HASOMED

RehaCom®

Cognitive therapy

Screening:
Divided Attention

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HASOMED 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).

⚠ CAUTION	Risk of misdiagnosis. Screening for use of RehaCom only. Use standardized tests for diagnostic.

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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 "Use of RehaCom screening modules".

Divided Attention is the ability to pay attention to several tasks or activities at the same time or alternate in short periods. Attention is therefore divided between several, competing stimuli. Colloquially, this ability is called multitasking.

In everyday life, this is the rule rather than the exception. Persons with deficits in this area often complain about huge problems of coping with everyday life.

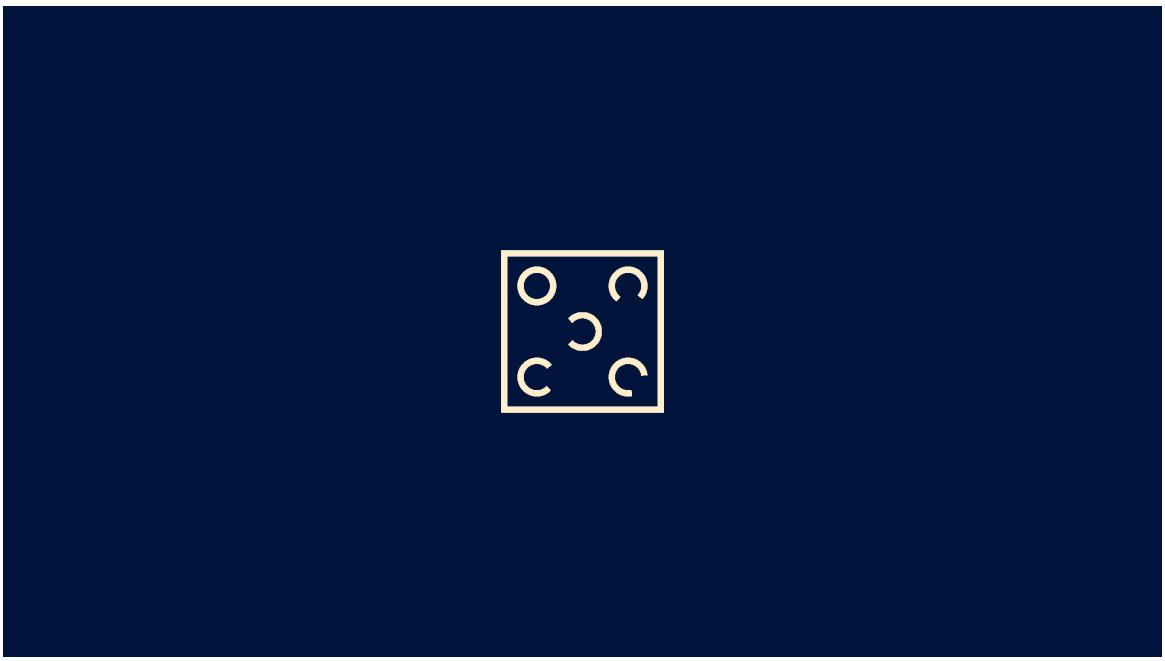

Fig. 1: Screening "Divided Attention",
irrelevant stimulus, visual stimulus

2 Target group

Attention disorders may occur in almost all neurological diseases, which affect the central nervous system. Depending on whether these diseases lead to rather circumscribed and localized brain damages (such as a stroke) or to rather diffused impairments (such as traumatic brain injury or degenerative diseases), the malfunction in the attention area can be rather specific or global.

Cerebrovascular Diseases

After lesions in the brain stem portion of the formatio reticularis (Mesulam, 1985) and after strokes, especially in the area of the median brain artery (A. cerebri media) of the right brain hemisphere, disorders of attention activation as well as of vigilance and the long-term maintenance of attention can occur (Posner, Inhoff, Friedrich, & Cohen, 1987).

While the reticular system of the brain stem portion is the "noradrenergic source" of attention activation (Stuss & Benson, 1984), the frontothalamic gating system controls the selective and directed allocation of this attention activation. Lesions of this system lead to a limited selectivity for external stimuli and to increased distractibility (i.e., to attention disorders).

Lesions especially of frontal parts of the left hemisphere, also cause impairments of attention selectivity, especially in situations in which decisions between relevant and irrelevant aspects of a task have to be made quickly (Dee & van Allen 1973; Sturm & Büssing 1986).

Disorders of spatial attention can be selectively affected by localized brain damages. Damages of the posterior parietal lobe seem to lead especially to disorders of disengaging attention from a stimulus, when the attention must be moved towards a target stimulus in the room on the opposite side of the lesion (Posner, Walker, Friedrich, & Rafel, 1984). Here, a cause for a unilateral neglect after a parietal lesion is seen (see the guideline "Rehabilitation of disorders of spatial cognition").

Disorders of divided attention seem to occur particularly often after bilateral frontal vascular injury (Rousseaux et al., 1996).

Traumatic Brain Injury (TBI)

Along with memory disorders, attention impairments are the most common neuropsychological deficits after a TBI. The most consistent result after TBI is a general, non-specific slowdown of the information processing. The cause of this slowdown after TBI remains largely unclear. As a pathological correlate of the damage due mainly to the rotational acceleration of the brain, diffuse axonal injuries are discussed or a hypometabolism in prefrontal and cingulate brain areas (Fontaine et al., 1999).

Multiple Sclerosis

Cognitive slowing and increased variability with an often preserved performance quality at the beginning of the disease are common symptoms in patients with multiple sclerosis (MA), so tests that measure reaction time are of special significance in diagnosing this disease. It is obvious that the deficit in reaction time is relatively independent of the individual sub-functions of attention performance. Because MS is neuronal based, a diffusely localized axonal injury and demyelination is assumed, and a generally increased degree of brain atrophy could be proved (Lazeron et al., 2006).

Neurodegenerative Diseases

Attention deficits are often seen during the early stage of Alzheimer disease (AD). They often seem to occur after memory disorders, but before impairments of language and spatial performances (Perry, Watson, & Hodges, 2000). Other results indicate a relative maintenance of the cognitive control of attention activation and visuo-spatial attention, but also early disorders of selective attention. In the course of the disease, disorders of inhibitory control also increase.

In Lewy body dementia (LBD), fluctuating attention performances and deficits in the visuo-spatial attention are a central diagnostic criterion. Some studies (Calderon et al., 2001) have reported that patients with LBD showed significantly worse results in almost all attention functions (sustained attention, selective attention, divided attention) compared to AD patients.

Patients with Parkinson's disease or Huntington's disease generally show no deficits in phasic alertness and vigilance tasks, whereas patients with progressive supranuclear palsy (Steele-Richardson-Olszewski-Syndrome) suffer from such deficits. Deficits in divided attention seem to be a general problem in later stages of the diseases.

Depression and Attention Disorders

Even in the case of depression, memory and attention disorders are to the fore of the cognitive functional impairments. Primarily, conscious cognitive controlled functions are affected. Especially the performance during tasks for the attention distribution has been identified as a prognostic parameter (Majer et al., 2004). Disorders of automatic processing can be present only in case of very severe depression (Hartlage, Alloy, Vásquez, & Dykman, 1993). In comparison to patients after traumatic brain injury (TBI), depressed patients often estimate their performances worse than they actually are in the psychometric examination. Farrin et al. (2003) could show that this negative self-assessment (e.g., during task for sustained attention) can lead to "disaster reactions" after mistakes with increased reaction times immediately afterwards. TBI patients did not show such reactions.

Source: 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.

3 Structure

The patient has to work on a visual and an auditive task in parallel.

Auditive - visual requirements

Visual task:

In the center of the screen, a square field with 5 circles is displayed.

All circles are open (Fig. 2). During task performance, the position of the openings changes. The position of the circles remains unchanged.

Fig. 2: irrelevant stimulus

When a closed circle appears in the square field (Fig. 3), the patient has to press the OK button as quickly as possible. Only one circle can be closed at any time.

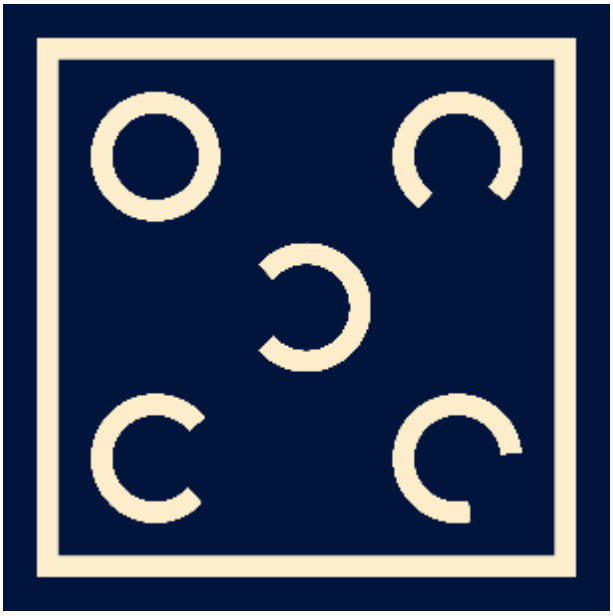

Fig. 3: relevant stimulus

Auditive task:

Synchronously with each set of circles, the patient hears two tones, alternating between a high tone and a low tone.

When the same tone sounds two times in a row, the patient has to press the OK button as quickly as possible.

4 Implementation and Duration

The screening module begins with an exercise. It is considered passed if the participant responds once to each relevant auditory and visual stimulus.

Once the exercise has been passed, the actual screening is carried out.

Five circles with openings in different positions must be observed. If a circle is closed, the participant should press the response button.

At the same time, high and low tones are presented alternately. If the same tone sounds twice in succession, the test person should press the answer button.

Fig. 4: Target stimulus: one circle completely closed

Fig. 5: Non Target: all circles are open

Duration

3 min (without practice)

5 Data analysis

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

For the *Divided Attention* screening module, two Z-values are calculated.

Z-values 1: Auditive divided attention

Standard value is the number of auditive omissions, meaning: the number of missed reactions to two consecutive, identical acoustic stimuli.

Z-values 2: Visual divided attention

Standard value is the number of visual omissions, meaning: the number of missed reactions to a relevant visual stimulus.

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 Divided Attention 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).

When you click on a screening session in the list, the display in the diagrams changes accordingly.

Marc Testpatient B-Day.: 01/01/2000 Date: 09/02/2016

HASOMED RehaCom® **Divided Attention**

Condition	Correct	Mistakes	Omissions	Outliers	Avg. Reac. Time [ms]	Median Reac. Time [ms]	SD Reac. Time [ms]	Z Value
Auditive	13 (100%)		0 (0%)	0	597	523	184	0.54 (70.4%)
Visual	13 (93%)		1 (7%)	0	1067	753	929	-0.49 (31.2%)
Overall		0	1					

Norm Auditory modality (Average value: 0.5; Standard deviation: 1.0) - Omissions of auditive Stimuli
Norm Visual modality (Average value: 0.5; Standard deviation: 1.0) - Omissions of visual Stimuli

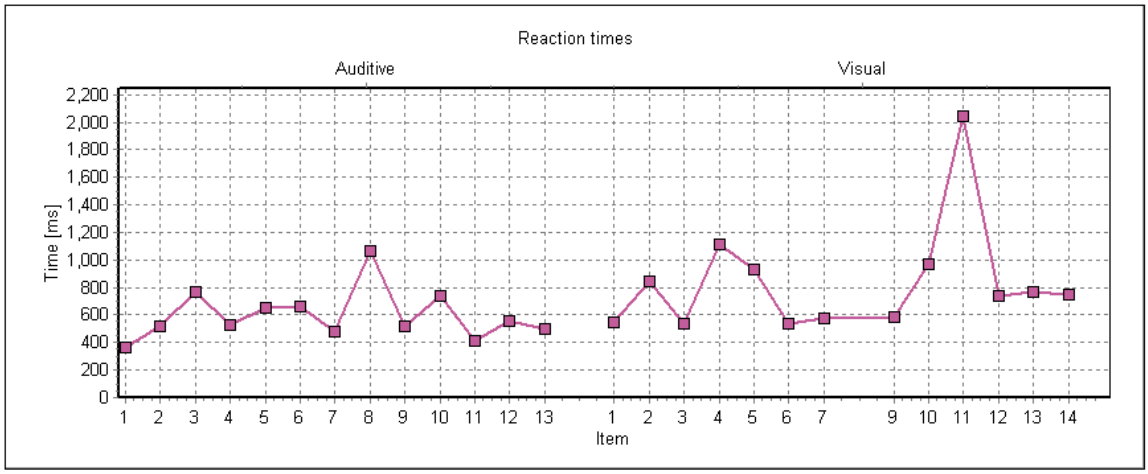

Fig. 6: Results scrrening "Divided attention"

On the upper table, rows for each condition (Auditive, Visual) show the number of correct and omitted reactions, reaction time values, and the calculated Z-values. Percentile rank is presented after the Z-value in parentheses. The given value is an approximation based on the Gaussian normal distribution. The reaction time values include the mean, the median, and the standard deviation of all reactions to relevant stimuli. In addition, the number of correct reactions (max. 13 for auditive, max. 14 for visual) as well as the number of mistakes, omissions, and outliers are included. Because reactions cannot be assigned clearly to a certain type of stimulus, they are only visible in the Overall row.

Anticipation: If the reaction time is less than 100 milliseconds.

Outliers: Each reaction time, which lies over the mean reaction time plus the 2.35-times standard deviation.

The diagram "Reaction times" shows all single reaction times on relevant stimuli: auditive stimuli on the left and visual stimuli on the right. If the patient didn't react to a stimulus, no marker is set.

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