

# Manual of the digital motor performance test

## *DigiMot*



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## Foreword

The *DigiMot* digital motor performance test described in this manual would not exist without the events with the COVID-19 infectious disease outbreak in the year 2020 and its associated impact. Like so many activities during the pandemic, motor performance assessment was impossible due to contact restrictions. The crisis has provided the impetus to think about other ways and possibilities of assessing motor performance and to evaluate them in pilot studies. A digital measurement environment is an alternative not only because of its suitability for a pandemical situations. Furthermore, it offers the chance to reach and test far-away target groups via video meeting. It does not require a test centre and only little material is necessary. Nevertheless, the expectations should be realistic: the digital motor performance test presented here does not cover all dimensions of motor performance in the differentiated way like many field tests are able to detect. Digital tests should therefore be understood as an extension and thus enrichment of the existing "present" test profiles and not as their replacement.

The developed DigiMot was used for the first time on a larger scale in the MoMo study in 2021 (MoMo Wave 3). We would like to thank the following colleagues and study assistants for their support in the study: *Tobias Kolb, Simon Kolb, Dr. Doris Oriwol, Leon Klos, Alexander Burchartz, Ines Liebenau, Katharina Hotz.*

We would also like to thank the following (former) students at the Karlsruhe University of Education and the Karlsruhe Institute of Technology, who helped to advance the development of the DigiMot with their qualification work: *Joann Greiner, Paul Schmidt, Max Pauli, Naomi Reinhardt, Pascal Gutzeit.*

The present test manual is based, among other things, on the principles set out in the test manual of the MoMo study (2004 and 2015). The authors of this test manual would like to thank *Prof. Dr. Klaus Bös* (initiator of the MoMo study), *Dr. Jennifer Oberger, Prof. Dr. Elke Oppen, Dr. Claudia Hellmund and Dr. Lars Schlenker.*

The DigiMot motor performance test is being used in Germany on a population basis as part of the COMO study, a study on the impact of the COVID-19 pandemic on the physical and mental health and health behaviour of children and adolescents against the background of socio-ecological contexts in Germany (2023-2026).



The COMO study is made possible by the financial support of the Federal Ministry of Education and Research (BMBF).



The CoMo study is a joint project of the Karlsruhe Institute of Technology, Karlsruhe University of Education, University of Konstanz, Ruhr University Bochum, University Medical Centre Hamburg-Eppendorf.



Universität  
Konstanz



We would also like to thank the partners of the COMO project for their joint commitment to the health of children and adolescents in Germany, in which the digital recording of motor performance with the DigiMot is a part of.

We wish you a pleasant reading of this manual and especially a fruitful work with the DigiMot test,

*Anke Hanssen-Doose, Thorsten Klein, Claudia Niessner, Alexander Woll & Annette Worth!*

# 1 Background and test procedures for assessing motor performance

Diagnostic data on motor performance form an essential basis for targeted development and health promotion in childhood and adolescence (Worth et al., 2022).

Motor performance is an essential part of healthy overall development because it is fundamental to all bodily functions needed to cope with everyday situations and to be engaged in sports (García-Hermoso et al., 2019; Ortega, 2008; Stodden & Holfelder, 2013).

Studies show that good motor performance at a young age is associated with a lower acute and future risk of disease (Mintjens et al., 2018) and a lower risk of premature death (Högström et al., 2016; Sato et al., 2009). A well-developed motor performance at an appropriate age is important for a physically active lifestyle and sports and the development of the entire personality (Ruiz-Ariza et al., 2017; Robinson et al., 2015b; Stodden & Holfelder, 2013). It must be considered that there does not exist a "pure" motor performance, but that the motor performance is closely intertwined with the physiological, psychological and cognitive performance (Diamond et al., 2000; Kastner & Petermann, 2009).

The scientific assessment of motor performance dates back to the 18th century (Barnett et al., 2020). Over time, numerous methods have been developed for different target groups and study objectives.

Motor performance tests are used across the lifespan to measure and evaluate current status and changes in different contexts. In addition to sports science research, motor performance data is used, for example, for health reporting, aptitude testing (school entrance test, sports promotion schools, allocation to training groups) and evaluation of physical activity and sports-related interventions. Tests to assess motor performance are also used in the context of outpatient and inpatient rehabilitation.

A distinctive feature arises with regard to the target value of a measurement. There are different approaches that go back to different theoretical foundations.

The first approach is product-oriented tests, which evaluate the motor performance achieved and thus focus on the outcome of the test items, such as jumping or throwing distances (Barnett et al., 2020; Büsch & Utesch, 2023). The equivalent to the internationally used product-oriented approach in German-speaking countries is the capability-oriented approach (Worth et al., 2022), which will be used as a synonym in the following. An example of motor test batteries for the capability-oriented approach would be the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2; Bru-

ininks & Bruininks, 2005) in the international area and the MoMo test battery in German-speaking countries, originally by Bös et al. (2004), further developed by Worth et al. (2015), which forms the basis of the digital test DigiMot described here. These tests allow in-tra- and inter-individual comparisons over time, cover a broad age range and are relatively economical to apply.

The second approach is the process-oriented approach, which evaluates the movement coordination and patterns of movements using quantitative biomechanical properties or qualitative analyses of segmental movements (Barnett et al, 2020). These tests focus on the evaluation of movement execution according to standardised criteria (Büsch & Utesch, 2023). These tests are particularly concerned with how a performance is achieved and qualitative nuances for improving performance are recorded (Büsch & Utesch, 2023). The equivalent to the internationally used process-oriented approach in German-speaking countries is the skill-oriented approach (Büsch & Utesch, 2023; Worth et al., 2022) and is used as a synonym in the following. An example of motor test batteries for the skill-oriented approach is the Test Gross Motor Development (TGMD-3; Ulrich, 2016) in the international area and the Test for Basic Motor Skills (MOBAK; Herrmann et al, 2015).

The international debate on the assessment of motor performance in children and adolescents has been going on for over 70 years, resulting in the development of a large number of motor test batteries (Boddy & Stratton, 2020). Three of the most widely used test batteries in recent years are the Fitnessgram (Meredith & Welk, 2010), the Eurofit (Council of Europe, 1988) and the Assessing Levels of Physical Activity Test Battery (ALPHA; Ruiz et al., 2011). Following Worth et al. (2022), Table 1 provides a rough overview of different validated motor test procedures that are used to assess the motor performance of children and adolescents



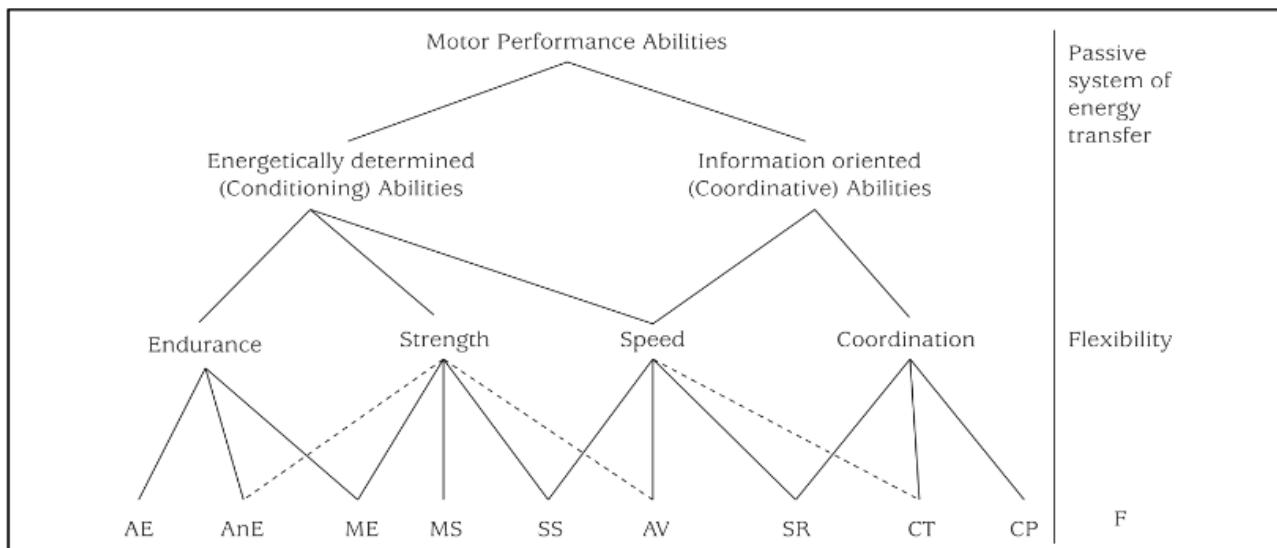
Table 1: Motor test procedures for children and adolescents (mod. after Worth et al., 2022)

Test procedure (authors)	Age	Test items
Fitnessgram (Meredith & Welk, 2010)	5-17	PACER, 1-Mile Run, 1-Mile Walk, curl-up, trunk-lift, push-up, pull-up, flexed arm hang, sit-and-reach & shoulder stretch
Eurofit (Council of Europe, 1988)	6-18	Endurance shuttle-run, handgrip, standing long jump, pull-up hang, sit-ups, shuttle-run, tapping, sit-and-reach & single-leg stand
Alpha (Ruiz et al., 2011)	6-18	Handgrip, standing long jump 20m shuttle run test & shuttle run
Test Gross Motor Development (TGMD-3; Ulrich, 2016)	3-10	6 locomotion tasks: Running, galloping, one-legged jump, hop run, two-legged jump from a standing position & side gallop; 7 Object control tasks: stationary baseball shot, forehand shot of a bouncing ball, one-handed dribbling on the spot, two-handed catching, side kick of a stationary ball, slap throw & underhand throw.
Movement Assessment Battery for Children - second Edition (M-ABC-2) (Petermann, Bös & Kastner, 2009)	3-16	24 test items for three age groups. Each age group is assigned different test items to assess hand dexterity (e.g., throwing a coin), ball skills (e.g., catching a bean bag) and static and dynamic balance (e.g., standing on one leg).
Test to assess basic motor competencies (MOBAK; Herrmann et al., 2015)	6-9	Recording the competence areas "moving" (balancing, rolling, jumping, running) and "moving something" (throwing, catching, bouncing, dribbling).
German Motor Performance Test 6-18 (DMT 6-18; Bös et al., 2016)	6-18	6-minute run, side jumping, backward balancing, torso bend, push-ups, sit-ups, standing long jump & 20-metre sprint
International Physical Performance Test Profile (IPPTP; Bös & Mechling, 1985)	9-17	20-metre sprint, push-ups in 30 sec, sit-ups in 30 sec, medicine ball throw, standing long jump & 6-min run.
MoMo test profile (Bös et al., 2004)	4-17	From 4 years: Reaction test, MLS lines tracing, MLS pins tucking, static stand, balancing backwards, stand and reach, standing long jump & jumping sideways; ages 6 and up: push-ups, sit-ups & endurance bicycle PWC 170.

## 2 Digital motor performance test DigiMot

The present digital motor performance test DigiMot builds on the foundations of the MoMo test profile as well as the systematisation of motor performance shown in Figure 1 (Bös & Mechling, 1983; Bös, 1987, Bös et al., 2001; Bös et al. 2016). The DigiMot test includes four test tasks of jumping sideways, push-ups, sit-ups and trunk bends.

The systematisation according to Bös (1987) is a 3-level model, which distinguishes in a first level between energetically determined abilities („condition“) and information-oriented abilities („coordination“).



Motor performance abilities : AE = aerobic endurance; AnE = anaerobic endurance; ME = muscular endurance; MS = maximum strength; SS = speed strength; AV = action velocity; SR = speed of response; CT = coordination under time pressure; CP = coordination with precision demands; F = flexibility

Figure 1: Systematisation of motor performance abilities (Bös, 1987)

On the second model level, these abilities are divided into the 5 dimensions of motor performance: endurance, strength, speed, coordination and flexibility.

Endurance and strength are assigned to the energetically determined abilities. They are determined by the cardiovascular system and the musculoskeletal system as central systems of energy production and transport in the human organism. Coordination is to be located with the information-oriented abilities. In its various sport-specific manifestations, speed cannot be clearly assigned to the conditional or coordinative abilities; it represents a complex ability (Bös, 1987). Furthermore, flexibility occupies a separate position. It is considered to be largely anatomically determined and is assigned to the passive system of energy transfer.

In a final level of the model, 10 motor performance abilities can be distinguished. Based on the duration and intensity of the load, endurance and strength are differentiated into aerobic (AE) and anaerobic (AnE) endurance, into maximum strength (MS), speed strength (SS) and muscular endurance (ME). The coordinative abilities are differentiated according to the type of sensory regulation as well as depending on the requirement profile of the movement actions. Roth (1982) gives two motor performance description categories for coordination: coordination under time pressure and coordination under precision pressure. In Bös' (1987) systematisation, speed is regarded as an energetically-informationally determined complex ability. It is divided into action velocity (AV) and speed of response (SR). Flexibility (F), on the other hand, is not further differentiated according to Bös (1987). Maximum strength (MS), coordination in precision tasks (CP) and aerobic endurance (AE) as one-dimensional abilities can clearly be attributed to the dimensions of motor performance at model level 2. In contrast, anaerobic endurance (AnE), muscular endurance (ME), speed strength (SS), action velocity (AV), speed of response (SR) and coordination under time pressure (CT) are multidimensional abilities.

## 2.1 *Criteria for the selection of motor test items for digital recording*

The following criteria guided the selection of the test items:

- Validity (meaningfulness of the item, scientific foundation)
- Reliability (accuracy of measurement)
- Objectivity
- Economy of the items (acceptance)
- Safe practicability in the home environment with the spatial resources available in the household (except for test mat, which is sent in advance).
- Feasibility in all age groups
- Correlative relationship to health

The following criteria were also considered when compiling the test profile:

- High coverage of the motor dimensions (statement about fitness, coordination and condition possible)
- Feasibility
- Innovation (the tests should be used in the future)
- transfer for school environment

## 2.2 *Selection of test items for the digital assessment of motor performance*

The four test items of the DigiMot were selected from the 12 test items of the MoMo test profile (2004, 2015). Three of the four test items are carried out analogously to the field test of the MoMo study (Worth et al., 2015). For this, the test participants receive a test mat that is usually sent by post. In the case of the test item stand and reach, the task is set in the same way, but with a simplified measurement recording.

The stand and reach test task is used to test trunk flexibility and the stretching ability of the ischiocrural muscles. It was taken from the Kraus-Weber test for testing minimal muscular performance in school children (Kraus & Hirschland, 1954).

The test task push-ups for testing the dynamic strength endurance of the upper extremities was taken from the Physical Fitness Test (PFT by Beck & Bös, 1997).

The test task sit-ups is used to test the strength endurance of the trunk muscles and is part of the Karlsruhe Test System for Children (KATS-K by Bös et al., 2001).

The test task Jumping sideways serves to test large motor coordination under time pressure and was modified on the basis of the Body Coordination Test for Children (KTK by Schilling, 1974) (use of a carpet mat instead of a wooden board). A detailed description of the individual tests with test administrator instructions, recording of measured values, sources of error, test set-up and test material can be found in chapter four.

### 3 State of research on digital motor tests

When looking at the national and international state of research, it is noticeable that motor performance has very rarely been examined digitally, both in children and adolescents as well as in adults. There are correspondingly few procedures available for the digital recording of motor performance.

Studies comparing 'analogue' and 'digital' testing of motor performance and physical fitness in adults have been conducted by Russel et al. (2013), Lu et al. (2019) and Jansson et al. (2022). In the pilot study by Russel et al. (2013), the accuracy and reliability of digital recording of physical fitness was investigated in comparison to conventional on-site recording in 12 patients with Parkinson's disease. Very good inter- (ICC (2.1)>0.96) and intrarater (ICC (2.1)>0.98) reliability was found for the Timed "Up and Go" test, Step test, Step with 360° rotation, Berg Balance Scale and the Lateral and Functional Reach Test (Russel et al., 2013). Lu et al. (2019) investigated the extent to which a measurement of physical fitness of college students using a specially developed smartphone application is comparable to conventional measurements. A total of 116 students aged 18 to 22 performed the digital endurance, muscle endurance, flexibility and body composition tests (Lu et al., 2019). A comparison with traditional tests showed high correlations and no statistically significant differences for the digital endurance and flexibility tests (Lu et al., 2019). Likewise, the study by Jansson et al. (2022) followed a smartphone approach. The aim of the study was to test the validity of the assessment of muscular fitness using the *ecofit smartphone* app by comparing the data collected with the smartphone app with previously collected control data for the validated 90° push-up (13 subjects) and for the sit-to-stand test (54 subjects) (Jansson et al., 2022). A high significant correlation (0.83,  $p<0.001$ ) and a good intraclass correlation (0.84; 95% CI = .57 to .95) were found for the push-up and a moderate significant correlation (0.63,  $p<0.001$ ) and a moderate intraclass correlation (0.65; 95% CI = 0.46 to 0.78) for the sit-to-stand test (Jansson et al., 2022).

In a comparison with 45 children aged 5 to 10 years, Robinson et al. (2015a) found no significant differences between a live and a video demonstration for the results of the test items of the TGMD-2. All test items were video recorded for both measurement conditions and scored by a trained coder who had 96% interrater reliability with the test administration (Robinson et al., 2015a).

Spinosa et al. (2020) conducted a similar study with a total of 131 children aged 5 to 11 years and compared the effects of live and video demonstration using an augmented reality model for the TGMD-2 test items standing long jump and overhand throw. All performances of the test items were also video-recorded and scored by two independent coders who had an interrater reliability of 85.8% (Spinosa et al.,

2020). As a result, no significant differences in performance were found (Spinosa et al., 2020).

A direct comparison of the results of an analogue measurement of motor performance with the results of a measurement via video conference has so far only been investigated in final theses at the Karlsruhe University of Education.

The bachelor's thesis by Schmidt (2021), which investigated the possibilities and limitations of digital testing, and the master's thesis by Greiner (2021), which investigated the test quality criteria of digital testing, are based on the results of the same sample recruited for this work. The participants completed the four test items twice digitally at intervals of three to four weeks (Greiner, 2021; Schmidt, 2021). A direct comparison of the digital measurement values was carried out for the individual age groups and genders with the help of the existing comparison percentiles of the MoMo study (Niessner et al., 2020) (Greiner, 2021). With regard to the quality criteria, all quality criteria could be fulfilled for the digital tests and good (push-ups) to very good reliability (lateral jumping back and forth and sit-ups) could be demonstrated (Greiner, 2021). The findings from the work of Schmidt (2021) show the practicability of digital motor performance tests and provide important insights into the implementation of digital motor performance tests.

The master's thesis by Pauli (2022) focused on the reliability of digital motor performance tests and their measurement accuracy in direct comparison with analogue measurements. A sample of 47 children aged 8-12 years also completed the four test tasks of lateral jumping, trunk bending, push-ups and sit-ups both digitally and in situ (Pauli, 2022). The reliability and accuracy of the lateral jumping test was satisfactory (no difference,  $r=0.66$ ,  $p<0.001$ ), the reliability and accuracy of the push-up test was unsatisfactory (no difference,  $r=0.41$ ,  $p=0.005$ ), and the reliability and accuracy of the trunk bend and sit-up test were very good: Trunk flexion (no difference,  $r=0.88$ ,  $p<0.001$ ) and sit-ups (no difference,  $r=0.70$ ,  $p=0.005$ ) (Pauli, 2022).

Table 2: Overview of studies on digital motor performance tests sorted by author with information on the year of publication, the sample and the test items used.

Published work on the study situation			
Authors	Year	Sample	Test items
Jansson et al.	2022	54 adults aged 18-80 (MW= 55.6, SD=14.2; 18 ♀, 36 ♂).	Push-up & Sit-to-Stand
Lu et al.	2019	116 college students aged 18-22 (57 ♀, 59 ♂)	Sit-ups, pull-ups, 1.6km fast walk, sit-and-reach, trunk bend & BMI
Robinson et al.	2015a	45 children between 5-10 years in two age groups: Younger (n = 21, MW=5.95 years, SD=.80) and Older (n = 24, MW=8.96 years, SD = .86).	TGMD-2 Test items
Russell et al.	2013	12 Parkinson's disease patients aged 45-76 years (MW=66.1 years, SD=8.5; 6 ♀, 6 ♂)	Timed "Up and Go" Test, Step Test, Step with 360° Rotation, Berg Balance Scale, Lateral and Functional Reach Test
Spinosa et al.	2020	131 children in three age groups: G1, 3-5 years (MW=4.25, SD=0.71); G2, 6-8 years (MW=7.16, SD=0.79); G3, 9-11 years (MW=10.13, SD=0.84).	Standing Long Jump & Overhand Throw
Unpublished work on the study situation			
Authors	Year	Sample	Test items
Greiner	2021	30 children aged 5-13 years (MW=8.92, SD=2.243; 17 ♀, 13 ♂).	Lateral jumping back and forth, torso bend, push-ups & sit-ups
Pauli	2022	47 children aged 8-12 years (MW=9.55, SD=0.717; 19 ♀, 28 ♂).	Lateral jumping back and forth, torso bend, push-ups & sit-ups
Schmidt	2021	30 children aged 5-13 years (MW=8.92, SD=2.243; 17 ♀, 13 ♂).	Lateral jumping back and forth, torso bend, push-ups & sit-ups
Gutzeit	2022	10 male squad athletes from Hertha BSC (age U16)	Lateral jumping back and forth, torso bend, push-ups & sit-ups

The current state of research on digital tests of motor performance in children and adolescents can be summarised as follows: Digital motor performance tests fulfil the test quality criteria to a large extent and show good to very good reliability with repeated measures and good reliability in comparison to on-site tests. So far, the digital motor performance tests have been well accepted by the participants and their feasibility has been good. Nevertheless, research in this area is still in its infancy and not all dimensions of motor performance can yet be surveyed digitally in a differentiated manner. This form of testing offers the possibility to include children and adolescents living in remote locations, since the use of end devices (tablet, smartphone and laptop/computer) in the household makes the measurement possible for almost all children and adolescents. Furthermore, a high degree of quality assurance is possible if the participants give their consent to the recording of the tests. Limitations of



digital motor performance tests are, apart from the shortened test selection, technical malfunctions of the end devices and software used as well as a generally insufficient internet connection. Limited living conditions of the participants, unfavourable lighting conditions as well as more difficult correction and motivational support of the participants are possible sources of error in digital motor performance tests. Nevertheless, it has been shown that the opportunities of digital motor performance tests outweigh the limitations and that the results achieved so far can be further improved by adapting and further developing digital tests in all facets.



Figure 2: Digital motor performance test DigiMot

## 4 Organisation and framework conditions of digital capture

### Equipment of the digital test room

The workplace should be set up against a background that is as neutral as possible (ideally a white wall), where a poster or roll-up will be placed. Nothing should distract from the examination. For optimal illumination, no daylight should shine in from behind and a desk lamp or ring lamp should be placed in front of the computer. The workstation should be professionally set up as a standing or sitting area. The test mat should also be set up at the test administrator's place to demonstrate the test items, so that the camera can be panned and the test taker can see well.



Figure 3: Workplace for digital survey

The technical equipment should enable transmission in very good quality (if necessary, headphones with microphone and additional camera). The camera should be placed at eye level if possible (possibly place books under the laptop). The test leader wears a professional shirt. The following materials are available at the workplace:

- Computer and accessories (for the video meeting)
- Tablet (for data entry)
- Stopwatch or mobile phone with timer function (or digital solution in video meeting)
- Repeat counter
- Overview of the measurement procedure,

- Additional survey form in paper (in case tablet fails, or similar), paper and pencil
- Test mat to demonstrate again

### **To be announced when making the appointment**

- Suitable end device (laptop, tablet, alternatively also mobile phone)
- Package with test material delivered beforehand: please accept and unpack, unroll the mat if you like
- Room with good internet connection, table and sufficient space as well as an accompanying person who supports
- Appear in sportswear, e.g., shorts, sports leggings or tight-fitting sports trousers, and have sports shoes ready (no slippers!).
- Measure weight and height in advance and pass them on the day of the test (otherwise parents/support person should do this during the test).
- All information will be provided in writing with the agreed date.

### **Appointment confirmation**

The appointment is confirmed in writing, with an additional reminder 3 days before the digital test date.

## Test procedure:

### Greeting, state of health and body measurements

We are delighted that you have decided to take part in today's digital motor performance test and thank you!

We hope that you have received the test mat and now have it ready at hand. We will now check together that everything is present and in the correct place. Please turn your sound up to full volume on your device so that you can understand me easily. Place the device on a table with a height of 70-80 cm at a distance of approximately 1.50 m-2.00 m from the mat. Tilt the device with the camera so that you can see the mat at the bottom of the screen.



Figure 4: Test setup at the beginning



Figure 5: Test setup Lateral jumping back and forth

For the stand and reach, place the laptop or mobile phone on the floor about 1.30 m from the mat.

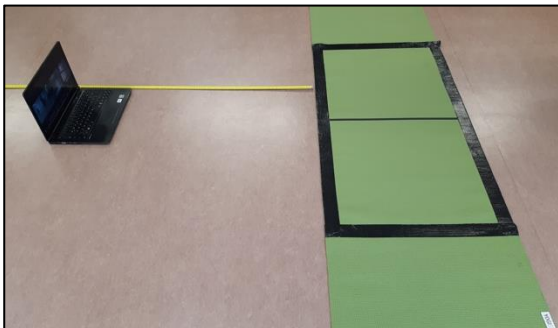


Figure 6: Test setup stand and reach

First, I have some questions about your health: *Asking health questions*

Beforehand, we asked you to measure your height and weight. You can now give me both pieces of information. ("If you have forgotten, let's measure it together now!")

## **Instruction**

Now we will show you a short film of the entire test procedure so that you know what to expect.

Film sequence (1:13 min)

We will start with the tasks right away. While you are doing them, I may cheer you on or correct you. Don't let this distract you, just keep going and do your best.

To parents/guardians: Please feel free to cheer, it helps your child!

## **Warm-up**

We're going to warm up together. Short age-appropriate warm-up (e.g., running in loosely, around the mat, 5 jumping jacks or based on the child's activity type).

*Test leader actively participates in the warm-up!*

## **Test**

See chapter 4 Test items

## **Thanks and feedback**

Thank you, now you have done everything! (This is followed by "pedagogical" feedback with classification of the performance using the percentile curves. Those with a lower level of motor performance can be praised for trying, for example!)

## 5 Test items

### 5.1 *Jumping sideways*



Figure 7: *Jumping sideways back and forth*

### Test target

Measurement of whole-body coordination under time pressure.

### Test task

The task is to jump back and forth sideways across the centre line of a sports mat with both legs at the same time as fast as possible within 15 seconds. The test leader shows the demonstration video. 5 trial jumps are performed before the test begins. The test person has two test attempts. Between the test attempts there is a break of one minute during which the test leader distracts the test person for a short rest and talks to him/her.

### Special notes

The exercise is performed with sports shoes!



## **Test instruction**

Film: "Stand with your feet together on the mat next to the centre line. On my signal, start jumping back and forth sideways across the line as fast as you can until I say "stop". If you step next to the mat or on the centre line, don't stop, just keep jumping."

Test leader: "Before we start with the task, I ask you to do 5 test jumps. Make sure that you always jump within the space and do not hit any lines."

After the test jumps, feedback is given (praise/correction/repeat if necessary).

Afterwards give the information: "We're going to start the test now. You try to jump back and forth as often as possible in 15 seconds. After that you have a minute's break and then we repeat the exercise."

Note: Feel free to motivate/correct. Make it clear to the participant beforehand that the performance should not be interrupted.

## **Measured value recording**

The number of jumps performed in two valid attempts (back counts as 1, forth as 2, etc.) of 15 seconds each is recorded. The average of both attempts is evaluated. There is a one-minute break between the test attempts. Jumps in which the test person steps on the centre line or crosses one of the other side lines or jumps that are not performed with both legs are not counted.

## **Time scope**

2 minutes.

## **Test set-up with test person**

The yoga mat with the test field applied (2 x 50 cm x 50 cm) is placed on the floor. If it slips, it must be additionally fixed with gaffer tape.

## **Test materials at test conductor**

Timer function of the mobile phone (or stopwatch), repetition counter if required.

## Camera position

### Laptop:

In the centre in an elevated position (on a table ~75cm high) at a distance of approximately 1.5 m to 2 m in front of the mat. Tilt the laptop so that the mat is positioned at the bottom of the image.

### Mobile phone:

In the centre in an elevated position (on a table (~75cm high)) at a distance of approximately 1.5 m to 2 m in front of the mat. The mobile phone should be near the edge of the table and upright. To prevent it from falling over, it should be leaned against a bottle, for example.



Figure 8: Camera position laptop



Figure 9: Camera position mobile phone

## Reference:

Schilling (1974), Kiphard & Schilling (2007) and Bös et al. (2016).



## 5.2 Push-up



Figure 10: Push-up position top



Figure 11: Push-up

### Test target

Measurement of dynamic strength endurance of the upper extremities; stabilising trunk muscles.

### Test task

The subject is asked to perform as many push-ups as possible within 40 seconds. The subject lies prone with hands touching on the buttocks. The subject releases the hands behind the back, places them next to the shoulders and pushes off the floor until the arms are extended and the body is off the floor (see Fig. 11). Then one hand is released from the floor and touches the other hand. During this process only the hands and feet are in contact with the floor. The torso and legs are extended. A hollow back posture is to be avoided. Then the arms are bent until the body is again in prone position and the starting position is assumed. Before a new push-up is performed, the subject touches the hands behind the back. The test leader counts the correctly performed push-ups in a period of 40 seconds, i.e., each time the hands touch behind the back again in the prone position. The test leader demonstrates the test task. The test person then has 2 test attempts in a row.

## Special notes

**The exercise should be done with sports shoes.**

### Test instruction:

Film: "Now you are supposed to do push-ups. But these are not normal push-ups! You lie on your stomach with your legs together and straight. Your hands touch your buttocks. Now place your hands next to your shoulders and push yourself up. Your knees should come off the floor and your back and legs should remain straight. When your arms are extended, touch one hand to the other. Then support yourself again with both hands and bend your arms until you are lying on the floor again. Now touch your hands behind your back and do the next push-up".

Test leader: Before we start the task, try two push-ups.

After the trial runs: Now, after the start command, try to do as many push-ups as possible in 40 seconds. I may correct you and motivate you. Just keep going anyway.

*To parents/guardians: "Please cheer them on!"*

### Measured value recording

The test leader counts the push-ups performed correctly in 40 seconds. Hard criteria for this are:

- Only hands and feet touch the floor
- One hand strikes the back of the other hand in support (crossover movement)
- On the back is high-fived
- Legs and upper body must leave the floor at the same time when propped up

### Sources of error

The test leader should pay attention to body extension (straight back, legs stretched out) during the mock test and during the test performance and point this out to the test person if necessary.

## **Time scope**

2 minutes.

## **Test materials**

Laptop:

In the centre in an elevated position (on a table ~75cm high) at a distance of approx. 1.5 - 2.0 m in front of the mat. Tilt the laptop so that the mat is positioned at the bottom of the image.

Mobile phone:

In the centre in an elevated position (on a table ~75cm high) at a distance of approx. 1.5-2.0m in front of the mat. The mobile phone should be near the edge of the table and upright. To prevent it from falling over, it should be leaned against a bottle, for example.

## **Reference:**

Beck & Bös (1997), Bös et al. (2001) and Bös et al. (2016)

### 5.3 Sit-ups



Figure 13: Sit-ups



Figure 12: Foot position sit-ups without another person (fixation under sofa or similar)



Figure 14: Sit-ups (elbows touch knees)



Figure 15: Sit-ups (thumb behind earlobe and fingertips to temple)

### Test target

The test task sit-ups serves to test the strength endurance of the trunk muscles.

### Test task

The test person lies on his back, bends his legs approximately  $80^\circ$  and places his feet hip-width open on the floor. The feet are fixed by the test leader by pressing them lightly on the floor. The fingertips are held against the temple and the thumb behind the earlobe. The hand position must not be changed during the test. When the upper body is placed down, the shoulder blades touch the mat. The test administrator has a stopwatch which he/she places on the mat during the test to monitor the test duration of 40 seconds. The test leader counts the number of valid attempts. A valid attempt is when the subject raises the upper body and touches both knees with both

elbows during a lie-down sit-up. If this does not happen, the corresponding attempt is not counted. The test leader demonstrates how to perform the test. The test person has two trial attempts. The test is performed for 40 seconds.

## **Special notes**

**The exercise should be done with sports shoes.**

## **Test instruction**

Film: "For this task you have to do as many sit-ups as possible in 40 seconds. You lie on your back and place your feet in front of you. Then you should fix your feet in place. Either someone helps you to hold your feet or you hold your feet under an object, e.g., under a sofa. Then place your fingertips at your temples and your thumb behind your earlobes. Now roll your upper body up until your elbows touch your knees. Then roll down again until your shoulder blades briefly touch the floor."

Test leader: Before we start with the task, you may now try two sit-ups.

After the trial runs: Now, after the start command, try to do as many sit-ups as possible in 40 seconds. I may correct you and motivate you. Just keep going anyway.

*To parents/guardians:* Please hold their feet and cheer them on!

## **Measured value recording**

The test leader counts the number of sit-ups correctly performed in 40 seconds.

The hard criteria for this are:

- Fingertips to temple / thumb behind the earlobes
- Hand position must not be changed during the performance
- When resting the upper body, the shoulder blades must touch the mat
- Both elbows touch the knees

## **Time scope**

2 minutes.

## **Test materials**

Mat, stopwatch.

## **Camera position**

Laptop:

In the centre in an elevated position (on a table ~75 cm high) at a distance of approx. 1.5 - 2.0 m in front of the mat. Tilt the laptop so that the mat is positioned at the bottom of the image.

Mobile phone:

In the centre in an elevated position (on a table ~75 cm high) at a distance of approx. 1.5-2.0m in front of the mat. The mobile phone should be close to the edge of the table and upright. To prevent it from falling over, it should be leaned against a bottle, for example.

## **Special notes**

Check that the correct starting position is adopted and that the elbows touch the knees each time they are raised. The subject's pelvis must not leave the floor during the exercise (do not swing the pelvis). The loads on the spine that occur during raising are not problematic for healthy test persons.

The task is performed with sports shoes!

## **Reference:**

Bös et al. (2001) and Bös et al. (2016)

## 5.4 Stand and reach



Figure 16: Stand and reach



Figure 17: Stand and reach (hands fix knees)

### Test target

Measurement of trunk mobility and stretching ability of the back muscles, lower extremities, long back extensor.

### Test task

The subject stands on the floor. The upper body is slowly bent forward and the hands are brought down as far as possible. The legs are stretched. The maximum stretch position that can be reached is to be held for two seconds. The subject has two attempts. Between the first and second attempt, the subject should stand up briefly.

### Special notes

**The exercise should be done WITHOUT sports shoes.**

### Test instruction

Film: "I will show you how the stand and reach task works. In this task, you have to move your laptop or mobile phone from the table onto the floor. The distance to the mat should be about 1.30 metres. Then stand on the mat, hip-width in front of the centre line. Bend forward and slowly push both hands towards the floor at the same time. It is very important that you keep your legs straight! Your companion can help you by checking the stretching of your knees. Try to come down as far as possible and hold this position for 2 seconds."

Test leader: Please put your laptop (mobile phone) on the floor and then we will start. You won't have a trial run. We will start with the task right away. You will have 2 attempts. Between the attempts, briefly relax your legs.



## Measured value recording

The test leader notes whether the sole of the foot level has been reached or not.

## Source of error

The test person should pay attention to a slow execution of the exercise and the stretched legs. The test leader must observe the knee joint of the test person and also give instructions to the person helping (see Fig. 16). A jerky movement of the test person falsifies the result. The maximum stretch position that can be reached must be held for 2 seconds.

If the test is carried out with children from the age of 11, the help of an accompanying person is necessary. It should also be noted that the legs may be longer in relation to the torso due to the 2nd shape change and that the test person may therefore not reach the zero level despite normal stretching ability and mobility of the muscles.

## Camera position

Laptop:

In the middle of the floor at a distance of approx. 130cm in front of the mat. Tilt the laptop so that the mat is positioned at the bottom of the image.

Mobile phone:

In the middle of the floor at a distance of about 130cm in front of the mat. The mobile phone should be near the edge of the table and upright. To prevent it from falling over, it should be leaned against a bottle, for example.

## Reference:

Kraus & Hirschland (1954), Fetz & Kornexl (1978) and Bös et al. (2016)



## 6 Anthropometric measurements

The collection of body measurements from height and weight, which should be collected as accurately as possible before testing at home.

### 6.1. Measurement of body height



Figure 18: Measuring body height

#### Method

Body height is measured in centimetres.

#### Measurement recording with a folding rule/measuring tape:

The size is read directly to 0.1 cm and communicated.

#### Time scope

Measuring height takes about one minute and should be done before the motor performance survey.

### **Test performance:**

The test person is asked to take off shoes and heavy outer clothing and stand against a door frame or similar. The back should face the door frame. Make sure that the back of the head and the buttocks are also touching the door frame. The test person should let the arms hang loosely down at the sides, push the knees through and look straight ahead. Before reading, check the head position and make sure that the knees are not pushed through. Reading is easy with a book or similar.

## 6.2. Recording of the body weight



Figure 19: Recording the body weight

### **Method:**

The body weight is recorded in kilograms.

### **Device:**

The scales available in the household are used to record the body weight.

### **Measured value recording:**

The value is read to the nearest 0.1 kg and entered on the recording sheet.

### **Time scope:**

1 minute.

### **Test performance:**

At the beginning, the test person is asked to take off shoes and heavy clothing.

The test person then stands on the scale. The test person is told not to hold on, lean against or touch anything. The result is read when the display no longer changes.

## 7 Summary of the digital motor performance test

Workplace equipment of the test administrator	<p>"Black text in quotes" = is said to the test taker as is;</p> <p>Grey text = the test administrator notes this and formulates freely</p> <p>Blue font: measured value recorded in the tablet</p> <p>Before starting the video meeting: check your own lighting conditions, background, test mat, material, and internet connection!</p>																														
Welcome, introduction and test set-up	<p>"We are delighted that you have decided to take part in today's digital motor performance test and thank you!"</p> <p>(also address and greet the parent/accompanying person, briefly introduce yourself, establish contact, ask for consent for recording and start recording.)</p> <p>"We hope that you have received the test mat and now have it ready at hand. We will now check together that everything is present and in the correct place. Please turn your sound up to full volume on your device so that you can understand me easily. Place the device on a table with a height of 70-80 cm at a distance of approximately 1.50 m-2.00 m from the mat. Tilt the device with the camera so that you can see the mat at the bottom of the screen.</p> <p>(Is it bright enough? Otherwise ask for another lamp. Is there backlighting from a window? If possible, close the curtains or blinds or turn the device. Adjust the test setup until it is ideal)</p>																														
Health questions and body measurements	<p>"First, I have some questions about your health:</p> <table><tr><td></td><td>No</td><td>Yes</td></tr><tr><td>1. Do you participate in sports activity/lessons? (Full weight-bearing)</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr></table> <p>If "no", why are you not participating or not participating fully in sports lessons?</p> <p>_____</p> <p>I'm going to ask you about some diseases. Most of them will not apply to you. But for safety reasons we have to ask you:</p> <table><tr><td>2. Have you had an infection in the last 2-6 months?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>3. Are you currently ill or feeling unwell?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>4. Do you have a heart condition?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>5. Do you have diabetes?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>6. Do you have exercise-induced asthma?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>7. Do you have allergies?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>8. Do you have joint pain or arthritis?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>9. Are you taking any medications that lower your heart rate? (e.g., beta blockers)? "</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr></table>		No	Yes	1. Do you participate in sports activity/lessons? (Full weight-bearing)	<input type="checkbox"/>	<input type="checkbox"/>	2. Have you had an infection in the last 2-6 months?	<input type="checkbox"/>	<input type="checkbox"/>	3. Are you currently ill or feeling unwell?	<input type="checkbox"/>	<input type="checkbox"/>	4. Do you have a heart condition?	<input type="checkbox"/>	<input type="checkbox"/>	5. Do you have diabetes?	<input type="checkbox"/>	<input type="checkbox"/>	6. Do you have exercise-induced asthma?	<input type="checkbox"/>	<input type="checkbox"/>	7. Do you have allergies?	<input type="checkbox"/>	<input type="checkbox"/>	8. Do you have joint pain or arthritis?	<input type="checkbox"/>	<input type="checkbox"/>	9. Are you taking any medications that lower your heart rate? (e.g., beta blockers)? "	<input type="checkbox"/>	<input type="checkbox"/>
	No	Yes																													
1. Do you participate in sports activity/lessons? (Full weight-bearing)	<input type="checkbox"/>	<input type="checkbox"/>																													
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9. Are you taking any medications that lower your heart rate? (e.g., beta blockers)? "	<input type="checkbox"/>	<input type="checkbox"/>																													

Comment on the health questions:

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"Beforehand, we asked you to measure your height and weight. You can now give me both pieces of information. ("If you have forgotten, let's measure it together now!"). The test subject is asked to take off their shoes and heavy outer clothing and stand against a door frame or similar. Their back should face the door frame. The back of their head and their buttocks also touch the door frame. The test subject should let their arms hang loosely down at their sides, hold their knees straight and look straight ahead. Before reading off the height, check the head posture and make sure that the knees are straight. Reading the measurement is easy with a book or such.)

**Height:** \_\_\_\_ . \_\_\_\_ cm    **Weight:** \_\_\_\_ . \_\_\_\_ kg

(Shoes are off; no heavy clothing, enter decimal place if possible)

**Comment:**

Instructions	Now we will show you a short film of the entire test procedure so that you know what to expect.
	<p>Film sequence (1:13 min):</p> <p>"Welcome to the digital motor performance tests. For the test tasks you need the sports mat, a table on which the laptop can be placed and about 1.50 m of space in between. For one of the tasks, the laptop is placed on the floor at a distance of about 1.30 m from the mat. If you don't have a laptop and are connected via your mobile phone, lean it against a bottle or similar counter-stand if necessary. We will do four tasks today. The first one will be Jumping side-ways. In the second task you will do special Push-ups. The third task will be Sit-ups. Ideally, you will have someone to help you with this exercise who will hold your feet. In the last exercise, the Stand and reach, we will see how flexible you are and whether you can touch the floor with your fingertips. Ideally, an assistant will check that your knees remain straight. Your test administrator will tell you the rest."</p>
General info	<p>"We will start with the tasks right away. While you are doing them, I may cheer you on or correct you. Don't let this distract you, just keep going and do your best."</p> <p>(To parent/guardian:) Please feel free to cheer, it helps your child!</p>
Warm-up	"We're going to warm up together" Short age-appropriate warm-up (e.g., running in loosely, around the mat, 5 jumping jacks or based on the child's activity type).
Jumping side-ways	"Our first task is to jump back and forth sideways. I'll show you a film so you can see how it's done:

<p>Observation criteria:</p> <p>With shoes!</p> <p>Only two-legged jumps are valid!</p> <p>Do not cross the lines!</p>	<p>Film sequence (38 seconds):</p> <p>"Stand with your feet together on the mat next to the centre line. On my signal, start jumping back and forth sideways across the line as fast as you can until I say "stop". If you step next to the mat or on the centre line, don't stop, just keep jumping."</p> <hr/> <p>"Before we start with the task, I ask you to do 5 test jumps. Make sure that you always jump within the space and do not hit any lines."</p> <p>After the test jumps, feedback is given (praise/correction/repeat if necessary). Afterwards give the information:</p> <p>"We're going to start the test now. You try to jump back and forth as often as possible in 15 seconds. After that you have a minute's break and then we repeat the exercise."</p> <p>Note to parents/guardian: "Please cheer them on!"</p> <p>Reflect briefly during the break/motivate them to increase their performance</p> <p><b>Jumping sideways</b></p> <p><b>Attempt 1 __ __ (15 sec.)</b>      <b>1 min. break</b>      <b>Attempt 2 __ __ (15 sec.)</b></p> <p>Comment:</p>
<p>Push-ups</p> <p>Observation criteria:</p> <p>"Stiff as a board" push up!</p> <p>1 push-up is completed when the hands touch the back!</p>	<p>"The second task probably challenges you the most: it's push-ups. I'll show you a film so you can see how it's done:"</p> <hr/> <p>Film sequence (44 seconds):</p> <p>"Now you are supposed to do push-ups. But these are not normal push-ups! You lie on your stomach with your legs together and straight. Your hands touch your buttocks. Now place your hands next to your shoulders and push yourself up. Your knees should come off the floor and your back and legs should remain straight. When your arms are extended, touch one hand to the other. Then support yourself again with both hands and bend your arms until you are lying on the floor again. Now touch your hands behind your back and do the next push-up".</p> <hr/> <p>Before we start the task, try two push-ups. <i>(Accompany the different stages with words, if necessary! Correct until the execution is understood and correct! If necessary, further trial runs and further demonstration by the test administrator.)</i></p> <p>After the trial runs:</p> <p>Now, after the start command, try to do as many push-ups as possible in 40 seconds. I may correct you and motivate you. Just keep going anyway.</p>

To parents/guardian: "Please cheer them on!" (The test administrator will also motivate if necessary)

### Push-ups

\_\_ \_\_ number in 40 seconds

Comment:

### Sit-ups

The third task is sit-ups. Again, I will show you a short film:

Film sequence (47 seconds):

Observation  
criteria:

Legs at 80°  
angle, feet  
hip-width

"For this task you have to do as many sit-ups as possible in 40 seconds. You lie on your back and place your feet in front of you. Then you should fix your feet in place. Either someone helps you to hold your feet or you hold your feet under an object, e.g., under a sofa. Then place your fingertips at your temples and your thumb behind your earlobes. Now roll your upper body up until your elbows touch your knees. Then roll down again until your shoulder blades briefly touch the floor."

Before we start with the task, you may now try two sit-ups.

After the trial runs:

Now, after the start command, try to do as many sit-ups as possible in 40 seconds. I may correct you and motivate you. Just keep going anyway.

To parents/guardian: Please hold their feet and cheer them on!

### Sit-ups

\_\_ \_\_ number in 40 seconds

Comment:

### Stand and reach

The last task is about mobility. Again, we will watch a short film:

Film sequence (45 seconds):

Observation  
criteria:

Shoes off!

Knees fully  
extended,  
hands paral-

"I will show you how the stand and reach task works. In this task, you have to move your laptop or mobile phone from the table onto the floor. The distance to the mat should be about 1.30 metres. Then stand on the mat, hip-width in front of the centre line. Bend forward and slowly push both hands towards the floor at the same time. It is very important that you keep your legs straight! Your companion can help you by checking the stretching of your knees. Try to come down as far as possible and hold this position for 2 seconds."



lel, slow execution! Hold for 2 seconds

Please put your laptop (mobile phone) on the floor and then we will start. You won't have a trial run. We will start with the task right away. You will have 2 attempts. Between the attempts, briefly relax your legs.

### Stand and reach

Bottom of the feet reached

Bottom of the feet not reached

Attempt 1

☐
☐

Attempt 2

☐
☐

Comment:

Thanks, and feedback

Thank you, now you have done everything!

(This is followed by "pedagogical" feedback with classification of the performance using the percentile curves. Those with a lower level of motor fitness can be praised for trying, for example!)

Dismissal

## 8 Test collection sheet

### Data entry form

#### I. Test information

Name Test administrator      Test date      Test start      Test location

\_\_\_\_\_ . \_\_\_\_ . \_\_\_\_ . 2023 \_\_\_\_ : \_\_\_\_ clock \_\_\_\_\_

General remarks:

#### II. Master data

ID: \_\_\_\_\_ Date of birth: \_\_\_\_ . \_\_\_\_ . \_\_\_\_

Gender: ☐ male ☐ female ☐ diverse, namely: \_\_\_\_\_

#### III. Health questions

*If there is "no" or "not full" participation in the sports lessons, please ask carefully, do not allow participation with unclear/ less stable state of health without prior consultation of a doctor!*

	No	Yes
1. Do you take part in sports activities/teaching? (Full load)	<input type="checkbox"/>	<input type="checkbox"/>

If "no", why do you not participate or not fully participate in sports lessons?

I have to ask you some questions about your health now:

2. Have you had an infection in the last 2-6 months?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are you ill or unwell at the moment?	<input type="checkbox"/>	<input type="checkbox"/>
4. Do you have a heart condition?	<input type="checkbox"/>	<input type="checkbox"/>
5. Do you have diabetes?	<input type="checkbox"/>	<input type="checkbox"/>
6. Do you have exercise-induced asthma?	<input type="checkbox"/>	<input type="checkbox"/>
7. Do you have allergies?	<input type="checkbox"/>	<input type="checkbox"/>
8. Do you have joint pain or arthritis?	<input type="checkbox"/>	<input type="checkbox"/>
9. Are you taking any medications that lower your heart rate? (e.g. beta blockers)?	<input type="checkbox"/>	<input type="checkbox"/>

Comment on the health questions:

#### IV. Anthropometric data

Height: \_\_ \_\_ \_\_, \_\_ cm Weight: \_\_ \_\_ \_\_, \_\_ kg Take off shoes; take off heavy clothes.

Comment:

#### V. Short age-appropriate warm-up

#### VI. Coordination

##### Jumping sideways

5 trial jumps; only two-legged jumps valid; with shoes.

V1 \_\_ \_\_ (15 sec.)

1 min break

V2 \_\_ \_\_ (15 sec.)

Comment:

#### VII. Strength

##### Push-up

After demonstration by test leader 2 trial attempts; only correctly performed push-ups count.

\_\_ \_\_ Number in 40 sec.

Comment:

##### Sit-ups

2 trial attempts; feet fixed by test leader; shoulder blades touching mat; both elbows touching knees.

\_\_ \_\_ Number in 40 sec.

Comment:

#### VIII. Mobility

##### Stand and Reach

Bottom of the feet reached

Bottom of the feet not  
reached

V1 ☐

☐

V2 ☐

☐

Comment:

#### IX. Test information

Time end \_\_ \_\_ : \_\_ \_\_ o'clock

Legend: V= trial; MW= mean; SD= standard deviation; sec.= seconds; min.= minutes; Y.= year

## 9 Problem solving ("trouble shooting")

Respondent missing	If the respondent does not show up at the appointed time, an attempt must be made to reach the respondent by telephone after a period of 5 to 10 minutes. If possible, the appointment should also be made late and sufficient buffer for the next appointment should be planned in advance. Otherwise, a new appointment must be made.
Test mat missing	If the test mat is not available at the time of the test, an alternative date must be arranged. In order to avoid this situation, it should be clarified in advance that all test materials are available to the participants.
Room unsuitable	If the room requirements are not sufficiently met at the beginning of the test, the test administrator must ensure that they are met by the start of the test. Otherwise, the respondent must be asked to move to another room that meets the requirements better.
No scales available in the household	Ask the respondent if family or friends live next door and if they can weigh themselves briefly there if necessary. Or maybe there are neighbours who have scales? Otherwise, an estimate is necessary (worst case).
Respondent does the task incorrectly	If the test item is not understood after the test leader's explanation and errors are detected in the execution of the test item, the test leader must explain the test item again and, if necessary, demonstrate until the test item is reliably executed correctly.
Respondent's health is not good	If any health problems occur before or during the test, the test taker must take a break immediately and first aid must be given. In an emergency, the test administrator must call an ambulance for the test person.
Device for recording measured values fails	If the test result entry device fails, the test administrator must back up the results in writing. A paper back-up must be available for each test.
Subject does not understand test administrator	If the test person does not hear (loudly) enough during the test, the test administrator must ensure that the sound transmission is properly guaranteed. For this purpose, the volume or, if necessary, the basic settings of the loudspeakers and the microphone must be checked or changed.

## 10 Quality development and assurance

Since the beginning of the first digital measurements towards the end of MoMo measurement wave 3 in 2021/2022 with a total of 275 test persons, this digital test battery has been continuously developed. Findings from the first wave of digital tests as well as the final work carried out in this context showed possibilities for improvement from the technical test preparation to the recording of measured values. These findings have already been considered in this manual. Furthermore, in terms of quality development, future findings from the digital tests and through exchange with experts will also be incorporated into this manual and constantly updated.

With regard to quality assurance, regular training and meetings are held for the test administrators. This serves to consolidate the standardised procedure for the tests and to eliminate sources of error that are identified through feedback from the test administrators and through quality controls of the recorded tests as videos.

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## Appendix

### Cover letter to participants

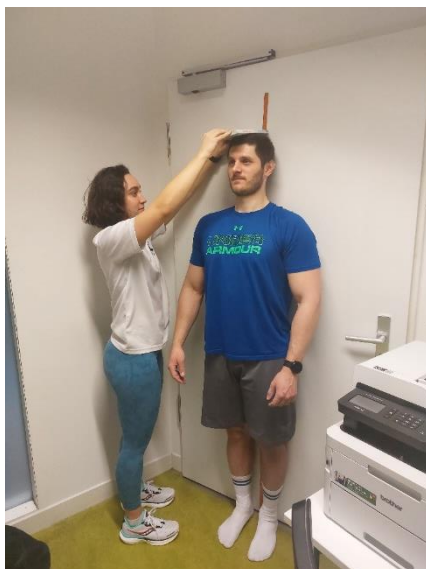
Dear children,  
(and dear parents and guardians)

We would like to thank you very much for your willingness to participate in the motor performance test. We hope that you have received the test mat with this letter. We would like to inform you in advance about the most important aspects of setting up and conducting the test. To carry out the test, you will need sufficient space to set up the mat (see below), an internet-enabled device (laptop, tablet, smartphone, etc.) as well as light sports clothing and shoes. The test set-up and the measurement of body height and weight are explained in more detail below.

### Measurement of body height and weight

Please measure your height and weight as accurately as possible (with decimal places) before the test day. An accompanying person should help and no shoes or heavy clothing should be worn.

To measure height, first attach a folding rule or tape measure to a door frame or wall. Then the test person (the child) stands with a straight back against the measuring device. Make sure that the knees are pushed through and that the head is straight. The accompanying person now places a book or similar flat on the test person's head and presses it against the wall. The accompanying person now reads off the height exactly with decimal places (0.1 cm).



To measure your body weight, the test person stands on a scale without shoes and with light clothing and reads the weight from the display. The body weight is given with decimal places (0.1 kg).

### Test setup in a room of sufficient size and internet connection

For the following test set-up, please select a suitable place in the flat, approximately 2.5m x 2.5m free space is required.

Clear a suitable surface of objects and unroll the test mat with the markings facing upwards. Make sure that it lies flat on the floor everywhere and does not slip. There should still be free space around the mat so that the tasks can be carried out unhindered.



Place the laptop/camera on a table or other elevation (approx. 70-80cm height) at a distance of 1.5-2 m from the test mat. Tilt the laptop/camera so that the mat can be seen at the bottom of the screen.

For the trunk flexion test task, the laptop/camera must be placed on the floor at a distance of approx. 1.3 m from the test mat.

At the beginning of the measurement, we will look together to see if everything is set up correctly and we will explain everything else to you calmly.

If you have any questions, please do not hesitate to contact us at:

**thorsten.klein@ph-karlsruhe.de**

Kind regards and we look forward to seeing you,

the DigiMot team