HASOMED

RehaCom®

Cognitive therapy

Screening:
Working Memory

HASOMED

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RehaCom®

Cognitive therapy

by Hasomed GmbH

This manual contains information about using the RehaCom therapy system.

Our therapy system RehaCom delivers tested methodologies and procedures to train brain performance.
RehaCom helps patients after stroke or brain trauma with the improvement on such important abilities like memory, attention, concentration, planning, etc.

Since 1986 we develop the therapy system progressive. It is our aim to give you a tool which supports your work by technical competence and simple handling, to support you at clinic and practice.

User assistance information:

Please find help on RehaCom website of your country. In case of any questions contact us via e-mail or phone (see contact information below).

Dear user,
please read the entire instruction manual before trying to operate RehaCom.
It's unsafe to start using RehaCom without reading this manual.
This manual includes lots of advice, supporting information and hints in order to reach
the best therapy results for the patients.

Table of contents

1   Applications

Basic information on the data analysis of screening results is available in the RehaCom manual, Chapter "Screening and Diagnostics".

In the Working Memory screening module, visual-spatial memory span and visual-spatial memory functions are measured.

The task is also used to test the implicit visual-spatial learning and the working memory.

This screening module has applications in experimental psychology, neuropsychology, rehabilitation, psychiatry, pharmacopsychology and industrial psychology.
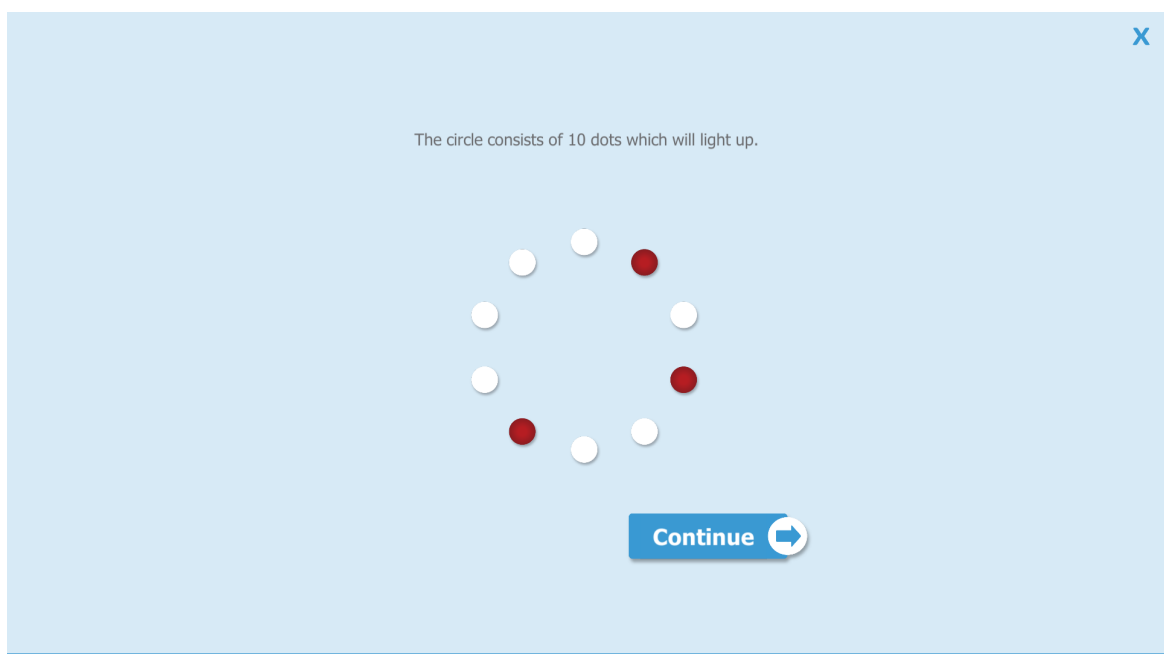

Fig. 1: Working Memory screening, instruction phase

The screening is similar to the classic Corsi-Block-Tapping.

2   Target group

A brain injury often leads to disorders of memory function. This has far-reaching consequences for the lives of patients and their relatives.

Depending on the location and extent of damage, the range of changes in a patient's performance varies from relatively minimal losses that are partly difficult to operationalize, to serious disorders that make coping with everyday life independently impossible.

Memory deficits are usually particularly stressful and, compared to limitations of motor skills, are more likely to lower self-esteem. After attention deficit disorders, memory disorders are the most common consequences of brain damage. On more than 60 percent of all patients, significant mnestic abnormalities could be noticed (Prosiegel, 1988).

Short-term and working memory

Short-term memory refers to a storage area which holds information for seconds, with limited capacity for newly recorded or just mentally "used" information. Up to about seven units of information can be temporarily stored here for a few seconds. Through repetition (rehearsal), the information may be stored in short-term memory for longer. All complex and longer lasting memory performance are associated with long-term memory, which has no limitation as to its duration and memory capacity.

The working memory model of Baddeley and Hitch (1974; Baddeley, 1997) postulated several short-term memory systems, controlled or coordinated by a higher authority ("central executive"). The memory systems are distinguished according to the stored contents: The "phonological loop" is used to store verbal information, and the "visuospatial sketchpad" stores visual-spatial information.

Diagnosis of short-term / working memory

This screening test is used for testing simple memory span (simple information holding) and simultaneously checks the retention and processing of visual-spatial information.

Similar to the Corsi-block-tapping, the visual-spatial memory span is measured by the maximum length of the memorized dot patterns that can be reproduced immediately without errors.

Source: Schellig, D.; Drechsler, R.; Heinemann, D.; & Sturm, W. (2009). *Handbuch neuropsychologischer Testverfahren* [Handbook of neuropsychological test methods]. Göttingen: Hogrefe.

3 Structure

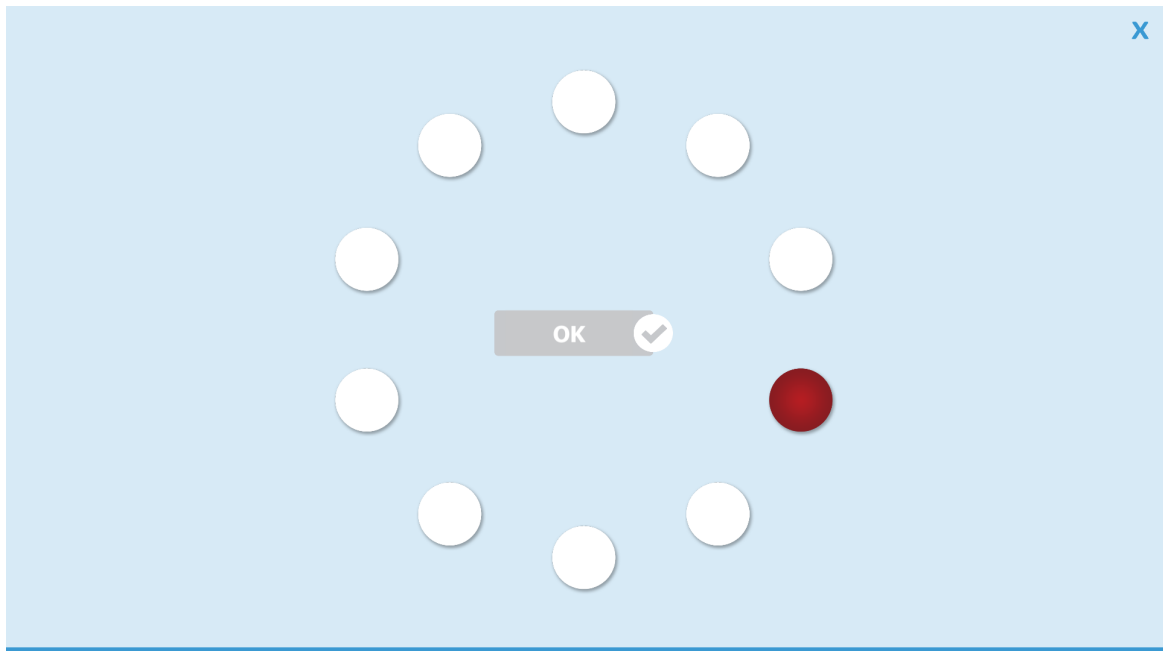Ten dots are presented in a circular arrangement.

Fig. 2: Circular arrangement of dots, colored dots light up in the sequence to be memorized

Individual dots sequentially turn red and fade. The first sequence consists of two random dots out of the 10 lighting up in a particular order. After the sequence is presented, the patient must select the same dots in the same order as they were presented. Each sequence is new, meaning sequences do not repeat the previous sequence. If the patient selects a sequence of dots correctly, the number of dots increases in the next sequence.

The task is to register and memorize the presented sequence of dots lighting up. The patient should try to memorize the sequence and position of the red dots and to reproduce them.

The program is adaptive, adjusting the difficulty according to the performance of the client. If the patient makes a mistake, the degree of difficulty is reduced.

The screening ends after the patient incorrectly reproduces two consecutive sequences or after 7 minutes.

4   Implementation and Duration

The screening starts with an exercise, in which a sequence of two dots has to be reproduced correctly.
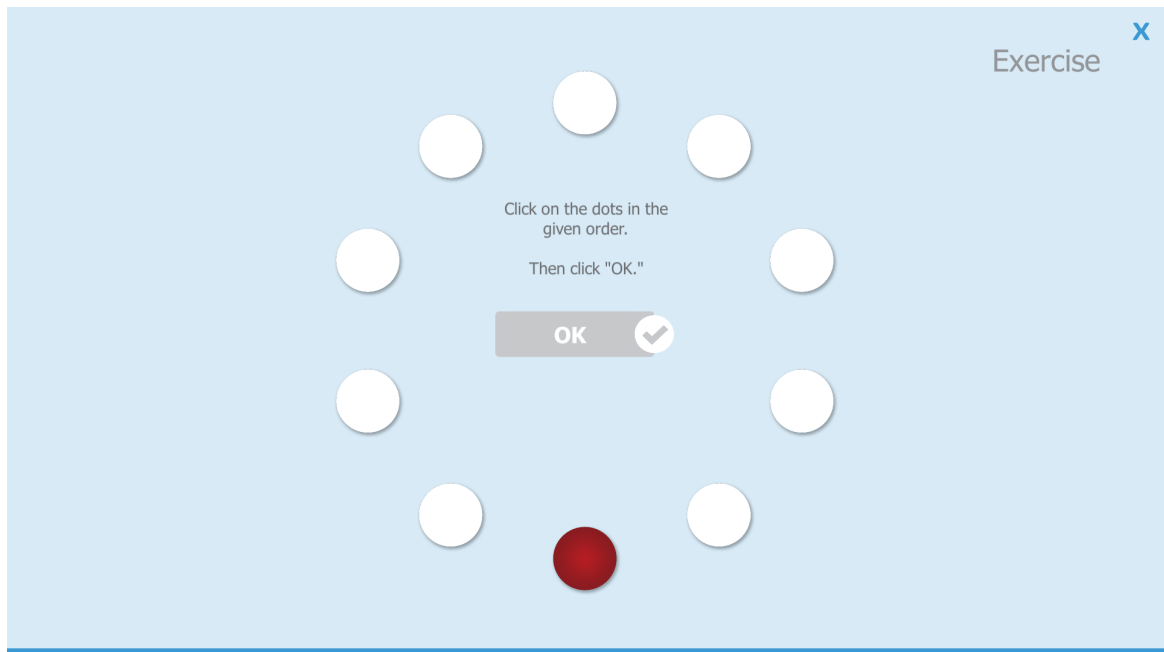

Fig. 3: Practice screen

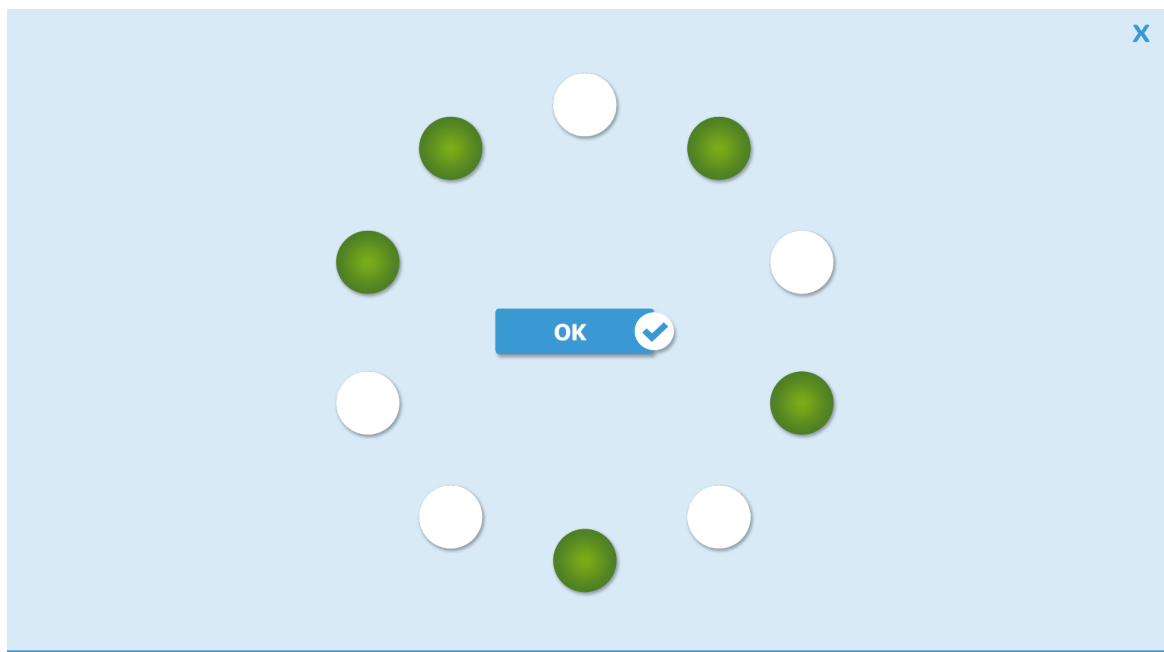After the exercise is completed, the test starts.

Fig. 4: During the screening

The patient has to memorize and reproduce the position and sequence of the colored flashing dots.

The first sequence includes two dots lighting up, and while the patient reproduces the sequences correctly, the number of the dots that light up increases. The sequence is extended whenever two consecutive sequences of the same length were reproduced without a mistake. When a mistake occurs, fewer dots are presented, i.e. the sequence length decreases.

When two consecutive sequences are reproduced incorrectly, the screening ends.

If the patient works on the task continually without incorrectly reproducing two consecutive sequences, the screening ends after 7 minutes.

Duration

 2–7 min.

5 Data analysis

Basic information on the data analysis of screening results is available in the RehaCom manual, chapter "Screening results".

In the Working Memory screening module, one Z-value is calculated.

Z-value: Memory span

The patient's memory span is based on the highest sequence length measured in number of dots, reproduced without mistakes in position and order. The memory span must be confirmed by completing two consecutive sequences with the same number of dots.

Details

Detailed information on the results of the screening can be displayed via the "Details" button. On the right side of the Details display, all conducted screenings for Working Memory are listed by date. Results marked with an asterisk (*) indicate that the particular screening was canceled. In this case, the evaluation is incomplete (i.e., no Z-values are displayed).

The detailed analysis allows the presentation of a maximum of three results at the same time. The first and the last fully completed screening is preselected; however you can change the selection by clicking the checkbox next to the date of the results you want to see. The display in the performance diagram and the table changes accordingly. The background color of each row of results corresponds to the line color in the diagram.

In the table, a row of results is assigned for every date selected on the right side. The columns have the following meaning:

Date:	Date of the screening
Memory span:	Highest sequence length measured in number of dots, reproduced without mistakes in position and order.
Max. level:	Max. level reached (Memory span - 1)
Correct:	No. of correct reproduced dot patterns (of any length) all together
Mistakes Order:	Sum of sequences with all correct dots, but marked in the wrong order
Mistakes Position:	Sum of sequences with incorrect dots marked
Z-Value Memory	Calculated Z-value for memory span

Span:

The percentile rank is presented after the Z-value in parentheses. The given value is an approximation based on the Gaussian normal distribution.

The performance graph shows the number of correctly reproduced sequences per memory span. Characteristic is a distinct performance peak in a closed memory span (in Fig. 5: memory span 5).

In the example, a dot pattern of 5 consecutive points could be correctly reproduced 10 times, a pattern of 6 dots 5 times, and a pattern of 4 dots 2 times.

Patient Test B-Day.: 8/2/1957

HASOMED
RehaCom® **Working Memory**

	Date	Memory Span	Max. Level	Correct	Mistakes Order	Mistakes Position	Z Value Memory Span
	6/8/2016	7	6	24	3	7	3.49 (99.9%)

Norm Memory Span (Average value: 3.2; Standard deviation: 0.8) - Max. num. dots errorless reproduction
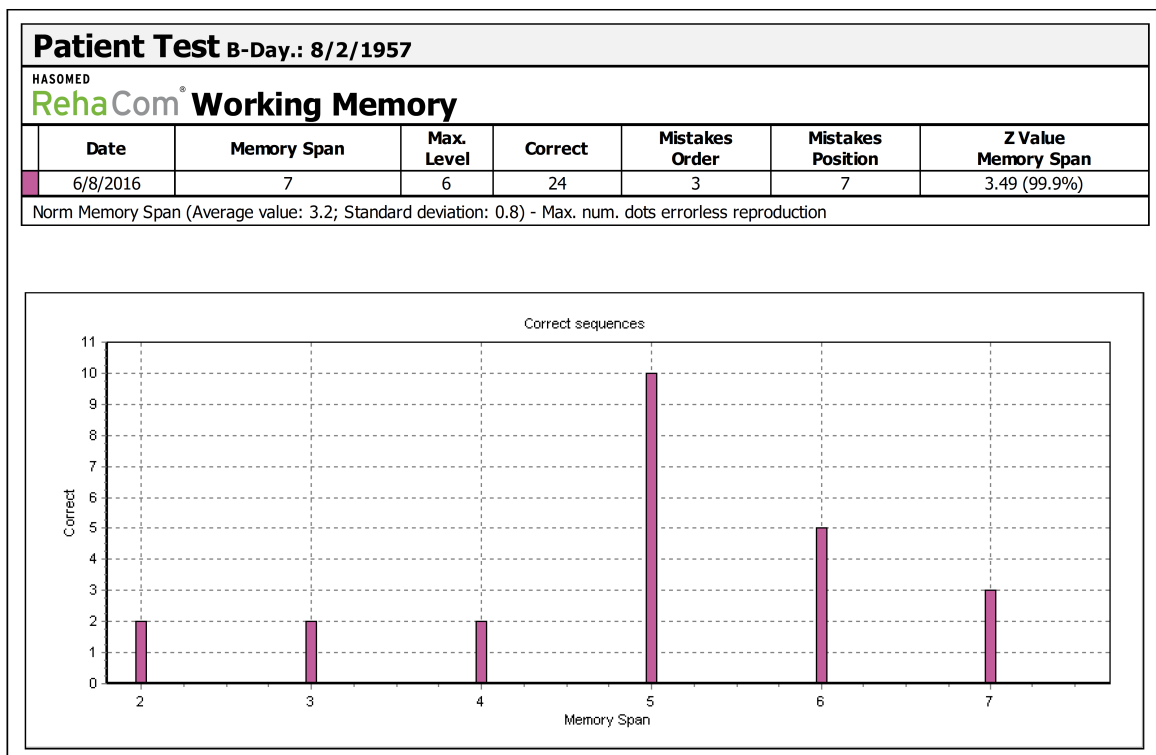

Fig.5: Working Memory screening results, values of a person without memory disturbance

6 Bibliography

Baddeley, A. D. (1986). *Working Memory*. Oxford: Oxford Univ. Press.

Baddeley, A. D. (1993). Working Memory or Working Attention. In A. D. Baddeley & L. Weiskrantz (HrsgEds..), *Attention: Selection, Awareness and Control*. Oxford: University Press.

Baddeley, A. D. (1997). Human memory: Theory and practice. Hove, UK: Psychology Press.

Baddeley, A. D. (2003). Working memory. Looking back and looking forward. *Nature Reviews Neuroscience, 4*, 829–839.

Baddeley, A. D. (2009). Working memory. In: A. D. Baddeley, M. W. Eysenck, & M. C. Anderson. *Memory* (pp. 41–68). Hove, New York: Psychology Press.

Baddeley, A. D. (2012). Working Memory: Theories, models, and controversies. *Annual Review of Psychology, 63*(1), 1–29.

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. H. Bower (HrsgEd.), *The Psychology of Learning and Motivation* (BdVol. 8, ppS. 47–89). New York, NY: Academic Press.

Berti, S. (2010). Arbeitsgedächtnis: Vergangenheit, Gegenwart und Zukunft eines theoretischen Konstruktes. *Psychologische Rundschau, 61*(1), 3–9.

Coull, J. T., & Frith, C. D., Frackowiak, R. S. J., & Grasby, P. M. (1996) A fronto-parietal network for rapid visual information processing: A PET study of sustained attention and working memory. *Neuropyschologia, 34*, 1085–1095.

de Fockert, J. W., Rees, G., Frith, C. D., & Lavie, N. (2001) The role of working memory in visual selective attention. *Science, 291*, 1803–1806.

Diener, H.-C., Putzki, N., Berlit, P., Deuschl, G., Elger, C., Gold, R., ... Weller, M. (2008). *Leitlinien für Diagnostik und Therapie in der Neurologie* [Guidelines for diagnosis and therapy in neurology] (4th rev. ed.). Stuttgart, Germany: Georg Thieme Verlag.

Miyake, A., & Shah, P. (Eds.) (1999). *Models of working memory: Mechanisms of active maintenance and excutive control*. Cambridge: Cambridge University Press.

Prosiegel, M. (1988). *Beschreibung der Patientenstichprobe einer neuropsychologischen Rehabilitationsklinik*. Neurologische Rehabilitation. Berlin: Springer, 386–398.

Prosiegel, M. (1988). Psychopathologische Symptome und Syndrome bei erworbenen Hirnschädigungen. In: v. Cramon, D.; Zihl J. (Eds.). Berlin: Springer, 57-

82.

Schellig, D., Drechsler, R., Heinemann, D., & Sturm, W. (2009). *Handbuch neuropsychologischer testverfahren* (Vol. 1). Göttingen, Germany: Hogrefe.

Sturm, W. (2002). Diagnostik von Aufmerksamkeitsstörungen in der Neurologie. Aktuelle *Neurologie, 29*, 25–29.

Thöne-Otto, A., George, S., Hildebrandt, H., Reuther, P., Schoof-Tams. K., Sturm, W., & Wallesch, C.-W. (2010). Leitlinie zur Diagnostik und Therapie von Gedächtnisstörungen. *Zeitschrift für Neuropsychologie, 21*, 271–281.

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