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Short term memory and working memory in blind versus sighted children

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ABSTRACT

There is evidence that blind people may strengthen their memory skills to compensate for absence of vision. However, which aspects of memory are involved is open to debate and a developmental perspective is generally lacking. In the present study, we compared the short term memory (STM) and working memory (WM) of 10-year-old blind children and sighted children. STM was measured using digit span forward, name learning, and word span tasks; WM was measured using listening span and digit span backward tasks. The blind children outperformed their sighted peers on both STM and WM tasks. The enhanced capacity of the blind children on digit span and other STM tasks confirms the results of earlier research; the significantly better performance of the blind children relative to their sighted peers on verbal WM tasks is a new interesting finding. Task characteristics, including the verbal nature of the WM tasks and strategies used to perform these tasks, are discussed.

1. Introduction

The touch, memory, and attention skills of blind people have been found to compensate for the absence of vision (Cattaneo & Vecchi, 2011; Warren, 1978). In recent studies, the short term memory (STM) performance of blind persons on verbal tasks was found to be superior to that of sighted people on the same verbal tasks (Hull & Mason, 1995; Pring, 2008; Raz, Striem, Pundak, Orlov, & Zohary, 2007; Röder & Rösler, 2003; Swanson & Luxenberg, 2009; Warren, 1994). The research findings for working memory (WM) are inconclusive, with most researchers finding no differences between blind and sighted people (Cornoldi & Vecchi, 2000; Rokem & Ahissar, 2009; Swanson & Luxenberg, 2009). Very few studies have been conducted with children, and only one study has compared STM and WM task performance (Swanson & Luxenberg, 2009). Therefore in the present study the scope was on difference in STM and WM performances of blind versus sighted children.

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1.1. Distinction between working memory and short term memory

The distinction between WM and STM can be viewed as gradual. WM has been described as an active system for holding and manipulating information over brief periods of time during the course of ongoing cognitive activities. STM is a more passive system in which information can be stored for a very brief period of time. Working memory (WM) is considered to be an active process that holds ongoing information, whereas the STM is a passive short term store. The WM makes more demands on the central executive system – the system that controls attention – than STM. Research has consistently demonstrated significant relationships between WM and cognitive abilities, such as reading comprehension (Daneman & Carpenter, 1980, 1983), reasoning (Kyllonen & Christal, 1990) and general intelligence (Daneman & Tardif, 1987).

According to the multicomponent model of Working Memory developed by Baddeley and Hitch (1974) and Baddeley (1986, 2003a, 2003b), WM can be divided into three subsystems: the phonological loop that allows for the temporary storage of verbal and acoustic information, the visuospatial sketchpad that allows for the storage of visual-spatial information for a short period, and the central executive system that is attention driven with limited control in direct contact with the phonological loop and visuospatial sketchpad and also responsible for coordinating activity. More recently, Baddeley (2000, 2003a, 2003b) introduced a fourth subsystem, namely the "the episodic buffer" which is a limited capacity system that depends heavily on the executive processing, but which differs from the central executive system in being primarily concerned with the storage of information rather than with attentional control. The episodic buffer binds information from different sources together into chunks of episodes. In this multicomponent model, there is a distinction between the central executive system and the specific storage systems (phonological loop and visuospatial sketchpad). Within Baddeley's model, STM is separate from long term memory (LTM) and characterized – as already stated – by information being stored for only seconds (i.e. temporal decay) and a limit on the number of chunks of information that can be stored (Baddeley, 2000; Baddeley & Logie, 1999). STM differs from WM in that WM allows not only the short term storage of information but also the simultaneous manipulation of the information being stored and other information to support a cognitive activity.

In research with adults, it has been found that WM tasks make more demands on the central executive or controlled attention component than STM tasks do (Engle, Tuholski, Laughlin, & Conway, 1999). According to these authors, STM and WM should therefore be thought of as distinct but highly interrelated systems. In studies with children different results are sometimes found. Hutton and Towse (2001), for example, have argued that the distinction between STM and WM tasks in adults may not be valid for children. They suggested that task characteristics and problem-solving strategies may determine whether a task measures STM or WM. They also call for a more complete description of the range of retention strategies and task characteristics in order to better understand the relations between memory tasks. Camos and Barrouillet (2011) studied the developmental shift in children from the passive maintenance to the active refreshing strategy in working memory. They found that cognitive activities in young children (aged 6 and 7 years) are directly mapped onto the structure of the working memory span tasks presented to them. Older children develop an increased capacity to control attention and they are allowed to deviate attention during the processing periods. So the performance on working memory tasks steadily improves during childhood, which might be explained by changes in strategy.

1.2. STM and WM in blind versus sighted adults

The memory performance of adult blind people has been investigated in several studies and their STM has been found to be superior to that of sighted people (Pring, Freestone, & Katon, 1990; Raz et al., 2007; Röder & Rösler, 2003). Raz et al. (2007) suggested that blind people possess a superior memory for serial information in particular. In their study, blind people outperformed sighted people on a word recall task and the advantage of the blind over the sighted was even larger for the recall of longer sequences of words. In an fMRI study, Amedi, Raz, Pianka, Malach, and Zohary (2003) found superior verbal memory performance for blind adults compared to sighted adults. The verbal memory task consisted of a pair association recall test, which involved recalling details of a story just heard, and a digit-span task. When Rokem and Ahissar (2009) compared congenitally blind individuals to matched sighted individuals, they found the blind to outperform the sighted on two STM tasks, namely a standard digit-span task and a task requiring respondents to repeat sequences of pseudowords.

The aforementioned studies all involved STM tasks and showed blind people to perform better than sighted people. However, on more complex tasks involving WM, the findings are less consistent. In a task in which participants listened to a series of tones and were then asked to decide if the first and last tones were the same or not, Wan, Wood, Reutens, and Wilson (2010) found no differences in the performances of blind versus sighted individuals. Rokem and Ahissar (2009) found blind participants to outperform sighted participants on two STM tasks, but overlapping STM spans when noise was added to the tasks. Stevens and Weaver (2005) found early blind participants to indeed perform significantly better on an auditory backward masking task than sighted participants. The task involved discriminating between two stimuli, with a backward mask presented at various delays after the second stimulus. The results showed the early blind participants to require less time to form a stable representation of the stimulus. According to Cattaneo and Vecchi (2011), this finding can be interpreted as an indication of enhanced auditory WM capacity in individuals who are blind from birth.

1.3. STM and WM in blind versus sighted children

Previously mentioned studies concerned blind adults. Only a few studies have examined the memory performance of blind children. The results of the scarce literature point in the same direction as those for adults: blind children outperform sighted children on STM tasks. When Smits and Mommers (1976) compared blind versus sighted children on a digit span task, they found better performance for the blind. Hull and Mason (1995) assessed a large group of blind children ($n = 314$) using a digit span test that allowed comparison to the standardized WISC-R values obtained for sighted children. The blind children had – at best – light perception and performed significantly better than the sighted children. The group of late blind children with more than just light perception did not perform significantly better than the sighted children. When Dekker (1993) compared children with and without usable vision on different tasks, she found the blind children to outperform the children with usable vision on not only verbal memory tests but also on school achievement tests requiring writing accuracy and technical reading. In still other research, Pring (2008) and Pring and Goddard (2003) followed the performance of blind versus sighted children and adults on several STM tasks across a period of 20 years and found superior memory performance for the blind participants. And most recently, Swanson and Luxenberg (2009) showed blind children (mean age: 11.5 years) to outperform sighted children on STM tasks but not on WM tasks. According to the authors of this study, the blind children perform better than sighted children on tasks that involve the phonological loop but not on tasks that involve the executive system.

1.4. The present study

Research suggests superior performance of blind children and adults on STM tasks but not WM tasks when compared to sighted children and adults. However, the classification of the tasks used in much of this research as STM or WM tasks can be disputed in terms of current theory regarding human memory. In the present study, we therefore adopted Baddeley's detailed theoretical framework to compare the performances of blind versus sighted children on STM versus WM tasks. For STM, we used learning names, digit span forward, and a word span task; for WM, we used a digit span backwards and listening span task. We asked ourselves the following questions:

1. How do the STM and WM abilities of blind versus sighted children differ?
2. To what extent do the STM and WM abilities relate *within* the two groups of children?

2. Methods

2.1. Participants

Both congenitally blind children without residual vision in regular schools in the Netherlands or Flanders and sighted classmates participated in the present study. The blind children all read Braille, had Dutch as their native language, and were in mainstream education. The control group consisted of sighted classmates of the blind children with the same educational level as determined by their teacher on the basis of their reading, writing, and arithmetic performance.

The selection of children was based on annual achievement scores. Children were only included when their intelligence score was within the normal range. The blind children were tested using the Blind children Learning Aptitude Test (BLAT) (Mason, 1991; Newland, 1969). The BLAT is a culturally independent test for visually impaired children and can be used for different purposes, including screening and the prediction of academic skills. The test–retest reliability of the BLAT is $r = .87$. The sighted children were tested using the RAVEN Standard Progressive Matrices (Raven SPM) (Raven, 2006). The internal consistency of this test of intelligence is $\alpha = .90$. Correlations with other western general cognitive capacity tests are in the range of .70 to .80. Like the BLAT, the Raven SPM is culture free. The group of congenitally blind children ($n = 14$; 7 boys, 7 girls) had a mean age of 10.71 years (SD = 2.01). One sighted classmate was not available for testing due to illness. The remaining sighted children ($n = 13$; 7 boys, 6 girls) had a mean age of 10.08 years (SD = 1.55). The age of the groups did not differ significantly, $t = .92$, df = 25, $p = .369$.

2.2. STM and WM measures

To the extent that this was possible, tasks that were used in previous studies to measure the STM and WM of children were used in the present study. If the task was not available in Dutch or not suited for the age range in our study, a comparable task was sought.

2.2.1. Short term memory

Digit Span Forward (subtest of the WISC III intelligence test; Wechsler, 2005). In this task, the children are dictated sequences of digits, which they must then repeat in the same order. The first sequence begins with two digits; the sequences then increase one digit at a time, with two trials for each number of digits. Testing stops when the participant fails on both trials for a particular number of digits. All correctly repeated sequences are counted to determine the raw score. This test is a classic STM task (see Swanson & Luxenberg, 2009).

15 Words Test for Children (Kingma & van der Burg, 1999). In this task, the experimenter reads 15 words aloud. There are no logical connections between the words. The respondent must then recall and repeat the words that they remember. This procedure is repeated four times using the same words in the same order. The raw score is the number of words recalled correctly across a series of five. More information about the content of this test can be found in Appendix A.

Learning Names (subtest of the Intelligence Test for Visually Impaired Children, ITVIC; Dekker, 1993). The sighted children in our study were blindfolded for this task. The experimenter presents 14 abstract objects and labels them with boys' names or animal names, which the children are asked to learn. After presentation and labeling by the experimenter, the children are again presented the 14 objects in two series (2×14 objects) and asked to name the objects after touching them. When the child fails to give the correct name for an object during the presentation of the first series, the experimenter provides the correct name. No correction is given during the presentation of the objects in the second series. The child's raw score is the number of correct answers. A photo of the objects together with their names can be found in Appendix B.

2.2.2. *Working memory*

The WM tasks in our study were chosen using the same requirements as Swanson and Luxenberg (2009) used. In all cases, the participants had to remember increasingly more complex information (e.g. increasingly longer lists of numbers, tasks containing both a memory and processing element) in WM, and had to retrieve information by answering questions about this stored information. The number of correctly remembered items is a direct measure of WM span during the processing of other information (see also Daneman & Carpenter, 1980).

Listening Span Task. This task is based on the listening span task as originally designed by Daneman and Carpenter (1980) and adapted for Dutch by van der Sluis, van der Leij, and de Jong (2005). The experimenter reads sentences that can be either true or false out loud; for instance, "Fishes bike in the sea." After hearing two sentences, the participant is asked to repeat the last word of both sentences and tell the experimenter whether the sentences are true or false. The number of sentences increases from two to five sentences, with three sets of sentences presented for each level of difficulty. When the participant is unable to recall the last words for two tests with the same level of difficulty in the right order, testing is terminated. The child's raw score is the number of correct answers. The sentences used in this test can be found in Appendix C.

Digit Span Backward (subtest of the WISC III intelligence test; Wechsler, 2005). Participants are dictated a series of digits, which they then have to repeat in reverse order. The sequences begin with two digits and increase one digit at a time, with two trials for each number of digits. Testing is terminated when the participant fails both trials for a particular number of digits. The number of sequences correctly repeated in reverse order is the child's raw score. St Clair-Thompson (2010) has reported this test to be a WM test for children but a STM test for adults. Given that we were studying children, we considered the test a WM test (see also Swanson & Luxenberg, 2009).

2.3. *Procedure*

All of the children were tested individually in either their home or a quiet room at their school. The total assessment took about 90 min. The order of task administration was the same for all participants: 15 Words Test, Intelligence Test (BLAT/RAVEN), Digit Span Forwards, Digit Span Backwards, Listening Task, and Learning Names.

2.4. *Data analysis*

For all of the memory tasks, composite scores were calculated by transforming the raw scores into *z*-scores and averaging the scores for the separate subtests. The composite score for STM was composed of the Digit Span Forward task, 15 word test, and Learning Names task scores. The composite score for WM was composed of the Digit Span Backwards task and Listening Task scores.

Significant group differences were tested for using t-tests and repeated measures ANOVAs. To compute the relations between the WM and STM abilities of the two groups, partial correlations were computed with age partialled out.

2.5. *Reliability of testing*

Reliability was determined by calculating the Cronbach alpha's coefficient for the internal consistency of the composite scores. The internal consistency for all of the subtests was $\alpha = .87$; for the STM Composite score $\alpha = .80$; and for the WM Composite score $\alpha = .60$. Note that coefficient alpha for the WM Composite score was calculated for only two subtests.

3. Results

The scores for the different subtests, the STM Composite scores, and the WM Composite scores are shown in Table 1. A 2×2 repeated measures ANOVA was carried out with visual status (Sighted, Blind) as a between-subject factors and type of task (STM, WM) as a within-subject factor. The data showed no significant effect of type of task. However, there was a main effect of visual status, $F(1,25) = 26.733$, $p < 001$, $\eta_p^2 = .517$. Compared to the sighted children, the blind children performed significantly better on both STM tasks, $F(1,25) = 35.04$, $p < 001$, $\eta_p^2 = .584$, and WM tasks, $F(1,25) = 15.976$, $p = .001$, $\eta_p^2 = .387$. All separate *t*-tests confirmed the significant differences between groups (see Table 1).

Table 1
Means and Standard Deviations for tests of STM and WM in blind versus sighted children.

Tasks	Blind (*n* = 14)		Sighted (*n* = 13)		*t* (df = 25)	*p*
	M	SD	M	SD		
Memory						
Digit Span Forward	10.71	1.98	8.92	1.66	2.54	.018
15 Words	58.79	8.03	42.77	6.88	5.544	<.001
Learning Names	23.07	3.50	14.54	4.50	5.524	<.001
STM Composite	.61	.48	-.66	.63	5.919	<.001
Digit Span Backwards	6.71	2.27	4.46	1.33	3.116	.005
Listening Task	6.00	1.52	4.23	1.48	3.061	.005
WM Composite	.50	.73	-.54	.60	3.974	.001

When age and visual status were both controlled for and the partial correlation between the WM Composite scores and STM Composite scores was calculated, a significant correlation was found ($r = .76$, $p < .001$). When only age was controlled for, significant partial correlations between the WM Composite scores and STM Composite scores were again found for both groups of children: blind children $r = .77$, $p = .002$; sighted children $r = .78$, $p = .003$.

Whether or not IQ related to memory performance was checked by correlating the children's IQ scores with their memory scores. Given that different IQ measures were used for the blind versus sighted groups of children, these analyses were conducted separately for each group. No significant correlations between IQ and memory performance were found.

4. Discussion and conclusions

The present study investigated the performance of blind versus sighted children on various STM and WM tasks. We found significantly better performance for the blind children relative to the sighted children on all memory tasks, both STM and WM. This finding is in line with those of Raz et al. (2007) who suggested that visually impaired individuals have superior memory abilities because they have trained themselves serial strategies to compensate for the absence of visual information. This superior ability is further thought to be the result of actual brain reorganization in blind people, whose brains become more adapted to spatial, sequential, and verbal information (Cornoldi & Vecchi, 2000). Although the participants in our study were children, the reorganization of their brains may already have taken place – at least in part. Lacking sight, blind children must develop serial strategies to identify objects in the environment and remember this information along with route information (Millar, 1994). According to Raz et al. (2007), blind people exercise their memories more often than sighted people. This hypothesis is confirmed by the results of other studies showing superior STM and LTM skills in blind adults relative to sighted adults (e.g. Röder & Neville, 2003; Röder & Rösler, 2004). This superiority is already visible in blind children around the age of 11 years.

That blind children outperform sighted children on STM tasks and especially verbal tasks confirms the results of earlier studies (Hull & Mason, 1995; Pring, 2008; Swanson & Luxenberg, 2009). New in our study is the finding that blind children also outperform sighted children on WM tasks. The fact that the blind children outperformed the sighted children on both STM and WM tasks in the current study but not in previous studies could relate to the type of memory tasks used. Particularly WM tasks can vary with regard to whether they measure only auditory–verbal capacities or also spatial–tactile capacities. Verbal memory abilities and strategies seem to improve particularly in the absence of sight. According to Hötting and Röder (2004) and Hötting, Rösler, and Röder (2004) reduced multimodal input in blind individuals can *enhance* their processing of unimodal input. In the present study, only verbal tasks were used to measure WM, which might explain the better performance of the blind children relative to the sighted children. Blind children may further benefit from the fact that verbal input is by definition sequential. In the absence of vision in individuals who are blind, there is a considerable dependence on auditory–verbal information and the sequential processing of information may be particularly well-developed. In addition to this, the main sensory channel for blind people to obtain information is touch. When blind individuals explore objects that cannot be held in two hands, they typically gather information about the object via successive exploratory movements (Hatwell, 2003; Révesz, 1950). The tactual processing and encoding of information is thus sequential by definition while visual processing is simultaneous. A training effect of learning to read Braille instead of print may also enhance the processing of sequential information among the blind. Understanding Braille requires the sequential encoding of input (Millar, 1997a, 1997b). The graphemic information encoded by Braille letters comes to the reader character by character, and the reading of Braille is known to be much slower on average than the reading of print letters.

The classification of a task as a measure of STM or WM is often ambiguous at best, which may explain conflicting results from the past. In the present study, for example, the subtest Digit Span Backwards was considered a WM task. Swanson and Luxenberg (2009) combined digit span forward and digit span backward to form a STM task in their first experiment but considered digit span backward a measure of WM in their second experiment. It is also not just the task itself but also the way in which the actual task is solved which determines whether a task should be considered a measure of STM or WM.

St Clair-Thompson (2010) showed that in children digit span backward should be considered a measure of WM because in children – but not in adults – the central executive system is also involved in the performance of this type of task. More specifically, the transposition of order calls for the involvement of executive attentional control and processing of information. Ideally, in future studies, other types of WM tasks should be used but obviously in separate testing sessions in order to avoid fatigue.

According to Engle et al. (1999), STM and WM can be expected to be highly intercorrelated in verbal tasks. This was confirmed by the present results, which showed significant and high correlations between the composite STM and WM scores for both the blind and sighted children. As already mentioned, this might be due to the specific type of WM task, which measured predominantly sequential verbal abilities. A possible next research step is therefore to study the strategies used spontaneously by blind versus sighted children on memory tasks. Neither in the current study nor in previous studies of the memory performance of blind versus sighted respondents were their strategies for remembering studied explicitly. Information on the strategies adopted can provide insight into the pathways blind and sighted children use to solve the tasks.

An unresolved question is whether blind children are also better in memory tasks when the incoming information is not unimodal and therefore calls upon both auditory and spatial capacities. According to Raz et al. (2007), blind people train their memories as part of recognizing objects. The Learning Names subtest in the current study indeed showed this to be the case: The blind children outperformed the sighted children on this task. In addition to having enhanced verbal memory capacities, blind people may also have enhanced tactile-spatial capacities that they use for object exploration. Recently, cross-modal research compared the storage of tactual-spatial and visual-spatial input and the possibility of blind people to have visual imagery (e.g. Cattaneo & Vecchi, 2011; Ohara, Lenz, & Zhou, 2006; Ricciardi et al., 2006). Findings suggested cross-modal connections for other sensory input where visual input is normally stored. These apparent predispositions for the processing of information may nevertheless depend upon the type of task. In an earlier study in which we performed tactual experiments with the same group of blind and sighted children as in the present study but also with blind and sighted adults (Withagen, Kappers, Vervloed, Knoors, & Verhoeven, 2012), the visual status of the participants did not affect the accuracy of their performance. However, age played a significant role, to the advantage of the adults who performed better than the children, irrespective of whether they were blind or sighted. Which specific WM tasks are performed better by blind as opposed to sighted children should be determined in future research in addition to whether the phonological loop or verbal abilities are always involved in the performance of these tasks or not.

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Appendix A

15 Words Test.

In Dutch	In English
1. gordijn	1. curtain
2. vogel	2. bird
3. potlood	3. pencil
4. bril	4. glasses
5. winkel	5. shop
6. spons	6. sponge
7. rivier	7. river
8. kleur	8. color
9. fluit	9. flute
10. plant	10. plant
11. koffie	11. coffee
12. stoel	12. chair
13. trommel	13. drum
14. schoen	14. shoe
15. lucht	15. air

Appendix B

Learning Names

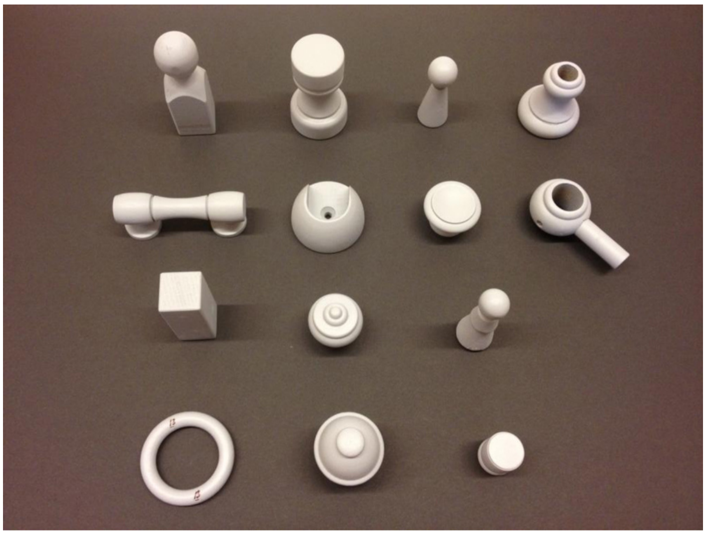

Photo of the objects used in the Learning Names subtest of the ITVIC

Photo of the objects used in the Learning Names subtest of the ITVIC.

In Dutch	In English (we have not translated the boys' names)
1. Piet	1. Piet
2. konijn	2. rabbit
3. Klaas	3. Klaas
4. Frank	4. Frank
5. vlieg	5. fly
6. vlinder	6. butterfly
7. Kees	7. Kees
8. Ton	8. Ton
9. hond	9. dog
10. mug	10. mosquito
11. poes	11. puss
12. Jan	12. Jan
13. vogel	13. bird
14. Hans	14. Hans

Appendix C

Listening Span Task

In Dutch:

Oefenopgave 1A
Een kleine kip heet een kuiken

Oefenopgave 1B
Vogels vliegen in de zee

Oefenopgave 1C
Melk is wit, een banaan is rood

Als je moe bent ga je naar bed

2A
De kleur van gras is geel
Rekenen en lezen leer je op school

2B
Bij voetbal schop je tegen een bal
Lopen gaat langzaam, rennen gaat snel

2C
Als je ziek bent ga je naar bed
In de lente vallen de blaadjes van de boom

3A
Koeien slapen in de stal
Na zeven komt acht en na negen komt vier
Een appel is groen, een citroen is rood

3B
Overdag schijnt de maan
De olifant is een groot dier
Een mus is een vogel

3C
Poezen drinken graag melk
In de winter is het warm
Slapen doe je in een bed

4A
Soep eet je met een vork
Met een boot vaar je op zee
Vlechten draag je in je haar
Water is nat, ijs is warm

4B
Aardbeien zijn rood, sneeuw is wit
Iemand die rijk is heeft veel geld
Vissen fietsen in de zee
Mensen hebben twee oren en een mond

4C
Een blokje is vierkant, een bal is rond
De zoon van een koning heet een prins

Een koe legt een ei
Een tomaat is wit, sla is groen

5A
We eten met mes en vork
Stenen zijn hard
In de winter schaats je op de straat
Een man is groot, een kind is klein
Het klein paard heet een kalf

5B
Een slak is langzaam, een haas is snel
Ik heb vijf tenen aan mijn voet
In de zomer draag je een muts
Kijken doe je met je mond
Knippen doe je met een vork

5C
Het kleine koe heet een kalf
De aarde is zwart, de lucht is geel
Een appel is een dier
Ik heb vijf vingers aan mijn hand
Vliegen doe je in een boot

In English:

Exercise question 1A
A little chicken is called a chick

Exercise question 1B
Birds fly in the sea

Exercise question 1C
Milk is white, a banana is red
If you are tired, you go to bed

2A
The color of grass is yellow
You learn to read and count at school

2B
In soccer, you kick a ball
Walking goes slow, running goes fast

2C
If you're sick, you go to bed

In the spring, the leaves fall from the trees

3A

Cows sleep in the barn
After seven comes eight and after nine comes four
An apple is green, a lemon is red

3B

During the day, the moon shines
An elephant is a big animal
A sparrow is a bird

3C

Cats like to drink milk
In the winter, it is warm
You sleep in a bed

4A

You eat soup with a fork
You sail with a boat in sea
You wear braids in your hair
Water is wet, ice is warm

4B

Strawberries are red, snow is white
Someone who is rich has a lot of money
Fishes bike in the sea
People have two ears and a mouth

4C

A block is square, a ball is round
The son of a king is called a prince
A cow lays an egg
A tomato is white, lettuce is green

5A

We eat with a knife and fork
Stones are hard
During the winter, you skate on the street
A man is big, a child is little
A little horse is called a calf

5B

A snail is slow, a hare is quick

I have five toes on my foot
During the summer, you wear a hat
You look with your mouth
You cut with a fork

5C

A little cow is called a calf
The earth is black, the air is yellow
An apple is an animal
I have five fingers on my hand
You fly in a boat

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