Sociobiology and Psychometrics: do they really need each other?

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ABSTRACT *Sociobiology has always had a strong relationship with classical psychometrics, and with intelligence testing in particular. The major ideological impact of Eugenics prior to 1940 led many psychometricians to adopt a sociobiological perspective, but when this turned out, in the 1960's, to be controversial many of the procedures of classical psychometrics were abandoned. Their place was taken by functional psychometrics, based on criterion reference testing, where the content of test items was related directly to very specific skills which may be required in the work place or other setting, and the use of intervening psychological traits such as intelligence was eliminated. It is demonstrated here that much of the theory of traits can be derived directly from functional psychometrics, without the need to make any sociobiological presuppositions.*

Introduction

Contemporary sociobiology (Wilson, 1975) owes a great deal to classical psychometrics, particularly as applied to intelligence testing. While many authors have looked at this relationship (e.g. Kitcher, 1985), this has largely been to draw attention to errors in sociobiology, rather than the other way round. In this paper I shall look at the impact sociobiology has had on psychometrics. It will be argued that the ideological impact of Eugenics, the precursor of sociobiology, in the 60 years up to 1940 led many classical psychometricians to treat the biological determinism of intelligence as self evident. When this turned out to be questionable many of the procedures of classical psychometrics were abandoned. Their place was taken by functional psychometrics, based on criterion reference testing (Berk, 1984). Within this approach the content of test items is related directly to very specific skills which may be required in the work place or other setting, and the use of intervening psychological traits such as intelligence, creativity, or sociability is eliminated. However, it is possible to show that much of the theory of traits can be derived directly from functional psychometrics, and that there is no need to make any sociobiological presuppositions in their derivation. Further, if the psychological trait is treated as a representational abstraction that plays a functional role in assessment and selection, a viable future for trait like concepts in psychometrics, such as those used in item response theory (Hambleton & Swaminathan, 1985), can be identified independently of sociobiological assumptions.

Some Dubious Heritage

Within the longer perspective both sociobiology and psychometrics owe their conceptual origins to Charles Darwin who in *The Descent of Man*, first printed in 1871, argued that the intellectual and moral senses have been gradually perfected through natural selection. He saw 'the savage' and 'the lower races' [sic] as being at earlier stages in this evolutionary process than members of 'the civilised nations'. The evolution of the human intellect was of particular interest to Sir Francis Galton, the originator of psychometrics, who in 1870 published 'Heredity Genius: An Inquiry into its Laws and Consequences'. Galton carried out a study of the genealogy of the famous scientific families of the time, and argued that genius was inherited in these families (which included his own). Thus we had at the end of the 19th century a popular scientific view, in accord with much of the ideology and politics of England at that time, that evolutionary theory could be applied to man, and that the white, English, middle class men of letters were at the peak of the human evolutionary tree. This hierarchical theory attributed inferior genetic status to apes, 'savages', the races of the Colonies, the Irish, and the English working class, and served as a justification for the social and political position of the dominant group.

Galton effectively defined intelligence as that faculty which the genius has and the idiot has not, while Spearman (1904) emphasised school achievement in subjects such as Greek. However, the many such attempts at definition at the turn of the century had not arisen out of a scientific psychology, but were extensions of the folk psychology of, if not the common man, the common school teacher. This recognised a distinction between the educated person and the intelligent person. The former was someone who has benefited from a sound education. The latter was someone whose disposition was such that, were they to receive such an education, they would perform very well. Whether a person receives an education or not is very much a matter of social circumstance, so that a particular educated person was not necessarily intelligent, nor a particular intelligent person educated. Rather, the intelligent person was someone who could make the most of their education, and this was seen as part of the persons 'disposition': Intelligence was not education, but educability. A disposition was something which was present at birth and was thus, by implication, part of the genetic make-up, so that intelligence when defined in this way was necessarily genetic in origin. Further underpinning, for this approach in the 19th century came from psychiatry, where elementary psychometric tests were being developed to distinguish the insane from the imbecile, and, as some of the various forms of mental defect were found to be due to genetic anomaly, so evidence was piled on presupposition.

The origins of sociobiology also owe much to the Eugenics movement which arose following concerns about the dangers of the working classes reproducing more quickly than the middle classes, therby lowering average intelligence. An important article, which influenced both Darwin and Galton, was that of W. R. Greg in *Fraser's Magazine* (1868). Greg stated that:

> The careless squalid, unaspiring Irishman multiplies like rabbits: the frugal, foreseeing, self-respecting, ambitious Scot, stern in his morality, spiritual in his faith, sagacious and disciplined in his intelligence, passes his best years in struggle, marries late and leaves few behind him.

Up until the 2nd World War there was a close relationship between the development of academic and social interest in intelligence testing and concerns about human breeding. Thus in 1919, Terman, in his introduction to the Manual for the first Stanford-Binet Intelligence Test, stated that:

> It is safe to predict that in the near future intelligence tests will bring tens of thousands of... high-grade defectives under the surveillance and protection of society. This will ultimately result in the curtailing of the reproduction of feeble-mindedness and in the elimination of enormous amounts of crime, pauperism and industrial inefficiency. It is hardly necessary to enphasise that the high-grade cases, of the type now so frequently overlooked, are precisely the ones whose guardianship it is most important for the State to assume.

This Darwinian/sociobiological approach saw intelligence as a general quality reflecting the person's moral and intellectual worth. The relation between moral qualities and intelligence is quite clear in this early literature, from Darwin and Galton to Terman and Burt.

Thus Terman tells us, about children with high intelligence, that:

> ... really serious faults are not common among them, they are nearly always socially adaptable, are sought after as playmates and companions, they are leaders far oftener than other children, and notwithstanding their many really superior qualities they are seldom vain or spoiled.

And again from Darwin in 'The Descent of Man':

> The moral sense perhaps affords the best and highest distinction between man and the lower animals.

This combination of the moral and intellectual also appears in Spearman's (1904) conception of general intelligence (g), which has an almost spiritual quality. In 'Human Ability' (1950) he speaks of a 'psychophysiological energy', which he compares to the basic theoretical concepts of physics (force, gravity, etc.). Again Spearman is not creating a new concept, but is making use of a very old and time honoured icon. It is not entirely facetious to suggest that it is the same 'psychophysiological energy' which has been thought of by some as providing the spiritual halo around the heads of religious saints. By using the metaphor in this way, Spearman generated an image of intelligence which represents not just the ability to answer simple arithmetical questions, but also implies high moral standing. These are just some of the many ideas from the Eugenics movement prior to 1940 which show clear parallels of thinking with Nazi ideology.

The Collapse of Classical Psychometrics

While all this was happening a much older tradition of testing and assessment in schools and in the work place was continuing. This wider movement traces its ancestry back to the Chinese Civil Service examinations devised by Confucius in Ancient China (Hu, 1984), but was also clearly an ongoing part of all societies in which people are given different responsibilities on the basis of the assessment of their previous knowledge and performance. Psychometrics was combined with this much older trend by Binet (1905) who devised the first intelligence tests for educational use. He developed a set of 30 standard scales which were easy and quick to administer, and which were able to discriminate between children who were seen by teachers to be bright and children who were seen as dull, as well as between mentally retarded children in an Institution and children in ordinary schools. Following Galton, psychophysical and sensory tests were known to be poorly related to educability, so Binet emphasised in his tests what he referred to as the higher mental processes: the execution of simple commands, co-ordination, object recognition, verbal knowledge, definitions, picture recognition, suggestability, and the completion of sentences. The first scale was published in 1905, but an improved version was produced in 1908 in which the tests were sorted into age levels, and in 1911 other modifications were made. Tests which might measure academic knowledge rather than intelligence were eliminated: reading, writing, or tests of knowledge that had been incidentally acquired.

The Binet test and its derivatives (the Stanford-Binet in America and the Burt tests in the United Kingdom) were widely used throughout the world for the next 60 years for diagnosing mental retardation in children. At the same time the sophisticated statistical techniques developed by the psychometricians for developing and evaluating intelligence tests also found wider application in educational, clinical and occupational settings. By the 1960's the entire testing movement was heavily contaminated by the sociobiological presuppositions of the historical psychometricians. Tests of reading, arithmetic, educational selection, personality, deviance, clinical diagnosis and job counselling were evaluated and interpreted in terms of this psychometrics, and many of its concepts, including IQ itself, had entered into everday use as folk psychological terms.

However, the significant social changes, which were at their maximum in the 1960's, soon presented a major political challenge to the racist ideology buried in traditional psychometrics. Receiving inspiration from decolonisation and from freedom movements throughout the world, battle was enjoined on all fronts. By the mid 1970's, the racist presuppositions of the intelligence testing movement had been widely exposed, and the use of many intelligence tests for educational purposes was outlawed in some states of the U.S.A., and fell into disuse in most others. Psychometrics ceased to be taught as part of many psychology courses, and the use of psychological tests became unfashionable in society at large.

Functionalism and the Criterion Testing Revival

But society could not operate without some selective process for personnel or educational purposes, and there was still a major need for instruments of clinical assessment. By 1980 psychological and educational testing was again on the increase, but this time different models of the process were being used. These 'new' ideas owed much to pre-psychometric models of testing and assessment in schools. A functional approach to testing became fashionable in which the content of items was directly related to very specific skills and achievements. This criterion testing model (Berk, 1984) made no presuppositions about the trait that was being measured, but instead tried to identify a direct relationship between the specific skills required for a particular task and the actual skills assessed in the test item. The operative criterion of success for a test became not construct validity (the extent to which the test was measuring a particular psychological trait or construct) but content validity (the extent of the match between a test specification and a job or curriculum specification).

The use of 'functional' in this context should not be confused too readily with functionalism in philosophy (Putnam, 1960), and probably owes as much to functionalism as a movement in design and architecture. However, these uses of the term are not independent, and the version of functionalism put forward by the criterion testing movement does indeed have much in common with philosophical functionalism, and is open to many of the same criticisms (Block, 1978). There are also practical limitations on the application of the strictly functional approach in psychometrics (Rust & Golombok, 1988). The main difficulty is its failure to adequately model the behaviour of human decision makers in the field. In practice, because judgements about which skills and abilities are relevant are made by humans, the identification of relevant categories for such skills follows human categorisation strategies. And these categories are themselves products of human folk psychology of which the attribution of personality and intellectual traits forms a part. Now of course it could be argued that this is irrelevant; if selection with minimum error is the criterion of success then we can envisage a computer specifically designed to look at the thousands of individual skills involved in a task and to devise psychometric test items based on these. If such a machine gave demonstrably better results than human selectors then the criteria would be met. There seem to be two major objections of this approach. Firstly, there is the difficulty that the complexity of the details of such a procedure would go beyond the understanding of humans, and this would be unsatisfactory as society expects someone to be ultimately responsible for any assessment process which affected individuals. Computers cannot be held legally accountable. Secondly, it seems unlikely that a description of human behaviour based on nothing but individual skills would be any more successful than behaviourism generally at predicting what humans will do, and this latter has proved woefully inadequate. The strong form of functionalism implied by the criterion testing movement seems to argue that there is 'nothing but' function, rather as behaviourism argues that there is 'nothing but' behaviour.

Modern Psychometrics

An alternative is to interpret functionalism teleologically (Lycan, 1987). This extension to functionalism is important here as it allows the unit of definition by function to include intentionality (Dennett, 1987), and it is difficult to conceive of a successful folk psychological use of personality constructs like intelligence which did not allow for the existence of intentions. In almost any situation where an Appointments Committee wants to select a person for a particular job they will be making a decision in which folk psychological terms such as intelligence or ability will be involved. The Committee will probably need to specify what they mean by these terms in this context and to assess them in some way. However, while they will certainly not be requiring that the selected person has some particular biological characteristic such as high speed neurones, neither will they be specifying merely that the person should do well on a set of very particular tasks. Just as sociobiology makes too many claims about the nature of intelligence, so strictly functional psychometrics makes too few.

The form of functional psychometrics advocated here bases itself on a teleological definition of functionalism, and uses as its conceptual basis the modelling of human decision makers in the situation where they are, expertly, making decisions about the assessment or selection of human individuals. Some of the criteria for success of models of this type will be the same as those used in criterion referenced testing, such as content and predictive validity. Another criterion, however, will be construct validity to the extent that the modelling process is enhanced by the presence of traits as 'objects' within the context of object-oriented programming, or, in more general terms, represents efficient practical use of folk psychological terms. Traits defined functionally can have applications in both practical and clinical settings (e.g. Rust & Golombok, 1986; Rust *et al.*, 1988; Rust, 1988). Psychological traits of this type can be ascribed existence independently of sociobiology and, as functional traits are dependent on teleological definition, are not reducible to sociobiology. Because of a confusion in much sociobiological literature between genetic traits and psychological traits (Eysenck, 1973), it has been assumed that the construct validation of psychological traits such as intelligence must be a part of the sociobiological method of classical psychometrics, and as a result construct validity and its associated techniques have often been rejected in recent years. It now seems that the totality of this rejection may have been premature. Not only can functional psychometrics account for the existence of psychological traits, it can also show that many of the biological generalisations made by sociobiologists on the basis of the properties of psychological traits are inappropriate.

Classical Issues in Perspective

For example, we can use the functional model to show that the idea of a single dimensional scale or unidimensional trait in psychometrics does not depend on the 'existence', biological or otherwise, of that trait in any physical sense, but rather follows as an artifact of the process of selection. If we take the simplest case where selection is made into two groups, we can consider testing as the allocation of test scores of 0 (fail) or 1 (pass) to all the candidates. This allocation may be on the basis of interview, of subjective opinion, of essay type examinations, of objective tests, or indeed of a combination of all of these. However, in whatever way the initial assessment is made, any scores or impressions will need to be combined to make the decision: pass or fail. Because there are only two points on such a scale it is only possible to allocate one dimension to the scale itself. And this follows from the functional nature of the task, not from any assumptions about the nature of what is measured. A dimensional theory in psychometrics, therefore, does not need to be seen as a reification of traits (whether biological or cognitive) but rather as a mirror to our own psychological processes whereby characteristics are attributed to individuals.

One particular difficulty with construct validity, as it was used by classical psychometricians, was its tendency to 'firm up' the construct or trait being measured into a single tightly defined dimension such that even minor deviations represented degrees of invalidity. Within functional psychometrics on the other hand the dimension can be fuzzy, so long as the function is met. The following example shows how this change of viewpoint can affect interpretation. In looking at the differences in mean IQ scores between different racial groups Jensen (1980) claimed that differences remained even when socio-economic and cultural factors were taken into account. However adjustment for cultural differences is no simple matter, and it seems implausible that complex interaction effects can be eliminated by any simple co-variance analyses of the type used. Where different sub-groups within society hold differing relations to the power structure, it is the dominant group which defines the parameters by which things are to be judged, including the school curriculum. Generally speaking, members of a group which define the standards perform higher on those standards, as was found, for example, in Quebec when the medium of instruction was changed from English to French. While previously the English-speaking Canadians had generally performed better than French-speaking Canadians in examinations, following the change this position was reversed. The social movements of immigrants and other sub-groups in society relates to the class and power structure in terms of the availability of resources, motivating factors for achievement, expectations of success and the perceived role of education. When one social group migrates to be within another, there is never a straightforward mixing of social equals. Many emigrant groups are driven out of their own countries by famine or persecution and arrive in the new society with nothing. Some groups emigrate to look for work, and will often find themselves at the bottom of the social structure in the new society, doing the jobs that natives refuse to do themselves. Other groups may have been driven out because of jealousy or political persecution, and may find a place for themselves in the new society providing specific skills for which there is a need. In all of these cases the tendency is often not towards absorption, but towards the development of a sub-culture. Members of these sub-cultures may, with luck, be free to compete for any advantages available to members of the society in which they find themselves. But it is unlikely that they will be quickly accepted into the groups of people who hold real power, that is, the power to say what counts as an advantage and to define the rules by which that society is controlled. It is those who hold this power within a society who also define what it means to behave 'intelligently' within it. Within functional psychometrics differences in test scores between groups are easily explained in terms of failure or discrepancies in content validity.

Another problem with the sociobiological approach has been its tendency to generalise from an idiosyncratic use of the construct of intelligence as biological to every situation where the word 'intelligence' is used. For example, evidence on the heritability of personality traits and of intelligence in particular is often quoted as evidence for their biological basis. The evidence of heritability as such is extensive but this does not of itself imply a biological basis for any such trait. Twin studies use biometrical genetics, and produce percentages of variation, rather than Mendelian characteristics. The definition of gene action used in Mendelian genetics is a strong one, whereas in biometrical genetics the underlying conception of the gene is relatively weak; it is an hypothetical entity subsumed by the effects of breeding. The biometrical genetical approach has arisen largely from agricultural engineering where it is applied to breeding more productive species of plant and animals. We are here dealing with a technology, rather than a science seeking true facts about the world. The results of genetic experiments, whatever their origin, are generally interpreted by the man in the street in Mendelian terms as it is taught in schools (for example the inheritance of eye colour). However to view biometrical genetics in this way is misleading as unlike Mendelian genetics it does not deal in absolutes (such as eye colour) but in the amount of variation in a particular trait. Thus, if we look at genetic dominance, with a Mendelian model this is fixed while in biometrical genetics the amount of dominance can disappear, or even alter direction, if we apply a transformation (e.g. a log transform or standardisation) to the scaling of our data. This manipulation can also be applied to the size of any genotype-environment interaction.

Another important 'paradox' of biometrical genetics is encountered in its application to social policy. Consider, for example, the effects on biometrical intelligence of developing a hypothetical perfectly equitable environment such that every person received the same education and social advantages. If this were the case there would be no environmental variance at all, so that biometrical intelligence would by default become 100% genetically determined. Thus the more fair the educational system the more variation in people will be determined by their birth. The fact that this perfectly straightforward aspect of biometrical genetics seems odd to us reflects the extent to which we are prone to misinterpret it. The form of surprise we feel with this failure of interpretation is demonstrated again when we look at the broader set of results in human twin studies. As more and more aspects of personality, ability and performance are investigated under the twin model it is found that almost all psychological characteristics that we can reliably measure on human beings turn out to have a genetic as well as an environmental component, each accounting for a significant proportion of the variance (e.g. Rust, 1975a; Wilson *et al.*, 1977; Rust 1984). These results have yielded a great deal of controversy, yet perhaps this is an over-reaction. Surely we have always known that much of our human identity is determined by our parents. Had the genes been different we could be apes, or fruit-flies, or oak-trees. It is common knowledge that many of our characteristics resemble those of our close relations, and observations of family resemblance are made in primitive as well as technological societies. The human personality exists in an exceptionally complex network, which draws not only on social and psychological factors but also on biology. All these aspects interact with each other and no aspects are truly independent. In making grandiose claims on the basis of twin studies it seems as if a scientific confidence trick has been pulled. Sociobiology seems to have a special knack for quantifying common knowledge, translating this into scientific jargon and serving it back to us as if it were a justification for a political ideology. But in spite of its technical format there is no new knowledge here, that is unless we wish to use the added precision of the technique and follow up the technology of biometrical genetics to breed people in the manner we breed farmyard animals!

There is no necessary relationship between genetic components of variation and biological theories. While the nature of any potential may be encoded in the (biological) genes, *what* is encoded is not biological (any more than a computer program is electronic). Even within Darwinian theory it is survival which determines what is inherited, and survival may depend on biology, but it may also depend on behaviour, or cognition.

The Impact of Cognitive Science

Most of the work on intelligence as a construct has been carried out by psychometricians committed to some form of sociobiology, and thus intelligence has come erroneously to be seen as itself a sociobiological construct. The biology in sociobiology tends to be of the extreme reductionist variety (Kitcher, 1985); to such an extent that the eventual explanation of all human activity in terms of neurone activity is not seen as an empirical matter at all, but as an *a priori* truth. To this extent it has elements in common with some trends in connectionist neuroscience (Churchland, 1986), however it differs from this development in its attempt to base intelligence not on neural organisation but on rather more basic characterisations of the neurones themselves. Eysenck and his colleagues at the Insitute of Psychiatry in London perhaps provide one of the best illustrations of this mode of thinking (Eysenck, 1986). They have carried out experiments which attempt to relate scores on IQ tests directly to brain functioning. Thus, for example, Elaine Hendrickson (1982) found that more intelligent individuals tended to have shorter latency for certain components within the EEG evoked potential, an electrical response measured in the brain following visual or auditory stimulation. While empirical evidence in this area is confused and contradictory (Rust, 1975b), Hendrickson interpreted her result as evidence that the neurones in the brains of intelligent people are faster than average; the neurones of people with high IQ process information more quickly. Another supporter of the Eysenck approach, Alan Hendrickson (1982), has also suggested that more intelligent people have faster synapses and more efficient RNA.

This approach clearly has many problems but one in particular, which arises from its extreme reductionism, is that it places the source of variation in intelligence, and therefore of limitations in intelligence, at neuronal or other very elementary levels of brain organisation. As with early information processing models in cognitive psychology (e.g. Broadbent, 1956) based on initial developments in computing, it was assumed that there are limitations on human problem solving operating at what now seem to be absurdly primitive levels. Stimulus information was shifted through a single information processing channel and sorted between various long and short term memory buffers to eventually produce a response. However, these early models soon proved to be inadequate. First because they failed to take heed of the enormous amount of representational activity that takes place in the computer software, and second because they implied that the limits on human performance are set by the extreme difficulty of carrying out advanced operations like remembering and filtering. Yet ability to remember soon became an easy task for computers, and it was hard to see, given the complexity of the nervous system why the brain should find it difficult.

By the 1980's the 'complex' activity of arithmetic, seen as higher order reasoning within intelligence tests, became available on cheap calculators. Increasingly, the development of expert knowledge based systems demonstrated that many of the skills of intelligent experts were fairly easily modelled on small personal computers. Paradoxically, it was the lower order activities of perception and motor control which proved much more difficult to model. While it can be argued that just because computers can do something does not necessarily mean it is easy, a comparison of the complexity of existing computers with the very much more complex structure of the brain does suggest that mechanical limitations of this sort are not the apparently self-evident source of human intellectual limitation they once were. Further, work on the development of fifth generation parallel processing computers has undermined any reason to suppose that there must be a physical or biological reason for there to be only a single channel in the brain. Parallel processing computers are many times more powerful than single processor machines. Recent evidence from neuroscience suggests that the brain itself, to the extent that it can be treated as a computational machine, is far more complex and more massively parallel than existing man-made computers (Rummelhart *et al.*, 1986). Seen from current perspectives in cognitive science it seems unlikely that any limitations on intelligent brain performance are due to lack of information processing power of the sort implied by these early models.

If the limitations on intelligence are not biological what are they? Psychological work on problem solving was able to throw some light on this. The work of Johnson-Laird (1983), and Tversky & Kahneman (1983), has shown that people make mistakes in many simple logical and probability exercises, a difficulty not shared with even simple computers. Their investigations of human cognitive strategies showed that these mistakes were not simple errors, but could be better described as intrusions from the general body of knowledge held by the individual. For human beings problem solving, and thus intelligent behaviour, is part of the social, linguistic and epistemological world.

The impact of the cognitive science revolution on intelligence research in psychology has led to a diversion of attention away from psychometric intelligence and towards the microstructure of problem solving. These new models of intelligence can be exemplified by the work of Sternberg (1977) who has put forward a componential model of intelligence, based on information processing. The component is defined as an elementary process that operates on internal representations of objects or symbols. Thus, when a person sees an object, the sensory input is translated by such a component into a conceptual representation in the mind. Components are of numerous different types and exist at several levels. Sternberg defines five major kinds of component: metacomponents, performance components, acquisition components, retention components, and transfer components. Metacomponents are responsible for higher order reasoning, they integrate components at lower levels and have a special role in planning out the steps for problem solving. Performance components are involved whenever a planned course of action is set in motion, including the processing of steps within a problem solving task. Acquisition components are activated whenever new learning is involved. Retention components are involved in the act of recall or remembering, but also generally wherever information of any type is searched for in the long term memory. Transfer components are involved when generalisation takes place, either transfer of training or the operation of the metaphorical process.

Conclusion

Thus neither intelligence research nor psychometrics are dependent on sociobiology or on its philosophical precursors, the stronger forms of biological reductionism and biological determinism. For psychometrics, the criterion testing movement in education has seen the rise of a behaviourally oriented alternative in functional psychometrics. While the overt behaviourism of the extreme of functional psychometrics may be unviable, a weaker version which accepts human folk psychological attributions of psychological traits as valid intervening variables shows considerable promise and is also able to demonstrate a useful future for many of the classical aspects of psychometrics such as item response theory and construct validity. Such a model is compatible with much of the current thinking in systems theory and cognitive psychology (Gardner, 1985), and it is of particular interest that systems analytic models of human society such as that of Wojciechowski (1986) have themselves been critical of sociobiology (Ganes & Shaw, 1987). By defining an individual in cognitive terms as a psychological process (Pask, 1980) we can model, as cognitive strategies on expert systems, the processes of selection and assessment of people by others. This approach enables new information processing models of psychometrics to be put forward.

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