

## STRUCTURE OF MOTOR ABILITIES OF FIVE AND A HALF YEARS OLD GIRLS

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### ABSTRACT

*The subject sample encompassed 189 girls, five and half years old (+/- 3 days). The test battery consisted of 28 composite motor tasks. The results were analysed with The SPSS-x statistical programme at the Computing Centre of Pedagogical Faculty of the University of Maribor (Slovenia). The Kaiser-Guttman criterion was used for factor extraction and the initial structure rotated to an Oblimin solution. The extraction of significant factor gave an eight factor model of basic motor abilities: realisation of rhythmic motor structures, balance, agility, whole-body coordination, explosive power, manipulative ability of the hands, kinaesthetic solving of spatial problems and factor x (provisionally-motor intelligence).*

**Key words:** children, motor abilities, tests

## STRUTTURA DELLE CAPACITÀ MOTORIE DI BAMBINE DI CINQUE ANNI E MEZZO D'ETÀ

### SINTESI

*All'Università di Maribor è in corso un progetto di ricerca pluriennale, intitolato Struttura e relazioni di capacità psicomotorie e caratteristiche morfologiche, psicosociali e sanitarie di bambini in tenera età. L'esperimento ha preso in considerazione più di 1400 bambini di entrambi i sessi, tra i cinque ed i sei anni e mezzo. L'articolo presenta la struttura motoria latente di bambine di cinque anni e mezzo. In Slovenia ricerche simili sono state condotte da Planinšek (1995), Pišot (1998), Rajtmajer (1994, 1997), Strel & Šturm (1981) e Videmšek & Cemič (1991). Il campione analizzato ha compreso 189 bambine di 5 anni e mezzo (più/meno 3 giorni). L'esperimento è stato effettuato mediante 28 compiti motori composti. I dati sono stati elaborati con il programma SPSS-x. Per l'estrazione delle componenti principali è stato utilizzato il criterio di Guttman-Kaiser  $\lambda \geq 1$ , mentre la rotazione dei fattori è stata effettuata nella posizione di Oblimin. L'estrazione dei fattori significativi ha portato ad un modello delle capacità motorie di queste bambine a 8 fattori: la realizzazione delle strutture ritmiche del movimento, l'equilibrio, l'agilità, la coordinazione del corpo, la forza esplosiva, la capacità manipolativa delle mani, la soluzione cinestetica dei problemi spaziali ed il fattore x, che gli autori hanno condizionatamente chiamato intelligenza motoria.*

**Parole chiave:** bambini, capacità motorie, esperimenti

### INTRODUCTION

At the University of Maribor, we have been studying latent and manifest motor abilities and anthropometric, psychosocial and health characteristics of young chil-

dren since 1988. The object of this study is the structure of motor abilities of 5.5 years old girls. Analysis is based on the results of studies by Strel & Šturm (1981), Zimmer & Volkamer (1984), Kiphard (1987, 1989), Cetin (1991), Videmšek & Cemič (1991), Rajtmajer (1994, 1997),

Planinšec (1995) and Pišot (1997). The above-stated authors studied motor structure of children between five and seven years of age. In setting the model of motorics of five-and-a-half years old girls we of course took into account also the findings of basic studies of motorics by Chaidze (1965), Berstein (1967), Agrež (1975), Gredel (1975), Kurelić *et al.* (1975), Šturm (1975), Hošek (1976), Mueller (1978), Boes & Mechling (1983), Luria (1983), Singer (1985) and many more. In order to define the motor status of the children as objectively as possible, it was necessary to study numerous researches, where the authors studied motorics of young children, from schooling children and youth to adults. It is a fact - and this is also the working hypothesis of the entire project, which encompasses four sub-populations aged 5, 5.5, 6 and 6.5 years old children of both genders - that motorics of a child is in some segments very similar or even identical to motorics of other populations, but that it also differs from them. This study also bases on a part of Gardner's (1995) theory of multiple intelligences, where the author defines physical-motor and partly spatial intelligence.

### METHODS

In this study 189 girls five and a half years old ( $\pm 3$  days) were tested, sampled from a population of about 900 girls entered into the register at the Paediatric Ward of the Health Clinic in Maribor, Slovenia. The testing battery consisted of twenty-eight composite motor tests, covering the following hypothetical sub-spaces of motorics: explosive and repetitive strength, speed of frequency of simple movements, balance, manipulative ability of arms, motor intelligence, reorganisation of stereotypes, whole-body co-ordination, agility. Choice of tests was made on the basis of the already mentioned authors, our own multi-year experiences and the requirement that the tests are sufficiently simple to be used by pedagogues in actual praxis. The data was analysed with the SPSS-X statistical package at the University of Maribor. The Kaiser-Guttman criterion was used for extraction of factors, deeming as significant all factors with an eigen value over one, representing the upper bound of the number of extracted factors.

### RESULTS

The extraction of factors gave an eight-factor model of basic motorics of 5.5 year-old girls (Tab. 1). A weakness of the Kaiser-Guttman criterion ( $\lambda \geq 1$ ) is in the hyper-production of factors, the good side is that all information is preserved. Because of the same reason we used the structure matrix, *i.e.* perpendicular projections of variable vectors on the factors, as the interpretation base, since they give somewhat higher coefficients than parallel projections (pattern matrix).

The first factor is defined by rather different tests according to their structure, but they do have a common object of measurement in cyclic motor actions for the same period of time (20 s): various tapping, lateral hops, bench stepping and ball circling around the body. These are simple repetitive movements, which can be named as the ability for realisation of rhythmic motor structures (F1). The second and the third factor have a simple structure; according to the classic terminology we can recognise them as the ability of balance on one leg (F2) and the ability for quick direction changes - agility (F3). The fourth factor is defined by the motor task running after rolling, which is for children this age a demanding movement from the co-ordination point of view, where the entire body co-operates in its realisation. In accord with this, we shall name it the ability of whole body co-ordination (F4). The fifth factor can be clearly recognised as explosive power (F5), the sixth as the ability for manipulation with the arms (F6), the seventh - with salient projections from the walking backwards through loops tests - is the well known ability of kinaesthetic solving of spatial problems (F7). The eighth factor is characterised by the test block building and throwing the ball at the floor. The execution of these two tests do not require cortical control of movement, since the action can be performed at this age only through "trial and error". We shall name it as the ability of motor intelligence (F8).

### DISCUSSION

Motor structure of 5.5 year-old girls is much more complicated than the one of boys of the same age (Ratmajer, 1997). In the psychomotor co-ordination sub-space there are several unusual correlations. It is obvious that one cannot use the same criteria in analysis of motorics for girls this age. The differences are evident; the most outstanding is the role of cyclic motor actions, *i.e.* characteristic rhythm. This hypothesis can be confirmed already with an analysis of the first factor, where the 20 s repetitive action requires rhythm of execution, rather than the energy part of repetitive strength.

We cannot confirm the hypothetical model of motor abilities of 5.5 year-old girls, especially significant are the differences in the tests that Gardner (1995) classifies with motor intelligence into the sub-space of skilful manipulation of objects: tests with a ball and tests with blocks do not have a common object of measurement for boys. For girls, the differentiation is much more demanding and manifests itself in the division by rhythm, simple manipulation and cortical control on the basis of trial and error. The test stepping on a bench, whose intentional object of measurement is repetitive strength, is completely irrelevant for girls this age - it does not have a measurement object of its own and therefore acts as a polygon test.

Tab. 1: Structure of the obtained factors

Tab. 1: Struktura izoliranih faktorjev

| M   | Variable                                | F1  | F2  | F3   | F4  | F5  | F6 | F7  | F8   |
|-----|-----------------------------------------|-----|-----|------|-----|-----|----|-----|------|
| 1.  | Standing broad jump                     |     |     |      |     | .81 |    |     |      |
| 2.  | Triple jump                             |     |     |      |     | .76 |    |     |      |
| 3.  | High jump                               |     |     |      |     | .66 |    |     |      |
| 4.  | Stepping on a bench                     | .49 |     |      | .45 | .41 |    |     | -.46 |
| 5.  | Lateral hops                            | .78 |     |      |     |     |    |     |      |
| 6.  | Lateral hops - frontal support on arms  | .75 |     |      |     |     |    | .41 |      |
| 7.  | Tapping - arm 1                         |     |     |      |     |     |    |     | -.47 |
| 8.  | Tapping - leg                           | .66 |     |      |     |     |    |     |      |
| 9.  | Tapping - arm 2                         | .75 |     |      |     |     |    |     |      |
| 10. | Lateral stance on lying block           |     | .84 |      |     |     |    |     |      |
| 11. | Frontal stance on lying block           |     | .86 |      |     |     |    |     |      |
| 12. | Stance on standing block                |     | .68 |      |     |     |    |     |      |
| 13. | Circling ball around body               | .61 |     |      |     |     |    |     | -.44 |
| 14. | Rolling ball standing up                |     |     |      | .58 |     |    |     |      |
| 15. | Rolling ball around hoop                |     |     |      |     |     |    | .49 | .51  |
| 16. | Building with hollow blocks             |     |     |      |     |     |    |     | .64  |
| 17. | Building with wooden blocks             |     |     |      |     | .77 |    |     |      |
| 18. | Building with plastic blocks            |     |     |      |     | .86 |    |     |      |
| 19. | Walking on ladder backwards             |     |     |      |     |     |    | .67 |      |
| 20. | Walking through hoops backward          |     |     |      |     |     |    | .83 |      |
| 21. | Walking backward - polygon              |     |     |      |     |     |    | .81 |      |
| 22. | Jumping over and crawling under a bench |     |     |      |     |     |    | .55 | .40  |
| 23. | Crawling with a ball                    |     |     |      |     |     |    | .50 |      |
| 24. | Running after rolling                   |     |     |      | .62 |     |    |     |      |
| 25. | Shuttle runs                            |     |     | -.83 |     |     |    |     |      |
| 26. | Lateral running                         |     |     | -.90 |     |     |    |     |      |
| 27. | Zigzag running                          |     |     |      |     |     |    | .41 |      |
| 28. | Throwing ball at floor                  |     |     |      |     |     |    |     | -.62 |

## CONCLUSIONS

Factor analysis of motor space of five-and-a-half years old girls, defined by 28 composite motor tasks, gave an eight-factor model of basic motorics of girls this age. The first four factors are relatively simple, the other four construct very complex latent dimensions. The factors are inter-correlated relatively weakly, or not at all. The results of this study are important also for praxis,

since it is possible to quickly and easily identify representative tests with which sport pedagogues can test children in praxis. An already constructed system of centile norms of manifest motor abilities (Rajtmajer, 1997) enables the use of findings of this study in actual praxis for diagnostic-prognostic purposes: an analysis of the motor status of a child and the construction of an operative exercise programme.

## STRUKTURA MOTORIČNIH SPOSOBNOSTI PET IN POLLETNIH DEKLIC

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## POVZETEK

Na Univerzi v Mariboru izvajamo večletni raziskovalni projekt z naslovom *Struktura in relacije psihomotoričnih sposobnosti, morfoloških, psihosocialnih in zdravstvenih karakteristik mlajših otrok*. Podatke smo zbrali s pomočjo

testiranja preko 1400 od pet do šest in polletnih otrok obeh spolov. V tej študiji predstavljamo latentno motorično strukturo pet in polletnih deklic. Podobne raziskave so v Sloveniji izvedli še Strel & Šturm (1981), Videmšek & Cemič (1991), Rajtmajer (1994, 1997), Planinšec (1995) in Pišot (1997). Vzorec merjenk je zajel 189 deklic, starih pet let in pol (plus/minus 3 dni). Testni instrumentarij je obsegal 28 kompozitnih motoričnih nalog. Rezultati so bili obdelani s programom SPSS-x. Za ekstrakcijo glavnih komponent je bil uporabljen Guttman-Kaiserjev kriterij  $\lambda \geq 1$ , rotacija faktorjev pa je bila izvedena v oblamin poziciji. Ekstrakcija značilnih faktorjev je dala 8-faktorski model motoričnih sposobnosti deklic te starosti: realizacijo ritmičnih struktur gibanja, ravnotežje, agilnost, koordinacijo vsega telesa, eksplozivno moč, manipulativno sposobnost rok, kinestetično reševanje prostorskih problemov in faktor x, ki smo ga pogojno poimenovali kot motorično inteligenco.

**Ključne besede:** otroci, motorične sposobnosti, testi

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