

# What is the difference between writing motor skills and graphomotor skills?

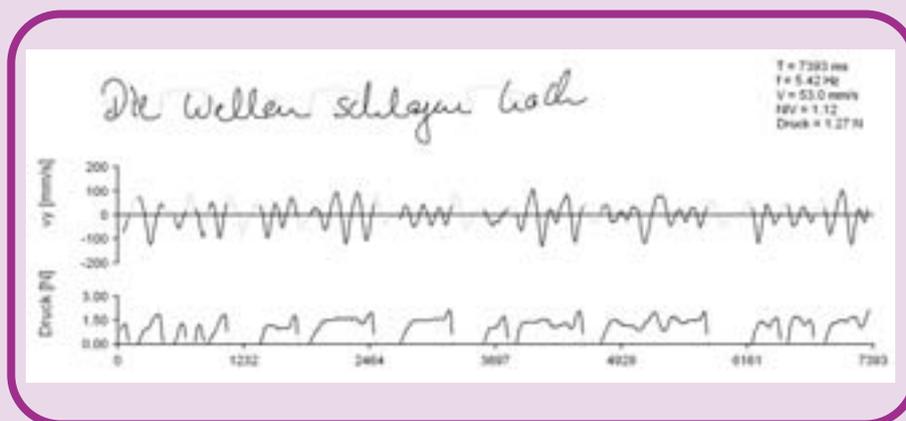
**Graphomotor skills** refer to the motor skills required for faster writing later in life. When children begin to learn to write, the focus is initially on the slow "drawing" of letters, or neat writing. The transition from a slower and more form-oriented set of graphomotor skills to flowing, dynamic writing movements is not normally the focus of the teaching of writing. It is hoped that flowing writing will simply develop on its own through regular practice. This, however, is often a fatal misconception. Many children develop severe problems with writing and illegible writing at precisely this juncture. The earlier emphasis on keeping shapes as precise as possible and within the lines aggravates these problems.

**Writing motor skills** on the other hand are motor processes which form the basis of flowing handwriting. In this sense, writing motor skills strictly differentiate between the slow drawing of letters and flowing writing. The difference is that the focus is on controlling the shape when drawing, while when writing the motor functions themselves are dominant, and shape is a result of the automatic movements learned previously. In other words, letters' shapes are formed directly by the movements made when writing.

## Kinaesthetic Learning

Recent scientific findings confirm this model in a wide range of aspects. Flowing movements performed once are saved in the motor memory as complete patterns for later retrieval. That is why writing remains exactly the same with open and closed eyes. The eyes, moreover, along with conscious movement control, are far too slow to control the flowing writing process while it is being performed. Well-practised writers write using an average of around 5 up and down strokes per second, whereas the eye can only follow 1.5 strokes per second in detail.

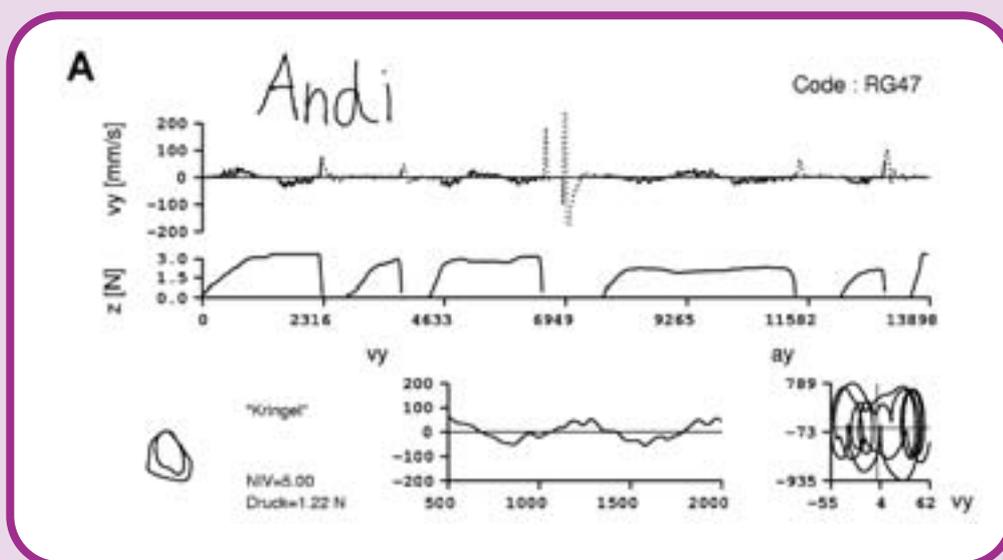
Learning these automatic motor patterns is described as kinaesthetic learning. In other words, one learns through experiencing movements. The movement has to be experienced at a certain minimum speed. If the muscles follow a precise shape in slow motion, then no motor patterns can be created and saved. In this case, the muscles are constantly activated and deactivated in order to be able to correct any deviations immediately. In well-practised writing, on the other hand, the muscles are activated precisely once and once alone for each up and down stroke.



Flowing writing movements of well-practised writing. The test sentence was written in just 7.3 seconds. The speed graph  $v_y$  (centre) shows the regularity of movements performed, including movements in the air (dotted). Writing pressure (below) is at a constant medium level

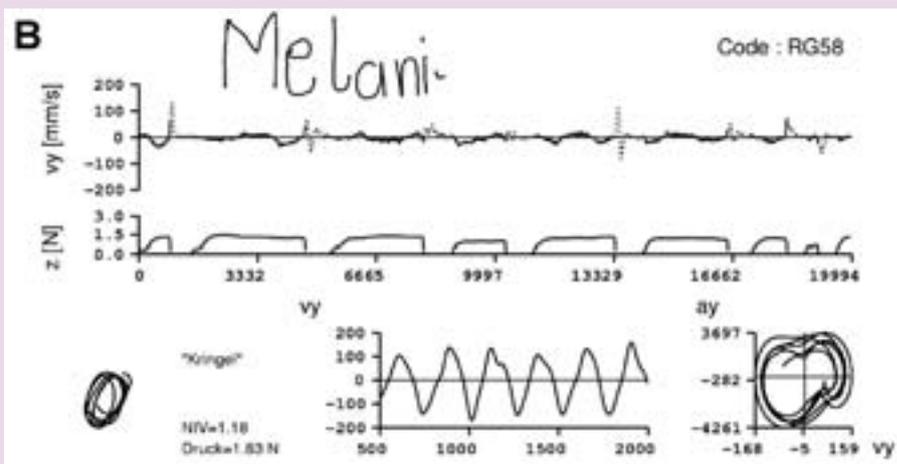
# Evaluation of writing performance in schoolchildren

Kinematic analysis of writing movements can help to discover early-stage writing problems and address these in a targeted manner. Serious writing problems can be found hidden even in what at first appears to be acceptable handwriting. What is more, when evaluating unsatisfactory writing, a crucial question is whether a basic motor skills disorder is actually the cause, or whether the child rather has problems with writing as such. In a study regarding this question, we examined pupils at a primary school four months after they had started school. First, the children were to write their first names in their own handwriting. In addition, overlapping loops were analysed to ascertain basic motor skills. In the subsequent evaluation, three main sub-groups emerged, with representative examples for each shown in the following illustrations.

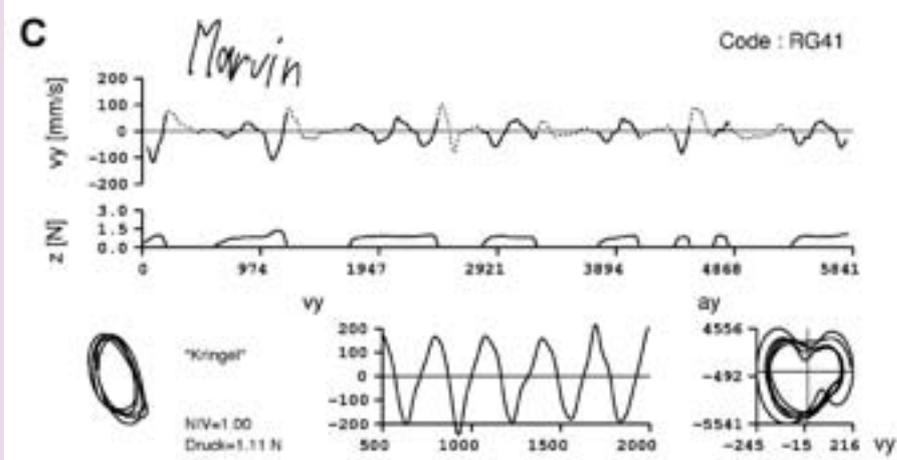


Writing by a school child. Above, sample of writing with speed graph  $v_y$  and pressure graph  $z$ . Below, one loop with speed graph  $v_y$  and phase diagram  $a_y/v_y$

The writing of the child's name (RG47) can be viewed as very well formed (A). However, the writing movements indicate an extremely slow and irregular speed. To write his name, he required 3.5 s per letter. The writing pressure level  $z$  is very high, which indicates poor writing technique. The child displays a slightly faster speed when drawing the loop, but a low frequency of just 1.5 Hz. The accompanying phase diagram  $a_y/v_y$  shows numerous irregularities. Despite this clear writing, the child's writing movements have to be classed as under-developed. **This child requires support with basic motor skills as a first step. Exercises 1 to 4 (pages 5–12) in this chapter would provide help here.**



For child (RG58), the writing speed is similarly slow and shaky with 3.3 s per letter (B). However, writing pressure  $z$  is at a rather lower level and indicates a slight cramping in the hand. Nevertheless, this child is able to write loops using an almost perfectly automated movement. The top speed and the frequency of 3.7 Hz is roughly in the same range as adult writers. The phase diagram shows a good level of repeated precision. The majority of schoolchildren tested by us performed well when writing loops, but wrote extremely slowly. **These children should be encouraged to write faster and therefore put more of their good motor skills into practice when writing. Exercises 5 to 9 (pages 13–20) can help support this.**



The writing of the name of child (RG41) initially leaves the poorest impression (C). However, this child is already able to implement automatic movement components when writing his name. The speed curve is generally regular, with some slightly extended pauses between the individual movements. The writing speed is relatively high at 1 s per letter. The writing pressure graph is at an optimally low level. The movements in the loops are very regular and have a high frequency of 3.3 Hz. **This child displays good motor performance with some automatic movements. Exercises 4 (pages 11, 12), 8 (page 18) and 9 (pages 19, 20) would help to make the movements more harmonious and the appearance of the writing more regular.**

# Exercises – Preliminary notes

The following exercises aim to improve children's movement skills, support their writing motor skills and make their handwriting flow better. The exercises are not to be viewed as a handwriting course, but focus rather on the motor aspects of learning to write, which are of great importance when developing joined-up writing.

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**The following points generally make it easier for children to learn to write:**

1. No lines or boundaries
  2. Individual sizes permitted
  3. No specified model to be followed
  4. Writing based on movement
  5. Short exercise units
  6. Sensible instead of strict practice
  7. Creative discovering and learning through fun
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Relaxation breaks should be included in all exercises. The children should enjoy the exercises and be encouraged to try things out. Every so often, the experience can be discussed and compared in class.

The real challenge of teaching how to write is finding the best learning conditions for the individual to achieve flowing movements and control of form. This includes individual pen hold, variations of writing speed, but also the difficult-to-ascertain effects of instruction and guidelines. The variety and individual combination of supporting and limiting factors really require an individual approach that a uniform programme of exercises cannot easily achieve. However, the exercises can be arranged in such a way that the child is allowed sufficient freedom to experience, form and learn for themselves. The child, and not the model to be followed, should be at the heart of learning, although basic uniform guidelines on how to create fundamental shapes are certainly advisable. It is up to the teacher to create suitable conditions for this. It therefore helps for them to reflect on their own pen hold, sitting posture and handwriting and to try out the exercises for themselves in preparation.



# Exercise 1: Pen hold and hand movement

## Aim of exercise

The children should learn a suitable sitting posture and pen hold. The hand should be free to move while writing and not pressed down.

## Materials

- Large sheet of paper for writing
- Small sheet of paper for putting underneath
- Pen/pencil

A relaxed posture, an appropriate pen hold and an unrestricted hand are key requirements for writing. An awkward posture causes children to tire unnecessarily and restricts their freedom of movement. If too much pressure is exerted on the writing surface, hand movement is made difficult. The result is that writing becomes increasingly smaller and more compact, and writing pressure increases greatly.

## Correct sitting posture

The child sits up straight in front of the desk with their shoulders relaxed. The height of the desk and chair are adjusted so that the child's feet have complete contact with the floor. The lower arms are at a 90° angle and are relaxed on the desk. The elbow is not raised, the hand is not exerting any pressure on the writing surface and the shoulder is not pushing the hand down. The hand should be able to move freely in all directions, to support flowing writing.



*Correct sitting posture*

## Correct pen hold

Writing involves a compromise between two opposing tendencies – holding the pen and moving it at the same time. The grip applied should, as far as possible, not prevent the fingers from being able to move freely. However, the ability of the fingers to move freely cannot be improved without taking grip into account. Without sufficient grip, the pen cannot be controlled. That is why an ergonomically-designed grip zone can help with pen hold. If the pen can be held securely with less of a firm grip, then this directly benefits the fingers by affording them more freedom to move. It is therefore preferable for children to write with thicker pens or pens with soft ergonomic grip zones.

A good pen hold can be demonstrated by first having the child let their hand fall on the desk in a writing-like position. All joints are now relaxed in a central position. A pen can then be inserted into this hand from above, gripped gently and moved softly across the paper. The pen is best held in a three-finger grip using the index finger, thumb and with support from the middle finger from behind. If the joints are in unusual positions, the muscles will cramp and movement is restricted. The central position of the joints allows maximum freedom of movement. Through a combination of wrist and finger movement, the pen can now be moved easily in all directions.



*Correct pen hold*

### **Exercise for hand movement**

Free movement of the hand can be practised initially using an imaginary pen. The writing hand is placed on a second sheet of paper, so that it can move around the desk freely. This way, children can perform initially large movements, and later increasingly small-scale movements, on the desk. The sheet underneath means that the hand encounters little resistance and is easy to move. Pay attention to a relaxed sitting posture during this exercise!



*Sheet underneath*

Once the children have a good feeling for hand movement, they can be given a pen in their hand. At first, the pen does not make contact with the paper and is moved around with the hand in a similar fashion to before. Later, the pen can be placed on the paper (as large a sheet as possible) and written with. This moving around can start with free movements and later incorporate large letters.

The next step is to remove the additional sheet underneath the hand and continue moving around the surface of the desk. The children should now feel how firmly they can press in order to still be able to move their hand freely. At the end of the exercise they can write with and without a sheet underneath, and there should be no difference between the two.

# Exercise 2: Wrist exercises

## Aim of exercise

The children should practise flowing wrist movements and implement these increasingly when writing.

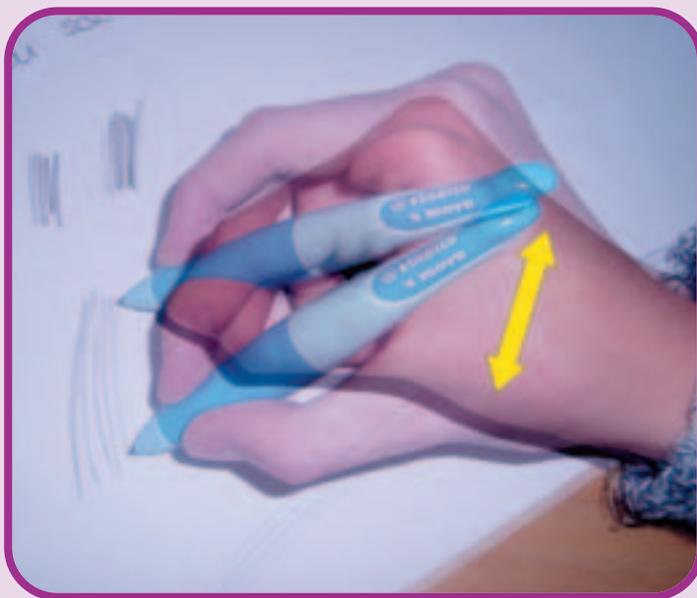
## Materials

- Wrist movement exercise sheet

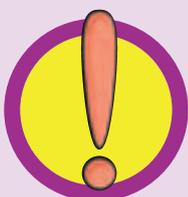


Writing always develops from large joints to small joints, and from large movements to small-scale movements. The coordination of arm and wrist movements is normally already fairly well-developed by the time they begin to learn to write. The wrist is already used successfully in a range of daily activities (e.g. reaching, catching, eating). From the very beginning of learning to write, existing wrist movements should be implemented and refined.

Children find it relatively easy to make large-scale, writing-like movements freely with the hand. Something as simple as the flowing “windscreen-wiper” movements by the wrist emerge on paper as slight arches. The wrist is in a central position and the lower arm is relaxed on the desk. In this position diagonal hatching on the spot can be done using wrist movements, and if the hand is moved into the writing position from here, diagonal lines with jags are created. These shapes can be varied in terms of size, angle and shape. The child should playfully get to grips with how different movements create different shapes. Flowing movement and a regular and even rhythm are important.



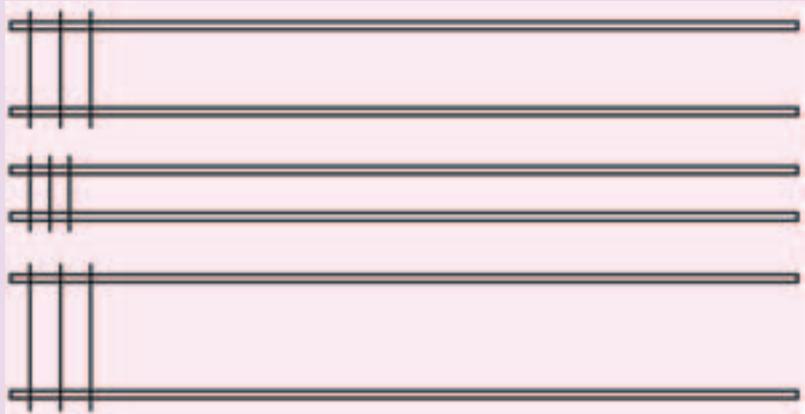
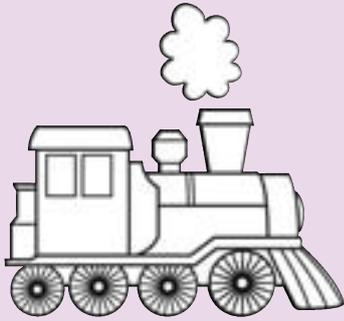
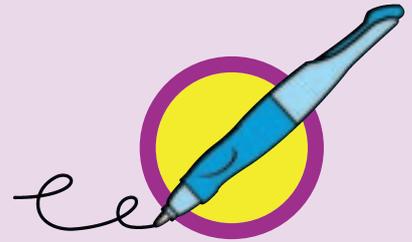
*Wrist movement*



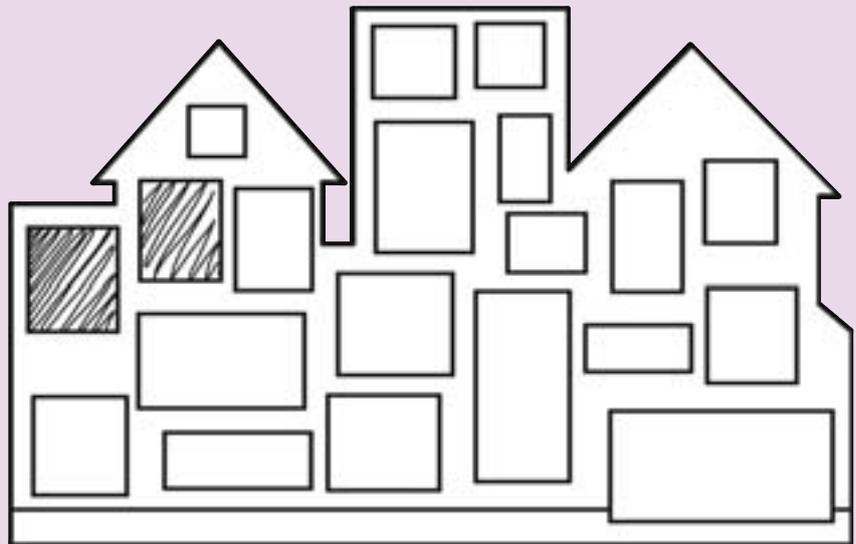
It is important that the hand is positioned on the paper at an angle of around 45 degrees, so that it is the wrist that is used for vertical hatching and the fingers for the horizontal.

## Exercise sheet – Wrist movements

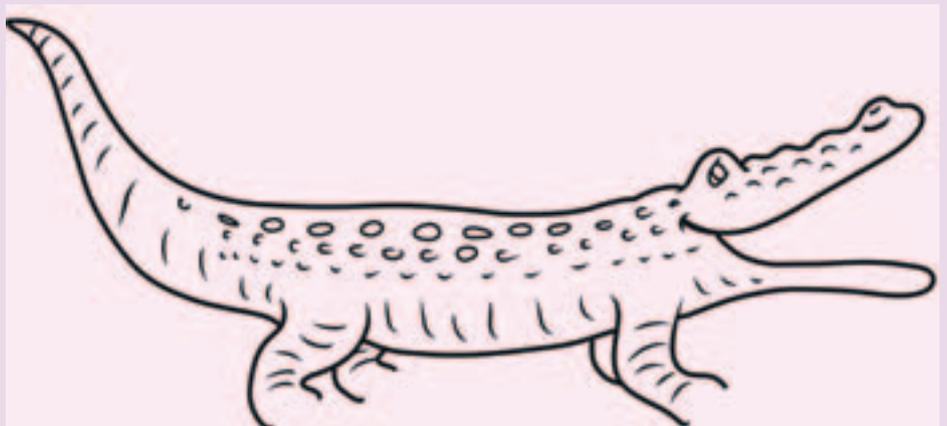
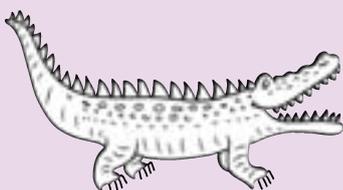
1. Laying train tracks. Vertical hatching.



2. Lights out at night! Diagonal hatching in different sizes.



3. Zig-zag. Diagonal jags.



# Exercise 3:

## Practising finger dexterity

### Aim of exercise

The children should practise finger dexterity and use their fingers more when writing.

### Materials

- Finger dexterity exercise sheet



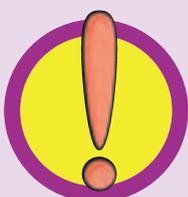
Selective finger movements are learned later than wrist movements and are therefore difficult for the majority of children when they begin to write. Many children also do not use their fingers enough on a daily basis. A lack of fine motor skills in the fingers should be remedied directly. While it is possible to write using the lower arm and wrist, this is detrimental to the writing flow and requires considerably more effort when writing for longer periods. In many children, a lack of finger dexterity is compensated through maximum gripping of the fingers and greater grip pressure. **In principle, all games and activities which promote selective finger movements (shape-sorting games, model building sets), are helpful in improving dexterity.**

All exercises should always begin with a relaxed pen hold. If the hand cramps while the exercise is being carried out, the exercise should be stopped and started again using a relaxed hold after a short break. First, the teacher demonstrates how fingers can be used in writing. They show for example how fingers can pick up a crumb using a pincer-like movement and how the fingers move backwards and forwards while doing so. These finger movements should also be used when writing.



For this exercise sheet, the children move their writing hand from left to right and draw lines, alternating between large and small movements. The smaller the lines, the more finger movements can support their formation. During the exercise the hand should increasingly remain in one position, with only the fingers being used to write or hatch short lines on the paper. If the hand cramps by this point, the child should start again from the beginning with larger movements. The children should feel what a relaxed hand feels like, and continue with this feeling while writing.

*Finger movements*

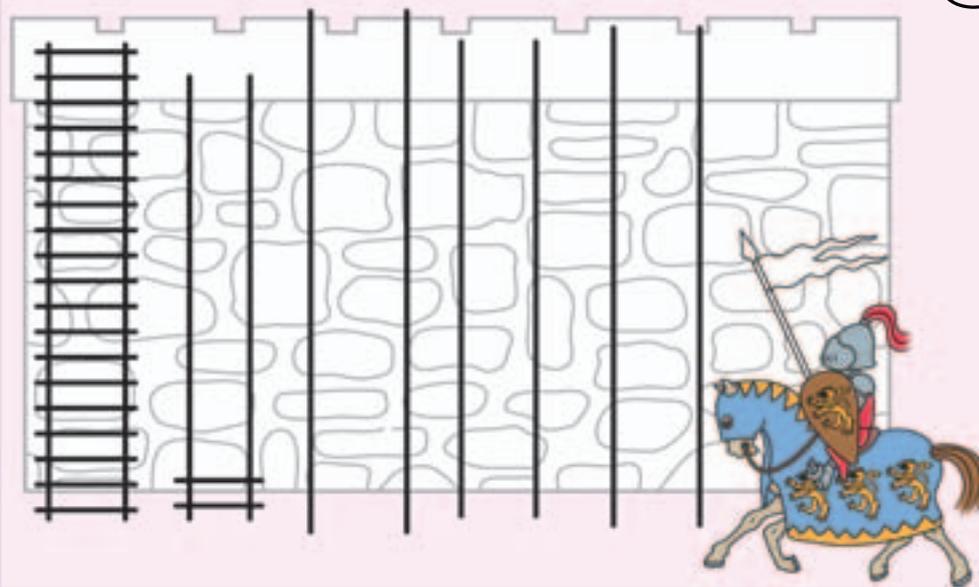


The smaller and more precise the movement required, the more likely it is that the child will experience cramping. A cramped pen hold is the result of excessive demands being placed upon the child, either in terms of the level of precision desired or the size of writing required.

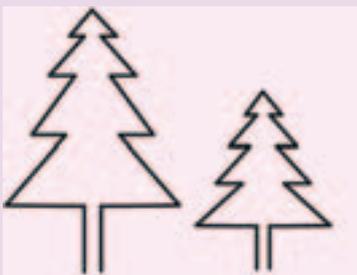
## Exercise sheet – Finger movements



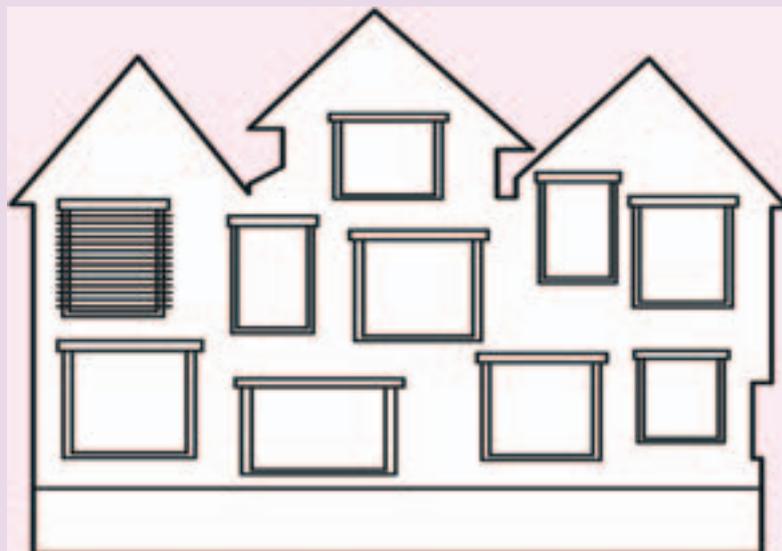
1. The castle is being stormed. Long and short horizontal strokes.



2. Pine forest. Zig-zags under each other.



3. Venetian blinds.  
Horizontal hatching.



# Exercise 4: Coordinating wrist and fingers

## Aim of exercise

The children should be able to write various round shapes using a quick combination of wrist and finger movements.

## Materials

- Wrist and finger coordination exercise sheet



Writing is the result of coordinated and small-scale movements by the wrist and fingers. The round shapes are also created by wrist and finger movements working together. Playfully and using flowing movements, many letter-like shapes can be created at an early stage using up and down movements by the hand together with back and forth movements by the fingers.



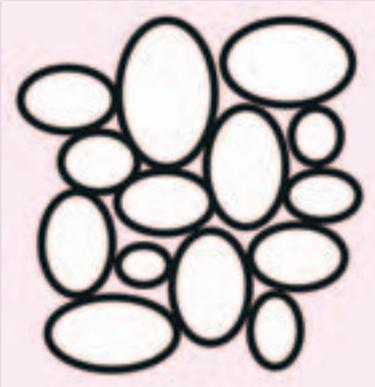
This exercise sheet is not concerned with drawing shapes precisely, but rather with discovering how different shapes are created with a flourish and a willingness to experiment. The children should be encouraged to try out whatever different shapes they like. If the movements from the wrist become larger, the shapes become longer; if the movements by the fingers become larger, the shapes become squatter. Here, too, the children should initially practise larger movements and then move on to smaller ones. To encourage flowing movements, they can decide for themselves on the exact size.

After the exercise, discuss with the children which of the shapes practised they recognised from letters they already know (e.g. the “belly” of the B, the dip of U or the loop on e and l). The children can then practise writing these letters with similarly fast movements (see also writing rhythm exercise sheet). It is precisely this transfer early on of existing motor skills to writing letters that can make it significantly easier for children to make the transition later to joined-up writing later.

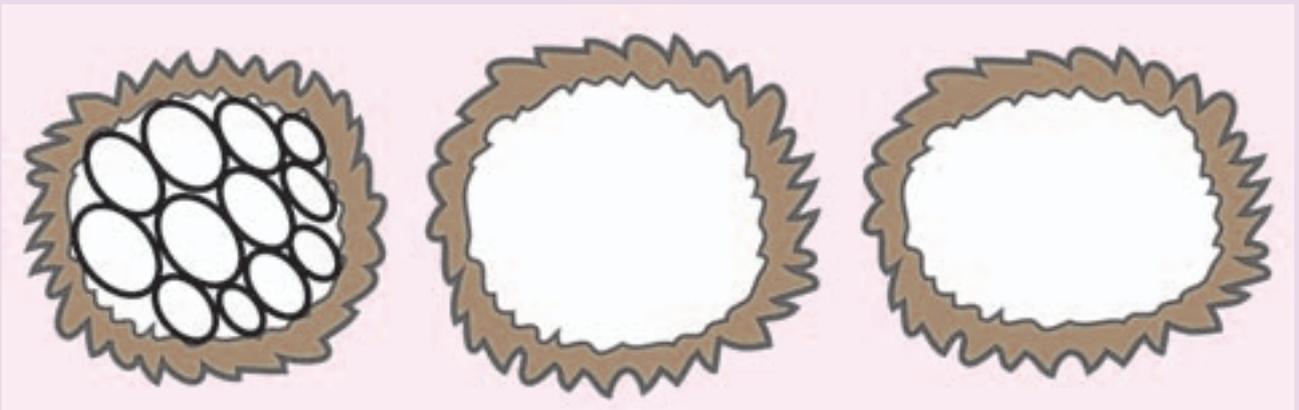
## Exercise sheet – Wrist and finger movement



1. Piles of pebbles. Ovals standing up and lying down.



2. Easter nests. Slanted ovals.



3. Mountains, valleys and birds.



# Exercise 5: Scaling sizes freely

## Aim of exercise

The children should learn how size can be controlled even with fast movements.

## Materials

- Resizing exercise sheet



## Writing size and border lines

Our studies have found that a precisely-set writing size and observation of exact border lines can cause unnecessary problems when children first start learning to write. **Even well-practised writers cannot write flowingly when required to write between two precise lines.** This not only applies to words but can even be demonstrated with elementary writing movements such as isolated lines.

Children are often told to keep to a set size. Shape-focused drawing does help with precision, but does not teach how to scale the intended size by activating the appropriate muscles. Motor learning, on the other hand, requires size to be "experienced". Children should be allowed to begin with their preferred size and then vary this as they like.

## Experiencing size

To experience size kinaesthetically, the child is taught first of all to write very large, then very small, and then roughly medium-sized. The size should now be roughly within the target area. The key aspect of this exercise sheet is that the child always uses fast movements and does not draw precisely. It does not matter, therefore, if a certain size is achieved. Exaggerating ("much much bigger/smaller") can help children in the right direction here, without precision being stressed at all. In the course of the exercise the child will learn increasingly to scale sizes using forward planning and based on movement.



In this exercise, the teacher can announce the size wanted in any order, e.g. "big, very big, small, about the middle". The size selected should not be too small at the start. It is better to practise from big to small. Children with motor problems should practise more with larger sizes, while children with good coordination skills can practise smaller sizes.

## Exercise sheet – Scaling



1. Vertical lines in writing spaces.

Four horizontal grey writing lines. The first line has three vertical blue lines of different heights: a tall line on the left, a short line in the middle, and a medium-height line on the right. The second, third, and fourth lines are empty for practice.

2. Horizontal lines in writing spaces.

Two vertical grey writing lines. The first line has three horizontal blue lines of different lengths: a long line at the top, a short line in the middle, and a medium-length line at the bottom. The second vertical line is empty for practice.

# Exercise 6: Scaling shape sizes freely

## Aim of exercise

Children should learn how to write and scale various shapes using fast movements.

## Materials

- Scaling shape size exercise sheet



## Shape and size

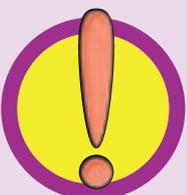
Just as with the scaling of simple lines, there is also a balance between accuracy and writing speed when scaling shapes.

The more precisely the shape in question is to be copied, the more this leads to drawing and not writing. The exercise is aimed at finding the individual balance between shape and speed.



## Experiencing the creation of shapes

Using the two simple shapes of squares and circles, the child should experience how shapes of different sizes can also be created with faster movements. Children who focus too much on shape precision should be encouraged to move more. Children love to move. It helps some children if pictures are provided at the same time, for example a square can be a dice or a circle can be a football. Children tend to draw objects more freely than abstract shapes or letters. Other children who write too quickly and lose the shape completely may need to have their urge for movement reined in slightly. Each child should find their own individual balance. In terms of teaching, however, the focus should be on flowing movements. The aim is "brisk" drawing which may be slightly less precise initially, yet which is regular in its flow of movements. The shapes automatically become more attractive in the course of the exercise.

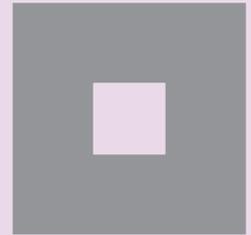
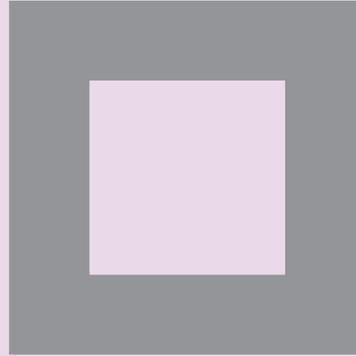
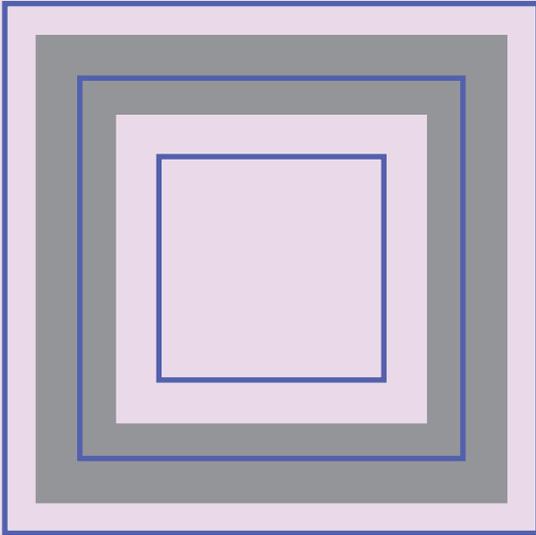


Here, too, shapes are practised from large to small. However, the teacher can also announce the size wanted in any order, e.g. "big, very big, small, about the middle". The size selected should not be too small at the start.

## Exercise sheet – Scaling shape sizes



1. Fit in the squares.



2. Fit in the circles.



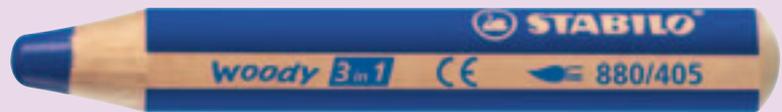
# Exercise 7: Writing in the air

## Aim of exercise

The children should be able to transfer flowing writing movements in the air to actual writing.

## Materials

- Large sheets of paper/Plain wallpaper
- Thick pens



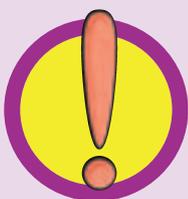
Large-scale writing movements using the shoulder and arm are always easier for children than movements using hands and fingers. Movements using the small joints are always learned later. The flowing nature of large-scale movements can, however, be transferred to small-scale movements, if both conditions are merged. Writing in the air is a very effective exercise for achieving this.

## Writing in the air

Children hold a wax crayon or a thick colored pencil and write, depending on their level of proficiency, shapes, letters or even words in the air using large movements. Attention should be paid to a flowing and regular writing rhythm. Children should be encouraged to "let go" in the movements. Demonstrating the movements made with the correct rhythm is very helpful here. All joints involved should be able to move freely and be used. The arm moves lightly, as if holding a puppet on strings. If the arm starts to cramp, the child should relax it, let it hang and shake it slightly. Only once the movements in the air are performed freely and flowingly, can the exercise to be transferred to writing.

## The transfer

The hand is now placed on the desk. A large sheet is best placed on the desk to capture the movement – plain wallpaper can also be used here. The movements are performed on the desk using the same speed and flow, initially without the pen making contact with the paper. If this is successful, the child can put pen to paper and continue with the movements. The letters created are now the result of the movements already performed, and both children and teachers will be surprised at how easy it is and how flowing the movements are. The next step is to make the movements bigger and smaller in an irregular order, without disrupting the flow of movement. At the end of the exercise the writing should be closer to the target size. However, the movements should never be smaller than normal writing.



This sequence can be repeated several times for various complex shapes or letters. The exercise always begins with writing in the air, and is continued until the movement flow is satisfactory even for small letters. Once the children have a good feel for the movement flow, they can be asked to write various things on the paper quickly and in different sizes, for example: circle, "e", loop, "9", etc.

# Exercise 8:

## Fast and slow writing

### Aim of exercise

The children should learn what slow and fast movements feel like and how these influence their writing.

### Materials

- Samples of letters/words
- Sheets of unlined paper

There is always a compromise between accuracy and writing speed when learning to write. The more precisely a letter is to be copied, the slower it is written or drawn. In this exercise children get to know various writing speeds at an early stage of learning to write and observe the effects of this on their handwriting.

The children are provided with large sheets of paper, which they are allowed to write on in a size they find comfortable. However, it should not be smaller than normal writing. The exercise is interactive – children are asked about their experience and should tell each other about it.

### Copying

At first, children should copy as accurately as possible. A writing template with letters or a simple word to be copied as accurately as possible is placed next to the paper. Both the template and the paper are then turned over. Children then write the letters or word again from memory. Writing from memory may be difficult for the children at first, yet it promotes motor writing. Children have to think and plan their movements more than when copying shapes. Many children will be able to write from memory faster if they are already mastered what is to be written. The children should discuss which differences they felt, which conditions they preferred and what effect these had on what was written.

### Different speeds

The teacher now presents another word. They also state the approximate speed or precision, for example: fast, precise, slightly slower, very fast, very slow. The children should then report back on how fast they were able to write legibly, or how much longer they needed to write legibly.



It's also important that children find out which speed is best suited to them – in other words, where they can still write using flowing and fast movements, yet still sufficiently control the form of their writing.

# Exercise 9: Writing rhythm

## Aim of exercise

Encouraging rhythm in writing movements.

## Materials

- Writing rhythm exercise sheet

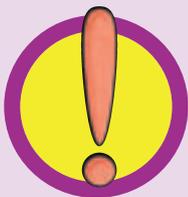


A regular writing rhythm is a typical characteristic of joined-up writing and leads to efficient, sustained and attractively-formed writing. A good writing rhythm not only makes movements easier to perform, but also structures the writing process. Many children lack a basic writing rhythm, their writing is not structured enough and they constantly stop at various points within individual letters. This not only leads to jerky writing with problems in forming the letters, but also to repeated mistakes in spelling. Instead of concentrating on spelling correctly, the child struggles with their handwriting.

The typical writing rhythm of adult writers is 5Hz, in other words 5 up and down strokes per second. When starting school, children can achieve 3Hz when moving their wrist to create simple hatching movements. However, when writing letters the frequency drops to 0.3Hz – extremely low. This is also due to excessive emphasis on precise copying of letters. Children are able to write at least simple letters considerably faster without the writing becoming illegible. As many children later fail to inject more rhythm into their writing, which until then has been highly form-oriented, writing rhythm should be practised as early as possible and used and expanded upon according to existing skills.

## Rhythm exercise

This exercise attempts to transfer the flowing rhythm of simple shapes to various complex letters. At first children repeatedly draw two to three overlapping loops using brisk movements on exercise sheet 9 on the left. This is practised in various sizes until the loops are written flowingly. Without a long pause, one or, later, more letters or even numbers are written on the right in the grid using the same rhythm and speed. Size does not have to be maintained precisely at this stage. However, depending on the grid point selected, the writing will fill a large or small box. The teacher sets the respective task, orienting this to the children's level of proficiency. Instructions should be given quickly, to encourage the children to write quickly. Start with simple letters. A possible order could be: loop – "o", loop – "e", loop – "l", loop – "el", loop – "c", loop – "h", loop "ch", etc.



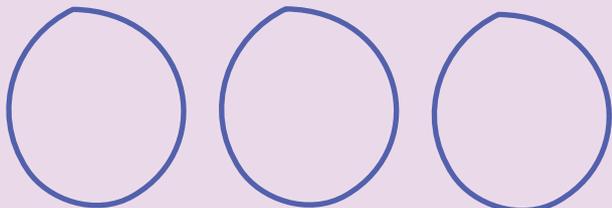
In this exercise, hand dexterity and a good pen hold should be observed. Don't forget to include breaks for relaxation every now and then! At the end of the exercise an appropriate rhythm can be used to attempt to write whole words.

In order to illustrate the rhythm, children can hum or speak along while drawing loops. Some children also find it helpful to form loops or write in time to music. If the rhythm is insufficient even when drawing loops, these children should repeat exercises one to four.

## Exercise sheet – writing rhythm



### 1. Area for loops.



### 2. Areas for filling in.

			4		
		o			
				e	
			a		
~					