HASOMED

RehaCom®

Cognitive therapy

Attention and Concentration

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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).

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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.

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1 Training description

1.1 Training task

In the Attention & Concentration module, a picture is presented separately from a matrix of pictures. The patient is asked to find the one picture in the matrix that resembles the separate picture in every detail. The pictures in the matrix—symbols, items, animals or abstract figures—are harder to differentiate the higher the level is. The abilities to differentiate and to concentrate are trained simultaneously.

The training screen is divided into two parts. One part contains the matrix of options consisting of

- 3 pictures (1 by 3 matrix),
- 6 pictures (2 by 3 matrix), or
- 9 pictures (3 by 3 matrix

according to the level of difficulty.

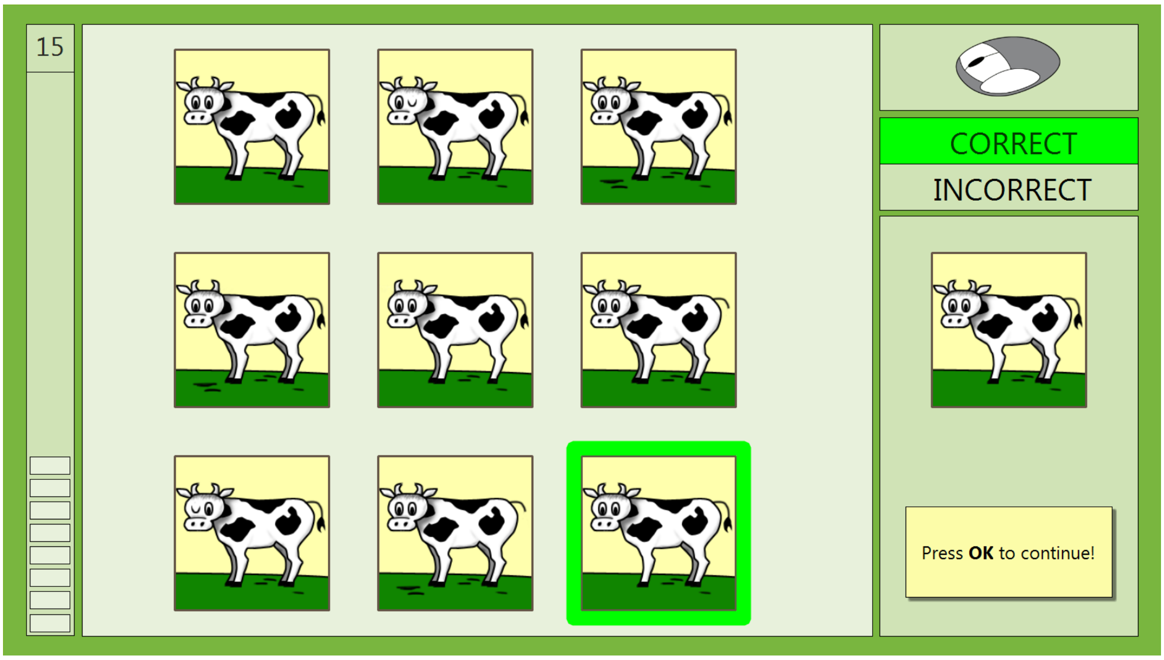

Fig. 1: Screen w ith a 3 by 3 matrix in level 15. The selected picture is framed. The sign signals a correct choice.

The patient has to ***recognize*** the picture shown separately and ***select*** the matching picture from the matrix.

The patient selects the corresponding picture from the matrix by using one of several possible interface options (customizable in the training parameters):

- arrow keys
- mouse

- touchscreen
- number keys
- single key (OK button)

When using the big arrow keys on the RehaCom keyboard, a frame marks a picture in the matrix. By means of the arrow keys, the patient moves the frame to a picture to select it. Once the picture is marked with the frame, press **OK**. This mode is recommended for patients with disturbances of eye- hand- coordination, coarse tremor, disturbances of hand movement or manually unskilled people.
The big RehaCom Keyboard keys can optionally be used by handicapped as pedals.

When the parameters are set so that number keys are used, the pictures are numbered. Pressing a number button selects the appropriate picture. The frame shows the selection. Pressing **OK** confirms the selection.

When the parameters are set so that the patient is using a mouse, an arrow appears on the screen. If it touches a picture, the frame appears around it. The selection is confirmed with the **OK** button on the keyboard, or the left mouse button. When this manner of selecting answers is engaged, visuo-motor skills are also trained.

Selecting via touchscreen is the easiest. Once a picture is touched, the frame will appear. Now the selected image can be zoomed using the yellow plus (+) button. When a selected picture is touched a second time, the selection will be confirmed and the framed picture will be evaluated. This alternative is especially recommended for children.

Another input option is the single key Input: One picture will be selected automatically. It will be changed after a specific period of time, so the frame will move to the next picture. When the **OK** button on the keyboard is pressed, the currently selected picture will be confirmed and evaluated. This alternative is especially recommended to patients with motor problems.

After selecting a picture the module evaluates the choice and either the green ***CORRECT*** sign or the red ***INCORRECT*** sign lights up. This performance bar grows or shrinks with every correct or incorrect choice. If it reaches its maximum or vanishes, the next higher or lower level starts. Before that switch a verbal evaluation is given stating the next level (see also feedback).

In the following, ***item*** means the presentation of the matrix, the selection of a picture and the final evaluation of the choice.

1.2 Performance feedback

When the patient chooses the correct picture, the patient's choice is framed in green, and the green ***CORRECT***- sign lights up. After a short time (3 seconds), the next item is presented.
When the patient chooses an incorrect picture, the patient's choice is framed in red while the correct picture is framed in orange. Additionally, a red ***INCORRECT*** sign lights up. The patient is then given time to compare the pictures and spot the differences. After an interval, which can be adapted in the parameter menu, or pressing **OK**, the next item is given.

On top of the performance bar, the current level of difficulty is shown.

1.3 Levels of difficulty

The levels of difficultly are adapted automatically. Tab. 1 shows the structure of difficulty.

Level	Difficulty (discriminability of images)	Number of images in matrix
1	1	3
2	1	6
3	1	9
4	2	3
5	2	6
6	2	9
7	3	3
8	3	6
9	3	9
10	4	3
11	4	6
12	4	9
13	5	3
14	5	6
15	5	9
16	6	3
17	6	6
18	6	9
19	7	3
20	7	6
21	7	9

22	8	3
23	8	6
24	8	9

Tab. 1: Structure of difficulty

There are 8 stages of difficulty. In each stage, there are several sets of 16 pictures, organized by theme. During the earlier stages, the pictures are different items within a theme (e.g., fruits, tools, vehicles). As the stages progress, the differences within a set are more subtle.

Each stage has 3 levels of increasing difficulty. The levels progress in difficulty by presenting more pictures (e.g., matrix containing 3, 6, or 9 pictures).

The degree of difficulty for each set of pictures was determined in a study. The variables in the study included the average time necessary to solve the item and the average number of mistakes (objective criteria), and the estimation of difficulty (subjective criteria).

1.4 Training parameters

Specific settings for the training module can be adjusted (see Fig. 3). This section describes each setting and explains how to adjust them.

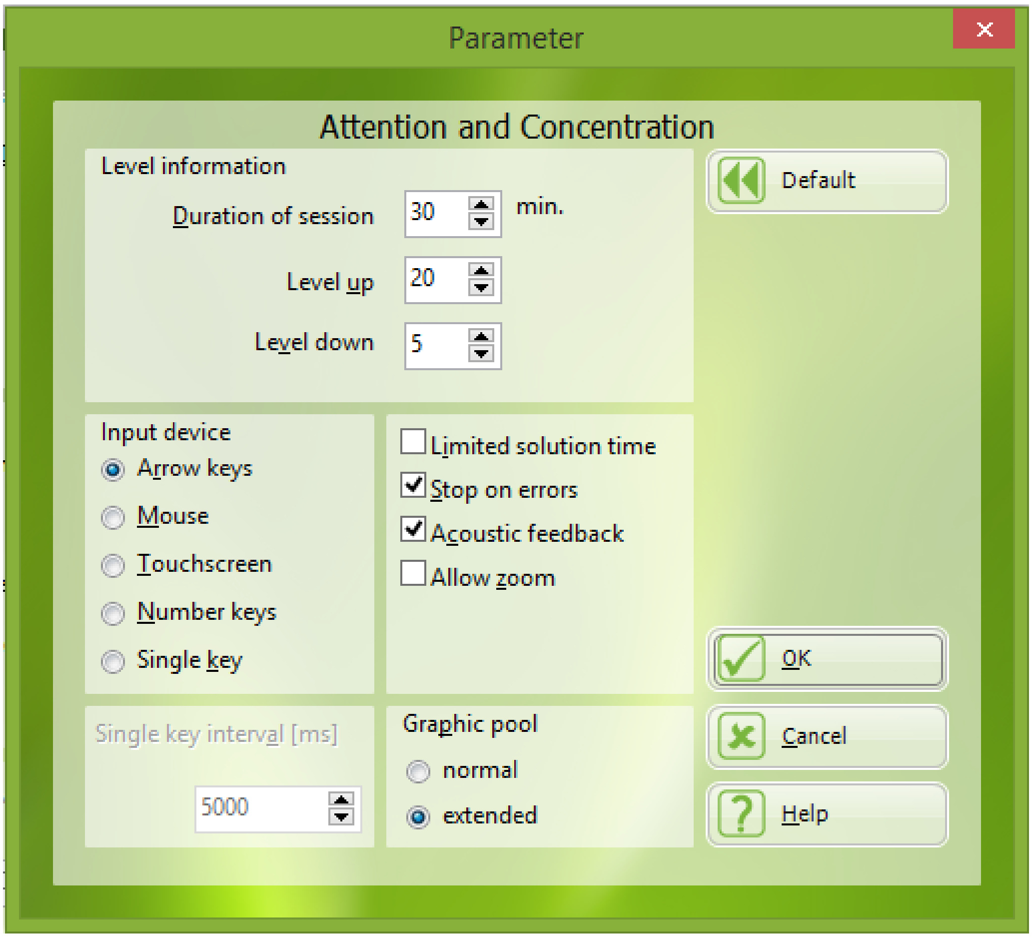

Fig. 2: Parameter menu

Duration of session:
It is recommended that the training session last 30 minutes (default).

Level up:
To reach the next higher level, the number of correct answers must exceed the number of incorrect answers by the number in the ***Level up*** setting. Incorrect decisions will reduce the performance bar on the left side of the screen while correct answer increase it. The next level begins when the performance bar reaches its maximum.

The levels can progress more quickly if no errors are made. If the patient makes no errors on the items in a level, the next level can be reached once half of the correct answers are made. For example, if the default value for ***Level up*** is used (20), and the patient makes no errors on the first 10 items, the next level will begin.

Level down:
The next lower level starts when the number of items solved incorrectly in succession is equal to the number in ***Level down***, or if the performance bar reaches its bottom.

Input device:
The different input options were described in the training task.

Limited solution time:
The limited solution time parameter creates a time stressor for those patients who find the items themselves easy. If this parameter is activated, the patient's time to solve an item is limited. The limitation depends on the level of the item: items for the first level have a time limit of 1 minute 5 seconds. The limitation expands for 5 seconds, so for the most difficult items (level 24) the time limit is 3 minutes.

If the parameter is not activated, the time to solve an item is unlimited.

Stop on errors:
If the parameter ***Stop on errors*** is activated, the patient can, in case of an incorrect choice, compare the incorrect choice (red frame) with the correct one (orange frame) without time limitation and spot the differences. The next item only starts when the patient presses **OK**.

If the parameter is not activated, the patient only has 10 seconds to compare the pictures. After that, the next item starts. This option is recommended as additional stressor for patients with slight deficits.

Acoustic feedback
When activated, the acoustic feedback makes a sound when an incorrect answer is selected. The acoustic feedback motivates most patients. However, if there are a number of patients working in one room, you should switch the acoustic feedback off or have the patients use headphones.

Allow zoom
This option is especially important for patients in an early rehabilitation phase and for patients with visual field problems.
When Allow zoom is activated, the patient can increase the size of the currently selected picture and the example picture together for easier comparison.
Pressing the plus (+) button will enlarge the picture in the orange frame and the example picture and set them side by side for comparison.
While the images are enlarged, pressing any button on the RehaCom keyboard (including the plus button again) will reduce their size and separate them.

Single key interval:
The ***Single key interval*** is a time delay setting used along with the ***Single key*** input device setting. The ***Single key interval*** sets the amount of time until the next picture is selected. When the ***Single key*** input device parameter is selected, the selection frame moves from one picture to the next at the rate set by the ***Single key interval*** parameter.

Graphic pool:
RehaCom uses a range of picture sets. The ***normal*** set was used for the validation

of the module. A second ***extended*** set may be used if a patient has been working with the normal set for a longer time and wants variation. Sets generated by the user may also be used and can be integrated easily. Therefor, please contact the system service.

Neglect and side orientation:
An additional setting that is not found in the parameter menu is for patients with neglect or hemianopsia. You can establish this setting in the Clients menu: Clients --> Edit --> File tab --> Hemianopsia. By selecting either left or right in this field, additional assistance will be provided in the training module.
When a setting for neglect or hemianopsia is selected, a blinking red arrow helps the patient to find the example picture to compare to. A red bar on screen border gives a clue where the screen ends. The patient can be instructed to look for the correct image "until the red bar is found."

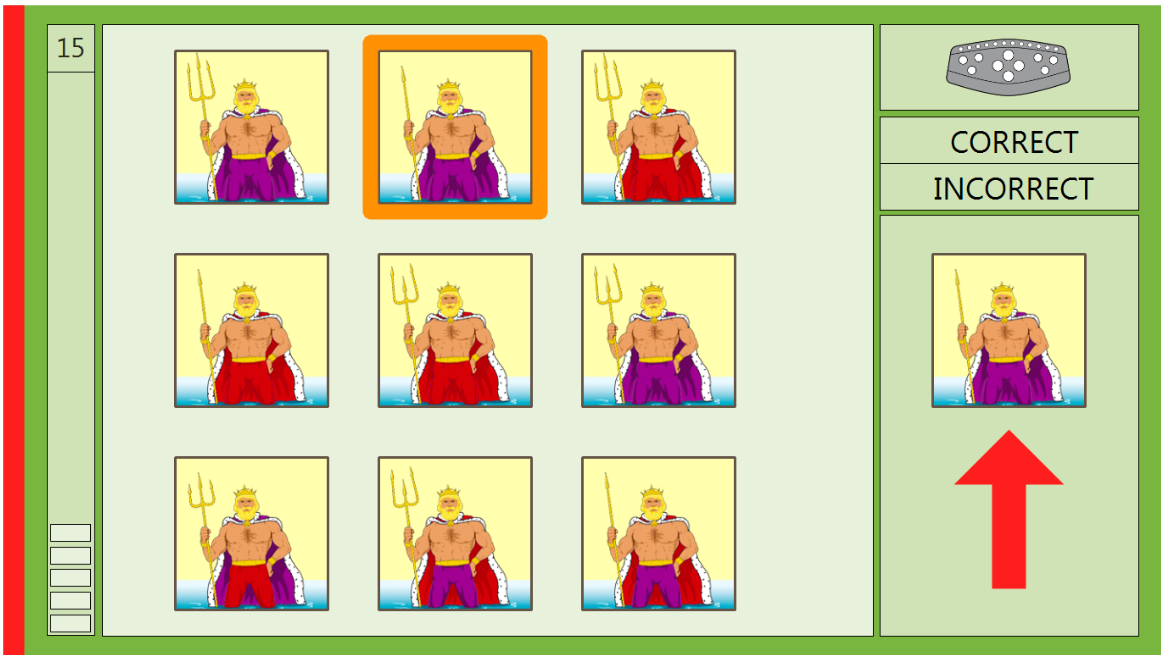

Fig. 3: Screen with a 3 by 3 matrix in level 15. Red arrow and margin for patients with neglect on the left hand side.

When starting this training for a patient for the first time, the system automatically uses the following default values:

Current level of difficulty	1
Duration of session	30 minutes
Level up	20
Level down	5
Input device	Arrow keys
Limited solution time	off
Stop on errors	on

Acoustic feedback	on
Allow zoom	off
Graphic pool	extended

1.5 Data analysis

All training sessions are placed in a chart within the Results tab. A training session is selected by double clicking on the bar in the chart. Once selected, the results of the session are presented in the Table and Chart tab.

Explanation of columns in the results table

Level	Current level of difficulty
Decisions	Number of decisions per task
Correct	Number of correct decisions per task
Correct [%]	Percent correct decisions per task
Mistakes	Mistakes in differentiation per task
Omissions	Omissions - exceeding time limitation
Median reac. time	Median of all reaction times in seconds (s)
Median reac. time left	Median of all reaction times of left column in s
Median reac. time center	Median of all reaction times of center column in s
Median reac. time right	Median of all reaction times of right column in s
Max. reaction time	Highest measured reaction time [s]
Min. reaction time	Lowest measured reaction time [s]
Quartil 3 reac. time	Reaction time quartile 3 in s
Quartil 1 reac. time	Reaction time quartile 1 in s
Train. time task	Effective duration of the training in h:mm:ss
Breaks	Number of breaks caused by the patient

The parameter settings used during the training are displayed directly below the table. The graphical presentation of the results (correct decisions per task, median of all reaction times) is also displayed on the Table and Chart tab.

2 Theoretical concept

2.1 Foundations

The term ***attention*** sums up functions which put external and internal sequences of processes on an orderly basis regarding time and content. They enable the waking, oriented organism to form a picture of the current circumstances at any time through selecting and integrating relevant information from different modes of perception.

Broadbent (1958) based his "bottleneck or filter theory" on the assumption of a *limited processing capacity* for incoming sensoric information meeting the organism, so that if reacting to *selected stimuli* other *stimuli simultaneously incoming are suppressed*. From nowadays´ point of view there are a range of input channels for every mode of perception filtering incoming information. Sternberg (1969; also Keller & Grömminger, 1993) differentiates in his *action oriented model of attention* between 4 phases:

1. perception,
2. identification of relevant stimuli,
3. choice of reaction and
4. starting a motor program as reaction to the stimulus.

These processes partly happen automatically; if specific aspects of the situation are understood active analysis processes are started.
Automated processes run parallel with little capacity, whereas all others want a serial processing which needs more attention capacity and time.

The ability for *directed attention* is a basic precondition for a general capability regarding different cognitive demands.

Disturbances of attention and concentration can manifest themselves in a reduced *perception and processing capacity*, reduced *information processing capacity*, rapid signs of *fatigue* especially when strained, but also higher *delicateness to distraction;* altogether intellectual and practical actions may be impaired to a high degree.

On the basis of empirical studies one can assume that attention is no uniform construct. Rather one can differentiate between 4 independent aspects of attention (cf. Fimm, 1997; cf. Sturm, 1990; Sturm, Hartje, Orgaß, & Willmes, 1994):

1. phasic activation, alertness
2. selective attention
3. divided attention
4. tonic activation, vigilance

Phasic activation is defined as the ability to increase the activation level for a subsequent reflex situation, rapidly reacting to a warning stimulus (alertness), while

tonic activation is designated for a relatively long, stable attention level.
Tasks requiring ***divided attention*** consist of at least 2 sources of stimuli which have to be observed at once in order to react to relevant stimuli appearing simultaneously or sequentially.
Vigilance means attention over longer periods with low denseness of the stimuli. High denseness with relevant stimuli appearing often is called ***long- term attention***.
Selective attention, which is especially relevant in this RehaCom module, refers to focusing on certain aspects of a task and thus reacting to relevant stimuli quickly while ignoring irrelevant ones.
This skill to select and integrate defined stimuli or ideas is closely associated with the term *power of concentration*, which is defined as short term (lasting for some minutes), active turning and focusing of attention with selective registration of relevant features of the situation (Sturm, 1990).
For the visual area, Posner & Rafal (1987) and also Fimm (1997) differentiate between three basic mechanisms regarding selective attention, which can also be selectively impaired after certain brain lesions:

1. disengage attention
2. move attention
3. engage attention.

Disturbances of these basic functions can manifest in increased distractibility, tendency to perseverate, or symptoms of neglect.

The ability to focus attention on relevant stimuli is dependent on internal variables (e.g., physiological state, cognitive processes, emotions) and external factors (e.g., stimulus intensity, contrast, color, shape, spatial relation). Attention can be focused automatically (i.e., involuntarily) through especially intense or novel stimuli (with high information content) by an orientation reflex. Cognitive processes modulate the current state of attention through thoughts, motivations, and interests (Fröhlich, 1987). Especially the selectiveness of attention depends on emotional valuations and is maintained through motivational processes.

Empirical studies with laterally presented stimuli were carried out among healthy people and split-brain patients. The studies suggest the right hemisphere of the brain has special relevance regarding control and maintenance of elementary activation processes (Sturm, Hartje, Orgaß, & Willmes, 1994). Nevertheless all patients with neurological deficits can possibly suffer from attention disturbances. Because many parts and structures of the brain are involved in attention processes, they are especially vulnerable to any cerebral insults and dysfunctions.

In a psychological performance diagnosis, especially in clinical-neuropsychological assessment, attention tests are firmly established. The aspects of attention mentioned before can be distinguished diagnostically by assigning different tasks to each of them. Apart from paper- and- pencil tests, the *test battery for assessment of attention deficits*, according to Zimmermann & Fimm (1989), gives a precise idea of

disturbed functions.
According to the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; *DSM–5*), attention disorders in children are defined as a persistent pattern of inattention, impulsiveness and hyperactivity that interferes with functioning or development (American Psychiatric Association, 2013).

In diagnostic practice, the estimation of attention is mostly done through "surface parameters" such as

- the time needed,
- the number and kind of mistakes made,
- the development of mistakes over time or
- the share of the jobs carried out in relation to all jobs given when coping with defined tasks.

The advantages of such a diagnostic procedure lies in the extraction of measurable variables, both intra-individual (development of the illness, therapy evaluation) as well as inter-individual comparisons (depending on the measurements of a normative group).
Efforts have increased to treat attention disorders, also in adult patients, by *cognitive training* (Säring, 1988). Mainly after cerebral damages the need for rehabilitation is enormous, because 80% of brain injuries result in attention and concentration disorders (Poeck, 1989, Van Zomeren & Brouwer, 1994).

Lauth (1988) suggests that, for the treatment of attention disorders, the methods of cognitive behavioral modification represent important ways of intervening. Through these methods, patients can learn skills to regulate and organize their actions.

The sections Training aim and Target groups provide further information.

2.2 Training aim

More recent research results recommend a differential approach to training, which deals with specifically targeted disturbances in attention, because less theoretically based or unspecific training tests have not been successful in all aspects of attention (Gray & Robertson, 1989; Sohlberg & Mateer, 1987; Poser, Kohler, Sedlmeier, & Strätz, 1992; Sturm, Hartje, Orgaß, & Willmes, 1994; Sturm, Willmes, Orgaß, 1997).
The RehaCom module **Attention & Concentration** is designed to train patients to overcome *selective attention deficits.* Further training effects in the sense of a general improvement of reaction speed can be expected though. Most of all, the ability to focus one's attention and simultaneously ignore irrelevant information is practiced. Choosing from different stimuli and reaction alternatives leads to a covert shift of attention. It is expected that, as the complexity of the tasks becomes greater, the patient has to develop new strategies to effectively compare the visual stimuli.

Furthermore, as with all cognitive tasks after a certain length of time, demands are also put on the patient's continuous attention capabilities.

Experience shows (Fernández et al., 2012) that computer-based training of one or more attention components is particularly successful if carried out in the post acute phase after the insult. In addition to the functional training, the computer gives *systematic feedback* to the patient which can improve his/her self-observation and thus teach him/her how to cope with his/her *attention resources*. For the therapy it is important that the patient is not only confronted with the deficits but also learns to develop strategies to cope with and compensate for them (e.g., to avoid certain stress factors or use external help in specific situations of requirement). Relatives could also be included in order to reduce stress levels.

The improvement of attention is a basic objective for the training of further cognitive functions. It is of fundamental importance for the treatment of memory disturbances (information recording as precondition for storage).

On the basis of results of the receipt or process diagnosis, one should decide whether the **Attention & Concentration** module is used alone for therapy or in combination with additional modules (e.g., **Divided Attention**, **Vigilance**).

2.3 Target groups

Attention disorders after functional or organic interference are the most frequent neuropsychological performance deficits after brain damage (Van Zomeren & Brouwer, 1994). Attention deficits affect 80% of patients after stroke, traumatic brain injury, diffuse organic brain injury (e.g., alcohol abuse or intoxication) or other diseases of CNS.

Conceptually, one suggests different attention functions which can be disturbed selectively. Diffuse brain injuries after traumatic or hypoxic etiology are often followed by unspecific attention deficits such as rapid fatigue, an increased need for sleep, and a general loss of motivation. Localized insults, however (e.g., after vascular genesis), often lead to *specific attention deficits*. Fundamentally insults of any cortex area can cause attention disturbances. Especially after lesions of the brainstem in the region of the reticular formation or after lesions of the right parietal cortex, disturbances in phasic or tonic alertness and in vigilance have been reported. Left-sided cortical lesions, on the other hand, damage aspects of attention selectivity, and is especially noticeable in tasks requiring a choice between a range of stimuli and reaction alternatives (covert shift of attention) (Sturm, 1990).

In this context, emotional problems such as particular stress in social situations as a consequence of serious attention disorders have to be taken into consideration as well.

From the assumption of specific deficits of different attention aspects their *specific*

capability of training should be postulated as well.
The particular module is especially suitable for patients who suffer from disturbances that affect phasic activation and selective attention.

On the assumption of maximum specific and in order to achieve the optimum efficiency of the training, a differentiated neuropsychological diagnosis should be prerequisite for the creation of a therapy plan including computer-based procedures.

The module **Attention & Concentration** was evaluated in a range of studies, some of them evaluating other RehaCom modules as well. Friedl-Francesconi (1995), Höschel (1996), Liewald (1996), Pfleger (1996), Preetz (1992), Puhr (1997), Regel & Fritsch (1997), and Wenzelburger (1996) worked with different groups of patients (vascular cerebral injury, traumatic brain injury, dementia). Improvements of the cognitive performances were proved in tests (pre-post- comparisons) and partly in transfer effects to everyday situations. The module was also tested with healthy children in the social-pediatric center Sozialpädiatrisches Zentrum Magdeburg (Diebel et al., 1998).

The module uses child-friendly instructions for patients aged 5 to 14. When testing children in this age range, a touchscreen is recommended as input device.

2.4 Bibliography

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Ben-Yishay, Y., Piasetzky, E. & Rattock, J. (1987). A systematic method for ameliorating disorders in basic attention. In Meier, M., Benton, A. & Diller, L. (Eds.). Neuropsychological rehabilitation. Livingstone, Edinburgh: Churchill.

Brickenkamp, R. & Karl R. (1986). Geräte zur Messung von Aufmerksamkeit, Konzentration und Vigilanz. In Brickenkamp, R. (Ed.). Handbuch apparativer Verfahren in der Psychologie. Göttingen: Hogrefe.

Broadbent, D. (1958). Perception and communication. London.

Cramon, D. v. (1988). Lern-und Gedächtnisstörungen bei umschriebenen zerebralen Gewebsläsionen. In Schönpflug, W. (Ed.). Bericht über den 36. Kongreß der Deutschen Gesellschaft für Psychologie. Berlin.

Diebel, A.; Feige, C.; Gedschold, J.; Goddemeier, A.; Schulze, F. & Weber, P. (1998): Computergesteuertes Aufmerksamkeits- und Konzentrationstraining bei gesunden Kindern. Praxis der Kinderpsychologie und Kinderpsychiatrie. In press.

Fernández, E., Bringas, M. L., Salazar, S., Rodríguez, D., García M. E., & Torres, M. (2012). Clinical impact of RehaCom software for cognitive rehabilitation of patients with acquired brain injury. MEDICC Review, 14(4), 32–35.

Fimm, B. (1997): Microanalyse von Aufmerksamkeitsprozessen. In: Gauggel, S. & Kerkhoff, G. (Eds.): Fallbuch der Klinischen Neuropsychologie. Praxis der Neurorehabilitation. Göttingen: Hogrefe. S. 25-38.

Friedl-Francesconi, H. (1995): "Leistungsinseln" bei Demenzpatienten. Diagnostische und therapeutische Möglichkeiten der Neuropsychologie. In: Hinterhuber, H. (Ed.): Dementielle Syndrome. Innsbruck: Integrative Psychiatrie VIP, S. 86-91.

Fröhlich, W. D. (1987). *Wörterbuch zur Psychologie*. München, Germany: DTV.

Gray, J. & Robertson, I.H. (1989). Remediation of attentional difficulties following brain injury: three experimental single case studies. Brain Injury, 3, 163-170.

Höschel,K. (1996): Effektivität eines ambulanten neuropsychologischen Aufmerksamkeits- und Gedächtnistrainings in der Spätphase nach Schädel-Hirn-Trauma. Zeitschrift für Neuropsychologie 7 (2), S. 69-82.

Keller, I. (1997): Aufmerksamkeitsstörungen. In: Gauggel, S. & Kerkhoff, G. (Eds.): Fallbuch der Klinischen Neuropsychologie. Praxis der Neurorehabilitation. Göttingen: Hogrefe. S. 39-47.

Keller, I. & Grömminger, O. (1993): Aufmerksamkeit. In: Cramon, D.Y. von; Mai, N. & Ziegler, W. (Eds.): Neuropsychologische Diagnostik. Weinheim: VCH.

Lauth, G. W. (1988). Die Vermittlung handlungsorganisierender und handlungsregulierender Komponenten in der Therapie von Aufmerksamkeitsstörungen. In Schönpflug, W. (Ed.). Bericht über den 36. Kongreß der Deutschen Gesellschaft für Psychologie. Berlin.

Liewald, A. (1996): Computerunterstütztes kognitives Training mit Alkoholabhängigen in der Entgiftungsphase. Dissertation an der medizinischen Fakultät der Eberhard-Karls-Universität Tübingen.

Lauth, G. W. & Schlottke, P.F. (1988). Aufmerksamkeitsstörungen. In Schönpflug, W. (Ed.). Bericht über den 36. Kongreß der Deutschen Gesellschaft für Psychologie. Berlin.

Niemann, T. & Gauggel, S. (1997): Computergestütztes Aufmerksamkeitstraining. In: Gauggel, S. & Kerkhoff, G. (Eds.): Fallbuch der Klinischen Neuropsychologie. Praxis der Neurorehabilitation. Göttingen: Hogrefe. S. 48-59.

Pfleger, U. (1996): Computerunterstütztes kognitives Trainingsprogramm mit schizophrenen Patienten. Münster: New York: Waxmann - Internationale Hochschulschriften, Bd. 204.

Poeck, K. (1989). (Ed.). Klinische Neuropsychologie. Stuttgart, New York: Thieme-Verlag.

Poser, U.; Kohler, J.; Sedlmeier, P. & Strätz, A. (1992): Evaluierung eines neuropsychologischen Funktionstrainings bei Patienten mit kognitiver Verlangsamung nach Schädelhirntrauma. Zeitschrift für Neuropsychologie, 1, 3-24.

Posner, M. & Rafal, R. (1987). Cognitive theories of attention and the rehabilitation of attentional deficits. In: Meier, M., Benton, A. & Diller, L. (Ed.). Neuropsychological rehabilitation. Edinburgh, London: Churchill Livingstone.

Polmin, K.; Schmidt, R.; Irmler, A. & Koch, M.(1994): Effektivität eines ambulanten neuropsychologischen Aufmerksamkeits- und gedächtnistrainings in der Spätphase nach Schädel-Hirn-Trauma. Referat der Jahrestagung der Österreichischen Gesellschaft für Neurorehabilitation.

Preetz, N. (1992): Untersuchung zur Validierung eines computergestützten neuropsychologischen Gedächtnis- und Konzentrations-Trainingsprogrammes für zerebralgeschädigte Patienten an einer Klinik für neurologische und orthopädische Rehabilitation. Dissertation an der Medizinischen Akademie Magdeburg.

Puhr, U. (1997): Effektivität der RehaCom-Programme in der neuropsychologischen Rehabilitation bei Schlaganfall-Patienten. Diplomarbeit an der Universität Wien.

Regel, H. & Fritsch, A. (1997): Evaluationsstudie zum computergestützten Training psychischer Basisfunktionen. Abschlußbericht zum geförderten Forschungsprojekt. Bonn: Kuratorium ZNS.

Regel, H., Krause, A. & Krüger, H. (1981). Konfigurationsfrequenzanalytische Einschätzung einiger psychometrischer Verfahren zur Hirnschadensdiagnostik. Psychiatrie, Neurologie, medizinische Psychologie 33, S. 347.

Säring, W. (1988). Aufmerksamkeit. In Cramon, D. v. & Zihl, J. (Eds.). Neuropsychologische Rehabilation. Berlin, Heidelberg, New York: Springerverlag.

Sohlberg, M.M. & Mateer, C.A. (1987): Effectiveness of an Attention Training Program. Journal of Clinical and Experimental Neuropsychology, 9, 117-130.

Sternberg, S. (1969). Memory-scanning: Mental processes revealed by reaction-time experiments. American Scientist, 57, 421-457.

Sturm, W. (1990): Neuropsychologische Therapie von hirnschädigungsbedingten Aufmerksamkeitsstörungen. Zeitschrift für Neuropsychologie, 1 (1), 23-31.

Sturm, W., Dahmen, W., Hartje, W. & Willmes, K. (1983). Ergebnisse eines Trainingsprogramms zur Verbesserung der visuellen Auffassungsschnelligkeit und

Konzentrationsfähigkeit bei Hirngeschädigten, Arch. Psychiatr. Nervenkr. 233, 9-22.

Sturm, W.; Hartje, W.; Orgaß, B. & Willmes, K. (1994): Effektivität eines computergestützten Trainings von vier Aufmerksamkeitsfunktionen. Zeitschrift für Neuropsychologie, 1, 15-28.

Sturm, W.; Willmes, K. & Orgaß, B. (1997): Do Specific Attention Deficits Need Specific Training? Neuropsychological Rehabilitation, 7 (2), 81-103.

Van Zomeren, A.H. & Brouwer, W.H. (1994): Clinical Neuropsychology of Attention. Oxford: Oxford University Press.

Wenzelburger, K.T. (1996): Veränderung und Trainierbarkeit kognitiver Funktionen bei alkoholabhängigen Patienten im Entzug - eine kontrollierte Verlaufsstudie. Dissertation an der medizinischen Fakultät der Eberhard-Karls-Universität Tübingen.

Zimmermann, P. & Fimm, B. (1989): Neuropsychologische Testbatterie zur Erfassung von Aufmerksamkeitsdefiziten. Freiburg: Psychologisches Institut der Universität.

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