Psychology of Human Intelligence in France and French Speaking Switzerland

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Introduction

In France and in French-speaking Switzerland, research on intelligence has traditionally referred to a relatively wide range of studies. On the one hand, intelligence is studied by differentialists - differential psychology, in the Francophone tradition, refers to both psychometrics and to the study of individual differences, the latter referring both to fundamental and to applied issues - who devise and use tests of intelligence. On the other hand, because Piaget referred to the "development of intelligence", it also includes developmental studies of cognition, in particular, the Piagetian studies. Presently, researchers working in the Piagetian tradition would no longer consider that they work on intelligence, but this is a relatively recent shift. Thus, the study of intelligence is not restricted to the use of standardized tests of intelligence scales, nor to interest in individual differences. For instance, the "Traité de Psychologie Expérimentale" first edited in 1963 devoted a whole volume to the study of intelligence (Oléron, et al., 1963), three chapters of which consisted essentially in the presentation of the Piagetian theory, by Piaget and collaborators. As in many other countries, experimental psychologists working with adults on reasoning, problem solving, language or other cognitive functions do not consider that they are working on intelligence.

This chapter will therefore reflect these fuzzy frontiers in including the differential and the Piagetian traditions, but not the other types of cognitive studies. The choice to present, in the same chapter, the situation in France and in the French-speaking part of Switzerland is justified by the geographical and linguistic proximity of these two countries, but also by the existence of numerous interactions between the researchers interested in intelligence in these two countries, including those due to the influence of Piaget's theory in France.

The first part of the chapter will provide some elements of the history of research on intelligence in these two countries, the second will deal with applications, in particular techniques of assessment, and the third will be devoted to contemporary research. Except for

history, we did not introduce subparts specifically devoted to France and Switzerland, but the country in question is specified each time the point discussed is specific to this country.

Some elements of history

France

In France, the psychology of human intelligence began with the development by Alfred Binet (1857-1911) and Théodore Simon (1873-1960) of the first measurement scale (Binet & Simon, 1905, 1908 ; Binet, 1911). The Binet-Simon test was immediately recognized as a major contribution to the assessment of intelligence in Europe and in the United States, where it was promptly translated and adapted. However, it did not have the same success in France. We will not dwell at length on the history of this discovery, which is now well known, but rather we seek to understand why this discovery occurred in France at this particular moment and why, nevertheless, it did not attract followers in France.

Why in France and why Binet?

At the turn of the 19th century, Binet was not the only psychologist seeking to devise an objective assessment of intelligence. But he was the first to free himself from the prevailing ideas on this issue. The leading approach at the time was associationism, a theory proposing that complex psychic phenomena such as images, ideas, and conscious thoughts were formed through associations of elementary sensations. Wundt, who created in 1879 the first laboratory of experimental psychology in Leipzig, had an associationist approach and popularized the idea that to study complex psychic phenomena, experimental psychology had first to break down these phenomena into their elements, i.e., sensations. Thus, the methods developed in Wundt's laboratory to implement this research program consisted essentially in measuring sensations: perceptive thresholds, sensory discrimination, reaction times. The early psychologists who sought to measure intelligence operated naturally within this theoretical framework and the tests they designed were in fact simplified versions of these new

experimental paradigms (Cattell, 1890) .

Binet broke the deadlock on this line of research by relying on two ideas that were quite original in the historical context. First, he proposed that the study of elementary processes was not a necessary step for research on intelligence. Binet argued that measures of intelligence should focus directly on individual differences in higher processes such as memory, imagination, judgment, and comprehension (Binet & Henri, 1895). Thus, this program broke with associationism, but came up against a major obstacle: Experimental psychology had made it possible at the time to measure sensations, but not higher processes. Binet's second idea allowed him to overcome this obstacle. His approach was to use development to rank tasks according to their cognitive complexity. Ranking the test items according to ages at which they were successfully completed defined, in an indirect way, their rank of cognitive complexity. This made it possible to rank children as well, depending on the level reached on this scale. Binet was well aware of the ordinal nature of this assessment procedure: "The word measure is not used here in its mathematical sense: it does not mean the number of times a quantity is contained in another. To us, the idea of measurement is one of hierarchical ranking"(Binet, 1911, p. 135).

Why was this breakthrough achieved by Binet rather than by one of the other psychologists seeking to measure intelligence at the same period? Part of the answer lies perhaps in the specificity of French psychology which, at the time, was oriented mainly toward psychopathology. Ribot (1839-1916), who can be considered as the founder of scientific psychology in France, defended the idea that pathological phenomena provided a privileged method for studying the mind, as this method provides a dissociation of processes that are usually integrated in non-pathological individuals. Binet came to psychology through Ribot’s influence and collaborated for seven years - from 1882 - with Charcot at “La Salpêtrière” Hospital, where he practiced hypnosis and observed hysterical patients. Through

this experience, Binet became familiar with the clinical method of observation, which allowed him to observe some of the deteriorations that pathology inflicts on higher processes. He could also observe that in psychiatric institutions, the diagnosis of mental retardation and the distinctions between different degrees of mental retardation were very subjective. This is the reason why he began, with the collaboration of a young psychiatrist, Dr Simon, to seek an objective method of assessment of mental retardation by comparing retarded and non-retarded subjects. Thus, the psychopathological orientation of French psychology at the turn of the 19th century could have been a facilitating factor in the sense that this approach was relatively focused on higher processes and that the comparison between normal and pathological cases offered an alternative to the experimental approach.

These facilitating factors are of course not sufficient to explain why Binet freed himself more easily than others from the associationist approach. His discovery may also be explained in terms of personal characteristics. Those who met Binet described him as an independent person, not very driven toward social contacts, more at the fringe of psychology's institutional circle. He was not a follower of any particular theoretical or methodological approach and he more or less practiced them all.

Why was the line of work of Binet abandoned in France?

The development of the psychology of intelligence in France between the world wars occurred in fact within another trend of research. While Binet designed his intelligence scale, another French psychologist, Edouard Toulouse (1865-1947), worked toward the same objective. The work of Toulouse is less well known than Binet's but thanks to recent research (Huteau, 2002) - on which we draw in this chapter - the complex relationships between Binet and Toulouse are better known today.

Toulouse, trained as a psychiatrist, became the head of a department at Villejuif's psychiatric hospital in 1898. Toulouse thought that psychiatry should be based on psychology.

Accordingly, as soon as he arrived in Villejuif, he created a laboratory of experimental psychology and asked two assistants, Nicolas Vaschide and Henri Piéron, to design rigorous observational techniques for psychological processes. Here we have to point out that both of them previously had been Binet's assistants at the Sorbonne's experimental psychology laboratory, which Binet headed from 1894. As Binet neglected this laboratory to observe children in schools, Vaschide first and Piéron, later, joined Toulouse's new laboratory. Their work led to the publication of the *Technique de Psychologie Expérimentale* (Toulouse, Vaschide & Piéron, 1904), a collection of tests designed within the associationist framework, with its main part devoted to the measurement of sensations. The second edition (Toulouse & Piéron, 1911) shows a slight evolution by integrating a few tasks designed to assess higher processes (comprehension, judgment, memory, reasoning). It is worth noting that even in this second edition, Binet's scale is not mentioned. This omission cannot be attributed to ignorance, but rather to a deep disagreement between the two laboratories. Toulouse and his collaborators believed firmly that experimental psychology was now being studied in their own laboratory and they accused Binet of having given up experimental psychology in favor of a kind of psychopathology based on observation. They criticized the concept of intellectual level, as assessed by Binet's scale, as being too global and unable to distinguish nature and nurture influences. Binet for his part said little about the *Technique de Psychologie expérimentale*, but found it vague and outdated when he reviewed it (Huteau, 2002).

Binet died in 1911, at 54 years of age, the same year the last version of his intelligence scale was published. The Sorbonne's laboratory of experimental psychology had been more or less deserted and he had no followers, which can probably be related to his personal characteristics mentioned above. Henri Piéron, one of the assistants who had left Binet to join Toulouse, took over in 1912 as the head of the Sorbonne's laboratory. Deeply at odds with Binet's global approach of intelligence, Piéron never extended this line of work but

reoriented the laboratory's activity toward the kind of analytical experimental psychology Binet had practiced for some time, then abandoned.

Piéron played a key role in the institutionalization of psychology in France. Most of his scientific work was in fact devoted to psychophysiology but he also was important in the development of the psychometric approach (called “psychotechnique”at the time) . Like his mentor Toulouse, Piéron was a positivist and believed that society should be reformed on a more rational and fair basis by drawing on a scientific approach. More specifically, he believed that students' academic and professional orientation should be chosen according to their aptitudes - objectively measured by means of a scientific psychology - rather than based on their social origins. He considered that these aptitudes were innate and independent, one from another. Thus, within a same individual, these aptitudes could be of varying levels, depending on the domains.

This conception ruled out the idea of a global hierarchy of intellectual levels. In some sense, Piéron's “theory of aptitudes” can be considered as a precursor to Gardner's (1983) theory of multiple intelligences. Within the framework of Piéron’s theory, the goal of a scientifically based program of vocational guidance was to match the aptitudes profile of each individual with the aptitudes profile required for a given occupation.

In 1928, Piéron was able to give substance to this social program by participating in the creation of an “Institut d’Orientation professionnelle” [Institute for vocational guidance] in charge of the training of vocational advisers using the psychometric approach. This institute, of which Piéron was in charge from 1928 to 1963, included a research department, whose first assignment was to design a battery of aptitudes tests, called the “Fiche d'Orientation Professionnelle” (Piéron, 1930). This battery was mainly composed of tasks drawn from the second version of the “*Technique de Psychologie expérimentale”;* however only tests assessing higher processes had been retained (4 attention tasks, 6 memory tasks, 2

verbal tasks, 1 task of imagination, and 6 concerning intelligence). The battery comprised a total of 21 tasks supposed to tap independent aptitudes (this independence was more postulated than demonstrated). Each one of these tasks was normed in percentiles and the results obtained were reported on a form as a scatterplot representing the profile of aptitudes of each individual.

The development of the psychology of intelligence at the beginning of the 20th century in France was thus influenced by the conflicting relation between two approaches to individual differences in terms of intelligence (Huteau, 2002). The first one, developed by Binet, was both global and oriented toward higher processes. The second one, supported by Toulouse and Piéron, was both analytical and oriented toward elementary processes. A sort of compromise finally took over. Toulouse and Piéron themselves evolved--more slowly than Binet--toward a measure of individual differences in higher processes but Piéron remained opposed to a global measure of intelligence and tried to develop an analytical evaluation of higher processes. In the meantime, the Binet-Simon scale was somewhat forgotten in French psychology and its use was restricted to the field of education for the diagnosis of mental retardation. It was not until 1949 that revised norms were established ; in 1966, a revised version appeared, called the "*Nouvelle Echelle Métrique de l'Intelligence"* (Zazzo et al, 1966). In the meantime, since the beginning of the fifties, the French versions of Wechsler's scales became more popular than the Binet-Simon scale among French psychologists.

French Switzerland

The French Swiss tradition has been very strongly marked by the work of Piaget and his collaborators, and interest was essentially placed on the theoretical aspects of the development of intelligence in children. Piaget himself was certainly influenced, by Baldwin (e.g., Case, 1985), and by both Edouard Claparède and Alfred Binet (or more exactly, by Simon, the collaborator of Binet) in whose laboratory he spent some time. Edouard

Claparède (1873-1940) was a precursor in proposing to link experimental pedagogy and the psychology of the child. He adopted a "genetico-functional" point of view, arguing that it was necessary, for child study to be useful for educators, to go beyond simple normative description. It was necessary to determine the role played by a given process in the individual's development, identify factors that favor or hinder development, and discover how and why, at a given period, one process is succeeded by another (e.g., Claparède, 1905). These principles are indeed very close to those adopted and defended later by Piaget.

The underrecognized contribution of Andre Rey

The empirical practices and methods, if perhaps not the theoretical approach, of the psychologists interested in assessing intellectual functions have been strongly influenced by the work of André Rey, who would certainly have been much better known internationally, had he not been in the same institute as Piaget. André Rey (1906-1965) was indeed a "universal psychologist" in that he was interested in many facets of behavior, as well as in the combination of many different approaches, ranging from clinical and school psychology to vocational guidance to neuropsychology (as a young researcher, he collaborated with Lashley), general and animal psychology. He wrote a number of books and papers on the clinical methods of psychological assessment, which very strongly contributed to establish the scientific foundations of psychometric assessment (e.g., Rey, 1958, 1963). He pleaded for the use, in psychological assessment, of a "hypothetico-deductive method" and considered that a psychological examination should consist in a "progressive experimental analysis of individual behavior". That is, he argued for the necessity to adopt a flexible battery of tests, adapted to the hypotheses progressively set with respect to the individual's difficulties as they progressively unfold in the course of a psychological examination.

Rey developed numerous, very ingenious psychometric tests, many of which unfortunately were not published. The best known, not only because they were commercially

published, but probably also because they crossed the Atlantic , are the "Fifteen words" test and the "Complex figure" (respectively translated as the Rey Auditory-Verbal learning test and the Rey-Osterrieth Complex Figure test – see Lezak, 1995). However, many other tasks were developed. Rey did not propose a theoretical model of intelligence; this is probably another reason why he is relatively little known despite his very abundant production. In fact, rather than speaking of intelligence, he preferred stressing the necessity to assess leaning competencies. Thus he emphasized the necessity to asses the capacity to learn, and systematically suggested to differentiate the results of past learning experience – nowadays one would probably speak of the knowledge base – from the present learning potential of an individual and he used this distinction to propose and classify a very wide variety of tests. In this context, it should be stressed that Rey's work was a very important source of Feuerstein's work (1979), all the more so because Feuerstein spent some time working in Geneva with André Rey. More generally, Rey can also be considered to be, at least in the French speaking countries, a precursor of the present cognitive neuropsychological approach (e.g., Seron, 1993).

The contribution of Piaget

Yet, Geneva remains best recognized in the field of research on intelligence because of Piaget's school. It is well known that Piaget, who trained as a biologist, had as a primary objective to understand the development of knowledge in the human species, rather than to describe and understand how children develop; that is, his ultimate goal was epistemological in nature. Nonetheless, it is Piaget's psychology of intelligence which is the most universally known (and disputed) facet of his work, even though he himself did not consider it to be the main part (e.g., Piaget, 1947, 1970; Piaget, & Inhelder, 1966). His theory transformed the field of developmental psychology, by providing it with a new vision of the development of the child. With his collaborators, he developed many test situations to understand the

construction of cognitive operations, addressing a very wide range of domains and using a quasi-standardized method of interview initially labeled the clinical method and later the critical method. Intelligence is defined as the most general form of coordination of the actions and operations which characterize the various developmental levels, and not as a mental faculty or an entity in itself; it develops through a succession of general stages, defined by overall structures ("structures d'ensemble").

The focus of Piagetian theory was always placed on the “epistemic” or an ideal subject, in order to unravel universal laws of development. Piaget was not interested in individual or task-specific performances, even though he acknowledged the existence of temporal lags between different notions supposed to pertain to a same general structure (horizontal decalages). For instance, he stated, addressing the issue of the use of data obtained through the clinical method for diagnostic purposes: “We are no longer dealing with a problem of general psychology, but of differential psychology, of psychology of the individual- of each individual. This, I must confess, is a problem I have unfortunately never studied, because I have no interest whatsoever in the individual. I am very interested in general mechanisms, intelligence and cognitive functions, but what makes one individual different from another seems to me far less instructive as regards the study of the human mind in general “ (Inhelder & Piaget, 1971, p. 211). The closest Piaget came to recognizing the potential theoretical relevance of individual differences and the possibility of different developmental pathways was in an article about the attainment of formal operations (Piaget, 1972); he then acknowledged the possibility that not all adolescents reach the stage of formal operations, and suggested that they might acquire formal thinking in different content domains depending on their specific aptitudes and professional expertise. However, he did not pursue further this line of exploration nor did he attempt to envisage the possible implications of such a hypothesis for his general model.

Piagetian theory and intelligence assessment

There were nevertheless two lines of work in Geneva that opened the way to the study of individual differences; they were concerned with applications of Piagetian theory and the clinical method to atypical populations, on the one hand, and with standardization, on the other hand. Barbel Inhelder (1943) was the first to use operational tasks with clinical populations. She argued that Piagetian theory offered more information and was more adapted than traditional tests to the understanding of the cognitive processes involved in mental retardation; she also emphasized the interest of using a flexible method of interviewing the child (critical method) rather than a fixed set of questions. She offered empirical evidence that mentally retarded children, while following apparently the same developmental path as normal children in terms of cognitive operations, did not reach formal operations, nor possibly the later substage of concrete operations. Inhelder nevertheless also stressed that mentally retarded children presented functional specificities, such as oscillations or perseverations, that were larger than those observed in normal children. Her work opened the way to a number of studies, particularly in Geneva, but also abroad, which applied the Piagetian method to a variety of cognitive disorders (Ajuriaguerra & Tissot, 1966). The argument was then that it was more promising to use theory-based tasks, firmly grounded in a developmental model, rather than tasks such as IQ tests which were atheoretical and had only empirical norms to offer.

However, these Genevan studies faced a major problem; they usually compared clinical populations to the epistemic subject, and often concluded that there are disharmonies in the face of large horizontal decalages whereas the amplitude of such decalages, in a normal population was not known. Yet, it has been shown since then that intraindividual decalages can also be very large in a normal population (see below). As a result, and because of both the scarcity of normative data and the difficulty of the critical method, Piagetian tasks have never

become a major tool of psychological assessment for the French Swiss clinical or educational psychologists. They have nevertheless remained in the toolbox of the psychologists, particularly those interested in understanding the cognitive functioning of the primary school-aged child.

In the early sixties, a second line of approach to the study of individual differences began in Geneva, initiated in particular by Inhelder and Vinh Bang (cited in Inhelder, 1963; see also Bang, 1988). It consisted in standardizing the tasks to establish valid evaluation and scoring criteria; approximately at the same time, longitudinal studies were launched. Unfortunately, none of these studies were published. Nassefat (1963) standardized a number of formal operational tasks, in order to offer norms to the psychologist interested in the cognitive functioning of adolescents, and to be used in the context of vocational guidance. There was also a Genevan project, in the seventies, to assemble a standard battery of Piagetian tasks, which led to the confection of two or three dozen standard sets of material. These sets remained, however, used within academic settings only and were never produced at a commercial level. To our knowledge, only the battery assembled by Longeot ("Echelle de la Pensée Logique") was produced on a relatively large scale by a test publisher. Most standardization work was accomplished outside of Geneva, both in Canada by Laurendeau and Pinard (1968), and in France, in particular by Longeot (see below). The initial objective of Rieben and de Ribaupierre's work (to be described below) was in direct continuation of these first attempts toward standardization. In view of the large inter- and intraindividual variability that was observed, however, they soon became more interested, in collaboration with Jacques Lautrey, to understand the processes underlying such variability, rather than to pursue strict standardization.

Applications of intelligence tests

In France, intelligence tests were rather widely used in the period following the second world war. Since the end of the 1960s, however, their use has declined, partly because of criticisms of these tests, but mainly because the social demands concerning intelligence tests evolved.

The criticisms

Before describing the various applications of intelligence tests, we will briefly summarize the main criticisms that were raised, restricting ourselves to the ones that are specific to the French and Francophone regions.

We already mentioned, when we discussed the contributions of Toulouse and Piéron, that one of the specificities of the development of psychometric tests in France was that this development was supported by left-wing intellectuals, convinced that society could be reformed by relying on science. For this group, the use of aptitude tests seemed to be a means to correct social inequalities concerning access to education, and thus to promote greater justice in the society. During the period between the two world wars, this social project and psychometrics were criticized by right-wing parties.

The situation changed after the second world war, when the use of intelligence tests was criticized by intellectuals and psychologists associated with the Communist Party. It should be noted that a resolution adopted in 1936 by the central committee of the Communist Party in USSR had forbidden the use of tests, psychometrics being considered as " bourgeois " and " anti-scientific ". In France, intellectuals close to the French Communist Party accused intelligence tests of confirming, legitimating, and even inducing the acceptance of social inequalities (La Raison, 1952). At the time, the criticisms remained in the realm of intellectual debates and did not have any major influence on the use of intelligence tests because their use was increasing in any case. After May 1968, however, these criticisms were revived by extreme-left movements (see, for example, Tort, 1974). They were then more

influential and contributed to a certain dismissal of tests, and more globally of any type of assessment.

In French-speaking Switzerland, the criticisms were of a rather different nature, and came from within the psychological community. As already mentioned above, the Piagetian school, and more particularly Inhelder, criticized the intelligence tests for totally lacking from a theoretical basis, and for being too static. Together with psychiatrists such as Ajuriaguerra and Tissot, Inhelder tried therefore to encourage, in the sixties, the use of Piagetian tasks in educational as well as in clinical psychology. However, the lack of proper standardization, the intensive training required by the Piagetian critical type of questioning and the absence of norms restricted the use of these tasks. In parallel, Rey was also showing the way to using a more adaptive and more analytical type of testing.

Returning now to the applications of tests, we will examine the three main domains in which they have been employed : education, health, and work.

The domain of education

In the French educational system, the use of intelligence tests has differed between elementary and secondary schooling. The problems are different at each of these two levels, and the psychologists involved at each level have different training.

At the elementary level, the main goal of the “Psychologues Scolaires” [School Psychologists], whose training is mainly oriented toward clinical psychology, consists of preventing school failure. These psychologists practice individual check-ups requested by parents or teachers when children are facing major difficulties. At times they include an intelligence test to determine whether the problems may be due to intellectual retardation. The tests most commonly employed are the WPPSI and the WISC or, less frequently, the NEMI (i.e., the revised version of the Binet-Simon) or the K-ABC.

Cases of mental retardation requiring special education are not very common

(currently less than 5% of the school population). Admission to special classes or institutions is subject to the decision of a commission. Intelligence test scores, interpreted by the school psychologist, are one of the major elements on which the decision is based. Thus, at the elementary level, the function of intelligence scales remains the same as in Binet's era when he created his first test.

Psychologists involved in the secondary school system are referred to as "Conseillers d'Orientation-Psychologues" (C.O.P.) [Guidance counselors – Psychologists]; their main function consists of guiding students in careers and courses choices made during schooling. The training of the C.O. P.s - there are currently about 4000 in France - has been oriented for a long time toward differential psychology and psychometrics, following the tradition established by Piéron when he created the "Institut d'Orientation Professionnelle". Between the 1950s and the 1980s, these psychologists administered factorial tests of aptitudes in a rather systematic fashion. The aim was to detect "aptitudes' reserves", in other words to detect, in the group of children not admitted into secondary school, those who performed well according to intelligence tests. It should be noted that in the 1950s, only children from upper class families had access to the secondary school system. The aptitude tests were administered at the end of the elementary school (5^{th} grade) with the goal of encouraging pupils who performed well on these tests to be candidates for the admission exam for secondary schools.

At the end of the 1950s, a reform of the educational system created the "collège unique" [unique junior high school], corresponding to the first part of secondary school (grade 6 to 9) and making schooling mandatory for all children up to grade 9. This reform eliminated the need to identify children having aptitudes for secondary school.

The testing activity of the C.O.P. moved then to grade 9, corresponding to the end of the junior high school. Factorial intelligence tests were administered systematically. The objective was then to take both school performance and test results into account for guidance

decisions. In this way students who showed good levels of intellectual aptitudes in the tests, even if their school results were not completely satisfactory, could have a chance to enter into high school (grades 10, 11, and 12). This practice of aptitude tests declined rapidly in the 1970s and has now disappeared. The criticism of tests which developed after May 1968 in France probably played a part in the discontent with the evaluation of aptitudes, but the main reason for the decline is the progressive generalization of the high school education, which made the identification of aptitudes reserves unnecessary at the end of ninth grade.

. It must be stressed that in France, diplomas are national, which means that students who earn a given diploma, for example the "baccalaureat" (diploma obtained at the end of the high school and which is required to enter to the university), have followed exactly the same curriculum, with the same program and passed the same national examination, whatever the area of France or the school in which they studied. The use of standardized tests at the entry to the University, such as the SAT in the United States where the diplomas and programs can be very different, is therefore not necessary in France. The homogeneity of programs and diplomas in the French system probably explains why, compared to the American system, the use of collective tests has now practically disappeared.

In French Switzerland, the situation was roughly similar with respect to intelligence testing. It should be stressed, however, that the educational system is different from France, and, more importantly, that it differs within the different "cantons" or provinces. Also, school psychologists do not exist in each canton, but are sometimes integrated within clinical guidance institutions, at least as concerns the primary school age range. As a result of this diversity, and also due to the small size of each region, there has never been general recommendations with respect to testing, nor national (or regional) norms, and the choice of psychological tools is left to the individual psychologists or to the institutions in which they are hired. The only generalized practice was to administer intelligence scales to youngsters

who had to enter special education programs, because social insurance at the federal level was assuming school costs for those who presented an IQ lower than 75; by now, this rule has been changed, while psychologists show a renewed interest for both intelligence tests (such as the WISC or the K-ABC) and analytical testing.

The health care domain

Several thousands of clinical psychologists are involved in the health care system. They practice psychological examinations in psychiatric hospitals or other institutions, or in private practice. The situation is roughly identical in both countries. Since the 1960s, clinical training has been strongly influenced by the psychoanalytic approach, with a clear neglect of the psychometric approach. This evolution led to a decreased use of tests, specifically intelligence tests. Lately, this situation seems to have changed and, as a recent survey (Castro, Meljac, & Joubert, 1996) shows, clinical psychologists are reintroducing intelligence tests as one of their assessment tools. According to this survey, the most widely-used tests are Wechsler's WPPSI, WISC and WAIS, Kaufman's K-ABC and the Brunet-Lézine (a developmental scale for infants, based on Piaget's work on the sensori-motor stage).

The work domain

In the occupational field, intelligence tests are not widely used. A few companies use factorial batteries of aptitudes tests, for example some companies in the transportation sector. Given the importance of the security issues in this field, there is a long tradition of psychometrics in this branch of industry and these companies have often their own psychological testing service. This is the case for the French railway company (SNCF), the Parisian transportation company (RATP), and major French airlines. Private recruitment agencies, which many companies hire, use intelligence tests (in general factorial tests of aptitude) only in approximately 30% of the cases. The majority of the recruitment procedures

are limited to examining curricula vita , an interview and often – it is a curious French and French-Swiss specificity – a graphological analysis (Bruchon-Schweitzer & Ferrieux, 1991).

The French army administered aptitude tests to its recruits for a long time. These tests were systematically administered to the 400 000 young recruits enrolled each year and the results were taken into account in their assignments. This passage is written in the past tense because mandatory military service was eliminated in 2001 and replaced by a professional army. The use of collective tests is thus also disappearing in the army.

In summary, the use of intelligence tests in social applications in France has experienced highs and lows. During the period between the Fifties and the Seventies, rather massive applications of collective tests occurred in the education system, the army, and more rarely in the industry. In French Switzerland, the use of tests was never so massive, however. Under the effect of the criticisms concerning these tests and the evolution of social institutions the systematic use of collective tests has practically disappeared. On the contrary, the use of intelligence scales in individual psychological examinations for guidance and therapeutic goals has been maintained. After a period of relative disinterest in the seventies and eighties, intelligence tests have seen a renewed interest in the fields of education and health.

Contemporary research on intelligence in France and Switzerland

Concerning the present state of research on intelligence in France and French Switzerland, we will distinguish three relatively original streams of studies. First, we will briefly describe developmental studies of intelligence or of cognitive development that can be qualified as post-piagetian or neopiagetian. These are studies which extended Piaget's general theory of intellectual development to areas that he already pointed to but ignored or treated only in passing (e.g., language or time, or the role of the social context) or studies which

combined the Piagetian theory (at least some of the Piagetian principles) with a very different approach (generally cognitive psychology), resting on different epistemological and psychological traditions. As Case (1992) already noted, the latter approaches cannot be considered as simple extensions of the Piagetian theory nor revisions along lines that Piaget might have followed himself. A second stream includes researchers who attempted to combine the Piagetian method with the differential or psychometric approach of intelligence. Third, there are a number of studies centered on the study of intelligence in an individual differences perspective, usually in adults. There is almost no research on new tests of intelligence, but there are a number of studies, particularly in France, which focus on the use of strategies in existent tests of intelligence, and their link to individual differences.

Developmental perspectives

Most of developmental research has retained Piaget's fundamentalist option, with little interest granted to individual differences, while nevertheless opening the way to the study of variability. Pierre Mounoud, a student of Piaget, conducted and initiated a large number of studies on infant and child development, basically related to motor and perceptual development (e.g., Mounoud & Hauert, 1982). Very early, he proposed a relatively radical departure from Piaget's model, in particular in suggesting the central role of representations during infancy, and in proposing cyclical recursion through substages at each level of development. Mounoud was always more interested, like most Piagetians and neoPiagetians, in the development of central systems, and defended the idea that action and thought (or procedural and declarative knowledge) entertain dialectic instead of unidirectional relationships in the course of development, considering that action is as much a product as a previous condition for thought (Mounoud, 1993; 1995). In his empirical research (in collaboration with Hauert, Vinter, Zesiger and Badan, in particular), he has mainly studied the elaboration of "motor" invariants by children, in a similar way as Piaget investigated the

"conceptual" ones (e.g., Badan, Hauert, & Mounoud, 1985; Mounoud et al., 1985; Zesiger, Mounoud, & Hauert, 1993). He has also studied the development of selective attention in the Stroop task and in pointing tasks, in collaboration with Koenig, Badan and Pegoraro, in particular. Presently, he is studying, in collaboration with Moy, Perraudin and Peyer, the role of perceived and evoked action on object recognition, by means of the semantic priming paradigm, in order to understand the structuration of semantic networks for manufactured objects.

Another direction, which was initiated in Geneva by Willem Doise under the inspiration of Piaget, was sociocognitive. Doise was a pioneer in empirically demonstrating the role of socio-cognitive conflict in the development of intelligence, and in promoting a strong research stream in developmental social psychology in Europe (e.g., Doise & Mugny, 1984). While Doise himself orientated more recently his research toward the domains of social representations and of human rights, the line of research which he initiated with respect to the influence of social interactions on intelligence was continued by Mugny and his students in Geneva, whose studies presently focus essentially on the themes of social marking and social influences (Doise, Mugny, & Perez, 1998; Mugny & Carugati, 1989), and by Perret-Clermont and her collaborators in Neuchâtel, mainly in educational psychology. Perret-Clermont conducted numerous studies on the role of peer interactions in cognitive development, most often with Piagetian tasks such as the conservation paradigm, showing that a child can take advantage of interactions with more advanced peers to restructure his/her answer and give a logically more complex response (e.g., Perret-Clermont, 1980). Such interactions create a sociocognitive conflict, which in turn accounts for the positive effect of social influence. A more recent line of studies consists in analyzing the social context itself, focusing on interactional patterns (e.g., Grossen & Perret-Clermont, 1994; Schubauer-Leoni, & Perret-Clermont, 1997) finely observed in the context of tests (e.g., conservation or mathematical

tasks) or didactic situations, and showing that children's cognitive abilities are the fruit of a social co-construction whose result does not depend solely on the child or the experimenter (teacher). These latter studies lead to conclusions that converge with propositions issued in a more Vygotskian perspective such as adopted by a number of North American researchers.

Montangero (e.g., 1984) extended Piaget's theory to the domain of the development of the concept of time. He recently developed studies on the development of diachronic thinking, that is, on how one understands changes in a given situation taking into account past and future, possible changes, in relation with reasoning and problem solving abilities (Montangero, 1996a; 1996b).

In France, Lécuyer and Streri's research on infant's development critically addressed the exclusive role attributed by Piaget to action in the structuration of cognition during the sensorimotor period. For Piaget, it is through motor activity that babies structure their environment, via the transformations that such activity makes possible. Piaget thought, for example, that intermodal transfer between vision and touch is only possible when vision and touch are coordinated by the activity of prehension. Lécuyer and Streri argue that motricity is too immature during the first months of life for the babies' action to play this structuring role; it does not allow an efficient transformation of their environment. In contrast, perceptual activity – which, however, does not impose a transformation on the environment – would already be sufficiently functional to play this structuring role (Lécuyer & Streri, 1992). This hypothesis about developmental processes at work in the sensori-motor period is tested by studies showing that capacities of transfer from touch to vision and from vision to touch develop between 2 and 4 months of age, that is, before vision and prehension are coordinated (Streri & Molina , 1994). Along the same line, Lécuyer and colleague, also consider that perceptual activity is sufficient to explain early abstract categorization – 3 versus 4 objects - observed in 3 and 5 month-old infants (Poirier, Lécuyer, & Cybula (2000).

As concerns the age period corresponding to concrete operations, studies conducted by Bideaud contributed to demonstrate that, besides action, various representational systems which Piaget considered to be only secondary (language, mental imagery, socially transmitted knowledge, etc.) play an important role in the development of logical operations. Operations of classification, seriation and numeration were studied (Bideaud, 1988; Lautrey & Bideaud, 1985; Lautrey, Bideaud, & Puysegur, 1986). A review of the French language research on the developmental studies of numeration was recently published (Bideaud & Lehalle, 2002).

Concerning mental retardation, the line of work opened by Inhelder has been extended by Paour; he abandoned Inhelder's structural approach but pursued functional analyses that she had also conducted (Paour, 2001). Paour's research stresses the fact that several levels of processing co-exist in retarded children-- that their responses are fragile and that non-cognitive factors (emotional, motivational) determine this fragility. This functional approach led Paour to develop a procedure of cognitive remediation that consists in training mentally retarded children to deal with abstract arbitrary relations as well as to defend, anticipate and apply their inferences. Training thus results in improved comparison, classification, and even conservation skills, and ultimately in greater interest and more efficient performance in academic learning (Paour, 1992; Paour & Soavi, 1992; Paour, Cèbe, & Haywood, 2000)[1].

Within a neopiagetian framework (e.g., Demetriou, 1988), and in parallel with her work in collaboration with Lautrey and Rieben on individual differences and cognitive development (see below), de Ribaupierre pursued studies on the development of working memory or attentional capacity, considering that working memory tasks tap central resources in terms of activation and inhibition (e.g., de Ribaupierre, 2000; de Ribaupierre & Bailleux, 1995). These central or attentional resources develop with age and set upper limits on cognitive development as assessed by logical or reasoning tasks. In line also with approaches such as

[1] For other, non Post-Piagetian, research on cognitive remediation in this part of the world, see Loarer (2002) and Büchel (2000, 2001)

Engle's (Engle, Kane, & Tuholski, 1999)'s or Miyake's (Miyake & Shah, 1999), her hypothesis is that individual and developmental differences in working memory tasks reflect the interplay of underlying processes that are the same as those at work in fluid intelligence tasks. Her work has presently extended to a lifespan perspective, in order to understand the relationships between working memory, inhibition, and processing speed, assuming that the latter two constructs might account for age differences in working memory, while working memory in turn accounts for age differences in fluid intelligence tasks, both during childhood and during older adulthood (de Ribaupierre, in press).

Another neo-piagetian line of work considers limitations in inhibitory capacities as being the major constraint shaping cognitive development (Houdé, 2000). Following Dempster (1992) and Pascual-Leone (1987), Houdé considers that many Piagetian tasks are misleading situations, in which the correct answer implies the inhibition of a more primitive but salient response scheme. The assumption underlying this line of work is that development cannot be reduced to the coordination-activation of structural units but that it also requires learning to inhibit a competing structure or scheme. This approach has been applied to the study of number (Houdé & Guichart, 2001), categorization and reasoning. Concerning the role of inhibition in reasoning tasks, functional imagery techniques used during a Wason-like reasoning task, have shown that, after a bias-inhibition training, a shift is observed in cortical activations from the posterior part of the brain to a left prefrontal network (Houdé et al, 2000).

Piagetian theory and individual differences

The so-called "French connection" (Larivée, Normandeau, & Parent, 2000) is based on Reuchlin's (1964) proposal to articulate the developmental piagetian and the factorial psychometric approaches. This proposal was in line with Cronbach's (1957) address to the APA meeting in which he argued for the unification of general and differential psychology. Reuchlin suggested that Piaget's notion of an overall structure could provide a theoretical

explanation of the *g* factor of intelligence, on the one hand, and that the "horizontal decalage" well known in Piagetian studies could be linked to the existence of group factors in factorial approaches, on the other hand. These hypotheses proved to be very fruitful, because Reuchlin provided both a theoretical framework, and some methodological avenues; they generated a host of empirical studies, among which the most extensive were those by Longeot, and by Rieben, de Ribaupierre and Lautrey.

Later on, Reuchlin (1978) developed another productive hypothesis, that of the existence of vicarious or equifunctional processes. The idea underlying the notion of vicariance is that, in many situations, every individual has in his or her repertoire several processes available to elaborate an adaptive response. The processes which are likely to fulfill the same function are considered vicarious because they can substitute each other in cognitive functioning. This kind of redundancy is a fundamental property that offers the cognitive system its reliability and resistance to local impairments. These possibilities of substitution can also explain the various forms of intra and interindividual variability, observed in cognitive strategies (Lautrey, 2002).

Longeot's first set of studies (Longeot, 1969) confirmed the existence of a general factor in formal operational tasks, observing not only that the Piagetian tasks tended to load on the same factor, but also that subjects at the formal operational level succeeded better than the others in all kinds of psychometric tests; factor analyses also showed the existence of two group factors that were defined by Longeot as combinatorial and INRC (e.g., proportionality), corresponding to the two main structures defined by Piaget at this stage. On the basis of a second set of studies, Longeot (1978) proposed some years later a model of development in which several routes are possible within a same stage.

Rieben, de Ribaupierre, and Lautrey launched at the beginning of the 80's a set of studies to investigate inter- and intraindividual variability in Piagetian tasks, in school-age

children (de Ribaupierre & Rieben, 1995; de Ribaupierre, Rieben, & Lautrey, 1991; Rieben, de Ribaupierre, & Lautrey, 1983, 1990). Using several tasks, representative of different domains, they proposed a qualitative type of analysis in terms of dimensions of transformation, which made it possible to conduct cross-domain comparisons; they also resorted to correspondence analyses and other, more quantitative techniques (Lautrey, Rieben, & de Ribaupierre, 1986). A quasi-longitudinal design was adopted, with two points of measurement, separated by a three-year interval. All analyses pointed to a large individual variability which is not compatible with a unidimensional model of development. Although a general factor was obtained, it was largely insufficient to account for all the variance. The analysis of the form of intraindividual variability, and in particular of the decalages that were termed "individual", as well as the observation of group factors in correspondence analyses, led these researchers to propose that there are different developmental pathways, for different types of children; such a proposition was backed up by the variability observed in intra-individual change over the three-year interval. Combining these results with Reuchlin's model of vicarious processes led to a pluralistic model of development, in which several processes are likely to fulfill a same cognitive function; these processes would be present across all subjects, but their relative weight and their interplay might vary between individuals, these variations accounting then for variations in the developmental trajectories (Lautrey, 1993, 2002; Lautrey, & Caroff, 1996; de Ribaupierre, 1993).

Rieben et al. also studied severely learning disabled children and pre-adolescents with the same set of tasks, showing once again that inter- and intra-individual variability was very large (but not larger) in such a population (de Ribaupierre, & Rieben, 1987; Rieben, de Ribaupierre, & Lautrey, 1985). Doudin and Grégoire (1992) partly replicated these results in other types of learning disabled children. Rieben et al. resorted to the concept of executive control to account for the fact that these learning disabled children displayed discordant

performances between Piagetian tasks in which they did not present a large developmental lag, on the one hand, and school performance, on the other hand. In particular, they suggested that, due to the Piagetian method of critical questioning that was used, the experimenter provided executive processes that children could not use spontaneously. Their conclusions thus converged with those of North American researchers involved in so-called metacognitive studies (e.g., Brown, Bransford, Ferrara, & Campione, 1983; Campione, & Brown, 1977).

The differential perspective

Research aiming at developing new tests of intelligence is currently practically nonexistent in this part of the world. The differential approach to intelligence tests seeks rather to reinterpret the behaviors observed in the existing tests within the framework of cognitive psychology. This approach can be illustrated by three examples of research on individual differences in the strategies used when solving intelligence tests. The first and the second studies are inspired by the vicariance model proposed by Reuchlin (see above), whereas the third study relies on a model of problem-solving.

The first example is Rozencwajg's work on strategies in the Kohs Block design task. In a first phase of the research, video-recordings of 17-year-old subjects were analysed and three different strategies were observed : a global and an analytic strategy (i.e., the two classically observed strategies), and a third strategy labeled "synthetic" (Rozencwajg, 1991), according to which subjects place the blocks in an order that conforms to the gestalt in the test design (for example, triangles, diamond, stripes). These strategies were related to the cognitive style of Field Dependence-Independence: field-independent subjects adopted more frequently the analytic and the synthetic strategy whereas field-dependent subjects more often used global strategies. In the second phase of the research, the Kohs blocks task was computerized in order to facilitate the automatic collection of the behavioral indices characterizing the strategy of subjects (inspection time of the design, placement order of the

cubes, anticipation, etc). Software was devised to assess the subject's strategy by comparing its profile with a theoretical profile characterizing each strategy. This computerized version of the task is published (Corroyer & Rozencwajg, 1995). It has been used to study the developmental evolution of strategies from age 12 to adulthood. The results showed that the frequency of the global strategy decreases regularly with age whereas the frequencies of the analytic and the synthetic strategies increase (Rozencwajg & Corroyer, 2002).

Another example is the research on the processes used for solving the D70, a g factor test used in France (Dickes & Martin, 1998). Each item of this test is made of a series of dominoes. Each domino has a given number of dots on each of its two faces. The configuration of the series of dominoes varies with items: they can form a line, a circle, a cross, etc. One of the dominoes in the series is empty and the task is to infer the rule of the series in order to find the number of dots that should be put on each face of this domino. A factorial analysis of the items showed that some of them load on a numerical factor and others on a spatial factor (Dickes & Martin, 1998). In a subsequent study, the strategies used by subjects to solve the D70 items were studied by relying on verbalisations and on reaction times (Rémy & Gilles, 1999). Two main strategies were found: The numerical strategy consists in counting the number of dots on each face of each domino and in searching for the underlying rule; the spatial strategy consists in relying on the symmetries present in the set of dominoes of a series. Some items can only be solved by using a numerical strategy, others are easily solved by a spatial strategy and there are "equipotent" items, lending themselves to either strategy. In these "equipotent" items, subjects show a relatively stable preference for one of these two strategies. In a study in progress a clever and economic method for diagnosing the strategies was designed, using items with two possible correct answers, one for each strategy. This device is used to study the stability of strategies and their relations to aptitudes (Rémy, 2001).

Individual differences in strategy use in intelligence tests are also studied within the framework of problemsolving. Richard and Zamani (2000) proposed a model in which the representation of the situation is formalized as an ordered list of constraints, a constraint being defined as a restriction on the set of a priori possible responses. Three types of constraints are distinguished: those relative to the interpretation of instructions, which may be correct or not, those relative to heuristics, and those relative to goals. The method of individual protocol analysis is used to identify the set of constraints which is sufficient to simulate the solving procedure adopted by a given individual. Within this approach, individual differences are accounted for by differences in the constraints underlying the representation (differences in either the list of constraints and/or their order of priority). This approach has been applied to the stategies used when solving a computerized version of the Passalong test. Results have shown that differences in the ability to discover and learn useful information from failures and impasses account for a large part of the individual differences observed in strategy and performance in this test (Richard & Zamani, 2002; Zamani & Richard, 2000).

Conclusion

How specific is the French and French Swiss research on human intelligence? Two major contributions emanated from this part of the world, that of Binet, who proposed the first test of intelligence, and that of Piaget, who proposed the first developmental theory of intelligence. Both propositions were made outside, if not in rupture with, the mainstream of the time: associationism in the case of Binet and behaviorism in the case of Piaget. In both cases, too, the focus was placed on intelligence as a general characteristic of behavior: an undifferentiated product of a variety of performances as concerns Binet, an overall structure of behaviors as concerns Piaget. These two contributions have perhaps also in common to have been too general.

Another characteristic of the French and French Swiss research on intelligence is to have addressed fundamental rather than applied issues. Binet's test was adapted, improved and disseminated in other regions than France, and the Piagetian theory has rarely been used to build techniques for assessing intelligence. The latter theory inspired more tentatives in educational psychology (but again more so in other countries), where it has been used to stress the role of action in the construction of knowledge; it also helped educators to draw attention to the limits that a developmental stage imposes on learning. This fundamental orientation of research still prevails today, and very few studies are devoted to the elaboration of new diagnostic tools.

Finally, and as a result, there is also a certain French and French Swiss specificity in the theoretical orientations of the contemporary research on intelligence. From a developmental perspective, the influence of the Piagetian theory remains strong. Even though several features of the original theory have been disregarded or adapted, such as the purely structural approach which was only a part of Piaget's work, many facets of the theory were retained and often combined with other perspectives. This is the case, for instance, of Piaget's constructivist option, of the structuring role of action or of decentration mechanisms. The objects of study remain often those that Piaget identified as particularly heuristic for a developmental study of intelligence. This is for instance the case of the child's naive ideas, of the coordination of perspectives, of the permanence of objects, of number; even theories of mind, which is often considered as a new field of study, is a concept very close to the Piagetian theory. From the stance point of differential psychology, the influence of Reuchlin is obvious in the development of a fundamental approach, within which the different forms of inter- and intraindividual variability are studied from a theoretical point of view rather than from a psychometric and applied perspective; the objective is to integrate the study of variability within the general theories of cognition, in order to better understand the

individuality as well as the universality of human intelligence.

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