The ET 6–6
A Method for Developmental Assessment for German-Speaking Countries

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Abstract. The ET 6–6 presents a procedure for the assessment of a developmental status in children from 6 months to 6 years of age that uses experimentally based test tasks for a great variety of developmental skills. The results are shown in a multidimensional and age-specific profile. The instrument has been standardized by testing 950 children.

Keywords: developmental test, developmental assessment, child development

Preventive medical check-ups for children that rely on medical examination, short conversation with parents, and some behavior monitoring may not be sufficient to detect or exclude the presence of a developmental disorder. The ET 6–6 (Developmental Test 6 Months to 6 Years; Petermann, Stein, & Macha, 2006a) provides a standardized test procedure suitable for a large age range that allows for norm-oriented assessment based on a new model of development.

Theoretical Considerations

The development of the ET 6–6 was based on suggestions by pediatricians as well as results from research in developmental neurology and neuropsychology. This resulted in a multiperspective view:

– **Age**: Is a skill profile of a child typical for a particular developmental period?
– **Disorder**: Do signs and symptoms relate to specific categories of developmental deviations?
– **Course**: Can valid predictions of future development be derived from the instrument’s scoring pattern?

The ET 6–6 is based on theories of maturation (Plomin et al., 1993; Scarr, 1992) as well as on learning theory, Piaget’s theory of cognitive development, and Bronfenbrenner’s ecological theory (2006). Other concepts considered include sensitive phases, risk and protective factors, developmental tasks, or milestones. A core characteristic of the ET 6–6 is the concept of development as complex interaction instead of linear progression. Stroufe (1997), for example, suggests a tree-like structure of developmental pathways (patterns), featuring increased differentiation with increasing age, and different normal and abnormal trajectories in different developmental areas. Touwen (1984; see Michailis & Niemann, 2004) argues that a large amount of interindividual and intra-individual variability is characteristic even for normal child development. Low-contact pathways, then, describe basic abilities that may expedite or inhibit the development of skills. A large number of such developmental pathways are supposed to interact in a complex manner such that they cannot be observed by standard psychometric testing. Consequently, it is the interaction that forms an observable skill pattern and that needs to be monitored by a developmental test.

The individual developmental process is modeled by a circumscribed developmental cone (see Figure 1). The status at a particular time (e.g., T) can be obtained by considering the appropriate section of the cone. At time 0, individual development begins. At the time of birth (B), the individual developmental process has already differentiated progressively, which is illustrated by the increased expansion of the conic section. For example, at times $t_1$ and $t_2$, the differentiation of the developmental paths are illustrated by $P_1$ and $P_2$. They attain stability after a certain time interval. By interaction of different developmental paths in the individual’s bio-psychosocial context, specific skills are developed at time $t_3$. Such skills are accessible to assessment and can be measured by items of the ET 6–6. With the continuous influence of developmental paths, these skills are further differentiated and lead to complex skills (C). The complex skills are known as context bound behavioral dispositions and frequently give the impression of an abnormal development.

Methodic Implementation and Structure of the Test

For normal development and specific types of disorders, Petermann, Stein, and Macha (2006b) analyze configur-
tions of age-specific and age-typical developmental paths, basic skills, and complex skills. Quantifiable developmental deviations can however arise from minute causes like disturbances in the development of one of the developmental paths. The ET 6–6 shows these typical configurations using the empirically based constellation of items. In addition descriptive dimensions based on historically developed, evident classification categories are used. A multiplicity of age-relevant and different qualitative developmental aspects will be considered within each dimension. This heterogeneity of the dimensions ensures an inventory of complex developmental processes. The areas of measurement are then represented by 10 empirical developmental dimensions (see Table 1). Starting from the middle of the 4th year, an additional descriptive category is introduced: the subtest drawing. The content of the developmental dimension is different for each age-group. While some dimensions are tested globally during early infancy, the precise developmental status can be indicated through differentiated assessment of motor skills. For older children, age-appropriate differentiated tasks for the cognitive and emotional development, as well as language and social development, are necessary. The grouping of items within each age-group (see below) of the ET 6–6 was not used to develop subtests with scales over a wide age range. Therefore, quantitative progress in specific ranges can be recorded exactly. However, such procedures frequently lead to the neglect of qualitative aspects. Very reliable methods whose validity appears questionable are often used. The ET 6–6 concentrates on the collection of multiple, age-specific,

Table 1. Dimensions of the ET 6–6

<table>
<thead>
<tr>
<th>Descriptive dimensions</th>
<th>Empirical developmental dimensions</th>
<th>Represented complex abilities</th>
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<tbody>
<tr>
<td>Gross motor skills</td>
<td>– Gross motor skills (GMS)</td>
<td>Head and body control, development of locomotion, progressive differentiation and integration of basal elements of body control by acquiring typical daily and game skills e.g., climbing stairs, jumping, balancing, catching, using a tricycle or bicycle.</td>
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<tr>
<td>Fine motor skills</td>
<td>– Fine motor skills (FMS)</td>
<td>Targeted grasping and releasing, manipulation and use of objects, improvement in handling a pen, implied aspects of visuomotor activities (frequent evaluation in relation to Subtest Drawing is meaningful).</td>
</tr>
<tr>
<td>Cognitive development</td>
<td>– Memory (M)</td>
<td>Different aspects of the memory (visual as well as phonetic recognition, visual and phoneticic reproduction); perception control, object permanence, understanding of causation, spatial perspective consideration, action planning, formation of categories, differentiation and specification within and between categories, consideration of many categories, class inclusion, aspect of conception about knowledge of and orientation to one’s body and the body of others.</td>
</tr>
<tr>
<td></td>
<td>– Action strategies (Strat)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Categorization (Cat)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Body awareness (BA)</td>
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<tr>
<td>Language development</td>
<td>– receptive language (RL)</td>
<td>Different aspects of sound, word and sentence production; understanding of words and sentences.</td>
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<td></td>
<td>– expressive language (EL)</td>
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<tr>
<td>Social development</td>
<td>– Social development (Soc)</td>
<td>Start and organization of relationships with important related people and peers as well as within groups according to age; signs of temporary and accompanying symptoms of behavior disorder.</td>
</tr>
<tr>
<td>Emotional development</td>
<td>– Emotional development (Emo)</td>
<td>Emotion regulation, exploration behaviors, behavior in specific daily life situations (meeting, separation, annoyance); qualities of children’s games.</td>
</tr>
<tr>
<td></td>
<td>Additionally from 3:6 mon.:</td>
<td>Apart from hand motor talents, aspects of visual perception, spatial-constructive abilities as well as additional aspects of perception organization (”integrated comprehension,” ”aspect of form”) are collected and particularly indicate specific neurological/fine neurological impairments.</td>
</tr>
<tr>
<td>Subtest Drawing (SD)</td>
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</tbody>
</table>
and relevant qualitative characteristics within the individual developmental status (Macha & Petermann, 2006).

The ET 6–6 provides a development assessment for a wide age spectrum. From the extensive item pool (113 test items, 67 items for parent questionnaires), an age-specific item selection for carrying out the test is conducted. For this, the entire age span is classified into 12 groups; the respective age ranges are presented in Figure 2. Preliminary studies on ET 6–6 were performed with a constructive sample of 260 children from Bremen, Germany. The standardization was conducted with 950 children from three regions (Bremen, Dortmund, Rostock; all in Germany).

The construction of the ET 6–6 allows practitioners to conduct a time-effective assessment. As shown in Figure 2, the average administration time for the individual age groups ranges from about 12 minutes (babies) to about 50 minutes for ages 3 years and above.

Administration and Scoring

The ET 6–6 is administered while playing with the child. Thus, a parent can be present during the test. The results are documented using age-group-specific protocol and scoring questionnaires, each of which are based on general knowledge from research on toddlers, infants and preschoolers. Information about social and emotional development is obtained with the help of a parent questionnaire that can be completed during testing. Following the test, a structured sampling of possible conditions influencing the testing process is conducted.

The scoring and interpretation of individual test profiles is very economical since a greater part of the respective age-group-specific standardization data is contained in the protocol and scoring questionnaires. Hence, referring to the specific tables of the manual is only necessary in a few cases. For the scoring of the subtest drawing, scoring stencils are available. First, a developmental profile of all dimensions collected in the respective age group is produced. This permits an initial orientation concerning the strengths and weaknesses of the individual profile. The dimension-specific test values can be converted into the assessment classes “unremarkable,” “risk range,” and “serious deficit.”

An Example of a Developmental Profile

Figure 3 shows the development profile of a 5.8-year-old girl with global developmental deficits in the motor as well as cognitive domains.

The motor performances (gross motor skills, GMS; fine motor skills, FMS) lie far within the serious deficits range, the cognitive performances (memory, M; strategies, Strat; categorization, Cat; body Awareness, BA; expressive language, EL) also lie in the range of serious deficits but partly less clearly. The result of an additional intelligence test showed mental retardation (IQ = 69). The subtest drawing (SD) gave similar results, because the girl could not obtain a score. Additionally, unremarkable test scores were obtained from the parents’ information concerning social development (Soc), while emotional development (Emo) was slightly above the risk range.

Figure 2. Duration of administration (average values) of the ET 6–6 in the age groups.

Note: The values on the category axis mark the respective upper limits of an age group (“9” describes the age range from 6 to 9 months). The age group “at least 6 months” (6) is not a part of the age range of the ET 6–6, but supplies an additional reference for the age group “at least 9 months.”

Figure 3. The ET 6–6 profile of a girl (68 months old) with the Kabuki-syndrome. Remarks: See Table 1 for an explanation of the abbreviations on the category axis; for each developmental dimension, the average of the test values of age groups (60–72 months) as well as their respective upward and downward standard deviations are shown as a corridor.
Validation

In order to evaluate the validity of a developmental test, the following topics need to be addressed empirically:

– Can children with developmental disorders or delays be reliably identified?
– Can a developmental status in normal children be modeled by means of a differentiated profile?
– Do quantitative scale characteristics derived from data conform to theoretical assumptions?
– Will scores or scoring patterns allow for predictions?

The ET 6–6 consists of 12 age-specific subtests that, by scale structure and item compilation, display a certain degree of incommensurability. Therefore, validation must account for this heterogeneity: Do empirical results conform to theoretical assumptions pertaining to the respective age groups? During the past years, numerous studies have established evidence that the ET 6–6 meets the requirements quoted above (see Table 2).

Extreme Group Comparisons

Premature-born infants are not a homogeneous clinical group, but, on average, have developmental deficits when compared to full-term children (Schneider, Wolke, Schlagmüller, & Meyer, 2004). A study by Macha, Proske, and Petermann (2005) showed that underachievement as expected in premature infants can be identified using the ET 6–6. In a sample of \( N = 69 \) prematures, significant reduction in motor skill as well as cognitive abilities were found even in 1-year-olds. Rapp, Thyen, Müller-Steinhardt, and Kohl (2005) achieved similar results using a sample of \( N = 63 \) very-preterm children tested in preschool age. Here, 68.3% of subjects displayed deviations of more than 1 standard deviation (SD) unit from the age-corrected mean score (profile center), and 38.1% of subjects scored even more than 2 SD units below average. Hampel et al. (2007) were able to show cognitive and socioemotional deficits in premature when testing 5- and 6-year-old children with the ET 6–6 (\( N = 29 \)).

Physical Disorder and Handicap

Hülser, Dubowny, Knobl, Meyer, and Schölmerich (2007) tested motor function and cognitive abilities in children with congenital heart disease (\( N = 44 \)) as compared to matched controls. Supposedly due to reduced performance capacity and power of concentration, diseased children scored significantly lower. Daseking, Lemcke, Macha, & Petermann (2007) studied stroke children (\( N = 32 \)) who had significantly lower levels of achievement (again compared to matched controls). They were able to attribute specific deficits to the location of etiologic brain lesion.

Behavioral Disorders

Deficits in cognition, social development, and emotional development in children with behavior disorders (ADHS, oppositional disorder; \( N = 54 \)) were investigated by Gadow (2003). Compared to controls matched for ethnicity, age and gender, motor skills did not differ significantly from normal level, but achievement in all cognitive areas as well as the social and emotional domain did.

Criterion Validity

Various studies of criterion validity demonstrate that results of the ET 6–6 correspond to scores from other tests. A pilot study by Petermann et al. (2006b) resulted in moderate correlations between scores of the Kaufman Assessment Battery for Children (K-ABC, German version; Melchers & Preuß, 2001) and the ET 6–6. These findings are considered highly plausible because K-ABC subtests are constructed as homogeneous scales and assess isolated partial abilities, whereas the ET 6–6 purposely compiles heterogeneous items into its dimensions. Since the ET 6–6 model assumes high variability even in normal children, statistical association cannot be expected. For children with cognitive deficits, however, the following can be stated:

– Children with reduced global cognitive ability in K-ABC (2 SD below average in summative scores) display pronounced cognitive retardation with the ET 6–6.
– Specific cognitive deficits are detected by both tests, albeit in a different manner. Inspection of patients profile from the Psychological Ambulance of the Center for Clinical Psychology and Rehabilitation (University of Bremen, Germany) indicate that children with deviation of 2 SD below average in at least one K-ABC subtest have regularly significant deviating patterns in ET 6–6 profile. Thus, the ET 6–6 can be considered as a screening instrument suitable for initial diagnosis.

A recent study by Goertz, Kolling, Frahsek, and Knopf (2008; Goertz, Kolling, Frahsek, Stanisch, & Knopf, 2007; Goertz, Knopf, Kolling, Frahsek, & Kressley, 2006; Kolling, Goertz, Frahsek, & Knopf, 2007) demonstrated an association of cognitive achievement as assessed by the ET 6–6 and nonverbal declarative memory in 2-year-old children (\( N = 174 \)). They found highly significant correlations of achievement in the Frankfurter Imitationstests (FIT 12/FIT 18/FIT 24) and indicators of cognitive abilities in the ET 6–6, especially action strategies. Thus, the ET 6–6 may be used to evaluate prospects for troubled language
acquisition even in preverbal children. The German Language Development Test for 2 years olds (SETK-2; Grimm, 2000) as well as the German Language Development Test for 3- to 5-year-olds (SETK 3–5; Grimm, 2001) also validate ET 6–6 indications of language disorders (Lissmann, Domsch, & Lohaus, 2006). Predictive validity of the ET 6–6 has been demonstrated in a pilot study by Lissmann et al. (2006) using the Bayley Scales (Bayley II; Bayley, 1993) as a reference.

### Longitudinal Studies

Petermann et al. (2006b) used a sample of $N = 41$ normal children to demonstrate a high but regular fluctuation of ET 6–6 scores even within the normal range (1 $SD$ unit above/below the average) in children from their 3rd to their 4th year. Lissmann et al. (2006) found similar variability in children assessed at 6, 12, and 24 months of age. Here, significant test-retest correlations were obtained between the ages 6 months and 12 months in the cognitive and emotional domain, whereas there was far less stability from 6 to 24 months and 12 to 24 months of age (Lissmann, Korntheuer, & Lohaus, 2007).

### Practicability

Aspects of practicability and predictive validity of the ET 6–6 were investigated in a single-case study of a child with severe developmental disorders (Heubrock, Spranger, Lex, Lepach, & Petermann, 2003). Profound retardation is expected to produce substantial, and noticeable, deviation from the normal range in a developmental profile from the ET 6–6, on the premise that the child is challenged with the tasks suitable for his or her actual age. Deliberately choosing a test level for earlier ages, on the other hand, will provide differentiated information on actual competence instead of deficits: information most valuable for indication of special training or therapy.

Results by Macha, Daseking, Vogel, and Petermann (2008) suggest that language-oriented testing with the ET 6–6 might introduce bias in a developmental profile for language-impaired children. Diagnosed children (ICD-10 F80.1 or F80.2, $N = 26$) of preschool age attained lower profile scores (0.5 to 0.9 $SD$ units) when tested with the ET 6–6 than when tested with the completely nonverbal SON-R (Janke & Petermann, 2006). Using a sample of children with cerebral palsy ($N = 23$) Macha, Mayer, Petermann, and Waldeck (2007) point out the influence of motor skills on testing cognitive functions and argue that the ET 6–6 is suitable also for children with motor impairment.

### Table 2. Overview of validation studies of the ET 6–6

<table>
<thead>
<tr>
<th>Studies</th>
<th>Authors (year)</th>
</tr>
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<tbody>
<tr>
<td>Extreme group comparisons</td>
<td>Manual</td>
</tr>
<tr>
<td>– Premature infants</td>
<td>Macha, Proske, &amp; Petermann (2005)</td>
</tr>
<tr>
<td>– Premature infants</td>
<td>Hampel, Kropf, Petermann, König, Glöger-Tippelt, &amp; Dikici (2007)</td>
</tr>
<tr>
<td>– Very premature infants</td>
<td>Rapp, Thyen, Müller-Steinhardt, &amp; Kohl (2005)</td>
</tr>
<tr>
<td>Physical disorders</td>
<td>Manual</td>
</tr>
<tr>
<td>– Perinatal stroke</td>
<td>Daseking, Lemcke, Macha, &amp; Petermann (2007)</td>
</tr>
<tr>
<td>Behavioral disorders</td>
<td>Manual</td>
</tr>
<tr>
<td>– Intelligence assessment (K-ABC)</td>
<td>Lissmann, Domsch, &amp; Lohaus (2006)</td>
</tr>
<tr>
<td>– Language (SETK-2; SETK 3–5)</td>
<td>Goertz, Knopf, Kolling, Frahsek, &amp; Kressley (2006)</td>
</tr>
<tr>
<td>– Specific cognitive abilities</td>
<td>Goertz, Kolling, Frahsek, &amp; Knopf (2008)</td>
</tr>
<tr>
<td>Longitudinal studies</td>
<td>Manual</td>
</tr>
<tr>
<td>– Normal infants (6–24 months)</td>
<td>Lissmann, Korntheuer, &amp; Lohaus (2007)</td>
</tr>
<tr>
<td>Practicability</td>
<td>Manual</td>
</tr>
<tr>
<td>– Practicability of verbal testing</td>
<td>Macha, Daseking, Vogel, &amp; Petermann (2008)</td>
</tr>
<tr>
<td>– Practicability of motor testing</td>
<td>Macha, Mayer, Petermann, Petermann, &amp; Waldeck (2007)</td>
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</tbody>
</table>

### Conclusion

Since 2000, the ET 6–6 has received widespread recognition and is increasingly used in German-speaking countries, in both practical health care settings and academic research.

In consideration of recent advances of child neuropsychology (Petermann & Lepach, 2007), the test will undergo extensive revision in near future, and will then, of course, be based on updated norms.
References


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