Screening: Response Control
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.

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1 Applications

You will find basic information on the data analysis of screening results in the RehaCom manual, Chapter “Screening and Diagnostics”.

The ”Go/NoGo” paradigm was developed for testing the selective attention.

The ability to perform an appropriate reaction under time pressure is tested as well as the control of not appropriate behavioral impulses. It is relevant, to suppress a reaction triggered by external stimuli in favor of an internal controlled behavior.

The attention focus is directed on the foreseeable appearance of stimuli, which then require a selective reaction, like, for example, to react or to not react.
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 the vigilance and the long-term maintenance of attention can occur (Posner et al. 1987).

While the reticular system of the brain stem portion is the "noradrenergic source" of attention activation (Stuss u. 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 disorders of the attention focus.

Lesions especially of frontal parts of the left hemisphere, also cause impairments of attention selectivity, especially in situations, in which fast decisions between relevant and irrelevant aspects of a task have to be made (Dee u. van Allen 1973, Sturm u. Bussing 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 the attention off a stimulus, when the attention must be moved towards a target stimulus in the room half on the opposite side of the lesion (Posner et al. 1984). Here, a cause for a unilateral neglect after a parietal lesion is seen (see guideline "Rehabilitation of disorders of spatial cognition").

Disorders of divided attention seem to occur particularly often after bilateral frontal vascular damages (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 malfunction after TBI remains largely unclear. As a pathological correlate of the damage due to the mainly rotational acceleration of the brain, "diffuse axonal damages" 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 is a widespread deficit in patients with multiple sclerosis, so that tests with reaction time measurement are of special significance in this disease. It is obvious, that this retardation relatively independent of the individual sub-functions of the attentional performance. As neuronal basis, a diffusely localized axonal damage and demyelination is assumed, whose counterpart a generally increased degree of brain atrophy could be proved (e.g. Lazeron et al. 2006).

**Neurodegenerative Diseases**

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

In Lewy body dementia, fluctuating attention performances and deficits in the visuo-spatial attention are a central diagnostic criterion. Recent studies (Calderon et al. 2005) reported that clients showed significant 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 chorea generally show no deficits in phasic alertness and vigilance tasks, whereas patients with progressive supranuclear paralysis (Steele-Richardson-Olszewski-Syndrome) suffer from such disorders. Disorders of the divided attention seem to be a general problem in dementia diseases in later stages of diseases.

**Depression and Attention Disorders**

Even in 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). Only in very severe depressions, disorders of automatic processing can be present (Hartlage et al. 1993). In comparison to e.g. 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 an enlarged reaction times immediately afterwards. TBI-patients did not show such reactions.

3 Structure

The following task is to process:

A fixation stimulus is presented in the middle of the screen.
In random intervals, a striped crosswise stimulus and a striped lengthwise stimulus is presented.
When the striped crosswise stimulus is shown, the subject has to press the answer-button as fast as possible.
When the striped lengthwise stimulus is shown, the subject should not react.

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Fig. 1: Fixation  Fig. 2: Go  Fig. 3: No/Go

The stimuli are good and easy to distinguish and can cause a reaction impulse immediately. Thus, an inappropriate behavior is controllable and the lacking ability to control the impulse becomes clear.
4 Implementation and Duration

The screening starts with an exercise in which notes appear in case of a wrong (too early, no) reaction. The exercise is not complete until the subject reacted correctly two times in succession.

After having passed the exercise the screening is performed.

The subject looks to the fixation stimulus in the middle of the screen.

![Fig. 4: Fixation](image)

When the striped crosswise stimulus is shown, the subject has to press the answer-button as fast as possible.

![Fig. 5: Go](image)

When the striped lengthwise stimulus is shown, the subject should not react.

![Fig. 6: No/Go](image)

**Duration**
2 min (without exercise)
5 Data analysis

Basic information on the data analysis of the screening results you will find in the RehaCom manual, chapter “Results screening”.

In the screening Selective Attention, two Z-values are calculated.

Z-value 1: Reaction speed
Median of the reaction time on relevant stimuli

Z-value 2: Reaction control
Number of reactions on irrelevant stimuli

Details

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

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. One can change the selection by clicking the particular checkbox. The display in the diagrams changes accordingly. The background color of each result row corresponds to the line color in the diagrams.

An important point for analyzing the capability of reaction control is the number of errors. An increased number of errors is an indicator for an impaired impulse control.

Reaction times can provide information on the speed of the decision process. The impulse control is possible when long reaction times (in Median) for a minimum number of errors are necessary while processing the task.
In the table a row is assigned for every result selected on the right side. The columns have the following meaning:

- **Date**: End of the screening
- **Correct**: Number of reactions to relevant stimuli (max. 20)
- **Mistakes**: Number of reactions to irrelevant stimuli
- **Omissions**: Number of omitted relevant stimuli (max. 26)
- **Outliers**: Number of outliers (each reaction time, which lies over the mean reaction time plus the 2.35-times standard deviation)
- **Anticipation**: Number of incorrect reaction by anticipating (reaction time is less than 100 ms)
- **Avg. Reac. Time**: Average of all reaction times to relevant stimuli in ms
- **Median Reac. Time**: Median of all reaction times to relevant stimuli in ms
- **SD Reac. Time**: Standard deviation from the mean value of the reaction times to relevant stimuli in ms
- **Z Value React. Speed**: 
- **Z Value React. Control**: 

**Fig. 7: Detailed data analysis**
<table>
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<th>Z-Value React. speed</th>
<th>Calculated Z-value for the reaction speed</th>
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<tr>
<td>Z-Value React. control</td>
<td>Calculated Z-value for the reaction control</td>
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The diagram "Reaction times" shows all single reaction times on relevant stimuli. If the subject didn't react to a stimulus or reacted before the stimulus was presented, no marker is set. Regularly, the subject has to react to 20 stimuli during the training. If errors are made, the number increases to a maximum of 26.
6 Bibliography


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