HASOMED

RehaCom®

Cognitive therapy

Figural Memory

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HASOMED

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).

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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 Training description

1.1 Training task

The module Figural Memory requires committing objects to visual memory and then recognizing them when included in a stream of irrelevant objects. Object-word associations can also be tested as evident in the three different training modes:

1. Pictures are presented -> Pictures are recognized
2. Pictures are presented -> Words are recognized
3. Words are presented -> Pictures are recognized

You can setup the trainings mode for each patient in the parameter menu.

Fig. 1: : Level 5 acquisition phase. Five objects have to be memorized.

During a session several tasks have to be carried out. Each task consists of an ***acquisition phase*** and a ***recognition phase***.

In the ***acquisition phase*** (see Fig. 1), pictures/words of concrete objects are presented to the patient. The number of pictures/words depends on the level of difficulty. The length of the acquisition phase is determined by the patient. Once the patient has memorized the pictures/words, he or she can continue to the next phase by pressing **OK**.

In the ***recognition phase*** (see Fig. 2) the patient has to recognize the names/ pictures of the concrete objects. The picture/word has to be picked out from a number of stimuli moving over the screen from one side to the other. By pressing

OK, the patient selects a relevant word/picture when it reaches the red marked area. The recognition phase closes when all words/pictures of a task have been presented. The performance of the patient is rated as follows: patient is told which and how many mistakes were made and whether the patient will continue to the next level or return to a previous one.

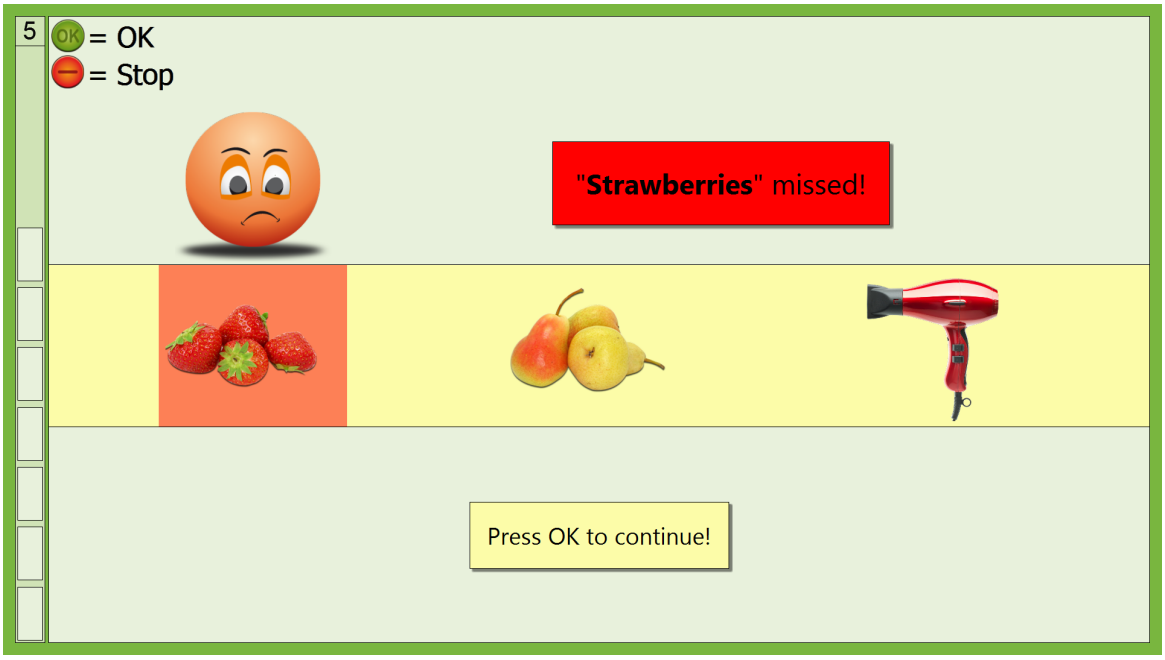

Fig. 2: Recognition phase when an error is made. The text / autostop feature is enabled.

The speed at which the images or words are moving across the screen can be adjusted by pressing the keys "1" and "2" on the therapist's keyboard.
Images/words can move from right to left or left to right, depending on the need of the patient (e.g., neglect).
The direction and the initial speed of the images or words is set up in the Parameters menu.

1.2 Performance feedback

The following modes of feedback can be set by the therapist in the parameter menu (see training parameters):

- Acoustic feedback,
- Visual feedback, and
- Text / autostop.

The pictures and words were selected in a way to ensure a clear association. Nevertheless a patient could possibly associate a picture with a name different from

the name saved, and therefore make a mistake.

If the ***Text / autostop feedback*** is enabled, the patient receives a note indicating which object was missed when the mistake "***Relevant word/picture missed***" is made (see Fig. 3). Thereby incorrect associations can be corrected. The training stops, and continues only after pressing **OK**. If the patient selects a word or object that was not presented during the acquisition phase (mistake "incorrect word/picture selected"), the message "Incorrect!" is displayed. If the patient selects a correct word, the message "Correct!" is displayed (see Fig. 4).

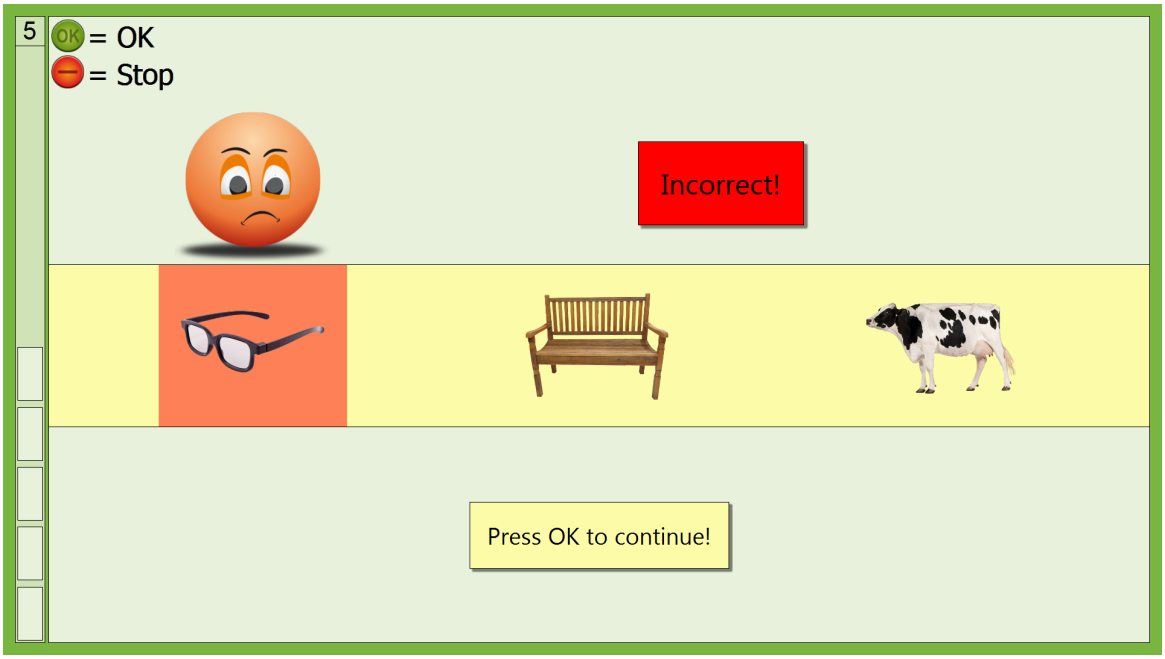

Fig. 3: Feedback "Text / autostop" in case of an error.

If ***visual feedback*** or ***acoustic feedback*** is enabled, each of the patient's responses is evaluated with a visual or acoustic reaction. If ***visual feedback*** is enabled, a positive smiley is shown when a correct decision was made. In case of an incorrect decision, a negative smiley is shown.

Fig. 4: "Visual" feedback in case of a correct reaction.

The ***acoustic feedback*** plays a positive sound when the patient answers correctly. Incorrect decisions prompt a negative sound.

A performance bar is displayed on the left or right side of the screen, showing the state of the performance in the current task (see Fig. 3). The bar grows with every correct response and shrinks with every incorrect one. If the bar reaches its top in the course of a task, the task is evaluated as ***solved correctly***.

1.3 Levels of difficulty

The training uses a pool of more than 120 concrete pictures (register cash, tree, horse, etc.). Each picture is matched with a term (name) which can be presented in the recognition phase.

The program works adaptively. The level of difficulty can be set between 1 and 9. The levels are determined by the number of pictures to memorize. Tasks range from very easy with only 1 picture to memorize up to very hard with the maximum number of 9 pictures to memorize, which has been set according to clinical studies.

level	no. of images	max. errors
1	1	0
2	2	0
3	3	0
4	4	0
5	5	0
6	6	0

7	7	0
8	8	1
9	9	1

Tab. 1: Structure of difficulty

A task is evaluated as solved if the number of errors is smaller than the error limit. This error limit is defined in Tab. 1. Up to level 7, no error is allowed. From level 8 onward, it is possible to make one error and still go on to the next level. After a task has been solved, the patient proceeds to the next level with new, randomly selected pictures. Pictures the patient had to memorize in the current training are excluded.

After two consecutive tasks at a given level have been solved correctly, the program switches to the next higher level of difficulty.

If a task has been solved ***incorrectly***, the same pictures are presented for up to ***5 times***. The patient has the chance to memorize the same pictures again. When this happens, the sequence of stimuli in the recognition phase is varied, although the sequence in the acquisition phase when stimuli are re-presented does not change. After 5 incorrect tasks, the module switches to the next lower level of difficulty.

The therapist helps the patient to develop strategies for memorizing and improving memory capacity. The module helps to apply and train these strategies.

1.4 Training parameters

Specific settings for the training module can be adjusted (see Fig. 5). This section describes each setting and explains how to adjust them.

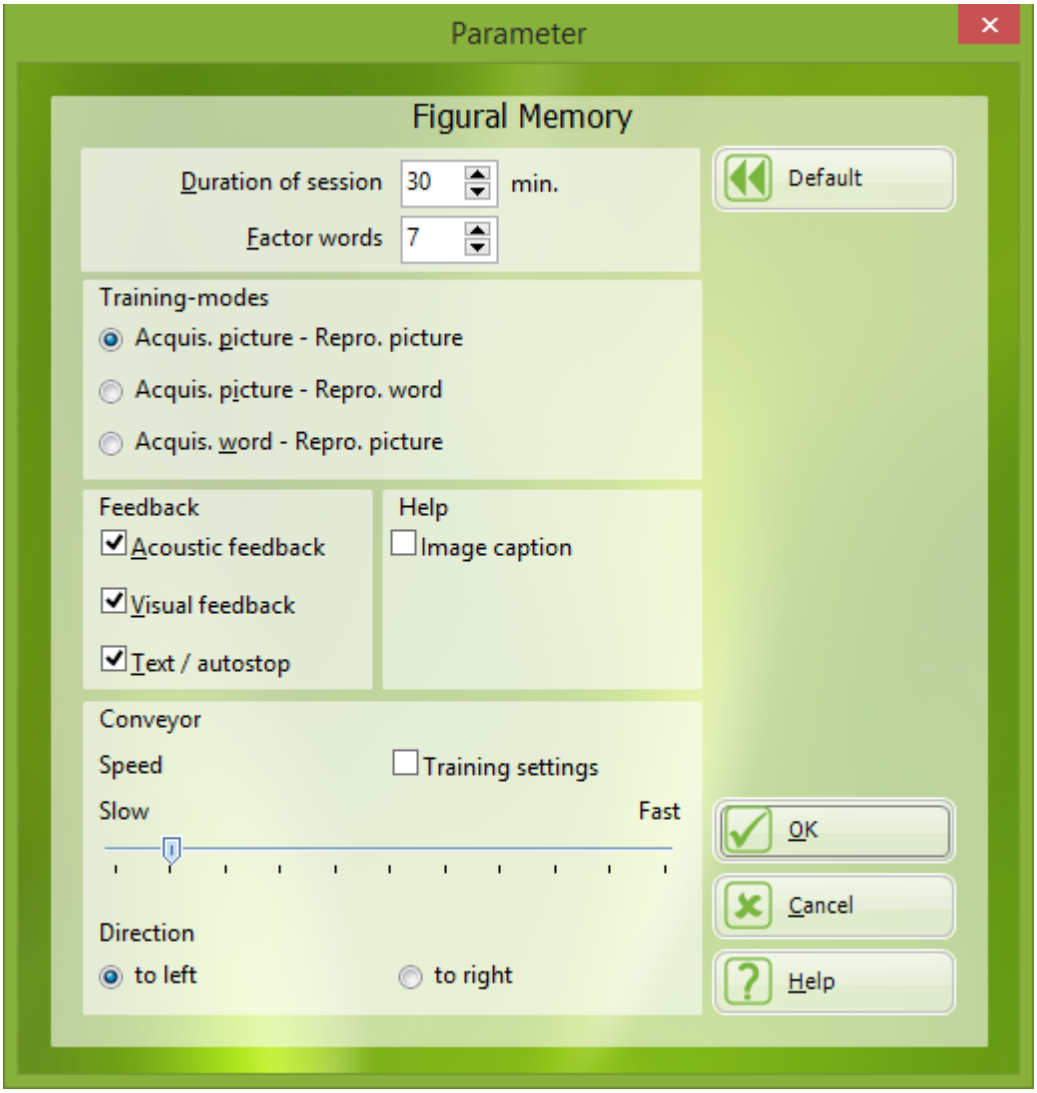

Fig. 5: Parameter settings

Duration of session (in min.):
A duration of 15–30 minutes is recommended.

Factor words:
The ***Factor words*** setting is used to establish the number of stimuli in the recognition phase. The total number of stimuli results from the number of stimuli the patient has to memorize multiplied by the value in the ***factor words*** setting. However, at least ten words will be shown. The factor ranges from 5 to 10. If a low factor is chosen, the time for recognition will be shorter. If a high factor is chosen, then ***long-term attention span*** is also trained in the higher levels of difficulty.

Training-modes:
Here you can change modes. Both, words and pictures, can appear in the acquisition phase and recognition phase. However, using words in both, the acquisition and recognition phases, is not available in this module. For that, please

take advantage of the module **Memory for Words**.

Acoustic feedback:
This feature should generally be enabled. Disabling this feature can raise the difficulty for patients with high performance as an additional stressor. In that case, however, all the other feedback modes should be disabled. If there are several patients training in one room, the acoustic feedback may lead to interference. In that case, acoustic feedback should be turned off or headphones used.

Visual feedback:
We recommend this feedback especially for children.

Textual feedback:
Generally this option should be enabled. For patients with high performance, the difficulty is increased if the option is disabled.

Help image caption:
As an additional help, the name of the image can be displayed as a text underneath the image during the recognition of images.

Trainings Settings:
If individual adjustments of the speed of stimuli during the recognition phase is desired, then the option **Training settings** should be enabled. When this setting is enabled, the controller for speed in the parameter settings is ignored.

Speed:
The rate at which the stimuli move across the screen can be modified in the parameter menu or during the training. Before the training starts, one can use the controller to change the speed at which the stimuli move across the screen. If the training has already started, the "1" or "2" button on the therapist's keyboard can decrease or increase the speed, respectively. If the parameter *Training settings* is enabled, the speed setting, which is set during the training, will be used the next time the training starts. In general one should work with an average rate. Changing to the slower speed is recommended for patients with a weaker performance level. However, returning to the average speed is recommended when performance improves.

Direction:
The direction in which the stimuli move across the screen can be changed. If ***to left*** is selected, the stimuli move from right to left. This corresponds to a reading direction from left to right. If ***to right*** is selected, the stimuli move from left to right. This corresponds to a reading direction from right to left.

When starting this module with a new patient, the following defaults are automatically set up:

Current level of difficulty	1

Duration of training session	30 minutes
Factor words	7
Speed	slow
Acoustic feedback	enabled
Visual feedback	enabled
Feedback text	enabled
Training-modes	Acquis. picture -> Repro. picture
Direction	to left
Help Image caption	disabled

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 or under More Details on the results page

Level	Current level of difficulty
Items	Number of items (images or words) per task to memorize
Correct	Number of correctly recognized items per task
Correct %	Number of correct reactions in % (Reactions to target items and not reactions to non-target items)
Mistakes	Number of errors where the incorrect word/picture was selected
Omissions	Number of errors where the relevant word/picture was missed
Acquis. time	Acquisition time in seconds (s)
Solution time	Time for solving the task in s
Comparisons	Number of stimuli (relevant and irrelevant) shown in the recognition phase
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 (percent correct per task, number of omissions per task) is also displayed on the Table and Chart tab.

2 Theoretical concept

2.1 Foundations

Memory is understood to be a process leading to a relatively stable change of the behavior (Kolb & Whishaw, 1985).

Impairments in memory capacities are often found in patients with brain insults of various origins, which may lead to serious handicaps in their professional and private life. The clinical image of such a disturbance is inconsistent and can selectively afflict particular memory areas concerning duration and character of the learning material. In memory disturbances, a distinction is made between ***retrograde*** and ***anterograde amnesia***. The first refers to the inability to remember a particular period before the disease, whereas the latter refers to the inability to memorize new things (after the lesion of the brain).

The first attempts to study and understand the complex functional system of our memory were carried out at the beginning of the 19th century.
In the basic research and clinical reality, a distinction is made between the ***short-term memory*** and the ***long-time memory*** (Atkinson & Shiffrin 1968, Warrington 1982), the procedural and the declarative (Cohen & Squire, 1980), the semantic and the episodic (Tulving, 1972), the verbal and the non-verbal or figural memory, explicit and implicit (Graf & Schacter, 1985) capacities.

The description of the structure of memory, based on the duration of information storage, results from the outcome of interdisciplinary research:

- sensory memory (retention time of a few hundred milliseconds),
- short-term memory (Broadbent, 1958; Wickelgreen, 1970) and working memory (cf. Baddeley, 1997) with an availability of information for a few seconds up to one minute, and
- long-term memory with a retention time from minutes to hours, weeks, or years.

The capacity of short-term memory, the memory span, is in healthy people 7± 2 information units. The model of the working memory assumes that several neural subsystems are involved which store predominantly visual-spatial information and phonological information (Hömberg, 1995). In addition to short-term retention of information, working memory also processes content in parallel. Some indicators for evaluating the functioning of working memory are the recall of numbers backwards, or the recall of visual memory span backwards.

The functions described as long-term memory are often divided into

- explicit memory; which stores semantic knowledge and biographic data (episodic knowledge) and can be recalled and named directly, and
- implicit (procedural) memory; which stores memories about motor sequences or rules which cannot be described directly (Hömberg, 1995).

Theories about the physiological and morphological correlation of memory processes have been postulated by, among others, Hebb (1949; cf. Kolb & Whishaw, 1985). Models on rules of coding, storing, and recalling of contents or their organization is still very controversial.

An important result of memory research is the current treatment of memory as an integral part of cognitive activity, and as an active process.
In this sense, memory functions are not only processes of information acquisition, long-term storage, and recall (in the sense of a passive store). Rather, existing memory contents have an impact on future information processing and undergo a ***re-evaluation*** for practical behavior (Hoffmann, 1983). Therefore, they also modulate a person's emotional experiences.

The diversity of the memory regions plays an important role in distinguishing memory functions. An evaluation of a patient's cognitive skills is possible only after extensive analysis, which includes the phase of acquisition, short- or long-term retention, and recall or recognition of new and old memory contents (with or without external help). Possible interference effects may impair the storage or recall of information, which should be taken into account in patients with attention disturbances.

Four methods in the rehabilitation of memory disorders are distinguished (von Cramon, 1988):

- repeated presentation of learning material,
- learning memory strategies,
- using external aids, and
- teaching specific knowledge about memory and possible disturbances (Glisky & Schacter, 1989).

When a patient's visual perception capacities are disturbed, restoring those capacities seems possible through direct stimulation. In contrast, restoring impaired memory functions is acknowledged to be hardly possible (Sturm, 1989). That means neuropsychological training of memory capacities should concentrate on substitution and compensation strategies.

The sections Training aim and Target groups provides further information.

2.2 Training aim

The objective of this module is to improve the patient's memory for visual material by exercising recognition capabilities. Demands on the patient's continuous attention are also made.
The module **Figural Memory** requires committing visually presented pictures to memory and then recognizing them when they are included in a stream of irrelevant objects.

This strategy of acquiring and then recognizing objects makes it possible for therapist and patient to work together to develop effective memory strategies and practice them to overcome deficits in memory processes.
A range of memory strategies can be used: associating pictures (and names) with existing memories, forming categories of the words (semantically or phonologically), or forming a new word with the first letters of several words . Furthermore a connection regarding the content can be found through using the words in a sentence or making up a story or a sequence of actions. By using these methods, the information can be stored more easily.

Spontaneous individual strategies found by the patient should be taken up, discussed and developed into effective strategies. Please note that processes that function automatically in healthy people will require a conscious effort in patients suffering from amnesia, and therefore represent an additional load or stress factor.

The module **Figural Memory** can be supplemented with the training of different memory functions by means of the RehaCom modules **Memory for Words** (WORT), **Topological Memory** (MEMO), and **Verbal Memory** (VERB). Specific training is offered in the module **Physiognomic Memory** (GESI). The module **Shopping** (EINK) requires additional action planning skills.

2.3 Target groups

People with brain injuries often have difficulty learning new information and storing or recalling information from long-term memory.

In addition to being prone to distraction and attention deficits, the patients who have a brain injury often have problems keeping track of things if confronted with a lot of information. They have difficulty ordering information logically and encoding it for long-term storage. Deficits in working memory and attention disturbances prevent the information from transferring to long-term storage.

Such memory disturbances can occur after numerous different types of injuries to the brain (e.g., primary and secondary degenerative diseases of the brain, hypoxia, infections,), in vascular cerebral injuries (e.g., infarcts, hemorrhages), traumatic brain injuries and tumors with lesions on one or both sides. Neurosurgical operations also can often lead to memory disorders. Damage to the medial temporal or thalamic regions, mammillary bodies, frontal cerebral structures, parahippocampal gyrus, and hippocampus often lead to memory disturbances.

When an infarct occurs, most of all the supply regions of the anterior cerebral artery and posterior cerebral artery as well as the polar thalamus artery are of great importance concerning memory disorders.

Often, visual memory is impaired after insults/strokes to the right hemisphere, whereas insults to the left hemisphere impact verbal memory.

Memory disturbances are often accompanied by further brain capacity disorders such as attention and linguistic problems, which have a strong impact on memory performance. The confounding effects makes neuropsychological diagnostics complicated.
Disturbances in action planning or problem-solving thinking or a lack of understanding about the disease can reduce the effectiveness of therapeutic memory strategies because the use of the therapeutic strategies outside the clinical setting is often inconsistent. An independent use of strategies often happens insufficiently then.

The training module was developed most of all for patients with impairments of visual short-term and working memory. It is also suitable for patients with visual span impairments and reduced recognition capacity. The training can also be used with patients who suffer from aphasic disturbances. Patients with serious attention deficits should first train with the RehaCom module **Attention & Concentration**, and patients with serious deficits of the visual perception functions should also train their visual perception function before beginning training with this module. Figural Memory can also be used for cognitive therapy in the scholastic and geriatric area. For children 11 years and older, a therapist should always be available. The module uses child-friendly instructions for patients up to the age of 14, and the instructions and words are on the vocabulary level of a 10-year-old.

Polmin, Schmidt, Irmler, and Koch (1994) tested 30 patients who had memory impairments after stroke with the RehaCom module **Figural Memory**. In the control group receiving no training, only 22% showed cognitive improvement over a short term and 17% over a longer term. In contrast, the training group showed 60% cognitive improvement over a short term and 70% over a longer term.

Friedl-Francesconi (1995) tested patients suffering from dementia with several of the RehaCom modules. They achieved improvements in memory and attention functions.

Höschel (1996) tested the effectiveness of a range of RehaCom modules in delayed rehabilitation of patients who had a traumatic brain injury and suffered from attention and memory disturbances. The pre–post comparison showed improvements for a range of functions, too.

2.4 Bibliography

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