Boben, D. (2007, May 23). The standardization of all the main Raven Progressive Matrices tests in Slovenia. *WebPsychEmpiricist*. Retrieved from http::://wpe.info May 23, 2007.

WPE WebPsychEmpiricist

The Standardisation of all the Main *Raven Progressive Matrices* Tests in Slovenia

May 23, 2007

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Abstract

The *Standard Progressive Matrices* (and possibly other RPM tests) has been in use in the former Yugoslavia (of which Slovenia formed a part) since at least the early 1960s. More recently, i.e. since 1999, the CPM, SPM, SPM *Plus*, and APM have been standardised in Slovenia. In each case, new item analyses were carried out and the tests shown to work in similar ways to other countries and, within Slovenia, for different ability and socio-economic groups. As far as comparative norms are concerned, it seems that, allowing for the universal increase in norms over time, the Slovenian norms are similar to those obtained in other European countries.

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Introduction

Let me first briefly introduce Slovenia: its history, population, school system and test use.

Slovenia and its population

Slovenia is a small Central European country with a rich history. It gained its independence in 1991. Before that, the Slovene people lived in different countries, political regimes and cultural circles. Until World War I, Slovenians lived in the Austro-Hungarian Empire. After World War I, they united with other Slavic peoples in the Kingdom of Serbs, Croats and Slovenes. After World War II, most of the Slovenians lived in Yugoslavia. Nowadays, some Slovenians still live in Austria, Italy, Hungary, and Croatia.

We are hence a young country, and compared to other countries, a small one. Nevertheless, Slovenia's geography is very diverse. Its 20,000 square kilometres cover Alps, the Pannonic Plain, Karst, and the Adriatic Coast, as well as several lakes and thermal wells. The country has two million inhabitants and is divided into 12 regions, that differ regarding both the number of population (also the number of children and young adults, Table 1) and the living standard of their inhabitants. In general we could say that the west is more developed than the east. The country has approximately 25% rural parts. In the capital, Ljubljana, and its surroundings live 600,000 people. 87% of Slovenia's inhabitants are Slovene. Approximately 12% have Slovene citizenship but belong to other ethnic groups. The proportions by region are different. Most important ethnic groups are Croats (2.8%), Serbs (2.4%), Muslims (1.4%), Hungarians (0.4%), Macedonians (0.2%), Montenegrins (0.2%), Albanians (0.2%), Italians (0.2%), Romanies (0.1%). The nations from the former Yugoslavia live in all regions. 99% of Hungarians live in the North-Eastern Pomurska region, 90% of Italians live in the South-Western Obalno-kraska region and 94% of Romanies live in the Pomurska, Podravska, Dolenjska and Osrednjeslovenska regions. Italians and Hungarians are recognised national minorities in these respective regions, meaning that their language is also an official one, including use in education. The majority of inhabitants of Slovenia is Roman Catholic (Rapid Reports, 1992).

The number of inhabitants of Slovenia is constantly slightly decreasing. There are approximately 22,000 -- 27,000 children in one generation. The average proportion between the sexes is 51:49 (males-females).

School system

In the year 1990 Slovenia started to reform its school system progressively. After the reform, obligatory schooling starts with six years of age (formerly seven) and lasts for nine years. Before that, the so called "preschool", which was not obligatory, had been organised for six-year old children, followed by compulsory eight-year primary school. Regarding the new school system,

one of the biggest changes as to the content and organisational level is working with children with special needs.

After completing compulsory education at a primary school, adolescents have the opportunity to continue their education at one of the secondary schools. These basically belong to three categories: general secondary schools (*gimnazija*, roughly equivalent to the German *Gymnasium*, that lasts four years and prepares their students for university study; professional secondary schools, that last four years; and vocational schools that can last from 2.5 years to 4 years. Secondary schooling is not compulsory. Yet according to statistical data, about 98% of adolescents start it but only two thirds finish it successfully.

Tests and testing

The beginning of applied psychology and psychological testing in Slovenia dates back to the period before World War II. Vlado Schmidt, referred to as the pioneer of applied psychology (Pecjak, 1983), was also the first to work on adaptations of group psychological tests (Lapajne, 1997). An independent Chair of Psychology within the Faculty of Arts of the University of Ljubljana was only founded in 1950. After that, systematic work on psychological tests began. In 1977, Center za psihodiagnosticna sredstva was founded. At that time it was one of the units of the state Agency for Work Productivity. Via its centres in different parts of the country, this Agency developed psychological tests in the Serbian and Croat languages as well as Slovenian.

After Slovenia gained independence in 1991 and changed its political and economic system, work continued and the need for internationally recognised work of high quality grew. The circumstances in which psychologists work changed as well with the coming of liberal economy. Test developers faced higher accessibility to foreign tests and larger needs, whereas the financial means remained scarce. As specific as the situation may be, Slovene psychologists and test developers remain firm in their ambition to acquire quality adaptations of psychological tests with international reputations as we wish to maintain a level of professional and research activity and results comparable to the rest of the developed world.

Historical Sketch of the Usage of *Raven's Progressive Matrices* (RPM) in Slovenia

According to MacKintosh (1998), the RPM are one of the most widely used tests of general cognitive ability. In the course of an international survey, Oakland (1995) found that the RPM are the second most widely used psychological tests in the world. It is probably unnecessary to underline the presence of RPM in practical work as well as in basic research. The grounds are numerous: Simple, individual or group administration, and non-verbal items that can be used regardless of language and culture. Numerous references cited in the RPM *Manual* prove that RPM tests are indeed present in all of the five continents. The analysis of Center za psihodiagnosticna sredstva shows that immediately after (re)publication, all three forms of the RPM became the best selling tests in Slovenia.

The *Standard Progressive Matrices* (SPM) has been used in Slovenia since the beginning of the sixties, at which time Slovenia formed part of Yugoslavia. The first attempt to provide a manual for the test dates back to 1966, when the state agency for the productivity of work (Zavod SRS

za produktivnost dela) published the so-called "Test information", which presented data from the 1957 edition of the British manual and data from Vito Ahtik's 1955 research on the test (that took place in Ljubljana). The title of the SPM version that this information referred to, was "Revidirana oblika 1956 Zoran Bujas" (1956 Zoran Bujas Revised Version). At that time, the SPM was mainly used in Slovenia to normalise primary school classes. After several years of use, psychologists began slowly to refrain from using the SPM for this purpose, as the results failed to express normal distribution. It was believed that the increase in scores was due to too great familiarity with the SPM items, although we now know that it was due to the so-called "Flynn's effect". Other RPM forms were not available.

In 1996, Center za psihodiagnosticna sredstva signed an adaptation agreement for all of Raven's tests (matrices and verbal scales) with J. C. Raven Ltd. We began to standardize the three classical forms: CPM, SPM and APM for pupils and young people aged 6 to 19. Simultaneously we gathered data for students and adults but, since these samples were not representative of the general population the results will not be summarised here.

The programme to standardise the classical form of the CPM, the classical form of the SPM and the APM II began in 1997. The first four volumes of the Slovenian translation of the Manual were published in 1999 (Raven, Raven, & Court, 1999a,b,c&d). The project was carried out at the Center za psihodiagnosticna sredstva under the leadership of Dusica Boben, in co-operation with several Slovene psychologists and students of psychology, and under the supervision and with the help of John and Jean Raven. The psychometric from the standardisation were published in a supplement to the SPM *Manual*: "The Slovene Standardisation of RPM" in 2003.

However, as elsewhere in the world, it became apparent that norms for the SPM-*Plus* are necessary. The main reason for that was a reform of the educational system that included a recommendation that the RPM be used to identify talented children among primary school students. As the introduction of nine-year primary school system was a gradual one, the identification of talented students took place both in the fourth and in the eighth grade of primary school. In practice, however, the SPM proved to be too easy for students of the eighth grade. On the other hand, the APM proved to be too difficult and lacking adequate norms for younger students. In 2004, the decision to standardise the SPM-*Plus* for children between age 10.5 and 14.5 was made. This standardisation was completed in 2005 and resulted in the norms published in a supplement to the SPM-*Plus Manual* ("Slovenske norme za mladostnike v primerjavi z drugimi normami" -- Slovenian norms for adolescents in comparison to other norms).

In 2006, as part of dissertation research carried out by two psychology students (de Reggi, 2007, Klopcic, 2007), SPM-*Plus* norms for adolescents aged 14 to 17 and adults aged 38 to 53 were collected. The results for adolescents were analysed using item response theory in addition to the classical test theory.

We also started to adapt the Mill Hill Vocabulary Scales. Two pilot studies were performed (Plut, 2003, Zalik, 2003) using a sample of primary school students. This adaptation has not yet been completed, and is not, therefore, included in this presentation.

In the remainder of this chapter, the results of the standardisation of the CPM, SPM and APM in 1998 will be presented, together with those from the standardisation of the SPM-*Plus* for children and adolescents in 2005 and 2006. These data will be compared with results obtained in other countries. Most of the analyses reported below have been conducted according to classical test theory.

CPM Standardisation, 1998

Sampling and the Sample

Population of primary school students.

The sampling method employed for the Classic versions of all three tests (the CPM, SPM and APM) was a stratified random sampling procedure. First, schools were randomly selected from a list of all schools (Research results, 1996). The number of schools was set according to regions and proportionally to the number of children in a certain region. Altogether, we chose 42 schools: 29 primary and 13 secondary schools (vocational, professional, and general). The schools were requested to take part in the project and if one of them refused, another was selected from the same region using the same key. At some of the schools, data for the CPM, the SPM and the APM standardisations were collected. At other schools only data for one or two tests were collected. In the CPM sample we also included children from special schools. In the CPM and the SPM samples we included one primary and one secondary bilingual school.

We assumed that the regional sampling system would capture children from more and less developed parts of the country, and children of different social-economic status. No data regarding the education and ethnic origins was collected. Altogether, 49% of data collected was from Eastern Slovenia (regions 1 to 7), 28% from Central Slovenia (including Ljubljana), and 23% from Western Slovenia (regions 9 to 12). The percentage of data collected corresponds to the percentage of children in the abovementioned parts of the countries.

The data collection coordinators at individual schools were requested to select one class from each grade. Parents of the selected children were sent a written presentation of the project and a request for co-operation. Very few requests were refused. Testing took place in 1998 and was performed by school psychologists, psychologists of the Center za psihodiagnosticna sredstva, and assisted by several final year psychology students. An educational event was organised for the test administrators, where the project of standardisation was presented, and test administrators were trained to administer the test (testing instructions, conditions etc…). Testing was performed as group testing, it took place at the schools in time of lectures and without time limitation. Data was processed using STATISTICA software (StatSoft, 1999). The norms were calculated by J. C. Raven Ltd.

The CPM sample included students from 1st to 6th grade drawn from 23 schools in 20 different cities and towns of various sizes from all of the regions. In the end, 1,230 children aged 6.5 to 14 were tested. This amounts to 0.85% of the population of this age. For the calculation of one year age norms we considered the results of 1,199 children (Table 2). 53% of them were male; 88% of them came from regular primary schools.

Population of pre-school children.

The sample of pre-school children was planned within the framework of research towards a PhD. thesis bearing the title *Development of phonological conscience at pre-school children* (Jerman, 2000). 541 children aged 6 to 7.5 were included in the sample (Table 3). All of them were involved in pre-school programmes in 29 kindergartens in 29 different towns in Slovenia. The sample represents 0.95% of the population of Slovene children of this age. 48.7% of children in the sample were male. The children were tested individually and without time limitation. The testing was performed by 32 psychology students and psychologists that had previously been trained for this type of testing.

Item analysis.

The (conventional) difficulty indexes of the CPM items largely correspond to those established in the British studies. There were, however, small differences. For example, items A9 and A10 are slightly easier for our sample and would be set two and one places higher in the Slovenian order. Additionally, two items in the AB part are easier for Slovene children: AB7 and AB11. The differences on Set B were the smallest; only item B8 is more difficult and would take the 10^{th} place in the Slovene order of items.

The frequency distribution of difficulty indexes is left asymmetric. The mean difficulty index is 0.78 (standard deviation = 0.20), and the median is 0.84. This indicates that the items are, in general, easy for this sample. Most items are easy (0.7--0.9 difficulty index) and with good sensitivity (0.4--0.6). As many as 10 items, mostly from Set A are very easy (0.9--1.0 difficulty index).

The difficulty indexes were also calculated within age groups. This revealed only slight differences, mostly among 12 year olds (where the test is not discriminating well). The correlations between item difficulties established separately within age groups ranged from 0.98 to 0.91. These results are similar to those reported for the British SPM sample (Raven, 1981).

A distractor analysis was performed for each item. For every item, we calculated how many of those who failed to solve the item correctly chose one of the remaining five answers. Distractors should, theoretically, be equally attractive to the tested person. Thus the probability for each being chosen instead of the correct answer should be the same. This is of course very difficult to achieve in practice and even an approximation to this ideal is a considered a very good achievement. Our criterion was one half of the difference between 100 and the percent of correctly selected and missing. In the British project, those achieving 45 percent and more have been selected. In the Slovene CPM sample, there were no examples that would stand out to such and extent. The percent of the correct answer was always, in all of the items, higher than the remaining possible answers, which is very good. In 14 cases (as much as 5 of them from the AB set) there is one distractor, that is “misleading” according to the criterion described above.

Reliability.

The reliability of CPM, as calculated on the sample of primary school students described above, is 0.89 (Cronbach alpha coefficient), or 0.91, if calculated using the split-half method. These figures are similar to those found in other countries and continents (Raven et al., 1999a). The average correlation between the items was 0.20.

The reliability indices increase with age, rising from 0.86 among seven year olds to 0.92 among thirteen-year olds. However, there is a slight deviation around age eleven, where it is 0.85. The conclusion that reliability is lowest for the younger age groups also replicates findings from other studies (Raven, Raven, & Court, 1999a).

The reliability of CPM based on the sample of preschool children, is 0.90 or 0.89 (standardised Cronbach alpha coefficient).

Sex and age differences.

We also checked whether there are statistically significant differences among age and sex subgroups (one year intervals, from age 7 to 13). It is generally accepted that differences appear among subgroups of different age ($F = 25.60$, $p = 0.00$), but not among subgroups of different sex ($F = 0.11$, $p = 0.74$) or in the sex-age interaction ($F = 0.73$, $p = 0.62$).

Raw scores distributions and descriptive statistics.

In the course of testing, data on the time needed to complete the test was recorded. The shortest time needed by a child to complete the test was four minutes and the longest 33 minutes. On the average, children aged 7--13 completed the CPM in 10 minutes (with a standard deviation of 4.3 minutes). The older the children required less time and there was less variability between them. 7-year olds need 13.5 minutes on the average (standard deviation = 5.2), whereas 11-year olds need 8.7 minutes (standard deviation = 5.2).

Means, standard deviations, skewness and kurtosis are presented in Table 4. All distributions are left asymmetric, and, as expected, the most asymmetric distribution is in the group of oldest children. None of the distributions is explicitly bimodal, as are some found in the literature (e.g. Raven, 1981).

SPM Standardisation, 1998

Sampling and the sample.

As described in the previous section, the SPM sample was drawn at the same time as the CPM one. The SPM sample includes secondary pupils as well as primary school pupils.
The expression “secondary school” in this context refers to all three categories of secondary school: vocational, professional, and general (“*gimnazije*”). Thus it included students of educational programmes lasting three years, preparing them for vocations such as hairdressers,

painters, car mechanics etc., students enrolled in educational programmes lasting four or five years and awarding professional qualifications such as mechanical technician, chemistry technician, construction technician, and students enrolled in general 'gimnazija' programmes.

Overall, included students from the 1st to the 8th year at 10 primary schools and students of the first and second year at 14 secondary schools -- altogether 1,556 children and adolescents aged 7.5--18 years (Table 5). This amounts to 0.6 percent of the population. The groups of youngest students and of oldest students were the less numerous ones. 53% of the sample were male students.

Item Analysis

The difficulty indexes for the SPM items match the original British ones very well. The minimal differences are that, in Set A, items A6, A9 and A10 would be moved up two places if only the Slovenian data were used, whereas, in Set B, the set of items from B9 to B11 would be "lifted" upwards for a couple of places. In Set C, it would make sense to test Slovenian children with items C5, C7 and C9 positioned slightly differently -- a matter of one or two places. In Set D, item D5 is the second easiest item. Item E11 is the most difficult item in Set E as well as in the entire SPM test.

The frequency distribution of the difficulty indexes is left asymmetrical (skewness = -0.82, kurtosis = -0.27). The mean of difficulty indexes is 0.68 (standard deviation = 0.26) and the median is 0.74. The difficulty indexes were again calculated separately for each age group and, again, were found to be slightly different for each age group. The correlations between the item difficulties established separately within age group ranged from 0.76 (between 8- and 18-year olds) to 0.99 between two "neighbouring" age groups. These are comparable to the information from Great Britain (Raven, 1981).

As with the CPM, we made a distractor analysis. If the chosen distractors are at least approximately the same, we can conclude that they are equally attractive for the children and do not mislead them in choosing the right answer. Our criterion for declaring a distractor to be misleading was if it was chosen in over fifty per cent of cases substracted from the number of cases where the correct choice was selected and from the number of cases where no answer chosen. There were five such distractors among the sixty SPM items, i.e. the most difficult (the last) items in Sets C and D and the last three items in Set E. In Sets C, B and D, according to our criterion, distractors are quite balanced. There are more misleading distractors in Sets A and B (Boben, 2003).

Reliability

The reliability of SPM was 0.95, whether calculated according to Cronbach alpha or the split-half method. The average correlation between the items was 0.22. Cronbach alpha calculated within one year age groups ranged from 0.89 (age group of 12-year olds) to 0.93 (age groups of 9 and 17-year olds), with a mean of 0.92. Hence, there are no great differences between older and younger children, like the ones they discovered in Great Britain (Raven, 1981).

Gender and Age Differences

ANOVA shows that subgroups differ in statistically significant ways in relation to sex (F = 13.13, p = 0.00) and age group (one year intervals) from 8 to 18 years (F = 76.48, p = 0.00), but not regarding the interaction between them (F = 0.65, p = 0.77). A more detailed analysis shows that sex differences occur only in the older age groups. T-test revealed statistically significant differences for age groups of 16-year olds (p = 0.02), 17-year olds (p = 0.01) and 18-year olds (p = 0.04). Nevertheless, statistically significant differences regarding sex were not confirmed by Tukey's HSD test for individual subgroups, separated by age. The bar diagrams in Figure 1 show the frequency distribution of raw scores for males and females. The females cored slightly higher in all age groups. In Great Britain, higher results were only achieved by girls older than 12 (Raven, 1981). Perhaps, in the Slovenian situation, bigger differences between the sexes at age of 16 to 18 could be explained by motivation.

Raw scores distributions and descriptive statistics.

The *average time* required to complete the test was 25 minutes (SD = 6.7) The minimum was 8 minutes and the maximum 33 minutes.

Means, standard deviations, skewness and kurtosis for males and females combined for individual age groups from age 8--18 are presented in Table 6.

All distributions, except the one for the 8-year olds' age group, are left asymmetric. The distributions for the 8 and 9-year old groups are bimodal, as in the British 1979 standardisation (Raven, 1981). For ages 9, 10.5 and 12, bimodality also appears as in the Irish 1972 standardisation (Raven, 1981). As peaks appear at different values of the raw result and disappear at larger sub-samples, Raven (1981) concludes that sampling mistakes are a possible reasons. Other reasons are also possible, for example the adoption of different strategies for solving the problems (Lake, in Raven, 1981).

SPM *Plus* Standardisation in 2005 and 2006

Sampling and the Sample

Adolescents aged 12 to 14.

As discussed in the introduction to this article, we decided to generate norms for SPM *Plus* for adolescents aged 12 to 14 (i.e. students of the 6th to 8th grade of primary school). The sampling process was similar to that employed to generate the 1998 sample discussed above. First, the number of schools from a certain region was set, depending on the size of the region. Second, schools were picked from the list of all schools that had agreed to co-operate with us in the project of standardisation. In the selection of schools, the distinction between schools from smaller towns (population under 6,000) and larger towns was respected, as was the proportion of such towns in the Slovenia. In every selected school, we designated a grade (year) and a class in

that grade, from which data were to be collected. Parents' and school management's co-operation was requested. Testing took place in groups, in the morning, and without time limitation. It was performed in 2005 by school resident psychologists and psychologists of Center za psihodiagnosticna sredstva, all of whom had had previous experience with RPM testing.

1,079 students were included in the final sample, aged 10 to 15.5 (Table 7). Only the results of children, aged 10.5—14.5 were included in our calculations. There were 1,056 such students. 50% of students included in the sample were female. 29% came from schools in towns with less than 6,000 inhabitants. Both these figures correspond well to the proportion in the population. Altogether, 25 primary schools took part in the project, 18--19 for each sub-sample.

15- and 17-year old adolescents.

In 2006, Center za psihodiagnosticna sredstva agreed to co-operate in a project leading towards a graduation thesis titled "*Psychometric characteristics of Raven's SPM-Plus regarding Slovene adolescents*" (de Reggi, 2007). The target population consisted of students of the ninth grade of primary school and of the first and second year of secondary schools. Schools were selected, as in the other research projects, according to the proportion of the population of the individual region. Regions with smaller populations were joined to neighbouring regions so that they are commonly represented in the sample. Ten primary schools and 10 secondary schools (three general secondary schools, five professional secondary schools, and two vocational schools) from all over the country were included in the sample. Schools, within the statistical region and educational programme categories, were selected randomly using a telephone directory. Principals from two schools declined co-operation but very few parents did so.

Testing was performed by resident school psychologists and psychologists from Center za psihodiagnosticna sredstva. There was no time limit.

The final sample included 610 adolescents, aged 14 to 17 (Table 7). Among them, 184 were students of the 9th grade of primary school, 225 of them were students of the first year of secondary school and 201 were students of the second year of secondary school. 49% of the students in the sample were male. There were fewer 14-year olds (n = 75), as this age group was not the target group of the project, as the norms for this age group had already been collected.

Item analysis

The correlation between the item difficulties for the SPM *Plus* (calculated in the traditional way - i.e. proportion choosing the correct answer) established separately in the first and the second samples described above was 0.998 (or 1.00 to two decimal places). These item difficulties also correspond to those published in the British *Manual*. It is important to note, however, that, as in the UK, the item difficulties do not increase steadily within Sets. The largest deviations are around B8-B12, C4-C8, and D6-D10. There is also a large discrepancy between the most difficult items of set C and the easiest items of set D. As explained in the original *Manual* (Raven et al 2000, updated 2004), this arose from the need to merge items from different Sets in

the *Parallel* version of the *Classic Standard Progressive Matrices* to make room for the more difficult items in the SPM ***Plus***. Despite these deviations from the, in some senses, ideal order of items, the net effect has, as can be seen from the graphs of item difficulties published in Raven et al (2000, updated 2004) and in the chapters reporting the results of the Romanian standardization of the SPM *Plus* in this volume, been the production of a test having an almost linear relationship between total score and item difficulty and an almost linear test characteristic curve. This has enormous benefits from the point of view of avoiding misinterpretations of research and the calculation of change scores.

De Reggi re-analysed the data using a three-parameter Item Response Theory Model (as operationalised in Bilog-MG software [(Du Toit, 2003)] and compared her results with the Romanian data reported elsewhere in this volume. The correlation between the conventional item difficulties (as reported above) and those derived from the IRT based procedures was -0.95, and the correlation between the IRT-based difficulty parameters from the Slovenian and Romanian sample was 0.95. The greatest deviation can be observed at extreme values and can probably be attributed to the narrower age base of the Slovenian sample.

Distractor analysis revealed that misleading distractors (cases where adolescents chose one of the false answers more often than the correct one) are most often to be found in Set E, which is, of course, the most difficult Set. (This can be understood as the test administration instructions encourage guessing.) Similar results were found for the last items of sets C and D.

Reliability

Like most of the authors of other chapters in this book, we sought to assess the internal consistency of the SPM *Plus* without fully appreciating the inappropriateness of intercorrelating the items of IRT-based tests (as explained in the General Introduction to this book). The Cronbach alpha coefficient derived from our sample of 1079 was 0.81, and the standardised Cronbach Alpha 0.80. The internal homogenity was 0.83 (calculated using split-half method – odd and even items). The average correlation between items was 0.06. These figures are all slightly lower than those for the Classic SPM for Slovene adolescents (Boben, 2003) and are probably due to the restricted range of scores in the sample (the test is, of course, intended for use also with children as young as 5 years old). Nevertheless, they are relatively high compared with other tests and similar to those for the SPM *Plus* published by others (e. g. Matesic, 2000b, Dobrean et al., 2005)

Although the internal consistency varies with age group, the differences are small. It is lowest among 12-year olds (0.79), and highest among 11 and 13-year olds (0.82).

The internal consistency index (Cronbach alpha) of the SPM *Plus* for the second sample (N = 610) is 0.82 varying across age groups from 0.78 to 0.83. The standard error of measurement was 2.59 and standard error of estimate 2.34 (de Reggi, 2007).

Sex and age differences.

The data from the first sample were checked for age and sex differences. ANOVA confirmed age group differences ($F = 13.22$, $p = 0.00$), but not differences between the sexes ($F = 3.33$, $p = 0.07$), which, considering numerous other researches, could be expected. Detailed analysis also showed that girls were better at solving the SPM *Plus* than boys in the subgroup of 11-year olds, which was the smallest group ($t = -3.42$, $p = 0.001$). This can probably be attributed to the size of the sample, which was too small and allowed different motivation of tested students to affect the results. Girls, on the average, achieved better results than boys in all of the age groups and in the entire sample. The results of the Romanian research for the entire sample were similar (Raven, Raven, & Court, 2004). Girls in Slovenia also achieve slightly higher results with the SPM (Boben, 2003).

Similar calculations were performed by de Reggi (2007). She found statistically insignificant differences between the sexes, with slightly higher average results in favour of girls aged 15--17. There were no statistically significant differences between age groups in this sample. The higher the year of tested students, the higher the average results, with one exception: 17-year olds achieved a lower average value than students who were two years younger. There were statistically significant differences between different categories of secondary schools: Students of vocational schools achieved results that were below the average values of the sample, whereas students of general secondary schools ("gimnazija") achieved results higher than the average results of the sample.

Raw scores distributions and descriptive statistics.

In the first sample, the average time required to complete the SPM *Plus* was between 30 minutes (11-year olds; SD = 12.6) and 34 minutes (14-year olds; SD = 13.2). The variability in the time required was highest among the oldest adolescents, and practically the same in the case of other tested adolescents -- approximately 12.5 minutes. The average time required to complete the test increases with the age.

In the second sample (N = 610), the average time taken to complete the test was very similar in all of the age groups -- approximately 26 minutes. Only variability differs between age groups, being greatest in the group of 17-year olds (9 minutes) and smallest in the group of 14-year olds (7.5 minutes).

The within-age frequency distributions for the SPM *Plus* test in the Slovenian sample are normal, as was the case for the Classic SPM for this age (11--14 years). The descriptive statistics are summarised in Table 8. Average SPM *Plus* scores increase with age. All distributions are somewhat left symmetric, i.e. positioned towards higher results. The Kurtosis among 11-year olds was less satisfactory, but probably due to the sample as differences between the sex groups are also greater. This was also true of 14-year olds, the achievements of whom also differ from results from the other sample. In general, we can observe that average results in the 2006 sample are lower, although one would - because of the Flynn effect - expect higher results. The results of the 17-year olds are the most surprising in the sense that the average score does not fit into the

general tendency of scores to increase with age. The most probable explanation of this is lower motivation level, however another hypothesis is that socio-economic status was not explicitly controlled in the selection of the sample.

APM Standardisation, 1998

Sampling and the Sample

As described earlier, the sample for the APM standardisation was drawn at the same time as that for the CPM and Classic SPM. Testing was carried out in groups, without time limitations. Only the APM II data were processed, although the APM I was used to present instructions and to check whether participants were capable of solving the test.

This way, the sample included students from the 6th to 8th year (grade) of nine primary schools and of all of the years of 15 secondary schools, i.e. adolescents aged 12--19. We included data collected from 1,363 adolescents, which represents 0.72% of the population of that age. 43% of the sample were male, which is slightly less than in the population. The reason for this is that the adolescents of this age, who are not enrolled in educational programmes, were not included in the sample, and this group is predominantly male.

Item Analysis

According to the difficulty indices, there are more cases than with the SPM and CPM, in which the Slovenian order of difficulty of the items differs from the original. Analysing the differences between the original and the Slovene order, however, we observe that they are not large. Only the first and the last item remain in the same position in APM II, other items change positions upwards or downwards for seven positions at most. There are only seven items that would change their positions for five to seven places, and these are: 4, 9, 11, 13, 24, 28, 33 (Boben, 2003).

The frequency distribution of the difficulty indexes is bimodal, with a mean of 0.49 (SD = 0.26) and median of 0.53. There are less items of moderate difficulty and good discrimination than one would have expected in a power test. A smaller number of easy items than with CPM and SPM can also be observed.

If we were to arrange the items from the easiest to the most difficult one, we would have to change the order for individual age groups as well as for the entire sample. There are, however, no essential discrepancies here. The correlations between the difficulty indexes established separately within age groups are high (0.97--0.99). Unlike those obtained with the SPM, they are not lower between more widely separated age groups.

Distractor analysis, using before mentioned criteria, lets us observe that 12- to 19-year olds from our sample chose one of the offered distractors as the correct choice in five items. For example for Item 24, a false answer was selected by 35%, and the correct one only by 20% adolescents. In the last three items, the largest portion of adolescents chose one of the offered false answers. As

these items are very difficult, this is not surprising. In the remaining items, only four distractors can be deemed as misleading in four items (7, 15, 17, 22).

Reliability

The reliability of APM II is 0.87 (Cronbach alpha coefficient), but the reliability index using the split-half method (odd and even item) was slightly higher (0.88). Cronbach alpha coefficients for individual age groups range between 0.83 (14-year olds) and 0.88 (15-year olds). The average correlation between items is 0.15.

Sex and age differences.

With sex and age (year intervals) as independent variables, ANOVA showed that there were differences in APM II raw score between age groups ($F = 7.98$, $p = 0.00$) but not between the sexes ($F = 1.82$, $p = 0.18$). Nor is there an interaction between age and sex.

Raw scores distributions and descriptive statistics.

The average time taken to complete the test was 29 minutes (SD = 9.8); 4 minutes minimum and 66 minutes maximum. There were some differences among primary school students. Whereas the differences among students attending secondary schools are not that big and do not deviate much from the total average there are however differences in standard deviation.

The 16-year olds got unexpectedly high scores in comparison with the younger and older groups (Table 10). All distributions (in individual age groups) are somewhat left asymmetric, but not distinctly, as the mean remains at the half of all possible points. A distinct bimodal distribution can be observed, in both sexes, among 13-year olds. Probably, the same hypotheses could be put forward to explain them as were suggested re the SPM.

Slovene Norms and Comparison Between Them and Other Countries

Tables 11 to 15 present smoothed RPM age norms for different age groups. The norms show the raw score required to do better than the stated percentage of the population of each age group. Norms presented in this way have been consistently used by Raven for the past 70 years since, unlike norms presented as having a mean of 100 and a SD of 16, they (a) make no assumptions about the shapes of the within age distributions, (b) do not exaggerate the discriminative power of the test (compare an SD of 15 with SDs of 6 to 10 in the tables above), and (c) do not perpetuate the images and myths associated with "IQ". All the norms presented have been smoothed to eliminate sampling error (see Raven, 2000 for a discussion of this problem.)

Table 11 presents CPM norms for Sloven pre-school children tested individually in the context of UK data from 1982. Table 12 presents CPM norms for Slovene primary school tested in groups in the context of the previously mentioned UK data. Table 13 presents Classic SPM norms for Slovenia in the context of the 1979 British data. Table 14 presents the Slovenian SPM ***Plus*** norms (from the first sample) in the context of German (D), American (FB), Romanian

(RO), Croatian (HR) and Polish (PL) data. Table 15 presents the Slovenian APM II norms in the context of British 1979 data.

By and large, the Slovene norms are remarkably similar to those obtained in other countries. The one exception seems to be that the Slovenian CPM norms for young children tested individually are well above those for the comparison group from the UK. The children in the UK group were, however, only tested individually if they could not cope with the answer sheets on their own. So the higher scores would seem, almost certainly, to be a product of individual testing.

Given the differences between the dates of testing, those familiar with the so-called "Flynn Effect" may have expected bigger differences between the Slovene norms and those collected in other countries. And, in fact, more recent data collected in some other countries (such as Switzerland and Norway) are higher than both the Slovene norms and their earlier UK counterparts (Raven et al., 1999c).

The UK SPM Manual (Raven, Raven, & Court, 1999c) presents tables (SPM3 and SPM5) to convert SPM *Plus* and APM scores to SPM scores. Doubts have sometimes been expressed about the accuracy of these conversion tables. We therefore thought it would be useful to see what would happen if we converted the SPM *Plus* and APM data we had collected from our different samples to SPM scores and compared the results.

The results for 13 year olds are presented in Figure 2. Those for the other age groups were similar. It will be seen that the estimated raw score equivalent to the 5^{th} and 10^{th} percentiles diverges somewhat between the tests, with data from the SPM *Plus* standardisation yielding the highest values. But, in general, the results give remarkable confirmation of the quality of the data collected with different tests from different samples and of the accuracy of the conversion tables.

Conclusion

Most of the data presented here suggest that the *Raven's Progressive Matrices* form an excellent series of tests embodying one of the most ingenious ideas test constructors have ever had.

Nevertheless, when interpreting test results, it is important to bear the theoretical basis, purposes, and limitations of the tests in mind. On the one hand, one must ensure that the tests and norms employed are appropriate not only to the group and individuals one wishes to test but also to the purposes for which the testing is being carried out. The results of individual testing must be interpreted in the context of wider information on the person being tested, including information on the tested person's previous experience with tests. Excessive generalisation from the results must be avoided. Deviations from standard procedures must be taken into account etc. (International Guidelines for Test Use, ITC, 2000). On the other hand, failure to fully understand the theoretical basis of the tests, and the measurement model employed in their development, has led to a great deal of misguided research and widespread misinterpretation of research results. It will only be if these things are done that the RPM will retain its value, and its unique place in psychology, into the future.

References

Boben, D. (2003). *Prirocnik za Ravnove progresivne matrice in besedne lestvice. Slovenska standardizacija Ravnovih progresivnih matric: norme CPM, SPM, APM. [Manual for Raven's Progressive Matrices and Vocabulary Scales. Slovenian Standardization of Raven's Progressive Matrices: CPM, SPM, AMP norms.]* Ljubljana: Center za psihodiagnosticna sredstva.

Boben, D. (2005). *Prirocnik za Ravnove progresivne matrice in besedne lestvice. SPM-Plus, Slovenske norme za mladostnike v primerjavi z drugimi normami : dodatek 3. zvezka prirocnika (SPM). [Manual for Raven's Progressive Matrices and Vocabulary Scales. SPM-Plus; Slovenian norms for adolescents in comparison to other norms. Supplement to Section 3.]* Ljubljana: Center za psihodiagnosticna sredstva.

De Reggi, M. (2007). *Psihometricne znacilnosti Ravnovih standardnih progresivnih matric, oblika plus, pri slovenskih mladostnikih. Diplomsko delo. [*Psychometric characteristics of Raven's SPM-*Plus* regarding Slovene adolescents. Diploma.*]*Ljubljana: Univerza v Ljubljani. Filozofska fakulteta. Oddelek za psihologijo.

Dobrean (Domuta), A., Comsa, M., Rusu, C. (2005). In R. Balazsi, *Romanian standardization of Raven's Standard Progressive Matrices Plus*. Budimpesta: 8EECPA.

International Test Commission (2000). *International Guidelines for Test Use*.

Jerman, J. (2000). *Ugotavljanje razvoja fonoloskega zavedanja pri predsolskih otrocih. Doktorska disertacija. [Development of phonological conscience at pre-school children. PhD Thesis.]* Ljubljana: Univerza v Ljubljani, Pedagoska fakulteta, Oddelek za defektologijo.

Klopcic, A. (2007). *Standardizacija Testa nizov in analiza Flynnovega ucinka. Diplomsko delo. [Test Series Standardization and Flynn Effect Analyses. Diploma.]* Ljubljana: Univerza v Ljubljani. Filozofska fakulteta. Oddelek za psihologijo.

Lapajne, Z. (1997). Vlado Schmidt (1910-1997) in prvi slovenski skupinski testi inteligentnosti. [Vlado Schmidt (1910-1997) and first Slovene group intelligence test.] *TESTinfo, novice Centra za psihodiagnosticna sredstva, letnik 2, st. 1.*

Matesic, K. (2000). Relations between results on *Raven Progressive Matrices Plus* sets and school achievement. *Review of Psychology, 7(1-2)*, 75-82.

MacKintosh, N. J. (1998). *IQ and Human Intelligence*. Oxford: Oxford University Press.

Pecjak, V. (1983). *Nastajanje psihologije*. [*Beginning of Psychology.*] Ljubljana: Dopisna delavska univerza Univerzum.

Plut, M. (2003). *Merske lastnosti poskusne verzije Besedne lestvice inteligentnosti Mill Hill. Diplomsko delo. [Psychometric characteristics of experimental version of Mill Hill Vocabulary Scales. Diploma.]* Ljubljana: Univerza v Ljubljani, Filozofska fakulteta, Oddelek za psihologijo.

Raven, J. (1981). *Manual for Raven's Progressive Matrices and Vocabulary Scales. Research Supplement No. 1: The 1979 British Standardisation of the Standard Progressive Matrices and Mill Hill Vocabulary Scales, Together With Comparative Date from Earlier Studies in the UK, US, Canada, Germany and Ireland.* San Antonio, TX: Harcourt Assessment.

Raven, J. (2000). The Raven's Progressive Matrices: Change and stability over culture and time. *Cognitive Psychology, 41*, 1-48.

Raven, J., Raven, J. C. & Court, J. H. (1999a). *Prirocnik za Ravnove progresivne matrice in besedne lestvice. 1. zvezek: Splosni pregled. [Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 1: General Overview]* Ljubljana: Center za psihodiagnosticna sredstva.

Raven, J., Raven, J. C., & Court, J. H. (1999b). *Prirocnik za Ravnove progresivne matrice in besedne lestvice. 2. zvezek: Barvne progresivne matrice. . [Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 2: CPM]* Ljubljana: Center za psihodiagnosticna sredstva.

Raven, J., Raven, J. C., & Court, J. H. (1999c). *Prirocnik za Ravnove progresivne matrice in besedne lestvice. 3. zvezek: Standardne progresivne matrice. . [Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 3: SPM]* Ljubljana: Center za psihodiagnosticna sredstva.

Raven, J., Raven, J. C., & Court, J. H. (1999d). *Prirocnik za Ravnove progresivne matrice in besedne lestvice. 4. zvezek: Zahtevne progresivne matrice. [Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 4: APM]* Ljubljana: Center za psihodiagnosticna sredstva.

Raven, J., Raven, J. C., & Court, J. H. (2000, updated 2004). *Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 3: The Standard Progressive Matrices, Iincluding the Parallel and Plus Versions*. San Antonio, TX: Harcourt Assessment.

Raven, J., Raven, J. C., & Court, J. H. (2004). *Manual for Raven's Progressive Matrices and Vocabulary Scales, Section 3: Standard Progressive Matrices*. San Antonio, TX: Harcourt Assessment.

Rezultati raziskovanj. Seznam sol s splosnimi podatki ob zacetku solskega leta 1995/96. [Research results. List of schools in the beginning of school year 1995/96.] (1996). Ljubljana: Statisticni urad Republike Slovenije.

Oakland, T. (1995). 44 country survey shows international test use patterns. *Psychology International, 6(1),* Winter, 7.

Statisticne informacije [Rapid Reports] (1992). Ljubljana: Statisticni urad Republike Slovenije.

Statisticne informacije [Rapid Reports] (1997). Ljubljana: Statisticni urad Republike Slovenije.

Statistica for Windows. (1995). StatSoft Inc.

Zalik, E. (2003). *Slovenska priredba besedne lestvice izbirnega tipa Mill Hill. Diplomsko delo. [Slovene adaptation of multiple-choice form of the Mill Hill Vocabulary Scales. Diploma.]* Ljubljana: Univerza v Ljubljani, Filozofska fakulteta, Oddelek za psihologijo.

Table 1
Slovenian Population Distribution

	Region	Total Population	% Population	Population Aged 5-19	% Aged 5-19
1	Pomurska	129,946	6.6	17,494	6.2
2	Podravska	320,800	16.3	43,240	15.3
3	Koroska	73,789	3.8	11,151	3.9
4	Savinjska	255,278	13.0	37,996	13.4
5	Zasavska	47,356	2.4	6,550	2.3
6	Spodnjeposavska	72,260	3.7	10,588	3.7
7	Dolenjska	95,066	4.8	15,616	5.5
8	Osrednjeslovenska	501,900	25.5	73,401	25.9
9	Gorenjska	191,688	9.8	29,398	10.4
10	Notranjsko-kraska	49,927	2.5	7,168	2.5
11	Goriska	128,124	6.5	17,392	6.1
12	Obalno-kraska	99,854	5.1	13,391	4.7
	Total	1,965,988	100.0	283,385	100.0

Rapid Reports (1992, 1997)

Table 2
Coloured Progressive Matrices
1998 Slovenian Sample (Primary School)

Age in Years	Age Years (Months)	Male	Female	Total
7	6(6)-7(5)	27	28	55
8	7(6)-8(5)	174	160	334
9	8(6)-9(5)	120	83	203
10	9(6)-10(5)	107	94	201
11	10(6)-11(5)	85	94	179
12	11(6)-12(5)	64	63	127
13	12(6)-13(5)	49	51	100
Total		626	573	1,199

Table 3
Coloured Progressive Matrices
1998 Slovenian Sample (Pre-School)

Age	Age Years (Months)	*n*
6	5(9) - 6(2)	113
6.5	6(3) - 6(8)	234
7	6(9) - 7(2)	178
7.5	7(3) - 7(8)	16
Total		541

Table 4
Coloured Progressive Matrices
Mean (M), Standard Deviation (SD), Skewness And Kurtosis for Different Age Groups

Age	Age Years (Months)	*n*	M	SD	Skewness	Kurtosis
Pre-School						
6	5(9)-6(2)	113	22.8	6.3	-0.79	0.20
6.5	6(3)-6(8)	234	22.8	6.7	-0.81	-0.07
7	6(9)-7(2)	178	24.6	7.1	-0.64	-0.22
Primary School						
7	6(6)-7(5)	54	25.2	5.8	-1.04	1,44
8	7(6)-8(5)	334	25.9	5.8	-0.83	0,68
9	8(6)-9(5)	203	27.5	5.9	-0.88	0,26
10	9(6)-10(5)	200	28.7	5.9	-1.28	1,23
11	10(6)-11(5)	179	30.2	4.8	-1.32	1,83
12-13	11(6)-13(5)	227	31.1	5.8	-1.77	2.68

Table 5
Standard Progressive Matrices
1998 Slovenian Sample

Age	Age Years (Months)	Male	Female	*n*
8	7(6)-8(5)	53	46	99
9	8(6)-9(5)	71	57	128
10	9(6)-10(5)	60	55	115
11	10(6)-11(5)	73	52	125
12	11(6)-12(5)	58	65	123
13	12(6)-13(5)	55	61	116
14	13(6)-14(5)	65	67	132
15	14(6)-15(5)	70	74	144
16	15(6)-16(5)	146	137	283
17	16(6)-17(5)	115	96	211
18	17(6)-18(5)	51	29	80
Total		817	739	1,556

Figure 1
Standard Progressive Matrices
Male and Female Distributions

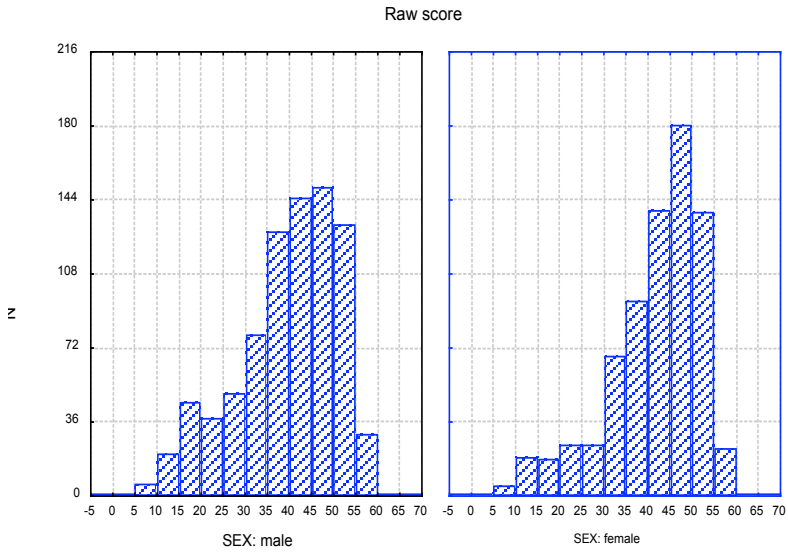

Table 6
Standard Progressive Matrices
Mean (M), Standard Deviation (SD), Skewness and Kurtosis for Age Groups

Age	Age Years (Months)	*n*	M	SD	Skewness	Kurtosis
8	7(6)-8(5)	99	24.8	9.2	0.17	-0.77
9	8(6)-9(5)	128	30.3	10.8	-0.36	-1.02
10	9(6)-10(5)	115	36.0	9.2	-0.29	-0.45
11	10(6)-11(5)	125	38.4	9.8	-1.00	0.60
12	11(6)-13(5)	123	42.1	7.8	-0.91	0.78
13	13(6)-14(5)	116	42.9	9.1	-1.35	2.28
14	14(6)-15(5)	132	42.6	9.0	-1.21	1.90
15	15(6)-16(5)	144	45.8	8.9	-1.40	2.35
16	16(6)-17(5)	283	45.5	8.9	-1.46	3.16
17	17(6)-18(5)	211	46.0	9.1	-1.40	1.82
18	18(6)-19(5)	80	46.4	7.7	-0.88	0.46

Table 7
Standard Progressive Matrices Plus
2005 and 2006 Slovenian Samples, Age, and Sex

Age	Age Years (Months)	Male	Female	*n*
Sample 2005				
11	10(6)-11(5)	33	45	78
12	11(6)-12(5)	169	152	321
13	12(6)-13(5)	183	186	369
14	13(6)-14(5)	139	149	288
Total		524	532	1056
Sample 2006				
14	13(6)-14(5)	37	38	75
15	14(6)-15(5)	91	103	194
16	15(6)-16(5)	106	103	211
17	16(6)-17(5)	65	65	130
Missing sex data				2
Total		299	309	610

Table 8
Standard Progressive Matrices ***Plus***
2005 and 2006 Slovenian Samples
Mean (M), Standard Deviation (SD), Skewness and Kurtosis for Different Age Groups

Age	Age Years (Months)	*n*	M	SD	Skewness	Kurtosis
Sample 2005						
11	10(6)-11(5)	78	31.35	6.18	-0.96	1.31
12	11(6)-12(5)	321	32.62	5.67	-0.38	0.21
13	12(6)-13(5)	371	34.08	5.89	-0.24	0.82
14	13(6)-14(5)	288	35.07	6.02	-0.56	1.24
Sample 2006						
14	13(6)-14(5)	75	33.2	5.5	-0.45	0.71
15	14(6)-15(5)	194	34.2	6.4	-0.30	1.00
16	15(6)-16(5)	211	35.3	5.9	-0.31	1.03
17	16(6)-17(5)	130	34.5	6.2	0.30	0.50

Table 9
Advanced Progressive Matrices
1998 Slovenian Sample

Age	Age Year s(Months)	Male	Female	*n*
13	12(6)-13(5)	61	65	126
14	13(6)-14(5)	78	76	154
15	14(6)-15(5)	87	90	177
16	15(6)-16(5)	112	124	236
17	16(6)-17(5)	101	163	264
18	17(6)-18(5)	91	156	247
19	18(6)-19(5)	65	94	159
Total		595	768	1,363

Table 10
Advanced Progressive Matrices Set II
Mean (M), Standard Deviation (SD), Skewness and Kurtosis for Different Age Groups

Age	Age Years (Months)	*n*	M	SD	Skewness	Kurtosis
13	12(6)-13(5)	126	15.3	6.6	-0.20	-0.93
14	13(6)-14(5)	154	16.2	5.9	-0.04	-0.91
15	14(6)-15(5)	177	17.3	7.0	-0.31	-0.79
16	15(6)-16(5)	236	19.0	6.5	-0.39	-0.40
17	16(6)-17(5)	264	17.7	6.4	-0.24	-0.36
18	17(6)-18(5)	247	18.2	6.3	-0.15	-0.08
19	18(6)-19(5)	159	19.3	6.0	-0.41	0.38

Table 11
Coloured Progressive Matrices
Smoothed 1998 Slovenian Norms (Pre-School, Individual Administration)
In the Context of 1983 Dumfries Data

	Age in Years (Months)					
	6 5(9) to 6(2)		6_ 6(3) to 6(8)		7 6(9) to 7(2)	
Percentile	UK	**SL**	UK	**SL**	UK	**SL**
95	24	**33**	26	**34**	28	**35**
90	21	**31**	23	**31**	25	**34**
75	19	**26**	20	**27**	21	**30**
50	**16**	**22**	**17**	**23**	**18**	**24**
25	13	**17**	14	**17**	16	**19**
10	11	**14**	12	**13**	13	**15**
5	9	**13**	11	**11**	12	**11**
n	23	**113**	42	**234**	54	**178**

Table 12

Coloured Progressive Matrices

Smoothed 1998 Slovenian Norms (Primary Schools) In the Context of 1982 Dumfries Data

	Age in Years (Months)									
	7_ 7(3) to 7(8)		8 7(9) to 8(2)		8_ 8(3) to 8(8)		9 8(9) to 9(2)		9_ 9(3) to 9(8)	
Percentile	UK	**SL**	UK	**SL**	UK	**SL**	UK	**SL**	UK	**SL**
95	31	**34**	32	**34**	33	**34**	34	**34**	35	**34**
90	28	**32**	30	**32**	32	**33**	33	**33**	33	**33**
75	23	**29**	25	**30**	27	**31**	29	**31**	31	**32**
50	**20**	**25**	**22**	**26**	**24**	**27**	**26**	**27**	**28**	**28**
25	17	**21**	18	**22**	20	**23**	22	**24**	24	**25**
10	14	**17**	15	**18**	16	**18**	17	**19**	19	**20**
5	13	**13**	14	**14**	14	**14**	15	**14**	16	**15**
n	55	**115**	44	**175**	48	**128**	52	**102**	37	**104**

Table 12 continued.

	Age in Years (Months)										
	10 9(9) to 10(2)		10_ 10(3) to 10(8)		11 10(9) to 11(2)		11_ 11(3) to 11(8)		12 11(9) to 12(2)	12_ 12(3) to 12(8)	13 12(9) to 13(2)
Percentile	UK	**SL**	UK	**SL**	UK	**SL**	UK	**SL**	**SL**	**SL**	**SL**
95	35	**34**	35	**34**	35	**35**	35	**35**	**35**	**35**	**35**
90	33	**33**	34	**33**	35	**34**	35	**34**	**34**	**34**	**34**
75	32	**32**	33	**32**	33	**33**	34	**33**	**33**	**33**	**33**
50	**30**	**29**	**31**	**30**	**31**	**31**	**32**	**31**	**32**	**32**	**32**
25	25	**26**	26	**27**	28	**28**	30	**29**	**29**	**30**	**30**
10	21	**21**	22	**22**	23	**23**	25	**23**	**24**	**24**	**25**
5	17	**16**	18	**17**	20	**18**	22	**19**	**19**	**19**	**19**
n	53	**96**	49	**104**	51	**83**	55	**80**	**67**	**61**	**59**

Table 13
Standard Progressive Matrices
1998 Slovenian Smoothed Norms In the Context of 1979 British Data

	Age in Years (Months)									
	8		9		10		11		12	
	7(9) to 8(2)	7(6) to 8(5)	8(9) to 9(2)	8(6) to 9(5)	9(9) to 10(2)	9(6) to 10(5)	10(9) to 11(2)	10(6) to 10(5)	11(9) to 12(2)	11(6) to 12(5)
Percentile	UK	**SL**	UK	**SL**	UK	**SL**	UK	**SL**	UK	**SL**
95	40	**40**	44	**46**	48	**48**	50	**50**	52	**52**
90	38	**37**	42	**42**	46	**46**	48	**48**	50	**50**
75	33	**32**	38	**39**	42	**43**	44	**45**	46	**47**
50	**25**	**23**	**33**	**31**	**38**	**36**	**40**	**40**	**41**	**42**
25	17	**18**	25	**22**	32	**28**	34	**33**	37	**37**
10	14	**12**	17	**16**	23	**20**	29	**24**	31	**30**
5	12	**10**	14	**11**	17	**14**	24	**17**	26	**23**
n	174	**99**	166	**128**	172	**115**	187	**125**	164	**123**

Table 13 continued

	Age in Years (Months)								
	13		14		15		16	17	18
	12(9) to 13(2)	12(6) to 13(5)	13(9) to 14(2)	13(6) to 14(5)	14(9) to 15(2)	14(6) to 15(5)	15(6) to 16(5)	16(6) to 17(5)	17(6) to 18(5)
Percentile	UK	**SL**	UK	**SL**	UK	**SL**	**SL**	**SL**	**SL**
95	54	**53**	55	**54**	57	**55**	**56**	**56**	**56**
90	52	**51**	54	**52**	55	**53**	**54**	**54**	**54**
75	49	**48**	50	**49**	51	**50**	**51**	**52**	**52**
50	**43**	**43**	**45**	**44**	**47**	**45**	**46**	**48**	**49**
25	39	**38**	42	**39**	42	**40**	**41**	**41**	**42**
10	33	**32**	36	**33**	36	**35**	**35**	**35**	**36**
5	28	**25**	30	**26**	33	**26**	**27**	**29**	**30**
n	185	**116**	196	**132**	191	**144**	**283**	**211**	**80**

Table 14
Standard Progressive Matrices ***Plus***
Comparison of Slovenian, German, Fort Bend (Texas), Romanian, Croation, and Polish Norms

	Age in Years (Months)											
	11 10(6) to 11(5)	12 11(6) to 12(5)	13 12(6) to 13(5)	14 13(6) to 14(5)	14	14 13(9) to 14(2)	14 13(9) to 14(2)	14.5 13.5 to 15.5	14.5 14(3) to 14(8)	15	15	15 14(9) to 15(2)
Percentile	**SL**	**SL**	**SL**	**SL**	**D**	**FB**	**RO**	**HR**	**RO**	**PL**	**D**	**FB**
95	40	42	43	45	43	44	41	44	42	49	45	46
90	37	40	41	42	40	41	39	42	40.1	48	43	43
75	35	37	38	39	37	39	35	38	35	44	40	40
50	**32**	**33**	**34**	**35**	**33**	**36**	**31**	**35**	**31**	39	**36**	**37**
25	28	29	30	32	29	32	24	31	25	36	32	34
10	24	25	27	28	26	30	18	27	19	33	29	31
5	21	23	24	25	24	27	15	21	15	30	27	29
n	78	321	371	288	181	24	69	295	70	98	523	24

Table 15
Advanced Progressive Matrices
Smoothed 1998 Slovenian Norms In the Context of 1979 UK Data

	Age in Years (Months)								
	12_ 12(3) to 12(8)	13 12(9) to 13(2)	13_ 133) to 13(8)	14 13(9) to 14(2)		14_ 14(3) to 14(8)		15 14(9) to 15(2)	
Percentile	**SL**	**SL**	**SL**	UK	**SL**	UK	**SL**	UK	**SL**
95	**23**	**23**	**24**	23	**24**	25	**25**	26	**25**
90	**22**	**22**	**23**	22	**23**	22	**24**	23	**24**
75	**19**	**19**	**20**	17	**20**	17	**21**	18	**21**
50	**15**	**15**	**16**	**12**	**16**	**13**	**17**	**14**	**17**
25	**9**	**9**	**10**	10	**10**	10	**11**	10	**11**
10	**5**	**5**	**6**	7	**6**	7	**7**	7	**7**
5	**3**	**3**	**4**	4	**4**	5	**5**	5	**5**
n	**50**	**62**	**75**	196	**66**	189	**84**	191	**71**

Table 15 - continued

	Age in Years (Months)								
	15_ 15(3) to 15(8)		16 15(9) to 16(2)	16_ 16(3) to 16(8)	17 16(9) to 17(2)	17_ 17(3) to 17(8)	18 17(9) to 18(2)	18_ 18(3) to 19(8)	19 19(9) To 20(2)
Percentile	UK	**SL**	**SL**	**SL**	**SL**	**SL**	**SL**	**SL**	**SL**
95	27	**26**	**26**	**27**	**27**	**28**	**28**	**29**	**29**
90	23	**25**	**25**	**26**	**26**	**27**	**27**	**28**	**28**
75	18	**22**	**22**	**23**	**23**	**24**	**24**	**25**	**25**
50	**14**	**18**	**18**	**19**	**19**	**20**	**20**	**21**	**21**
25	10	**12**	**12**	**13**	**13**	**14**	**14**	**15**	**15**
10	7	**8**	**8**	**9**	**9**	**10**	**10**	**11**	**11**
5	5	**6**	**6**	**7**	**7**	**8**	**8**	**9**	**9**
n	171	**117**	**116**	**123**	**141**	**130**	**126**	**109**	**90**

Figure 2
Slovenian SPM, SPM *Plus* and APM II Scores Converted to SPM (Example for Age 13)