The Importance of Cognitive Abilities at Primary School for Educational and Occupational Success in the Life Course of a Dutch Generation, born around 1940.

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1. Social stratification research and cognitive abilities

The interest of students of social stratification in the importance of cognitive abilities for occupational attainment processes has been changing since the fifties.

The first generation of researchers started their cooperation by making comparable tables of intergenerational mobility for industrial societies in order to answer their basic question whether the overall pattern of social mobility is much the same in these societies (Ganzeboom, Treiman & Ultee 1991). Although many researchers of this first generation were aware of the pivotal role of educational attainment in the intergenerational transmission of advantage (Glass 1954; van Heek 1968), they were not able to answer the crucial question of the importance of this role because of their limited statistical models and data. The relations between social class, intergenerational mobility, educational attainment and cognitive ability were therefore beyond their empirical horizon. However, Young (1958) pointed out the possible important but ambivalent role of cognitive ability for intergenerational mobility in his satirical novel on the rise and fall of meritocracy.

The second generation started with the work of O. D. Duncan, especially Blau & Duncan (1967). They introduced path models, which made it possible to access the relative importance of family background and education for the status attainment (occupation, income). This generation reformulated the old question of how much intergenerational mobility there is into the new ones of how much the (direct) influence of father's occupation on son's occupation compares with that of other background factors, especially education (Ganzeboom, Treiman & Ultee 1991: 283). The role of education for intergenerational mobility became more clearly but also more compound: respondent's occupational status is more related to education than to father's occupation, and most of the effect of education is independent of social origins. But at the same time a majority of the social reproduction is transmitted through education.

The work of this second generation stimulated the introduction of cognitive ability and motivational variables into the status attainment models (Duncan et al 1972). This effort was taken up in a long–term investigation of a cohort of high schools graduates by Sewell and his associates (Sewell & Hauser 1975): the so-called Wisconsin Longitudinal Study. In a review of their work in the early eighties (Sewell & Hauser 1980: 73-74) conclude that the effects of the parental socioeconomic background on the educational attainment, net of measured ability, are impressive, but that the influence of measured ability, net of socioeconomic background, is likewise impressive. Son's occupational status is affected by father's occupational status, but this direct effect is not large. They reported also substantial effects of ability, both directly and indirectly, and a very large direct effect of education on occupational status. Son's educational and occupational attainment play each an important part in son's

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earnings. About half of the effect of educational attainment on earnings is due to its effect on occupational attainment and about the half is due to its direct effect on earnings. Ability has an important effect on earnings which is virtually all mediated by its effects on grades, significant others, and aspirants. Sewell & Hauser (1980: 81) found in the 1975 follow-up study that among men the total effect of academic ability on the current occupational status is almost as large as its total effect on the first occupational status, while among women the total effect of ability on the current occupational status is larger than its effect on first occupational status. This is remarkable because the direct effects of social background and of most aspects of high school experiences tend to decrease the more distant in the life cycle the socioeconomic outcome is from these experiences. The causal model used in the Wisconsin Longitudinal Study (the so-called 'Wisconsin-model') has been applied in other societies: Canada, Costa Rica, Brasilia, Israel, Japan and the Netherlands. Sewell & Hauser summarize as a conclusion that they were impressed with the similarities of findings for the different societies where reasonable similar measurements were employed.

Another examples of the introduction of cognitive ability into status attainment models are the studies of Jencks and associates (Jencks et al 1972; 1979). They included cognitive ability as an intermediary variable between parental background and educational and occupational attainment. They did not use one specific data set, but combined different ones to artificial matrices. The conclusion from the first study (Jencks et al, 1972) that "neither family background, cognitive abilities, educational attainment, nor occupational status explain much of the variation in men's incomes", was reformulated by his later study: "educational attainment did have a significant effect on income in the U.S.A.".

The influence of this 'Wisconsin-model' in combination with the studies of Jencks (1972, 1979) on Dutch research was substantial, as we shall see in a next section.

However, these applications of the Wisconsin-model and the Jencks-studies remained marginal with the mainstream of the social stratification research of the second generation. Hauser (1997) reintroduced this Wisconsin Longitudinal Study again to students of social stratification in order to answer to the challenge of Herrnstein & Murray (1994). Hauser (1997: 5-8) summarize some causes of this marginality of the Wisconsin-model and the Jencks-studies: an inordinate and singular emphasis on the analysis of intergenerational social mobility tables; the easiness and lower costs to collect retrospective data than longitudinal data; a rejection of the quantification of occupational position or social class in gradational terms; the emerge of the 'new structuralism'; the political incorrectness of studying the role of intelligence in social life.

The third generation of stratification research replaced the multivariate linear regression models by a variety of loglinear models (Ganzeboom, Treiman & Ultee 1991: 286-288). The methodological advantages of these loglinear models are twofold: 1. Providing a technically adequate way to distinguish absolute mobility from relative mobility chances (social fluidity); 2. Treating a bivariate association as a multidimensional pattern. As a consequence of this emphasis on loglinear modeling by this third generation research questions of the second generations (like the role of cognitive ability in social mobility) dropped from the research agenda. Ganzeboom, Treiman & Ultee (1991: 290-297) discuss in their review new developments and suggestions beyond this third geneartion, but there is no reference to a possible future role of cognitive ability in intergenerational mobility research.

Recent developments outside the stratification research have forced USA scholars to address the question of the role of cognitive ability in intergenerational mobility: *The Bell Curve* of Herrnstein & Murray (1994). I shall not try to summarize this book and the following

discussions but only refer to reviews of this book written by social stratification scholars: Hauser (1995) and Fischer et al (1996). Hauser (1997: 63) summarize his conclusion as follows: "On the basis of the evidence reviewed here, it is fair to conclude that the traditional psychometric literature on cognitive ability - popularly resurrected in *The Bell Curve* - vastly overstates the case for the role of IQ in the stratification process. On the other hand, to say that the case has been overstated (…) does not say that there is no place for cognitive ability in our understanding of the stratification process. On the contrary, both as a defense against excessive claims of psychometricists and in developing our own scientific enterprise, we owe it to ourselves to take cognitive ability seriously and to seek and produce new evidence of its role in social stratification."

The Bell Curve has far less impact on the public and scientific debates in Europe. But as a consequence of the decline of leftist ideology since the seventies, the public belief in the importance of cognitive ability and individual motivation as cornerstones of successful mobility has become very common, also in Europe. Therefor European social scientists should address also the question of the role of cognitive ability in the stratification process in order to avoid overstatement and understatement of the role of IQ in their societies.

This paper contributes to this production of evidence of the role of cognitive ability in social stratification by analyzing a Dutch longitudinal data set, particularly well suited to investigate these questions for a European society (the so-called *Noord-Brabant* cohort). This cohort contains measurements of parental characteristics, cognitive ability at the end of primary school (Progressive Matrices; Raven, 1958) together with their educational and occupational attainment during the life course of 1519 children born around 1940, interviewed and tested in 1952 and re-interviewed in 1957-'59, 1983 and 1993.

2. Cognitive abilities in Dutch social stratification research

Measured cognitive ability as an intermediary variable in the intergenerational mobility processes was introduced for the first time in Dutch stratification and mobility research by a prominent member of the first generation of social stratification scholars: van Heek (1968). He studied the effect of parental class on the transmission from primary to secondary school, looking for 'hidden talents' among pupils from the lower classes. Because he could not find that 'hidden talents', he and his colleagues[1] introduced cognitive ability differences at the end of primary education as an explanation of that failure. This book and the following discussions laid the foundation of Dutch sociology of education, and as a consequence cognitive ability has always played an important role in the empirical oriented Dutch sociology of education (Dronkers 1989: 2; Wesselingh, 1982, 1996; Dronkers, Wesselingh & Rupp, 1997: 75-76). After the retirement of van Heek in the early seventies, the Dutch social stratification and mobility research broke down, only to re-emerge in the early eighties with scholars like Ganzeboom, Ultee and de Graaf (Dronkers, 1987), who had strong connections with the empirical oriented Dutch sociology of education[2]. This breakdown of Dutch social stratification research in the early seventies explains why Blau & Duncan (1967) had only a small influence on Dutch sociological research until the nineties.

The empirical Dutch sociology of education had to be active in the same intellectual arena as Dutch psychometric, because of the importance of Educational Sciences in the Netherlands and because the strong connections of Dutch sociology of education with national educational policy making[3]. In order to maintain their position in that intellectual arena, Dutch sociologists of education nearly always incorporated cognitive ability as a control variable in

their analyses of educational inequality. This incorporation was also possible because since the 'Hidden talent' project of van Heek (1968) the Dutch Central Office for Statistics has collected several longitudinal cohorts of pupils in secondary education, which contained information about their cognitive ability at the start of secondary school[4]. These different cohorts were used by Dutch sociologists of Education to analyze the changing role of parental class and cognitive ability for educational attainment (examples of those analyses are Vrooman & Dronkers 1986; Dronkers 1993). In order to increase the time span between the compared cohorts, older cohorts with information on cognitive ability were rediscovered: among them the oldest available longitudinal data-set which is used in this paper the *Noord-Brabant* cohort[5].

As said before the book of Blau & Duncan (1967) had only a small influence on Dutch research, contrary to the large influence of the comparable study of Jencks et al (1972) with the title *Inequality*. Its conclusion, "neither family background, cognitive abilities, educational attainment, nor occupational status explain much of the variation in men's incomes", played an important role in the public debate on the compulsory introduction of comprehensive schools in secondary education in stead of the more traditional hierarchy of different school types. The opponents of that introduction used this conclusion of Jencks to doubt the necessity of this educational reform, proposed by the most leftist Dutch government in the 20th century[6]. This conclusion of Jencks marked a shift in Dutch sociology of education in the early seventies. The optimistic view on the possibilities of influencing the distribution of chances in life through education was replaced by pessimism, because if this conclusion were correct, strategies for reducing economic inequality by equalizing educational opportunity would not work out. Jencks' study was one of the most cited books in this field of research, although the results were soon outdated, as can be seen from Jencks' own work of a later date (1979).

Replications of the early Jencks' study, made in Sweden (Fågerlind, 1975), Germany (Müller & Mayer, 1976), the United Kingdom (Psacharopoulos, 1977), Australia (Heady & O'Loughlin, 1978) and the Netherlands (Dronkers & De Jong, 1979) showed that educational attainment in those societies had more influence on income than Jencks found for the United States. Improvements in the technique of data-analysis and the availability of better new data, enabled Jencks to make a replication of his own study (Jencks, 1979). In a chapter on his previous work, he stated that his earlier conclusion needed some adjustment: educational attainment did have a significant effect on income in the U.S.A., although not as strong as in Europe and Australia.

Dronkers & Bakker (1989) replicated the Jencks-model for Dutch men with longitudinal data in stead of an artificial matrix, which was used by Jencks et al (1972) and Dronkers & De Jong (1979). They used the three first waves (1952, 1957-'59, 1983) of the *Noord-Brabant* cohort. In this paper I analyze four waves of the same longitudinal data. Although they did not replicate Jencks literally, they asked the same question: "how much can parental background, cognitive ability, educational attainment and occupational status explain in family income?" Their results showed that father's occupational and educational attainment, son's cognitive ability and son's educational and occupational attainment explain 30% of the variance in family income. Occupational attainment had the largest effect on family income, followed by cognitive ability and father's educational attainment. The effect of father's education on son's family income was mediated to a substantial degree by son's cognitive ability and educational attainment; cognitive ability mediated one fifth and educational attainment one eighth of the total effect of father's education on son's family income. The influence of cognitive ability on family income was to a large extent indirect. About 20% of the total effect were mediated by educational attainment and approximately 17% by occupational attainment. Educational attainment only had an indirect effect on family income, via occupational attainment.

Dronkers (1992) replicated the Jencks-model for married Dutch women with the same three waves of the *Noord-Brabant* cohort as used by Dronkers & Bakker (1989). I analyze four waves of the same cohort in this paper. The results showed that her cognitive ability depended on the occupational and educational level of her father. Her educational attainment depended directly mostly on her cognitive ability but to a lesser degree also on the occupational and educational level of her father. Paid work outside the home depended directly only on her educational attainment. The occupational level of her job outside the home depended directly on her educational attainment, on having a job outside the home and on the occupational level of her father. Her family-income depended directly on a series of variables: her educational attainment, her cognitive ability, her job outside the home, the occupational level of her father and the occupational level of her own job outside the home. If one compare these results for Dutch women with those of Dutch men (Dronkers and Bakker, 1989), one notice that the explained variances of both populations were nearly equal (e.g. the explained variance of family-income for men is .30; for women .28). Also the parameters of the equations for men and women did not differ fundamentally. Cognitive ability was the most important independent variable for educational attainment, which in its turn was the most important independent variable for the occupational level of the job outside the home, both for men and women. The largest differences between men and women were found in the family-income equation. The occupational level was the most important independent variable for men; for women it was the least important. Educational attainment was the most important independent variable for women, for men it had only an indirect effect on family-income. This difference however is not astonishing in view of the small number of women which worked outside the home in 1982 (36%).

Bros & Dronkers (1994) applied the Jencks-model on another Dutch longitudinal cohort: the 2324 pupils who entered in 1962 the primary schools of *Enschede*, a major town in the eastern *province Overijssel*, of which 1108 pupils were re-interviewed in 1994. This Enschede-cohort contains information on early cognitive ability, measured in the first class of primary school (Primary Mental Ability: Thurstone & Thurstone, 1954), fathers' occupational and educational level, mothers' educational level, respondents' educational and occupational level and net annual income. The results for men of this Enschede-cohort resembled strongly those for the men from the *Noord-Brabant* cohort. However, the results for the women of this Enschede-cohort deviated from those for women of the *Noord-Brabant* cohort: partly explainable by the strong difference of female labor-market participation between the two cohorts[7], partly by the use of family-income by Dronkers & Bakker (1989) and Dronkers (1992) and individual income by Bros & Dronkers (1994). Another interesting result was that women have less 'profit' of their early cognitive ability than men, but this difference in 'profit' occurred mostly on the labor-market and not in school.

The 'Wisconsin-model' is also much used in Dutch sociology of education, but it is only used to analyze educational attainment, not occupational attainment or income differences.

These Dutch results underline the conclusion of Hauser (1997) that researchers of social stratification have to take cognitive ability seriously and have to seek and produce new evidence of its role in social stratification.

Given the earlier Dutch research on the role of cognitive ability in social stratification of Dutch men and women the main topic of this paper will be the possible changes of the role of cognitive ability during the educational and occupational attainment in the different phases of their life course.

3. Main questions

An important question in the research on social stratification of all generations of scholars is the balance between the achievement processes (i.e. the influence of respondent's education relative to that of parental characteristics) and ascriptive processes (i.e. the influence of family background). Blau & Duncan (1967: 429), following Parsons (1940), Kerr et al (1960) and Lenski (1966), assumed that industrialization and modernization promote achievement and reduce ascription. Within the same tradition Treiman (1970) supposed that the direct effect of parental status on respondent's education and the status of the current occupation is weaker in economically developed societies than in less developed ones. If industrialization and modernization made individual achievement differences more important in the Netherlands one would expect that the importance of cognitive ability increases during the educational and occupational attainment in the different phases of the life course.

Early cognitive ability can be seen as an individual characteristic, which is partly influenced by his or her parental background. This parental influence has both a genetic component and an environmental component in a still unknown combination. Because of this environmental component in cognitive ability, it is important at what moment of the life course cognitive ability is measured. If it is measured near the end of the educational career[8], adult cognitive ability differences can be influenced by educational success. The use of this adult cognitive ability leads to an overestimation of the role of cognitive ability in social stratification, even if one controls for educational attainment. Therefore, it is important to apply early measurements of cognitive ability in the analysis of its role in mobility. However, the lack of suitable data on early cognitive ability forces USA scholars to apply cognitive ability, measured at the end of high school (Hauser, 1997), at the begin of adulthood (Fischer et al, 1996) or measured during adulthood (Herrnstein & Murray, 1994; Raudenbush & Kasim, 1998). The Dutch *Noord-Brabant* cohort has information on the early cognitive ability at the age of 12 at the end of primary school.

These arguments lead to three hypotheses:

1. The differences in early cognitive ability between respondents with different educational levels are significant and increase during their life course, also after controlling for parental background. If achievement processes are important in education and early cognitive ability doesn't change importantly during educational attainment, selection and allocation in school is also based on early cognitive ability.

2. *The differences in early cognitive ability between respondents with different occupational levels are significant and increase during the life course, also after controlling for educational attainment and parental background*. If individual achievement is important for the productivity of a job and early cognitive ability doesn't change importantly during the life course, selection and allocation for jobs are also based on early cognitive ability.

3. *The relation between early cognitive ability and income are significant and increases during the life course, also after controlling for occupational and educational attainment and parental background*. If individual achievement is important for productivity and early cognitive ability doesn't change importantly during the life course, earned income is also based on early cognitive ability.

Because men and women have different private and public roles in society and especially in the household and at the labor-market, I shall test these three hypotheses separately for men and women.

4. The *Noord-Brabant* cohort

The paper is based on longitudinal data on the educational and occupational careers of a generation born around 1940 in the province of '*Noord-Brabant*' in the Netherlands. The results of this study, however, can be regarded as representative of this generation in the Netherlands. Economically and culturally, this province does not deviate much from the average of the Netherlands. Furthermore, in the Netherlands regional differences in educational and occupational careers are generally significant but small (Meester & De Leeuw, 1984).

The data were collected in several surveys in 1952, 1957-1959, 1983 and 1993. The different questionnaires cover a wide range of topics like family background, schooling, occupation and income.

In 1952 a sample of the sixth-grade pupils in province of *Noord-Brabant* were surveyed, with a sample fraction of .25 of all sixth-grade pupils of that province. Observations were made, among other things, on father's occupation, cognitive ability and the early educational career of total 5771 pupils. This study was conducted by a commission of the provincial council of *Noord-Brabant* to study the quality of primary schools in *Noord-Brabant* (Rapport, 1957).

In the period 1957-1959 two follow-ups were held, commissioned by the same council of *Noord-Brabant* (Matthijssen & Sonnemans, 1958). The first one was among pupils who scored above average on a scholastic achievement test. The second one was among sons of farmers and laborers, and a control group consisting of sons from other origins. The questionnaires of the first and second follow-up were almost identical, and included, among other variables, education and income of the parents. These two follow-ups reached 2830 pupils (49%).

In 1983 the economists Hartog and Pfann (1985) recovered the addresses of 82 % of the 5771 pupils of the original sample of 1952, and sent these 4706 ex-pupils a questionnaire by mail. The male non-respondents were approached again for a face-to-face interview[9]. The ultimate response in 1983 for the pupils, whose addresses were recovered, was 58 % or 2641 ex-pupils. In this 1983-survey, information was collected on the respondent's education and occupation, partner's education and economic activity and income. It can be shown that the non-response of 1983 did not effect the representativity of the sample for men, compared with the original sample of 1952 (Vermunt, 1988).

In 1993 the economist van Praag (1992) recovered the addresses of 81% of 5602 pupils of the original sample of 1952[10], and sent these 4558 ex-pupils a questionnaire by mail. Only the male non-respondents were approached again for an interview by phone. The ultimate response in 1993 for the pupils, whose addresses were recovered, was 46% or 2397 ex-pupils. The response of men in 1993 was substantial higher (54%) than that of women (37%).

The total response of men who participated both in the 1983 and 1993 survey was 66% or 976 male pupils. For women this percentage was 51%, equal to 543 female pupils. In this paper we analyze only those pupils who participated both in the 1983 and 1993 survey and who had a valid score on the Progressive Matrices test of 1952.

The data of the *Noord-Brabant* cohort are used intensively both by economists and sociologists. Van Praag (1992) gives a survey of published studies until 1992.

5. The used variables of the *Noord-Brabant* cohort

The following variables are used in this paper.

Father's occupational level, measured in 1952 in six categories: laborers[11], lower employees, self-employed shopkeepers and artisans, farmers, middle employees[12], higher occupations[13]. Unemployed, retired and disabled are coded as missing.

Societal strength of family, measured in 1952 in two categories: normal family; societal weak family.

Cognitive ability, measured in 1952. The test is a Dutch replication of the British Progressive Matrices of Raven (Raven, 1958) and is relatively the least cultural biased of the available tests in the *Noord-Brabant* cohort. The test contains series of figures. They have in their succession some regularity, which have to be noticed by the pupil.

The educational attainment of the respondent is measured at four different phases: 1. Advice of the teacher at the end of primary school on the most suited type of secondary education[14] (measured in 1952); 2. Attained certificate in the first school of secondary education (measured in 1983); 3. Attained highest certificate in the first or second school of secondary education (measured in 1983); 4. Attained highest educational certificate in 1993 (including adult education, vocational schooling, open university, etc.). These four variables have the same categories: 1. Only primary education; 2. Junior vocational education or general education; 3. Senior vocational or general education; 4. Vocational college or the first stage of university; 5. Second stage of university. For obvious reasons the last two categories of the first two variables are empty.

Occupational level of current or last job in 1983[15] and current job in 1993[16]. It is based on the occupational titles and recoded into seven point scale developed by the Dutch Department of Labor. This scale was used in collective bargaining agreements between employers organizations and labor unions, which are very common in the Netherlands. It is intended to grade jobs according to the complexity of the activities performed. Level (1) is very simple work where proficiency is attained in a few days of experience. Level (7) involves work at an academic level.

Annual net income of current or last job in 1983 and of current job in 1993, measured as the sum of the annual earnings of the respondent (both self-employed and employed), including extra pay such as holiday allowances, bonuses and royalties. The two income variables are logarithmically transformed.

6. Cognitive ability differences and educational success

In this section the first hypothesis, which assumes that differences in early cognitive ability between respondents with different educational success are significant and increase during their life course, will be tested.

6.1. Differences in cognitive ability and educational success

Table 1 shows the raw average scores on the Progressive Matrices test of male and female respondents with different educational levels. The Total Row shows that the female response on the third and fourth wave of survey is considerably lower than the male response (543/976=0.56). This is a consequence of the lower rate of recovering the addresses of female ex-pupils[17], the occupational focus of the questionnaires making responding less interesting

for non-working women, and the special actions by the researchers to interview male non-respondents. The result of this lower response female rate is a higher average score on cognitive ability, because non-response is often higher among less-educated persons and persons with lower cognitive abilities.

The average cognitive ability score rises with each educational level both for men and women, as reflected by the F-values and the correlations. The variance in cognitive ability between-groups in relation to the variance within-groups is the largest for the advice of the primary school teacher. This indicates that the teachers' advice on the most suited type of secondary school is based mostly on the early cognitive ability of the pupils, while educational success itself is less based on the early cognitive ability of the pupils. One explanation of this phenomenon is that cognitive abilities still change considerably during the educational careers, which makes early cognitive ability a less adequate indicator of educational success. Another explanation is that educational success is influenced by other factors not related with cognitive ability (social class), which make cognitive ability less relevant for educational success. In the next section I come back to this question.

There is a small increase in the between-group variance between the levels of the attained certificate of the first school of secondary education and the between-group variance between the levels of the final educational level, especially for women. This result supports the first hypotheses, which assumed increased differences in cognitive ability between respondents with different educational levels. But this increase seems more a consequence of the decrease in between-group variance in the first phase of secondary education. The correlations support more clearly the first hypothesis: they increase between the attained certificate of the first school of secondary education and the final educational level, both for men and women.

The between-group variance is far smaller for women than for men at every phase of the educational career. This indicates that the other factors not related with cognitive ability influenced educational success of women more heavily than that of men. The correlations for women are also smaller than the correlations for men, although the differences are not so large as for the between group variances.

The standard deviations in cognitive ability scores are more or less equal at the different educational levels. Standard deviations among the women of each educational level are larger that that of men of the same educational level, which underlines the importance of the other factors than cognitive ability for the female educational success.

The cognitive ability of the respondent differs also with the educational level of his or her partner, partly as a consequence of the association between the educational levels of spouses (Uunk, 1996; Smits, 1996). The tendency of men to marry educationally downwards and of women to marry educationally upwards is also reflected in table 1: women with partners with a certain educational level have generally a lower cognitive ability than the women of that same educational level (last two columns).

6.2. Cognitive ability differences and educational success, controlled for parental class

As said before, cognitive ability, as measured by the Progressive Matrices test, is partly influenced by parental background. Table 2 shows this influence. Children of independent farmers have the lowest cognitive ability, even lower than children of laborers. Vrooman and Dronkers (1986) show that this low score of children of farmers is confined to this generation, in which were still many small farmers. The correlations between fathers' occupational level and cognitive ability are hardly significant. The explanation of this insignificance is the relatively low average cognitive ability of children of farmers and self-employed shopkeepers and artisans, compared to the average cognitive ability of children of lower employees. This

means that the economic independence of farmers, shopkeepers and artisans is not translated into higher cognitive ability of their children.

Again, the between-groups variance in cognitive ability is larger for men than for women, while female respondents have a larger standard deviation than male. This is also reflected in the lower correlation for women compared to that of men.

Differences in cognitive ability between pupils from normal and weak families, although these differences are weaker than the differences in cognitive ability between pupils from different occupational groups.

There for, it is important to control for parental background to get a clear picture of the importance of cognitive ability differences for educational success.

Table 3 presents the estimated average scores on the Progressive Matrices test of pupils with different educational success, corrected for the influence of parental background (fathers' occupational group; strength of family). There are still significant differences in cognitive ability between pupils with different educational success, also after correcting for parental background[18].

The between-group variances of cognitive ability between the levels of the attained certificate of the first school of secondary education is smaller than the between-group variance between the levels of the final educational level, both for men and women. The same holds for the partial correlations. These results are as expected by the first hypothesis, which assumes that differences in cognitive ability increase between respondents with different educational levels during their life course. However, it is important to note that the primary school teacher makes the largest differences between pupils suited for different school levels in their cognitive ability. We can conclude that early cognitive ability distinguishes better between different educational levels in the earliest phase of secondary education than in the final phase of schooling. This indicates that cognitive ability adjusts itself in a certain amount to the educational success of persons.

Controlling for parental background reduces differences in cognitive ability between men with different educational success, as one can see comparing table 1 with table 3. The F-values in tables 3 are considerably lower than in table 1. This reduction of F-values show that other factors like parental background are important for educational attainment. The use of difference of cognitive ability leads to an overestimation of its role in mobility processes. This reduction is less clear if one compares the bi-variate correlations of table 1 with the partial correlations from table 3. Partly this can be explained by the lower average cognitive ability of children of farmers, shopkeepers and artisans.

This reduction in F-values is far less true for the women. Controlling for parental background tends to increase differences in cognitive ability between women with different educational success, closer but these differences remain still below the level of differences in cognitive ability between men. This shows that parental background had a different meaning for differences in cognitive ability and educational success for the men than for the women of this generation.

7. Cognitive ability differences and occupational success

In this section the second hypothesis, which assumes that differences in early cognitive ability between respondents with different occupational success are significant and increase during their life course, will be tested.

7.1. Differences in cognitive ability and occupational level

Table 4 shows the raw average scores on the Progressive Matrices of male and female respondents with different occupational levels. The 1983 column represents the early cognitive ability of respondents with different occupational levels of their last or current job, measured in 1983. The 1993 column represents the early cognitive ability of respondents with different occupational levels of their current job in 1993. The between-groups variance of early cognitive ability is in both years significantly larger than the within-groups variance. The same holds for the correlation between cognitive ability and occupational success: in both years they are significant for both men and women. The fall in the number of respondents with a job between 1983 and 1993 (from 948 to 765) can be explained by the increase of the probability of unemployment and occupational disablement (especially among the elder) and by early retirement schemes (very popular in the nineties in the Netherlands to reduce unemployment) as this generation became fifties years and older during the nineties. Especially men with lower early cognitive ability seem to retire from jobs with more simple work. As a result of this retirement process and the normal job changes between 1983 and 1993[19], the differences in early cognitive ability between men with different occupational levels increase, just like the correlation between cognitive ability and occupational success. These results give support to the second hypothesis. This support is conditional, because we need to control for educational attainment and parental background.

However, this second hypothesis is not true for women. The between-group variance in early cognitive ability decreases between 1983 and 1993 in stead of increasing, just like the correlation between cognitive ability and occupational success. The strong fall in labor-market participation of women of this generation can have disturbed the normal selection processes, despite all the job changes[20]. The between-groups variance in 1993 is not significantly larger anymore than the within-groups variance, but the correlations between cognitive ability and occupational success are still significant. An explanation of this differences between variance-analysis and correlations is that the latter dependents more heavily on the extremes, while the former is more influenced by the categories with the largest number of cases.

7.2. Cognitive ability differences and occupational success, controlled for parental class and highest educational attainment

The found differences in cognitive ability of respondents with different occupational levels can be the outcome of selection and allocation processes during their educational and occupational careers. Success in school and at the labor-market can also dependent on the parental background of the respondents. Table 5 presents the estimated average scores on the Progressive Matrices test of pupils with different occupational levels, corrected for the influence of parental background (fathers' occupational group; strength of family) and for attained highest educational certificate. Although there are still differences in average scores, these differences are not longer significant: the between-groups variance is not significantly larger than the within-groups variance. This is true both for men and women and for 1983 and 1993. However, the partial correlations between cognitive ability and occupational success for men are still significant for men and even increases between 1983 and 1993, in accordance with hypothesis 2. The explanation for this significance is the same as suggested earlier: correlations dependent more heavily on the extremes, while variance-analysis is more influenced by the categories with the largest number of cases. Even the correlation between occupational success in 1983 and cognitive ability is significant for women, but it becomes insignificant for 1993, mainly by the drop in the number of working women.

Hypothesis 2 has to be rejected for women, because the relation between cognitive ability and occupational success is not increasing, probably as a consequence of the strong fall in their labor-market participation.

Hypothesis 2 can to be rejected or accepted for men, depending whether one uses correlation or variance analysis.

The variance analyses tells that differences in early cognitive ability, which are not reflected by differences in educational success and fathers occupation[21], are not significant for the majority of this population, and thus hypothesis 2 has to be rejected. Differences in early cognitive ability influence the selection and allocation processes on the Dutch labor-market only through the selection and allocation during education. A possible explanation of this insignificance of early cognitive ability at the labor-market is that cognitive ability develops itself, depending on the further educational attainment. If that is true a relatively high early cognitive ability decreases if a person attends only a few years of further education, while a relatively low early cognitive ability increases if a person gets many years quality schooling. In that case the attained educational level will be a better indicator of adult cognitive ability than early cognitive ability and thus will predict better the occupational level for the majority of the population. Meester en De Leeuw (1984) give evidence that scores on the Progressive Matrices test, taken at the age of 18 at the entrance of Dutch military service, corresponds closely with attained educational level.

The correlation analysis however tells that the differences in early cognitive ability between persons with the highest and lowest occupational success (a minority of the population) is significant and increases between 1983 and 1993, in accordance with hypothesis 2. This means that the difference between very high and very low occupational success dependents, next to parental background and educational success, also on early cognitive ability and this difference increases during the occupational career.

8. Cognitive ability and income differences

In this section the third hypothesis, which assumes that the relation between early cognitive ability and income increases during their life course, will be tested.

Table 6 shows the bi-variate correlations between the Progressive Matrices scores and the natural log of the net annual income of the current or last job, as measured in 1983 and the natural log of the net annual income of the current job in 1993. Although these correlations are not high, they are for men significant in both years and for women significant in 1993.

Annual net income is however dependent of the level of the job, educational certificates and parental background. If we control factor that variables, the partial correlations between annual net income and cognitive ability are not longer significant. Therefor the third hypothesis has to be rejected. Differences in early cognitive ability influence Dutch income differences through the selection and allocation during education.

9. Conclusion

We found that differences in early cognitive ability, measured at the end of primary school with the Progressive Matrices test, influence educational success. The differences in that early cognitive ability between respondents with different educational levels increase during their life course. Selection and allocation in the educational system is partly based on these differences in cognitive ability, independent of the parental background of pupils. This early

cognitive ability doesn't affect directly the selection and allocation at the labor-market, independent of the attained educational level. Differences in early cognitive ability between the majority of the respondents with different job levels are a consequence of the importance of education for the selection and allocation at the labor-market. But a possible explanation of this insignificance of early cognitive ability at the labor-market is that cognitive ability develops itself, depending on the further educational attainment. The same holds for income and early cognitive ability: this relation is a consequence of the relation between salary, occupational level and educational attainment and not of an extra 'bonus' for persons with higher early cognitive abilities. However, the difference between very high and very low occupational success for men dependents, next to parental background and educational success, also on early cognitive ability and this difference increases during the occupational career. This means that male respondents in extreme occupational positions differ increasingly in their early cognitive ability during their occupational career.

Early cognitive ability plays a different role for men and women. Generally speaking differences in early cognitive abilities are more important in processes of educational attainment for men than women. This might be specific for this generation Dutch woman, which was born at the moment that the traditional division of labor between men and women was very strong.

The role of cognitive ability in social mobility is indeed important. Children from different social classes have on the average significantly different early cognitive abilities. Seen from this perspective differences in cognitive ability reflect partly social inequality, based on class. But differences in early cognitive abilities within the same parental social classes are also considerable. Parental social class can not explain all the individual differences in cognitive ability. Seen from this perspective differences in cognitive ability 'equalize' social inequality, based on class. The differences in early cognitive ability lead to different educational outcomes and thus to different jobs, incomes, partners and thus social classes. There is no extra 'bonus' of early cognitive ability for the majority of the population at the Dutch labor-market, independent of its revenues in the educational system. As a consequence of this role of cognitive ability in social mobility, parents of different social classes have different averages of their cognitive abilities, which are partly transmitted to the next generation (Leijten, Ultee & Vroon, 1985). Differences in cognitive ability play therefore an important role in the making and unmaking of social inequality, based on class. But all mobility processes cannot be reduced to these differences. Therefore are the differences in cognitive ability within social classes too large.

Table 1: Averages scores, standard deviations & percentages or numbers respondents on the Progressive Matrices test of 1952 by level of educational attainment, the F-values of the between/within-groups variance, the Homogeneity of Variances (Levene Statistic) and correlation between cognitive ability and educational success

	Men					Women				
	Advice Teacher	Level 1th school	Level 2th school	Final Level	Educ. Level partner	Advice teacher	Level 1th school	Level 2th school	Final Level	Educ. Level Partner
Primary school	97.4 11.6 17%	101.6 12.9 37%	99.9 12.6 28%	99.6 12.5 27%	100.5 12.2 19%	100.1 13.7 24%	102.7 14.4 34%	101.3 13.9 27%	101.3 14.0 27%	101.2 12.8 15%
Junior school	102.5 12.6 65%	102.3 12.7 52%	102.0 12.8 48%	101.5 12.7 44%	102.4 12.9 62%	103.8 13.0 58%	105.0 13.3 59%	103.8 13.0 47%	103.5 13.1 43%	103.3 12.8 39%
Senior school	109.5 12.2 17%	110.2 12.7 11%	107.8 12.2 14%	106.8 12.3 13%	105.5 13.1 12%	112.3 13.5 18%	110.1 13.8 6%	106.7 13.1 16%	106.4 11.8 16%	103.3 13.5 18%
Vocational college			105.8 11.5 7%	108.2 11.8 11%	108.4 13.9 6%			113.3 14.7 9%	111.5 14.4 13%	108.1 15.0 19%
Uni-versity			116.5 12.7 3%	112.7 13.2 5%	112.1 11.5 1%			117.3 14.7 1%	114.0 20.9 1%	108.7 13.9 9%
Total	102.8 12.9 939	102.9 13.0 975	102.9 13.0 975	102.9 13.0 976	102.9 13.0 851	104.5 13.8 531	104.5 13.8 543	104.5 13.8 543	104.5 13.8 543	104.4 13.6 467
F-values	39.1 p=.00	19.5 p=.00	18.6 p=.00	20.7 p=.00	6.1 p=.00	24.1 p=.00	4.8 p=.01	8.9 p=.00	8.6 p=.00	4.2 p=.00
Levene Statistic	.059 p=.94	.112 p=.89	.158 p=.96	.268 p=.90	.373 p=.828	.935 p=.39	.375 p=.69	.273 p=.90	1.309 p=.27	.735 p=.568
Correlation	.28 p=.00	.15 p=.00	.24 p=.00	.27 p=.00	.17 p=.00	.28 p=.00	.13 p=.00	.24 p=.00	.24 p=.00	.18 p=.00

Table 2: Averages scores, standard deviations & percentages or numbers respondents on the Progressive Matrices test of 1952 by fathers' occupational level and societal strength of family, the F-values of the between/within-groups variance, the Homogeneity of Variances (Levene Statistic) and correlations between parental background and cognitive ability

	Men			Women		
	Average	St.. Dev.	% resp.	Average	St. dev.	% resp
Higher occupat.	111.9	14.9	3%	113.3	13.6	3%
Middle employees	108.8	13.0	11%	108.5	14.5	12%
Farmers	98.5	12.3	20%	100.8	12.2	23%
Shopkeepers	103.8	12.5	16%	105.5	14.6	18%
Lower employees	108.4	11.8	2%	103.3	12.4	3%
Labourers	102.1	12.5	47%	104.4	13.6	40%
F-values	12.9	P=.00		4.3	P=.00	
Levene St.	1.017	P=.41		.940	P=.46	
Correlation	-.08	P=.02		-.05	P=.26	
Weak family	99.6	13.6	8%	102.6	14.6	5%
Normal family	103.0	12.7	92%	104.7	13.8	95%
F-values	4.5	P=.03		.485	P=.49	
Levene St.	2.164	P=.14		.287	P=.59	
Correlation	.07	P=.03		.03	P=.49	

Table 3: Estimated averages scores & standard errors on the Progressive Matrices test of 1952 by level of educational attainment, corrected for parental background, the F-values of the between/within-groups variance, the Homogeneity of Error Variances (Levene Statistic) and the partial correlation between educational success and cognitive ability, controlled for parental background

	Men					Women				
	Advice	1th school	2th school	Final level	Partner	Advice	1th school	2th school	Final level	Partner
Prim. Educ	98.6 1.15	102.1 1,17	100.2 1.14	100.0 1.14	100.4 1.38	101.5 1.55	102.9 1.60	100.8 1.70	100.8 1.70	101.5 2.05
Junior Educ.	103.4 1.14	102.2 .88	101.8 .89	101.5 .90	101.5 .99	104.0 1.43	105.8 1.25	104.6 1.26	104.2 1.30	103.3 1.55
Senior Educ.	109.7 1.10	109.4 1.40	108.2 1.23	107.0 1.28	105.7 1.52	113.2 1.50	109.6 2.57	107.4 1.63	106.4 1.70	102.0 1.74
Vocal. Coll.			107.2 1.73	109.3 1.47	106.4 1.94			114.3 2.03	112.9 1.70	109.0 1.61
University			115.6 2.56	112.5 1.94	111.3 4.17			118.7 7.61	114.1 5.38	108.4 2.34
F-values	19.8 p=.00	8.3 p=.00	10.8 p=.00	12.8 p=.00	2.1 p=.01	18.9 p=.00	3.1 p=.05	8.4 p=.00	8.7 p=.00	3.3 p=.01
Levene St.	1.27 p=.16	1.34 p=.12	1.31 p=.10	1.32 p=.10	.77 p=.83	1.24 p=.19	1.09 p=.35	1.21 p=.20	1.45 p=.05	1.01 p=.45
Part. Cor.	.26 p=.00	.13 p=.00	.23 p=.00	.26 p=.00	.14 p=.00	.27 p=.00	.12 p=.01	.23 p=.00	.23 p=.00	.17 p=.00

Table 4: Averages scores, standard deviations & percentages or numbers respondents on the Progressive Matrices test of 1952 by level of occupation, the F-values of the between/within-groups variance, the Homogeneity of Variances (Levene Statistic) and correlations between occupational success and cognitive ability

	Men		Women	
	1983	1993	1983	1993
Very simple work	93.5 9.6 3%	98.9 9.8 3%	100,1 10.4 8%	97.7 9.7 8%
Simple work	99.0 12.5 8%	99.5 12.5 9%	101.5 14.2 20%	102.1 14.3 16%
Somewhat complex work	101.1 13.9 15%	99.2 12.7 12%	104.1 13.4 20%	102.6 15.8 9%
Rather complex work	101.3 11.9 17%	100.2 11.7 18%	108.6 14.7 14%	103.7 14.9 20%
Complex work	102.3 12.8 19%	102.6 12.6 15%	105.5 12.6 19%	103.0 12.2 18%
Very complex work	104.7 12.4 23%	105.6 12.4 25%	111.0 14.6 15%	109.1 14.5 45
Scientific work	108.3 12.9 16%	108.9 12.9 18%	111.1 9.5 4%	112.3 12.4 5%
Total	103.0 13.0 948	103.3 12.8 765	105.5 13.8 445	104.5 14.1 195
F-values	9.5 p=.00	10.5 p=.00	5.3 p=.00	2.1 p=.06
Levene statistic	.712 p=.64	.465 p=.84	1.86 p=.09	.783 p=.58
Correlation	.23 p=.00	.26 p=.00	.24 p=.00	.22 p=.00

Table 5: Estimated averages scores & standard error on the Progressive Matrices test of 1952 by level of occupation, corrected for parental background and final educational level, the F-values of the between/within-groups variance, the Homogeneity of Error Variances (Levene Statistic) and the partial correlation between cognitive ability and occupational success, controlled for parental background and highest educational level

	Men		Women	
	1983	1993	1983	1993
Very simple work	92.4 2.64	100.4 2.85	99.8 2.53	98.9 3.69
Simple work	99.4 1.60	100.1 1.64	101.6 1.74	101.5 2.72
Somewhat complex work	102.3 1.23	100.8 1.37	105.8 1.61	105.0 3.42
Rather complex work	102.0 1.12	101.3 1.25	107.6 1.81	105.2 2.40
Complex work	103.4 1.09	104.0 1.21	105.6 1.57	102.8 2.38
Very complex work	105.3 0.97	105.7 1.04	110.6 1.89	108.0 2.30
Scientific work	107.2 1.13	105.7 1.04	110.6 3.29	112.3 4.49
F-values	1.0 p=.42	1.2 p=.31	1.1 p=.34	0.1 p=.99
Levene statistic	1.038 p=.38	1.091 p=.25	1.271 p=.06	0.573 p=.99
Partial correlation	.09 p=.01	.16 p=.00	.11 p=.03	.10 p=.18

Table 6: Correlations between scores on the Progressive Matrices test and the natural log of the net annual income of the current or last job, as measures in 1983 and the natural log of the net annual income of the current job in 1993, bi-variate and controlled for parental background and highest educational and occupational level.

	Men		Women	
	1983	1993	1983	1993
Bi-variate Correlation	.17 p=.00 (n=835)	.19 p=.00 (n=819)	.03 p=.56 n=350	.19 p=.00 n=237
Partial Correlation	.06 p=.10	.03 p=.44	-.11 p=.06	.15 p=.08

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Abstract

This paper contributes to this production of evidence of the role of cognitive ability in social stratification by analyzing a Dutch longitudinal data set, particularly well suited to investigate these questions for a European society (the so-called Noord-Brabant cohort). This cohort contains measurements of parental characteristics, cognitive ability at the end of primary school (Progressive Matrices; Raven, 1958) together with their educational and occupational attainment during the life course of 1519 children born around 1940, interviewed and tested in 1952 and re-interviewed in 1957-‘59, 1983 and 1993. Three hypotheses are tested: 1. The differences in early cognitive ability between respondents with different educational levels are significant and increase during their life course, also after controlling for parental background. 2. The differences in early cognitive ability between respondents with different occupational levels are significant and increase during the life course, also after controlling for educational attainment and parental background 3. The relation between early cognitive ability and income are significant and increases during the life course, also after controlling for occupational and educational attainment and parental background. These three hypotheses are tested separately for men and women.
Differences in early cognitive ability influence educational success. The differences in that early cognitive ability between respondents with different educational levels increase during their life course. Selection and allocation in the educational system is partly based on these differences in cognitive ability, independent of the parental background of pupils. This early cognitive ability doesn’t affect directly the selection and allocation at the labor-market, independent of the attained educational level. Differences in early cognitive ability between respondents with different job levels are a consequence of the importance of education for the selection and allocation at the labor-market. But a possible explanation of this insignificance of early cognitive ability at the labor-market is that cognitive ability develops itself, depending on the further educational attainment. The same holds for income and early cognitive ability: this relation is a consequence of the relation between salary, occupational level and educational attainment and not of an extra ‘bonus’ for persons with higher early cognitive abilities. Early cognitive ability plays a different role for men and women. Generally speaking differences in early cognitive abilities are more important in processes of educational attainment for men than women. This might be specific for this generation Dutch woman, which was born at the moment that the traditional division of labor between men and women was very strong. Differences in cognitive ability play therefore an important role in the making and unmaking of social inequality, based on class. But all mobility processes cannot be reduced to these differences. Therefore are the differences in cognitive ability within social classes too large.

Notes

[1] Among these colleagues was prof. dr. C. van Calcar, the founder of the Enschede-cohort.
[2] The cooperation between Dutch researchers of social stratification and Dutch sociologists of education is still strong, as one can see in Dronkers & Ultee (1995).
[3] Dutch sociology of education has still strong connections with national educational policy making: for instance the current president of the national educational council prof. dr. H. Leune is a sociologist of education.
[4] The 'Hidden talent' project of van Heek was also the first longitudinal cohort of pupils in secondary education collected by the Dutch Central Office for Statistics.
[5] A common effort of Dutch economists (Joop Hartog) and sociologists of education (Dronkers) rediscovered this Noord-Brabant cohort.
[6] The minister of Education of that government happened to be sociologist of education: prof. dr. J. van Kemenade.
[7] The Enschede-cohort is born around 1958, while the Noord-Brabant cohort is born around 1940. Dutch women of both generations differ strongly in their labour-market participation, because of the strong increase of part-time labor participation of married Dutch women during the eighties and nineties.
[8] For instance as a part of testing for military service.
[9] This decision to approach only male non-respondents reflects the labor-market perspectives of Hartog and the weak labor-market position of this generation women.
[10] The difference of 169 pupils between 1983 and 1993 can be explained by death or emigration of respondents.
[11] Including both industrial and agrarian laborers.
[12] Including teachers in primary education.
[13] Including teachers in secondary education.
[14] The advice of the teacher of the end of primary school on the most suited type of secondary education was and is a crucial step in one's educational career (Vrooman & Dronkers 1986: Dronkers 1993). The Dutch educational system resembles still the former English 11+ system and other more traditional continental educational systems..
[15] 92.5% of all 976 male respondents had in 1983 a current job.
[16] 42.5% of all 543 female respondents had in 1983 a current job.
[17] Women changed their family-name if marrying in the sixties, which makes the recovering of their address more difficult
[18] If we control also for final educational level of the respondent, differences in cognitive ability between partners with different educational levels are not longer significant.
[19] 47.2% stable level between 1983 and 1993, 24.9% higher level in 1993 than in 1983.
[20] 38.9% stable level between 1983 and 1993, 33.2% higher level in 1993 than in 1983.
[21] Cognitive ability differs significantly between male and female respondents with different educational success and fathers with different occupations after controlling for parental background and educational occupational success.