 6.5.2 ATT: with  
skill, speed PAST POS
- 6.5.1 OBJECT: tasks ATT: writing POS
- 6.5.2 OBJECT: tasks ATT: drawing POS
- 6.6.0 ACT: held AGENT: he OBJECT: pencil  
ATT: well PAST POS
- 6.7.0 OBJECT: he ATT: right-handed PRES. POS
- 6.8.0 PROCESS: speaks PAT: he ATT: quickly POS
- 6.8.1 PROCESS: speaks PAT: he ATT: impulsively  
QUAL: sometimes POS
- 6.9.0 PROCESS: seemed THEME: 6.9.1 QUAL: of the time  
PAST POS
- 6.9.1 OR-ALT CONJOINT ARG: 6.9.2  
CONJOINT ARG: 6.9.3 POS
- 6.9.2 OBJECT: he ATT: troubled POS
- 6.9.3 OBJECT: he ATT: preoccupied POS
- 6.10.0 PROCESS: smiled PAT: he TEM: seldom PAST POS
- 6.11.0 ALGEBRAIC REL. EQUIV. ATT: 6.11.1  
ATT: 6.11.2 PAST NEG
- 6.11.1 OBJECT: he ATT: cheerful ATT: light-hearted ATT: age  
POS
- 6.11.2 OBJECT: children NUMBER: most  
ATT: cheerful  
ATT: light-hearted ATT: age DEG: his POS
- 6.11.3 ALGEBRAIC REL. EQUIV. DEG: 6.11.1  
DEG: 6.11.2 POS
- 6.12.0 ACT: talk AGENT: he THEME: himself, 6.12.1  
ATT: openly PAST POS
- 6.12.1 PROCESS: interests PAT: his POS
- 6.13.0 ACT: talk AGENT: he THEME: 6.13.1 PAST POS
- 6.13.1 ACT: saw AGENT: he ACT. REL: 6.13.2 PAST POS
- 6.13.2 IDENTITY. REL. ARG: what ARG: 6.13.3 POS

6.13.3 PROCESS: failings PAT: his  
PART. PROCESS: bad temper POS

6.14.0 ACT: said AGENT: he THEME: \*that\* 6.14.1 PAST POS  
6.14.1 ACT: read AGENT: he DEG: much PRES. NEG  
6.14.2 ACT: read AGENT: he OBJ: 6.14.3 PRES. POS  
6.14.3 OBJECT: magazines THEME: rock POS

6.15.0 PROCESS: likes PAT: he OBJ: music PRES. POS

6.16.0 PROCESS: watches PAT: he OBJ: TV  
DEG: lots PRES. POS

6.17.0 PROCESS: likes PAT: he OBJ: 6.17.1  
6.17.1 OBJECT: movies THEME: violence, horror

6.18.0 ACT: session PART: 6.18.1 PAST POS  
6.18.1 OR-ALT CONJOINT ARG: 6.18.2  
CONJOINT ARG: 6.18.4 ITER. MULT: several  
occasions POS

6.18.2 ACT: listen AGENT: he THEME: 6.18.3  
DUR: through NEG

6.18.3 ACT: question PART: end POS

6.18.4 BINARY DEPENDENCY DEPENDENT ARG: 6.18.5  
DEPENDENT ARG: 6.18.6 PAST POS

6.18.5 PROCESS: impatient PAT: he ATT: too PAST POS  
6.18.6 ACT: think through ACT REL: response POS

6.19.0 ACT: problem PART: 6.19.1 TEM: when PAST POS  
6.19.1 ACT: variables ATT: many DEG: too POS  
6.19.2 ACT: give-up AGENT: he PAST POS  
6.19.3 ALGEBRAIC REL. EQUIV. TEM: 6.19.0  
TEM: 6.19.2 POS

## TOPIC 7

7.1.0 OBJECT: Test Results POS  
7.1.1 OBJECT: Scores POS



- 7.2.0      PROCESS: Wechsler Intelligence Scale for Children - Revised  
(WISC-R) Scores POS
- 7.3.0      PROCESS. Tests PART: Verbal POS
- 7.4.0      ALGEBRAIC REL. EQUIV. NUM: Information scaled score  
EQUIV: 8 POS
- 7.5.0      ALGEBRAIC REL. EQUIV. NUM: Similarities scaled score  
EQUIV: 9 POS
- 7.6.0      ALGEBRAIC REL. EQUIV. NUM: Arithmetic scaled score  
EQUIV: 9 POS
- 7.7.0      ALGEBRAIC REL. EQUIV. NUM: Vocabulary scaled score  
EQUIV: 10 POS
- 7.8.0      ALGEBRAIC REL. EQUIV. NUM: Comprehension scaled  
score EQUIV: 10 POS
- 7.9.0      ALGEBRAIC REL. EQUIV. NUM: Digit Span scaled score  
EQUIV: (10) POS
- 7.10.0     ALGEBRAIC REL. EQUIV. NUM: Verbal IQ EQUIV: 98  
POS
- 7.11.0     PROCESS: Tests PART: Performance POS
- 7.12.0     ALGEBRAIC REL. EQUIV. NUM: Picture Completion scaled  
score EQUIV: 8 POS
- 7.13.0     ALGEBRAIC REL. EQUIV. NUM: Picture Arrangement scaled  
score EQUIV: 8 POS
- 7.14.0     ALGEBRAIC REL. EQUIV. NUM: Block Design scaled score  
EQUIV: 9 POS
- 7.15.0     ALGEBRAIC REL. EQUIV. NUM: Object Assembly scaled  
score EQUIV: 8 POS

- 7.16.0 ALGEBRAIC REL. EQUIV. NUM: Coding scaled score  
EQUIV: 15 POS
- 7.17.0 ALGEBRAIC REL. EQUIV. NUM: Performance IQ  
EQUIV: 96 POS
- 7.18.0 ALGEBRAIC REL. EQUIV. NUM: Full Scale IQ  
EQUIV: 95 POS
- 7.19.0 PROCESS: Peabody Individual Achievement Test (PIAT) POS
- 7.20.0 PROCESS: ability CAT: reading, spelling ATT: grade level  
POS
- 7.21.0 PROCESS: read PAT: he ATT: fluently  
ATT: accurately PAST POS
- 7.22.0 PROCESS: intonation PAT: his  
ATT: appropriate PAST POS
- 7.23.0 OBJECT: questions THEME: 7.23.1 POS  
7.23.1 ACT: answered ATT: accurately  
PROCESS: 7.23.2. PAST POS  
7.23.2 PROCESS: read PAT: he OBJ: paragraphs PAST COMP.  
POS
- 7.24.0 BINARY DEPENDENCY COND. ARG: dictation  
ARG: 7.24.1, 7.24.2 PAST POS  
7.24.1 PROCESS: spelling PAT: his ATT: accurate DEG: high  
Grade six level PAST POS  
7.24.2 PROCESS: spelling PAT: his ATT: written ATT: neatly  
ATT: cursive writing PAST POS
- 7.25.0 OBJECT: PIAT Score PRT: General Information Subtest  
ATT: Grade 6.3 POS
- 7.26.0 PROCESS: Durrell Analysis of Reading Difficulty  
PART: Oral Reading Subtest Score  
ATT: Grade 6, high POS

- 7.27.0 PROCESS: Wide Range Achievement Test (WRAT) POS
- 7.28.0 ACT: rate ACT REL: 7.28.1  
RESULT REL: 7.28.2 INSTRUMENT REL: WRAT  
PRES. POS
- 7.28.1 PROCESS: knowledge CAT: arithmetic POS
- 7.28.2 PROCESS: knowledge ATT: Grade 4.9 level POS
- 7.29.0 PROCESS: understands PAT: he  
ACT: operations PRES. POS
- 7.29.1 ACT: operations NUM: all POS
- 7.30.0 ACT: computation AGENT: he ATT: active  
DEG: reasonably PRES. POS
- 7.31.0 PROCESS: appears THEME: 7.31.1 PRES. NEG
- 7.31.1 ACT: know AGENT: he THEME: 7.31.2 POS
- 7.31.2 ACT: do ACT REL: 7.31.3 ATT: how POS
- 7.31.3 ACT: operations PROCESS REL: fractions ITER. MULT (s)  
POS
- 7.32.0 ALGEBRAIC REL. EQUIV. NUM: WRAT Score, Arithmetic  
Subtest EQUIV: Grade 4.9 POS

## TOPIC 8

### 8.1.0 COMPOSITION<sup>3</sup>

## TOPIC 9

### 9.1.0 DRAWING

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<sup>3</sup> The composition and the drawing (Topics 8 and 9) were not analysed as propositions.

## APPENDIX F

LINEARISED REPRESENTATION OF INFORMATION CONTAINED  
IN CASE-FILE<sup>1</sup>

## FAMILY

## [FAMILY]-

(CAT)→[CASE]→(ATT)→[1.4.0 age]→(DEG)→[\*x]  
 (CAT)→[brother 1]→(ATT)→[age]→(DEG)→[\*y<\*x]  
 (CAT)→[brother 2]→(ATT)→[age]→(DEG)→[\*z<\*x]<sup>3.5.0-3</sup>  
 (ATT)→[intact]<sup>1.2.0</sup>  
 (PAT)→[situation]-  
     (ATT)→[financial]  
     (ATT)→[stable]  
     (ATT)→[good],<sup>3.3.0-2</sup>  
 (PAT)→[family history]→(THM)→[learning  
     difficulties]<sup>3.4.0-1</sup>

## PARENTS' GOALS

## [PARENTS]-

(PAT)→[want]→(GOAL)→[CASE]-  
     (OBJ)→[2.3.0 evaluate]→(GOAL)→[plan]→(R.PROC)→  
     [PROC:\*p=schooling]→(TEM)→[TIME:\*t=next year],  
     (PAT)→[enter]-  
         (TEM)→[TIME:\*t=when]  
     (R.PROC)→[PROC:\*p=highschool],<sup>2.7.0-8</sup>  
 (PAT)→[would like]→(GOAL)→[advice]→(THM)→[PROC:\*p=deal  
     with]  
 (AGT)→[PROC:\*p=deal with]-  
     (PART)→[?(how)]  
     (R.ACT)→[2.6.1 difficult  
         behaviour]-<sup>2.8.0-3</sup>  
     (PAT)→[CASE]

## CHARACTERISTICS-CURRENT

## [CASE]-

(ATT)→[name]→(IDENT)→[Edgar]<sup>1.2.0</sup>  
 (ATT)→[sex]→(IDENT)→[male]<sup>1.3.0</sup>

[CASE]-

(ATT)→[age]→(DEG)→[12yrs.5mo.]<sup>1.4.0</sup>

(ATT)→[grade]→(DEG)→[6]<sup>1.5.0</sup>

(ATT)→[scattered]<sup>3.14.0</sup>

(ATT)→[impulsive]<sup>3.14.1</sup>

(ATT)→[immature]<sup>3.14.2</sup>

(ATT)→[appearance]→(ATT)→[pleasant]<sup>0.2.0</sup>

(PART)→[hair]→(ATT)→[dark]

(PART)→[eyes]→(ATT)→[brown]<sup>0.2.1.3</sup>

-[appears]←(PAT)←[psych.]<sup>0.3.0</sup>

(ATT)→[well-oriented]←(THM)<sup>6.3.1</sup>

(ATT)→[alert]←(THM)<sup>6.3.2</sup>

(ATT)→[quick]→(R.ACT)→[notice]→(OBJ)→  
[things]→(LOC)→[environment]<sup>6.3.3-4</sup>

-[appears]→(PAT)←[psych.]<sup>0.4.0</sup>

(PAT)→[sensitive]→(THM)→[cues]→(ATT)→[social]<sup>0.4.1.2</sup>

(ATT)→[right-handed]<sup>6.7.0</sup>

-[some of the time]

←(ITER)←[seemed]←(PAT)←[psych.]<sup>0.9.0-1</sup>

(ATT)→[troubled]←(THM)<sup>6.9.2</sup>

(ATT)→[preoccupied]←(THM)<sup>6.9.3</sup>

(PAT)→[smiled]→(ITER)→[seldom]<sup>6.10.0</sup>

(ATT)→[cheerful]→(DEG)→[\*x=x<sub>1</sub>]

(ATT)→[lighthearted]→(DEG)→[\*y=y<sub>1</sub>]

(ATT)→[1.4.0 age]→(EQUIV)→[age]→(ATT)→[other children]-

x<sub>1</sub><x<sub>2</sub> (ATT)→[cheerful]→(DEG)→[\*x=x<sub>2</sub>]

y<sub>1</sub><y<sub>2</sub> (ATT)→[lighthearted]→(DEG)→[\*y=y<sub>2</sub>],<sup>6.11.0-3</sup>

(ATT)→[impatient]-

(COND)→[PROC:\*p=think thro']→(R.ACT)→[response]

(DEG)→[too],

(PAT)→[PROC:\*p=think through]<sup>6.18.4-6</sup>

## CHARACTERISTICS-PAST

[CASE]-

(OBJ)←[born]→(TEM)→[birthdate:\*t<sub>1</sub>]

(ATT)→[weight]-

(TEM)→[birth:\*t<sub>2</sub>]t<sub>1</sub>=t<sub>2</sub>(DEG)→[\*d],<sup>5.3.0-2</sup>

d&lt;5lb

(AGT)→[eat]→(ATT)→[poor(ly)]<sup>5.8.0</sup>

(PAT)→[coordinated]-

(DEG)→[poorly]

(THM)→[observed]→(LOC)→[nursery school],<sup>3.9.0-1</sup>

## EVENTS-CURRENT

[CASE]-

(AGT)→[do/take]-

(R.ACT)→[tc:t]

(TEM)→[Jan.88],<sup>1.6.0</sup>(OBJ)→[refer]←(AGT)←[PARENTS]<sup>1.7.0</sup>

(AGT)→[tackle]-

(R.ACT)→[tasks]-

(CAT)→[writing]

(CAT)→[drawing].

(ATT)→[with skill]

(ATT)→[with speed],<sup>6.3.0-2</sup>

(AGT)→[held]-

(OBJ)→[pencil]

(ATT)→[well],<sup>6.6.0</sup>

(PAT)→[have interests:\*x]

(AGT)→[talked]-

(THM)→[himself]

(THM)→[interests:\*x]

(ATT)→[openly],<sup>6.12.0-1</sup>

(AGT)→[talked]→(THM)→[3.16.0 temper:\*x]

(PAT)→[have temper:\*x]→(ATT)→[bad]<sup>6.13.0-3</sup>

**[CASE]-**

(AGT)→[listen]-

(TRUTH VALUE)→[NEGATIVE]

(TEM)→[thro'to:\*t=t<sub>1</sub>]→(EQUIV)→[testing  
session]

(THM)→[questions]-

(TEM)→[\*t=t<sub>2</sub>](PART)→[end],<sup>6.18.0-3</sup>

(AGT)→[gave up]←(COND)←[problem]→(PART)→

[variables]→(NUM)→[many]→(DEG)→[too]<sup>6.19.0-3</sup>**EVENTS-PAST****[CASE]-**(PAT)→[learning difficulties]→(ITER)→[longstanding]<sup>2.2.0</sup>

(R.OBJ)→[2.7.0 investigation=evaluation]-

(ITER)→[plural]

(TEM)→[previous],<sup>2.3.0</sup>

(REC)←[help]-

(ATT)→[remedial]

(THM)→[4.7.2 work]→(ATT)→[school],<sup>2.4.0-1</sup>

(PAT)→[crawling]-

(INCP)→[begin]

(TEM)→[normal],

(PAT)→[walking]-

(INCP)→[begin]

(TEM)→[normal],

(PAT)→[talking]-

(INCP)→[begin]

(TEM)→[normal],<sup>3.7.0</sup>

(PAT)→[seated]-

(ITER)→[plural]

(LOC)→[\*l=l<sub>1</sub>], [teacher]→(LOC)→[\*l=l<sub>2</sub>][l<sub>1</sub>]-(DIST)→[l<sub>2</sub>](DIST)→[close],<sup>4.8.0-1</sup>

[CASE]-

(PAT)→[happenings]-

(ATT)→[bad]→(DEG)→[particularly]

(TEM)→[Gr.4: \*t=t<sub>1</sub>],<sup>4.10.0-1</sup> [t<sub>2</sub>]←(ORD >)→[t<sub>1</sub>]

(PAT)→[improved]→(TEM)→[subsequently: \*t=t<sub>2</sub>],<sup>4.11.0-1</sup>

(PAT)→[crises]-

(ITER)→[every]

(TEM)→[school year],<sup>4.12.0-1</sup>

(PAT)→[last part gestation]-

(DUR)→[2mo.]

(TEM)→[\*x=x<sub>1</sub>],<sup>5.1.1</sup>

(REC)←[received]-

(OBJ)→[nourishment]→(DEG)→[inadequate]<sup>5.1.0</sup>

(TEM)→[\*x=x<sub>2</sub>]<sup>x<sub>1</sub>=x<sub>2</sub></sup>

(CAU)←[placental insufficiency],<sup>5.1.2-4</sup>

(PAT)→[delivery]→(ATT)→[normal]<sup>5.2.0</sup>

(PAT)→[incubation]→(DUR)→[period]→(MEASURE)→[brief]<sup>5.4.0</sup>

(placed in incubator)

(LOC)→[hospital]-

(DUR)→[one month] t<sub>4</sub>>t<sub>3</sub>

(TEM)→[\*t=t<sub>4</sub>], t<sub>4</sub>=t<sub>1</sub> (see birth date)

t<sub>4</sub>]←(ORD:TEM)→[t<sub>3</sub>]

(after)

(PAT)→[birth]→(TEM)→[\*t=t<sub>3</sub>]<sup>5.5.0-2</sup>

(OBJ)→[visited]-

(PAT)→[PARENTS]

(ITER)→[daily],<sup>5.6.0</sup>

## PROCESSES-CURRENT

[CASE]-

(AGT)→[manifesting]→(R.ACT)→[2.8.3 behaviour difficulties]<sup>2.6.0-1</sup>

(PAT)→[tries]-

(ATT)→[hard]

(TEM)→[now]

(GOAL)→[?]-

(PAT)→[CASE]

(REC)→[friends],<sup>3.11.0</sup>



[CASE]-  
 (OBJ)→[liked]-  
     (ATT)→[well]  
     (PAT)→[CASE]  
     (LOC)→[school],<sup>3.12.0</sup>  
 (PAT)→[engages]→(R.ACT)→[behaviours]→(ITER)→  
     [repetitive]<sup>3.15.0-1</sup>  
 (PAT)→[6.13.3 losses temper]→(ATT)→[quickly]<sup>3.16.0-1</sup>  
 (PAT)→[frustrate]→(ATT)→[easily]<sup>3.17.0</sup>  
 (AGT)→[teases]→(R.OBJ)→[3.5.0-3 brothers]<sup>3.18.0-4</sup>  
 (CAU)→[worry]←(PAT)←[PARENTS]<sup>3.19.0</sup>  
     [PARENTS]→(AGT)→[list]→(THM)→[problem areas]<sup>3.20.0-1</sup>  
 (PAT)→(follow)-  
     (LOC)→[class]  
     (THM)→[teacher's (instructions)]<sup>3.20.4-5</sup>  
     (IS A)→  
 (PAT)→[sequencing]→(IS A)→<sup>3.20.6</sup>  
 (PAT)→[problem-solving]→(IS A)<sup>3.20.7</sup>  
 (PAT)→[following]-  
     (THM)→[directions]<sup>3.20.8</sup>  
     (IS A)→  
 (PAT)→[attention]-  
     (ATT)→[span]<sup>3.20.9</sup>  
     (IS A)→  
 (PAT)→[making inferences]→(IS A)→<sup>3.20.11</sup>  
 (PAT)→[abstracting]→(IS A)<sup>3.20.12</sup>  
 (PAT)→[remembering]-  
     (THM)→[what]←(THM)←[tell]-  
         (PAT)←[]  
         (REC)→[CASE]<sup>3.20.13-14</sup>  
     (IS A)→  
 (PAT)→[needs]-  
     (R.PROC)→[supervision]→(ITER)→[constant]<sup>3.20.16</sup>  
     (IS A)→  
 (PAT)→[needs]-  
     (R.OBJ)→[structure]<sup>3.20.17</sup>  
     (IS A)→  
 (PAT)→[enrolled]→(LOC)→[programme]→(ATT)→[bilingual]<sup>4.2.0-2</sup>

## [CASE]-

(PAT)→[skills]-

(ATT)→[basic-level], gaps=deficient=weak

(CAT)→[attention]→(ATT)→[weak]

(CAT)→[attitude]→(ATT)→[weak]<sup>4.3.0-2</sup>

(CAT)→[concentration]→(ATT)→[weak],

(PAT)→[committed]-

(THM)→[work]→(ATT)→[school]

(TRUTH VALUE)→[NEGATIVE],<sup>4.4.0-1</sup>(PAT)→[skills]→(CAT)→[math:\*x]→(ATT)→[weak]<sup>4.5.0</sup>

(PAT)→[understanding]-

(THM)→[subject:\*x]

(ATT)→[limited],<sup>4.6.0</sup>

(PAT)→[needs]→(R.PROC)→[help]→(INST)→[organise:\*x]→

(OBJ)→[work]→(ATT)→[school]

(PAT)→[organise:\*x]<sup>4.7.0-2</sup>(REC)←[supportive]←(GOAL)←[tried]←(PAT)←[teachers]<sup>4.9.0</sup>

(PAT)→[has/suffers illnesses]-

(CAT)→[allergies]<sup>5.10.0</sup>(CAT)→[colds]<sup>5.10.1</sup>(CAT)→[earaches]→(ITER)→[frequent],<sup>5.10.2</sup>

(PAT)→[speaks]-

(ATT)→[quickly]<sup>6.8.0</sup>(ATT)→[impulsively]→(QUAL)→[sometimes],<sup>6.8.1</sup>

(AGT)→[read]-

(ATT)→(much)

(TRUTH VALUE)→[NEGATIVE] -[said]←(AGT)←[CASE]

(THM)→[read]-<sup>6.14.0-1</sup>

(R.OBJ)→[magazine]→(THM)→[rock]

(PAT)→[CASE],<sup>6.14.2-3</sup>(PAT)→[likes]→(OBJ)→[music]<sup>6.15.1</sup>

(PAT)→[watches]-

(R.ACT)→[T.V.programmes]

(ITER)→[lots],<sup>6.16.0</sup>

(PAT)→[likes]→(R.OBJ)→[movies]→(THM)-

[violence]

[horror],<sup>6.17.0-1</sup>

**[CASE]-**

(PAT)→[read aloud]-

(R.OBJ)→[paragraphs:\*x]

(ATT)→[accurately]

(ATT)→[fluently]<sup>7.21.1</sup>(ATT)→[intonation]→(ATT)→[appropriate],<sup>7.22.0</sup>

(PAT)→[answered]-

(R.ACT)→[questions]→(THM)→[]→(THM)→[paragraphs:\*x]

(ATT)→[accurately],<sup>7.23.0-2</sup>

(PAT)→[understands]→(THM)→[operations]-

(ATT)→[arithmetic]

(UNIV)→[all],<sup>7.29.0-1</sup>(PAT)→[computation activity]→(ATT)→[reasonable]<sup>7.30.0</sup>

(PAT)→[do fractions]→(PART)→[how:\*x]

(PAT)→[know]-

(THM)→[how:\*x]

(TRUTH VALUE)→[NEGATIVE]

(THM)←[appear]←(PAT)←[psychologist],<sup>7.31.0-3</sup>**PROCESSES-PAST****[CASE]-**

(IS A)→[baby]-

(ATT)→[active]<sup>3.6.0</sup>(TEM)→[\*t=t<sub>1</sub>],

(PAT)→[like]-

(TRUTH VALUE)→[NEGATIVE]

(R.ACT)→[touch]-

(PAT)→[(someone)]<sup>3.6.1-2</sup>(TEM)→[\*t=t<sub>2</sub>], t<sub>1</sub>=t<sub>2</sub>

(PAT)→[toilet-training]→(CAU)→[problems]-

(TRUTH VALUE)→[negative]

(PAT)→[parents]<sup>3.8.0-1</sup>

(PAT)→[mix with]-

(OBJ)→[other children]

(LOC)→[3.9.0-1 nursery school]

(ATT)→[well]

(TRUTH VALUE)→[NEGATIVE],<sup>3.10.0</sup>

[CASE]-  
 (PAT)→[live]-  
     (DUR)→[2yrs]  
     (TEM)→[first:\*x],  
 (PAT)→[diarrhea]-  
     (ITER)→[persistent]  
     (TEM)→[first:\*x],<sup>5.7.0-2</sup>  
 (ATT)→[5yrs]-  
     (TEM)→[\*x],  
  
 (PAT)→[illnesses]-  
     (ATT)→[age]→(DEG)→[\*y] [\*y]←(ORD.TEM)→[\*x]  
     (ITER)→[several] <  
     (CAT)→[mononucleusis]  
     (CAT)→[hepatitis],<sup>5.9.0-3</sup>

### TEST RESULTS AND SCORES

[CASE]-  
     **WISC-R** <sup>7.1.0-7.18.0</sup>  
 (ATT)→[Information]→(DEG)→[8]<sup>7.4.0</sup>  
 (ATT)→[Similarities]→(DEG)→[9]<sup>7.5.0</sup>  
 (ATT)→[Arithmetic]→(DEG)→[9]<sup>7.6.0</sup>  
 (ATT)→[Vocabulary]→(DEG)→[10]<sup>7.7.0</sup>  
 (ATT)→[Comprehension]→(DEG)→[10]<sup>7.8.0</sup>  
 (ATT)→[DigitSpan]→(DEG)→[10]<sup>7.9.0</sup>  
 (ATT)→[VIQ]→(DEG)→[98]<sup>7.10.0</sup>  
 (ATT)→[Picture Completion]→(DEG)→[8]<sup>7.12.0</sup>  
 (ATT)→[Picture Arrangement]→(DEG)→[8]<sup>7.13.0</sup>  
 (ATT)→[Block Design]→(DEG)→[9]<sup>7.14.0</sup>  
 (ATT)→[Object Assembly]→(DEG)→[8]<sup>7.15.0</sup>  
 (ATT)→[Coding]→(DEG)→[15]<sup>7.16.0</sup>  
 (ATT)→[PIQ]→(DEG)→[96]<sup>7.17.0</sup>  
 (ATT)→[FSIQ]→(DEG)→[95]<sup>7.18.0</sup>

**[CASE]-****PIAT** <sup>7.9.0-7.25.0</sup>

(ATT)→[ability]-

(CAT)→[reading]→(DEG)→[grade level]

(CAT)→[spelling]→(DEG)→[grade level],<sup>7.20.0</sup>(ATT)→[spelling to dictation]-<sup>7.24.0</sup>

(ATT)→[accurate]

(DEG)→[high Gr.6]<sup>7.24.1</sup>

(ATT)→[cursive]

(ATT)→[neat],<sup>7.24.2</sup>(ATT)→[Gen.Info.]→(DEG)→[Gr.6.3]<sup>7.25.0</sup>**DURREL**(ATT)→[Durrel oral reading]→(DEG)→[Gr.6 high]<sup>7.26.0</sup>**WRAT** <sup>7.27.0-7.32.0</sup>(ATT)→[WRAT arithmetic]→(DEG)→[Gr.4.9]<sup>7.28.2,7.32.0</sup>COMPOSITION-TOPIC 8.1.0<sup>2</sup>

DRAWING-TOPIC 9.1.0

1. Superscripts refer to proposition numbers.

Figures included with concept, [in brackets], indicate cross-references to propositions in which the same concept occurs.

Bold script marks the case and his parents.

Tense is marked by the section headings.

Truth values are positive unless marked as negative.

Abbreviated relation labels, (in parentheses), are expanded as follows:

AGT: AGENT

ATT: ATTRIBUTE

CAT: CATEGORY

OBJ: OBJECT

ORD: ORDER

PAT: PATIENT

CAU: CAUSE  
COND: CONDITION  
DEG: DEGREE  
DIST: DISTANCE  
DUR: DURATION  
EQUIV: EQUIVALENCE  
IDENT: IDENTITY  
INCP: INCIPIENT  
ITER: ITERATIVE  
LOC: LOCATION  
NUM: NUMBER

PROC: PROCESS  
R. ACT: RELATED ACT  
R. OBJ: RELATED OBJECT  
R. PROC: RELATED PROCESS  
REC: RECIPIENT  
TEM: TEMPORAL  
THM: THEME  
UNIV: UNIVERSAL QUANTIFIER

2. The composition and drawing were not analysed as propositions or represented as networks.

## **APPENDIX G**

### **EXAMPLES FROM SUBJECTS' REPRESENTATIONS**

Well-integrated representations.

Subjects: EC, EG, EH, EJ, NA, NE, NG, NI,

Somewhat integrated representations.

Subjects: EA, EE, EI, NK,

Poorly integrated representations.

Subjects: EK, ED

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EC

TOPIC 3.1.0, TOPIC 4.1.0→COND→classic, itchy boy

TOPIC 4.1.0, 1.4.0→COND→\*x  
x = has pre-adolescent adjustment problems

TOPIC 4.1.0→COND→has missed things in school

TOPIC 5.1.00--  
COND→classic case medically  
CAU→soft neurological signs→COND→deal with medical  
problems on that level

7.3.0-7.10.0→COND→all round WISC-R Verbal average

7.2.0-7.26.0→NEG COND→7.28.0-7.28.2

TOPIC 7.1.0→COND→average intelligence--  
COND→testing will not  
reveal problem←CAU←problems:\*x  
are social/emotional

8.1.0→COND→language is immature, punctuation is immature

9.1.0→COND→immature drawing



8.1.0, 9.1.0--

COND→lack of detail→CAU→concern→COND→social/  
emotional problems:\*x

COND→infantalisation by parents:\*y--

CAU←TOPIC 5.1.00

CAU→\*x     x = conversion symptoms

CAU→\*x     x = developing personality disorder

CAU→\*x→COND→counselling for parents  
x = has not learned appropriate  
social behaviours

COND→teach child appropriate social behaviours

COND→overcome infantalisation by parents:\*y

NEG COND→worse behaviours  
(if steps not taken)

ENTIRE FILE→COND→alternative approach to assessment

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EG

3.6.0-3.6.2→COND→child has fragile nervous system,  
sensitive nervous system:\*v

2.6.0-2,

3.6.0-2,

3.4.0-1→COND→rigidity in new learning--

COND← \*v

COND←7.12.0, 7.13.0, 7.15.0

CAU→not fully utilising

abilities:\*u--

COND←7.4.0-10

CAU→parents have

become frustrated

TOPIC 4.1.0--

COND→difficulty becoming a teenager

COND→difficulty finding himself

COND→difficulty relating to school

environment:\*w

COND→difficulty being a

success←CAU←immaturities in CNS:\*v,

immature ways of

reacting←COND←TOPIC 3.1.0,

COND→discrepant academic functioning

5.1.0-5.8.0→COND→developmental difficulties

from the beginning→COND→inconsistent

progress predicted

6.4.0-2→COND→has difficulty relating to environment:\*w,  
has difficulty reacting to environment

6.16.0→COND→passive, not involved in environment--  
COND→sees a lot  
COND→good visual memory  
for surroundings

TOPIC 3.1.0, TOPIC 4.1.0--  
COND→WISC-R will show higher cognitive--  
COND→WISC-R will show lower visual-motor--  
COND→6.18.0-6  
COND←inconsistent test scores  
in WISC-R profile  
COND←7.4.0-7.9.0, 7.11.0-7.16.0

TOPIC 7.1.0--  
COND→not LD  
COND→not utilising abilities:\*u

?→COND→probably sensitive and sweet

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EH

2.4.0--

CAU→is at present level because  
of help received←COND←1.5.0  
CAU→is at present level in math  
because of help←COND←7.29.0-7.30.0

4.3.0-2←CAU←motivation:\*y is not strong

4.5.0, 4.7.0-2→COND→math skills are weak--  
OR CAU←lack of motivation:\*y  
OR CAU←lack of interest←COND←4.3.0-4.4.1  
OR CAU←lacks organisational  
skills:\*z←COND←4.7.0-2  
OR CAU←weak in math area

4.8.0--

OR CAU←dependency  
OR CAU←lacks self-direction,  
lacks organisational skills:\*z←COND←4.7.0-2

TOPIC 5.1.00--

COND→impulsivity:\*w←NEG COND←average score--  
COND←7.9.0  
COND→further exploration,  
COND→hyperactivity→COND→further exploration

TOPIC 3.1.0, TOPIC 4.1.0--

COND→neurological examination←COND TOPIC 5.1.00

COND→assessment of emotional structure

OR COND→explore difficulties

at home→CAU→school problems

OR COND→not very positive self-image

(though not seriously

maladjusted)←CAU←school experience

7.13.0→COND→low score--

CAU←impulsivity:\*w

NEG CAU←social awareness←COND←6.3.0-4

7.20.0-7.23.2,

7.26.0--

COND→reading is alright,

spelling is

alright←COND school concurs←COND←TOPIC 4.1.0

COND→reading-math

gap exists←COND 4.5.0, 7.28.2, 7.32.0

7.31.0-3--

OR CAU←insufficient (learning) time

OR CAU←visualisation abilities are weak,

organisation:\*z abilities

are weak←COND 4.7.0-2→COND→check math  
skills

8.1.0→COND→composition is poor--

OR CAU←lack of punctuation

OR CAU←poor organisational

abilities:\*z←COND←can be organised

for short periods

only←COND 6.18.0-3

COND→check writing skills

COND→investigate classroom functioning←COND←TOPIC 6.1.0

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EJ

2.2.0, 3.4.0-1, 3.9.0-1,  
3.20.6, 3.20.9--

NEG COND→hyperactivity:\*w←NEG COND←TOPIC 6.1.0  
COND→MBD:\*x--  
COND←3.20.13-14  
COND←classical MBD←COND←4.10.0-4.12.1

TOPIC 5.1.00--

COND→more than MBD:\*x--  
COND→neurological impairment--  
COND←TOPIC 6.1.0→COND→brain dysfunction  
(CD):\*y under control

7.4.0-7.18.0--

COND→WISC-R is normal  
COND→no Verbal/Performance difference  
COND→Coding is significantly  
higher than the rest←COND 7.16.0  
COND→has overcome features of  
cerebral dysfunction (CD):\*y←COND 9.1.0

7.9.0→COND→no memory problem←COND←7.16.0--

COND→good motor control  
COND→good incidental learning  
NEG COND→LD:\*z  
NEG COND→CD:\*y

?→COND→CD:\*y (NOTE: Stated twice, once during and once after  
discussing WISC-R scores as above.)

## 7.19.0-7.26.0--

COND→language arts are at (appropriate) level

COND→can keep up in language arts

COND→good recuperation in

language arts←COND TOPIC 3.1.0,

TOPIC 4.1.0→COND (avoid) high  
expectations→CAU→will  
result in failure

## TOPIC 3.1.0, TOPIC 4.1.0,

## TOPIC 5.1.00--

COND→has history of CD:\*y

COND→manifested in

many ways←NEG COND←hyperactivity:\*w

COND→history of CD:\*y,

remnants of CD:\*y←COND←1.4.0, 9.1.0,

present (emotional) problems are due

to age:\*v,←COND←1.4.0,

present (educational) problems are due

to school difficulty

## 2.8.0-3--

OR CAU←\*v←COND←1.4.0 v = usual adolescent  
adjustment problems

OR CAU←\*v←COND←\*y←COND←1.4.0

v = new manifestations of CD:

OR CAU←poor self-image:\*u→COND→needs special  
education support

NEG COND←child has personal resources

to reach present level←COND←1.5.0

COND→parents have fear of child's future

9.1.0--

COND→poor coordination

COND→poor self-image:\*u←CAU←difficulties at  
school←COND←TOPIC 3.1.0, TOPIC 4.1.0

COND→immature drawing

COND→control on smile

(in figure drawing)←CAU←rigidity

COND→developmental problems←CAU←CD:\*y

COND→shows remnants of CD:\*y



# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: NA

4.12.0-1←CAU←outside pressures:\*y

2.6.1--

CAU←5.10.0-5.10.2

CAU←pressure to excel:\*y←COND←3.5.3

CAU←inadequate bonding--

COND←3.6.0-1

CAU←5.5.0-2,

NEG CAU←3.2.0-3.3.1

6.10.0-6.11.3--

CAU←emotional problems:\*x

CAU←pressure to perform:\*y

7.12.0-7.17.0--

COND→no significant weaknesses

COND→some weaknesses←NEG COND←not different from  
general population  
especially in  
visual-motor skills

7.16.0→COND→above mean

7.20.0→COND→no problems with reading, no problems with spelling

7.25.0→COND→above average

7.26.0→COND→high

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: NE

3.3.0-3→COND→pressure on eldest child to perform:\*x

2.2.0, 3.4.0-1→COND→child is LD--  
 COND→check actions taken,  
 interview child  
 regarding pressures:\*x,  
 interview child regarding  
 self-esteem→COND→family therapy if  
 problems exist

2.6.1--  
 COND→behaviour modification programme  
 COND→pressure:\*x from father  
 about behaviour→CAU→child feels pressure:\*x  
 from authority figures

TOPIC 3.1.0→COND→family interview regarding  
 any family conflicts

7.16.0→COND→high score--  
 COND→good quick writing→COND→6.5.0  
 COND→good hand/eye coordination  
 CAU←pressure to perform:\*x  
 CAU←child is good at short tasks

TOPIC 4.1.0→COND→observation in classroom setting

TOPIC 3.1.0→COND→check sight, check hearing:\*z

5.10.0-1→COND→child takes medication--

COND→check medication

CAU→concentration problem→COND→better medical treatment

COND→teacher to be made aware of allergies

COND→hearing

problems:\*z→CAU→balance

problems→CAU→gross-motor

coordination

is not good←COND←3.9.0-1

TOPIC 5.1.00→CAU→structural damage during delivery--

CAU→effect on breathing

CAU→inner ear problems:\*z--

CAU→effect on hearing

COND←3.9.0-1,

COND→neurological testing

COND→check physical problems before

concluding that problems are

psychological or behavioural

9.1.0--

COND→unhappiness

COND→good detail, good proportion

COND→no unusual features

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: NG

2.8.0-3→COND→parents should be strict

3.17.0, 3.20.9,

3.20.13-14, 4.3.0-2, 6.18.0-6→COND→easily distracted:\*y

TOPIC 3.1.0--

CAU←distractibility:\*y,--

attention deficit--

COND←4.5.0, 4.3.1, 3.20.9,

COND→check influence of events at home

COND→check influence of parental discipline

COND→check influence of events

at home during Gr. 4 crisis--

COND→check influence of parental

discipline during Gr. 4 crisis--

COND←4.10.0-2

4.5.0, 7.28.2, 7.32.0--

OR CAU←work missed in Gr. 4←COND←4.10.0-1

OR CAU←impulsivity:\*x, distractibility:\*y

LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS  
GENERATION

SUBJECT: NI

4.3.0-2→CAU→distraction

TOPIC 6.1.0→COND→does alright in one-to one situation

7.4.0-7.18.0→COND→normal range

7.5.0→COND abstracting is OK→NEG COND→3.20.12

7.6.0, 7.9.0--

COND→good scores→NEG COND→6.18.0-6

COND→can concentrate:\*x→NEG COND→4.3.0-2

7.12.0→COND→observations in the environment are OK

7.13.0→COND→interpretations in social situations are OK

7.14.0→COND→better at going from whole to parts than vice-versa

7.16.0--

COND→good hand-eye coordination

COND→can stick at a task:\*x

7.20.0, 7.26.0--

COND→appropriate level

COND→supports WISC-R scores←COND←7.4.0-7.9.0, 7.11.0-7.16.0

COND→ability to concentrate:\*x

7.24.0-2→COND→verbal skills are OK

7.6.0→COND→? inconsistent scores←COND←7.28.2, 7.32.0--

COND→check tests against school curriculum

1.4.0, 8.1.0→COND→typical composition for age

9.1.0--

COND→appropriate developmentally

COND→shows concentration:\*x, and attention

COND→no psychopathology

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EA

2.6.1→CAU→behaviour problems in Grade 7

2.7.0-8--

COND→parents are wise

COND→parents are thinking ahead

COND→highschool will be another readjustment

3.15.0-3.18.4→CAU→stress at home--

CAU→parents are tense,

parents are not

positive--

COND←3.13.0-3.14.2

COND→programme for family  
to be more positive

3.18.0-3.19.0→COND→does not get along with

family→COND→talk to family about handling  
behaviour

4.10.0-1←CAU←behaviour crises

3.16.0-1,6.13.0-3→COND→needs to deal with temper

2.6.1, 3.14.0-2,→COND→LD--

COND→IQ high,

COND→LD-type WISC-R profile,

COND←allergies

NEG COND←actual WISC-R

profile←COND←7.1.0-7.18.0

3.20.9,  
 6.19.0-3→COND→ADD←NEG COND←actual WISC-R  
 profile←COND←7.1.0-7.18.0

4.2.0-2→COND→bilingual programme is too difficult

7.1.0-7.18.0→COND→school work is fine--  
 COND→build on strengths  
 COND→weaknesses  
 not so bad→COND→show where  
 weaknesses are

7.1.0-7.18.0,  
 7.26.0→COND→school success:\*y→COND→emotional difficulties:\*x

6.9.2-6.10.0←CAU←\*x←NEG CAU←school success:\*y  
 x = tension, unhappiness

ENTIRE FILE→COND→plan of action for family



# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EE

2.7.0-7,

2.8.0-3→COND→diverts attention  
from real problems→COND→look at what is really  
troubling child

3.19.0→COND→(subject agrees that) case is a worry

4.2.0-2,

4.10.0-2→CAU lack of commitment:\*y←COND←4.4.0-1

5.10.2→COND→auditory deficit:\*z→CAU→3.20.6, 3.20.9, 4.3.1

4.5.0--

COND→can't understand math--

COND←7.28.2, 7.32.0

NEG COND←mental computation OK←COND←7.6.0

7.20.0, 7.22.0--

NEG COND→LD--

COND←2.2.0

NEG COND←common not to be  
able to do fractions←COND 1.5.0, 7.31.0-3

7.4.0-7.18.0--

COND→WISC-R scores all average

COND→no WISC-R VIQ/PIQ

difference←CAU←visual motor memory has

raised PIQ score←COND←7.16.0.

COND→preference for whole to part approach

7.4.0→COND→low score→COND→not significantly low--

OR CAU←long term memory problem

OR CAU←cannot retain details

7.10.0, 7.20.0, 7.26.0→COND→very good verbal skills

3.20.4-3.20.7→COND→inconsistent

results:\*w←COND←7.4.0-7.18.0

ENTIRE FILE→COND→inconsistent results:\*w--

COND→explore auditory

deficit:\*z←CAU←5.10.2

COND→explore visual-perceptual skills

3.6.0-2,

3.10.0,

3.14.0-2→COND ADD--

COND←5.10.0-1

NEG COND←7.16.0

NEG COND←ENTIRE FILE→COND→lack of

commitment:\*y←CAU←something

other than ADD

ENTIRE FILE→COND→look for emotional side--

COND←behaviour is the real problem

COND→speak to parents

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EI

TOPIC 3.1.0→COND→parents may be  
expecting too  
much of child→COND→talk to parents regarding  
their expectations

TOPIC 4.1.0--  
COND→talk to child and teachers regarding  
school issues  
COND→problems are emotional→COND→projective testing

TOPIC 5.1.00--  
COND→stressful infancy  
COND→needed constant supervision←COND←3.20.16  
COND→parents chose a too stressful  
educational programme:\*x--  
COND→parents kept child in a  
too stressful programme  
COND←4.2.0-2  
COND→assessment of functioning  
in French

4.2.0-2→COND→\*x-- x = taught in french  
CAU→4.3.0-2  
CAU→4.5.0

4.10.0-4.12.1←CAU has need for attention--  
COND←5.1.0-5.10.2→CAU→lack of cheerfulness  
CAU→←parents' actions are part of the cycle

7.4.0→COND→low average--

CAU←taught in French. tested in English←COND←4.2.0

CAU←3.14.1→COND→not absorbed:\*w--

COND←not tuned to

environment←COND←7.5.0, 7.12.0,

7.15.0

NEG COND←7.20.0-7.25.0

4.2.0-2, 4.3.0-4.12.1→CAU→stress:\*z--

CAU→2.2.0-2.2.6

CAU→4.10.0-4.11.1←CAU←could barely  
manage Gr.4←COND←Gr.3 was a  
bad year

CAU←average ability only←COND←7.4.0-7.18.0

COND→bilingual programme is

inappropriate:\*x←COND←3.20.6-14

COND←TOPIC 5.1.00, TOPIC 6.1.0

COND→explore stress

7.16.0--

COND→quick in nonsense learning

COND→good hand-eye coordination

COND→problems are emotional←NEG COND←LD:\*y

NEG COND→stress:\*z

COND→high score←CAU←?(unknown reason)--

COND→visual-motor testing

COND→look at notebooks

CAU←visual-motor

skills are OK←COND←7.19.0-

7.24.2→COND→valid

Coding score

TOPIC 7.1.0--

COND→not so disorganised--

NEG COND→4.7.0-2, 3.14.0-2

NEG COND←is disorganised←COND←7.15.0, 7.12.0,

COND→has learned

COND→is absorbed:\*w

COND→is committed to school work→NEG COND→4.4.0-1

6.5.0-2, 7.19.0,

7.26.0, 8.1.0--

NEG COND←3.20.5-7→COND→average (only) skills  
in all areas→CAU→will struggle

COND→can read English, can write English, can spell

## LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: NK

2.2.0, 3.4.0-1--

COND→child is not an isolated case in the family

COND→obtain detailed case history of parents

4.10.0-4.12.1→COND→further investigations needed

5.1.0-5.9.3→COND→difficult start in life

5.5.0-2--

CAU→3.6.0-2

CAU→need for attention:\*x--

COND←3.16.0-3.20.5

COND←4.7.0-4.9.0,

COND→emotional blockages

5.9.0-5.10.2→COND→makes most of illnesses to get attention:\*x

TOPIC 5.1.00--

CAU→physical problems

CAU→LD

TOPIC 3.1.0--

COND→family therapy to deal  
with emotional

problems←COND←individual therapy would  
increase need for attention:\*x

COND→look at how behaviour has been maintained

COND→family's expectations are too high

6.9.2-6.10.0←CAU←child is depressed

6.18.0-3--

COND→needs exercises to improve concentration

COND→needs encouragement to stick to tasks

3.20.7,

6.18.5-6.19.3→COND→needs exercises to improve  
problem-solving skills

7.4.0-7.18.0→COND→normal scores

7.16.0→COND→excellent score→COND→good visual discrimination

7.20.0→COND→reading ability is normal

1.4.0, 7.26.0→COND→good for age

4.5.0, 7.28.2, 7.32.0←CAU←poor concentration←COND←4.3.1

TOPIC 5.1.00, TOPIC 7.1.0--

COND→child is functioning at a good level considering history

COND→at age level academically←CAU←improvement

8.1.0--

COND→lack of punctuation

COND→immature in style (emotional)

ENTIRE FILE→COND→child needs to develop more  
self-confidence

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: EK

3.1.0-3.20.17→COND→ADD:\*x→COND→may have tried Ritalin

6.1.0→COND→ADD:\*x→CAU→6.8.1, 6.18.4-6

3.10.0, 3.18.0-4--

COND→family interview  
CAU←letting out frustration

3.1.0→COND→contribution (to problems) from home

TOPIC 2.1.0, TOPIC 3.1.0←CAU←? unclear

5.1.00→COND→concern (on subject's part)

2.4.0, 4.9.0--

COND→help was given (type of help not known)  
COND→needs a tutor

7.11.0-7.15.0,

7.16.0→COND→below average←NEG COND 7.17.0

7.19.0-7.26.0→COND good

2.4.0, 4.5.0, 1.5.0,

7.25.0-7.26.0→COND→seen learning



3.7.0-3.8.1, TOPIC 7.1.0--

COND→reasonable recovery in development

COND→reasonable recovery in development.  
except for speech→COND→obtain more  
information

8.1.0→COND→good composition--

NEG COND←not much unity in composition

COND←good for age←COND←1.5.0

COND←written language is alright←COND←TOPIC 7.1.0

1.4.0, 9.1.0→COND→primitive drawing for age

# LINEARISED REPRESENTATION OF SUBJECT HYPOTHESIS GENERATION

SUBJECT: ND

1.4.0, 1.5.0→COND→failed a grade

3.9.0-1→COND→motor coordination problems←NEG COND←7.16.0

3.20.9, 4.3.0-2→COND→general agreement about  
attention span weakness←CAU←2 2.0

TOPIC 3.1.0--

COND→child has many problems

NEG COND→placement in regular class  
(subject expected placement in a  
special education class)

NEG COND→parents are supportive  
(subject guesses that this is the case,  
despite their report)

4.9.0→COND→teachers provide support

3.5.0-3.5.1→COND→child's problems stem  
from birth of siblings→CAU→4.12.0-4.12.1

4.12.0 -4.12.1←CAU←emotional problems stemming from home

TOPIC 5.1.00←COND←a sickly child

6.8.4-6→COND→impatient←CAU←? (unknown cause)

6.8.0-6.8.1→COND→impulsive

7.3.0-7.17.0--

COND→average

COND→not informative

7.24.1-2--

COND→speiling is good

COND→handwriting is good

7.26.0→COND→did well

7.28.0-7.32.0--

COND→below average

COND→primary problem is fractions

COND→math is a definite weakness←COND←4.5.0--

COND→help with math

8.1.0--

COND→reasonable

COND→immature

## APPENDIX H

### ANALYTIC PROCEDURES APPLIED TO PART OF ONE SUBJECT'S PROTOCOL: SUBJECT EK

#### Segmentation of Protocol Text

Reads Topic 3. Parents' report.

- 3.1 The first thing that comes to mind is A.D.D., attention deficit disorder
- 3.2 but I can't really imagine he would get to the age of twelve without having had
- 3.3 that diagnosed earlier  
and perhaps th-, he's tried a course of Ritalin.

Reads Topic 4. School's comments. To ... he is not committed to his school work.

- 4.1 Who would be if it had been that rough on you for six years.  
Continues to read Topic. 4.

Reads Topic 5. Birth and medical history.

Reads Topic 6. Psychologist's observations.

- 6.1 This also makes me think of A.D.D.
- 6.2 The impulsivity again makes me think of A.D.D. Um.
- 6.3 His inability to listen to a question to the end
- 6.4 and his-, his uh, quick-, speed to give up on a task.

Reads Topic 7. WISC-R.

- 7.1 I'm sorry that whoever the tester was didn't include Mazes.
- 7.2 I find that quite helpful in-, in gauging impulsivity, a
- 7.3 kid's ability to plan out a task before he rushes at it.  
(I'm very puzzled by the-,) there's tremendous strength in
- 7.4 Coding when everything else is average or below average.  
Uh. Obviously without the Coding his-, his Performance IQ
- 7.5 wouldn't even reach the av- average range.  
And yet, most kids who are impulsive, i-, in my experience,
- 7.6 don't get anywhere with Coding.  
The whole business of looking up and looking down and
- trying to remember the symbols um, I find many children
- can't do-, do well on that at all, and particularly
- impulsive ones

Continues to read Topic. 7. PIAT & Durrell.

- 7.7 I'm surprised that with this history of constant difficulty at school seems to be able to do so well on-, on a Durrell and on a PIAT.
- 7.8 There's really nothing inappropriate in those scores.

Continues to read Topic. 7. WRAT.

**Coding (see coding sheets included in this Appendix)**

**Case-file Propositions to which Subject EK Referred**

<b>Proposition no.</b>	<b>Case-file text.</b>
3.1.0-3.20.17	The family is intact. Their financial situation is stable and good. There is a family history of learning difficulties. Edgar is the eldest of three boys. He was an active baby who did not like being touched. Crawling, walking, and talking all occurred at normal times. There were no problems with toilet training. At nursery school he was observed as being poorly coordinated and he did not mix well with other children. He now tries hard with friends and is well liked at school. He is a demanding child. He is scattered, impulsive, and immature. He engages in repetitive behaviours. He has a quick temper and is easily frustrated.
TOPIC 6.1.0	PSYCHOLOGIST'S OBSERVATIONS. (Subject refers to the entire contents of this paragraph, which are set out in Appendix A.).
6.8.1	He speaks ... sometimes impulsively.
6.18.4 - 6	... he was too impatient to think a response through.
6.18.0 - 3	... there were several occasions when he would not listen through to the end of a question.
6.19.0 - 3	When a problem has too many variables he gave up.

7.11.0 - 7.15.0	WISC-R SCORES	
	VERBAL TESTS	
	Information	8
	Similarities	9
	Arithmetic	10
	Comprehension	10
	Digit Span	(10)
	Verbal IQ	98
	PERFORMANCE TESTS	
	Picture Completion	8
	Picture Arrangement	8
	Block Design	9
	Object Assembly	8
7.16.0	Coding	15
7.17.0	Performance IQ	96
7.19.0-7.26.0	PEABODY INDIVIDUAL ACHIEVEMENT TEST (PIAT). Reading and spelling ability are at his grade level. He read accurately and fluently. His intonation was appropriate. Questions about the paragraphs that he had read were answered accurately. His spelling to dictation was accurate (at the high Grade 6 level) and neatly written in cursive writing. PIAT SCORE, GENERAL INFORMATION SUBTEST - Grade 6.3.	
	DURREL ANALYSIS OF READING DIFFICULTY. ORAL READING SUBTEST SCORE - GRADE 6, HIGH.	

**Linearised Representation of Information from Case-File Text used by Subject EK**

The information from the case-file used by this subject, represented in linear form, is contained in Appendix F and is not reproduced again here. In Appendix F the superscript numbers refer to proposition numbers. Thus, the case-file information referred to in the subject's protocol could be matched against the representation of the complete case-file.

**Extract from Linearised Representation of Hypothesis Generation: Subject EK**

3.1.0-3.20.17→COND→ADD:\*x→COND→may have tried Ritalin

6.1.0→COND→ADD\*x→CAU→6.8.1, 6.18.4-6

3.10.0, 3.18.0-4 -

COND→family interview

CAU←letting out frustration

7.11.0-7.15.0, 7.16.0→COND→below average←NEG COND←7.17.0

7.19.0-7.26.0 -

COND→good,(surprising with  
history of difficulty)

COND→has been learning

NOTE: Only part of this subject's protocol was used in this example. (Appendix G contains the complete representation for Subject EK.) However, it is representative of the entire protocol in that few inferences about the student were combined into complex theories. There was only one instance of a cross-referenced inference in the representation of the protocol, that concerning attention deficit disorder (ADD) which is included in the above extract. The remainder of the representation was list-like. Hence, this protocol was judged to be poorly integrated.

PROP NO.	QUOTE	RESTATEMENT	INFERENCE	DATA REQUESTS	COMPARATIVE (NON-INFERENTIAL COMMENTS)
			-----		

TYPE A		TYPE B	
3.1.0		3.1	3.2
3.20.17		3.3	
4.4.0-1			4.1
TOPIC 6.1.0		6.1	
6.8.1,		6.2	
6.18.4-6			
6.18.0-3	6.3	6.3	
6.19.0-3	6.4	6.4	
7.2.0			7.2 7.1
7.16.0			7.3 7.5, 7.6
7.11.0-7.15.0, 7.16.0, 7.17.0		7.4	
7.19.0-7.26.0		7.7, 7.8	



PROP. NO.	EDUCATIONAL		EMOTIONAL		PHYSIOLOGICAL		CONTEXTUAL		PRESCRIPTIVE		
	+VE	-VE	+VE	-VE	+VE	-VE	+VE	-VE	PHYSICAL	EDUCATIONAL	EMOTIONAL

[illegible]

**APPENDIX I**  
**SUMMARY STATISTICS**

**Summary statistics for inference categories.**

The following results are for:

Group = 1 (Expert)

	Inference category			
	Negative	Positive	Rejected	Prescriptive
N of cases	12	12	12	12
Minimum	6	2	0	2
Maximum	30	30	12	12
Range	24	28	12	10
Mean	17.750	13.917	2.833	6.750
Variance	57.295	80.629	14.879	1.659
Standard dev.	7.569	8.979	3.857	3.415

The following results are for:

Group = 2 (Novice)

	Inference category			
	Negative	Positive	Rejected	Prescriptive
N of cases	12	12	12	12
Minimum	5	6	0	1
Maximum	38	19	8	10
Range	33	13	8	9
Mean	14.667	11.750	1.917	4.917
Variance	82.970	15.477	5.720	8.083
Standard dev.	9.109	3.934	2.392	2.843

**Sum of squares and cross products matrix**

	Group	Negative	Positive	Rejected	Prescriptive
Group	6.000				
Negative	-13.000	1599.985			
Positive	-18.500	758.833	1085.333		
Rejected	- 5.500	314.125	345.500	231.625	
Prescrip.	-11.000	226.833	135.333	82.500	237.333

The following results are for:  
Group = 1 (Expert)

	Inference category			
	Educational	Emotional	Physiological	Contextual
N of cases	12	12	12	12
Minimum	5	1	0	0
Maximum	29	16	8	6
Range	24	15	8	6
Mean	14.167	8.250	3.333	3.167
Variance	56.515	28.386	8.424	5.061
Standard dev.	7.518	5.328	2.902	2.250

The following results are for:  
Group = 2 (Novice)

	Inference category			
	Educational	Emotional	Physiological	Contextual
N of cases	12	12	12	12
Minimum	6	3	0	0
Maximum	20	14	13	6
Range	14	11	13	6
Mean	11.333	6.250	4.083	3.000
Variance	21.515	10.932	13.720	4.364
Standard dev.	4.638	3.306	3.704	2.089

Sum of squares and cross products matrix

	Group	Education <sup>2</sup>	Emotional	Physiological	Contextual
Group	6.000				
Education	-17.000	906.500			
Emotional	-12.000	330.500	465.500		
Physiolog.	4.500	111.250	54.750	248.958	
Contextual	-1.000	140.500	50.500	28.583	103.833

The following results are for:  
Group = 1 (Expert)

	Inference category			
	Educational	Negative Emotional	Physiological	Contextual
N of cases	2	12	12	12
Minimum	1	1	0	0
Maximum	11	13	5	6
Range	10	12	5	6
Mean	5.167	6.000	2.500	2.417
Variance	7.061	15.818	4.636	4.629
Standard dev.	2.657	3.977	2.153	2.151

The following results are for:  
Group = 2 (Novice)

	Inference category			
	Educational	Negative Emotional	Physiological	Contextual
N of cases	12	12	2	12
Minimum	1	1	0	0
Maximum	9	10	12	6
Range	8	9	12	6
Mean	3.750	4.000	3.167	2.417
Variance	8.023	8.000	12.515	4.265
Standard dev.	2.832	2.828	3.538	2.065

Sum of squares and cross products matrix

	Group	Educ.neg.	Emot.neg.	Phys.neg.	Cont.neg.
Group	6.000				
Educ.neg.	- 8.500	177.958			
Emot.neg.	-12.000	142.000	286.000		
Phys.neg.	4.000	44.833	30.000	191.333	
Cont.neg.	0.000	43.417	11.000	18.667	97.833

The following results are for:  
Group = 1 (Expert)

	Inference category			
	Educational	Emotional	Positive Physiological	Contextual
N of cases	2	12	12	12
Minimum	2	0	0	0
Maximum	21	6	3	4
Range	19	6	3	4
Mean	9.000	2.250	0.833	0.750
Variance	38.182	5.295	0.879	1.477
Standard dev.	6.179	2.301	0.937	1.215

The following results are for:  
Group = 2 (Novice)

	Inference category			
	Educational	Emotional	Positive Physiological	Contextual
N of cases	12	12	12	12
Minimum	4	0	0	0
Maximum	12	4	2	2
Range	8	4	2	2
Mean	7.583	2.250	0.917	0.583
Variance	7.720	2.386	0.629	0.629
Standard dev.	2.778	1.545	0.793	0.793

Sum of squares and cross products matrix

	Group	Educ.pos.	Emot.pos.	Phys.pos.	Cont.pos.
Group	6.000				
Educ.pos.	-8.500	516.958			
Emot.pos.	0.000	54.250	84.500		
Phys.pos.	0.500	24.875	10.750	16.625	
Cont.pos.	-1.000	3.333	3.000	7.000	23.333

The following results are for:  
Group = 1 (Expert)

	Inference category		
	Educational	Prescriptive Emotional	Physical
N of cases	12	12	2
Minimum	0	1	0
Maximum	5	8	2
Range	5	7	2
Mean	2.500	3.500	0.750
Variance	3.182	4.636	0.568
Standard dev.	1.784	2.153	0.754

The following results are for:  
Group = 2 (Novice)

	Inference category		
	Educational	Prescriptive Emotional	Physical
N of cases	12	12	12
Minimum	0	0	0
Maximum	4	6	1
Range	4	6	1
Mean	2.250	2.417	0.250
Variance	2.023	2.992	0.203
Standard dev.	1.422	1.730	0.452

Sum of squares and cross products matrix

	Group	Educational	Emotional	Physical
Group	6.000			
Educational	-1.500	57.625		
Emotional	-6.500	37.375	90.958	
Physical	-3.000	3.500	1.500	10.000

### Summary statistics for Counselor Orientation Scale scores.

The following results are for:  
Group = 1 (Expert)

	Counselor		Orientation		Scale scores		
	B	E	F	TF	CC	G	RE
N of cases	8	6	8	10	11	9	9
Minimum	9	13	12	11	13	9	9
Maximum	15	16	17	16	18	19	16
Range	6	3	5	5	5	5	5
Mean	11.500	14.500	14.250	12.900	15.636	16.000	13.111
Variance	4.571	1.100	3.357	2.767	2.455	2.250	2.861
Standard dev.	2.138	1.049	1.832	1.663	1.567	1.500	1.691

The following results are for:  
Group = 2 (Novice)

	Counselor		Orientation		Scale scores		
	B	E	F	TF	CC	G	RE
N of cases	12	11	11	11	12	10	12
Minimum	9	12	10	11	13	12	9
Maximum	14	17	15	17	20	18	18
Range	5	5	5	6	7	6	9
Mean	11.417	14.091	13.545	13.455	16.333	15.200	13.833
Variance	2.629	2.491	2.473	2.073	4.242	3.298	7.606
Standard dev.	1.621	1.578	1.572	1.440	2.060	1.814	2.758

B = Behavioural, E = Existential, F = Freudian,  
TF = Trait Factor, CC = Client-Centred, G = Gestalt,  
RE = Rational-Emotive



The following results are for 13 complete cases:

	Counselor		Orientation		Scale scores		
	B	E	F	TF	CC	G	RE
N of cases	13	13	13	13	13	13	13
Minimum	9	12	12	11	13	12	11
Maximum	14	17	17	14	18	17	18
Range	5	5	5	3	5	5	7
Mean	1.154	14.308	14.154	12.923	15.923	15.154	13.385
Variance	2.641	2.064	2.308	1.410	3.744	2.141	4.256
Standard dev.	1.525	1.437	1.519	1.188	1.935	1.463	2.063

B = Behavioural, E = Existential, F = Freudian,  
 TF = Trait Factor, CC = Client-Centred, G = Gestalt,  
 RE = Rational-Emotive

Sum of squares and cross products matrix

	B	E	F	TF	CC	G	RE	Group
B	31.692							
E	4.385	24.769						
F	5.692	-4.615	27.692					
TF	6.154	9.308	0.154	16.923				
CC	1.154	27.308	3.154	17.923	44.923			
G	6.692	9.385	2.692	11.154	22.154	25.692		
RE	24.231	17.462	-1.769	1.385	16.385	8.231	51.077	
Gr.	-1.231	0.538	-2.231	1.615	0.615	-1.231	0.923	3.077

### Summary statistics for causal links.

The following results are for:

Group = 1 (Expert)

	Causal links		
	Total	Forward	Backward
<i>N</i> of cases	12	12	12
Minimum	3	0	1
Maximum	26	7	19
Range	23	7	18
Mean	10.083	4.083	6.000
Variance	44.265	6.447	24.909
Standard dev.	6.653	2.539	4.991

The following results are for:

Group = 2 (Novice)

	Causal links		
	Total	Forward	Backward
<i>N</i> of cases	12	12	12
Minimum	4	0	2
Maximum	36	14	27
Range	32	14	25
Mean	11.667	4.500	7.167
Variance	109.697	17.364	56.333
Standard dev.	10.474	4.167	7.506

# Summary statistics for references to case-file.

The following results are for:  
Group = 1 (Expert)

Numbers of references to case-file topics					
	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
N of cases	12	12	12	12	12
Minimum	0	1	2	1	0
Maximum	10	29	33	9	
Range	7	9	27	32	9
Mean	2.917	4.917	15.667	11.500	4.333
Variance	4.265	8.083	84.424	86.636	10.788
Standard dev.	2.065	2.843	9.188	9.308	3.284
	Topic 6	Topic 7	Topic 8	Topic 9	
N of cases	12	12	12	12	
Minimum	1	3	0		
Maximum	14	74	8	9	
Range	13	71	8	8	
Mean	8.000	21.167	3.333	3.917	
Variance	20.000	375.788	7.333	6.083	
Standard dev.	4.472	19.385	2.708	2.466	

The following results are for:  
Group = 2 (Novice)

Numbers of references to case-file topics					
	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
N of cases	12	12	12	12	12
Minimum	0	0	1	2	1
Maximum	5	6	30	15	13
Range	5	6	29	13	12
Mean	1.667	2.750	12.417	8.000	4.333
Variance	3.152	4.023	76.811	13.818	19.697
Standard dev.	1.775	2.006	8.764	3.717	4.438
	Topic 6	Topic 7	Topic 8	Topic 9	
N of cases	12	12	12	12	
Minimum	1	5	1	0	
Maximum	22	31	6	6	
Range	21	26	5	6	
Mean	7.417	13.833	2.167	1.917	
Variance	37.356	58.879	2.333	2.447	
Standard dev.	6.112	7.673	1.528	1.564	

#### Sum of squares and cross products matrix

	Group	Topic 1	Topic 2	Topic 3	Topic 4
Group					
Topic 1	6.000				
Topic 2	-7.500	90.958			
Topic 3	-13.000	66.167	161.333		
Topic 4	-19.500	151.708	418.167	1836.958	
Topic 5	-21.000	111.750	154.000	796.250	1178.500
Topic 6	0.000	29.667	93.333	351.667	247.000
Topic 7	-3.500	68.042	130.833	861.292	512.250
Topic 8	-7.000	29.750	32.000	199.250	209.500
Topic 9	-12.000	54.583	82.667	178.083	68.500
	Topic 5	Topic 6	Topic 7	Topic 8	Topic 9
Topic 5	335.333				
Topic 6	162.333	632.958			
Topic 7	495.000	1012.500	5104.000		
Topic 8	98.000	134.250	456.000	114.500	
Topic 9	88.667	45.417	287.000	41.500	117.833

The following results are for:  
Group = 1 (Expert)

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References to case-file topics: percentage of total references					
	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
N of cases	12	12	12	12	12
Minimum	0.000	2.900	6.000	3.000	0.000
Maximum	9.000	13.000	31.000	32.400	33.000
Range	9.000	10.100	25.000	29.400	33.000
Mean	4.475	7.017	21.033	14.575	8.108
Variance	9.835	11.536	43.708	60.622	75.759
Standard dev.	3.136	3.396	6.611	7.786	8.875
	Topic 6	Topic 7	Topic 8	Topic 9	
N of cases	12	12	12	12	
Minimum	3.000	9.000	0.000	2.000	
Maximum	19.000	43.000	21.000	21.000	
Range	16.000	34.000	21.000	19.000	
Mean	11.258	24.817	5.083	6.225	
Variance	24.248	76.374	31.174	27.949	
Standard dev.	4.924	8.739	5.583	5.287	

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The following results are for:  
Group = 2 (Novice)

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References to case-file topics: percentage of total references					
	Topic 1	Topic 2	Topic3	Topic 4	Topic 5
N of cases	12	12	12	12	12
Minimum	0	0	2	4	2
Maximum	10.000	13.900	33.300	23.000	21.000
Range	10.000	13.900	31.300	19.000	19.000
Mean	3.150	5.225	22.200	15.683	7.775
Variance	12.154	15.577	70.220	30.054	48.437
Standard dev.	3.486	3.947	8.380	5.482	6.960
	Topic 6	Topic 7	Topic 8	Topic 9	
N of cases	12	12	12	12	
Minimum	2.800	13.900	2.000	0.000	
Maximum	22.000	52.000	6.000	7.000	
Range	19.200	38.100	4.000	7.000	
Mean	12.608	26.150	3.883	3.583	
Variance	35.703	120.214	1.597	5.031	
Standard dev.	5.975	10.964	1.264	2.243	

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