HASOMED

RehaCom®

Cognitive therapy

Memory for Words

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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).

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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 therapy module 'Memory for words' the patient has to memorize a group of words. In every consultation, several tasks have to dealt with. Every task consists of an **acquisition** and a **recognition phase**.

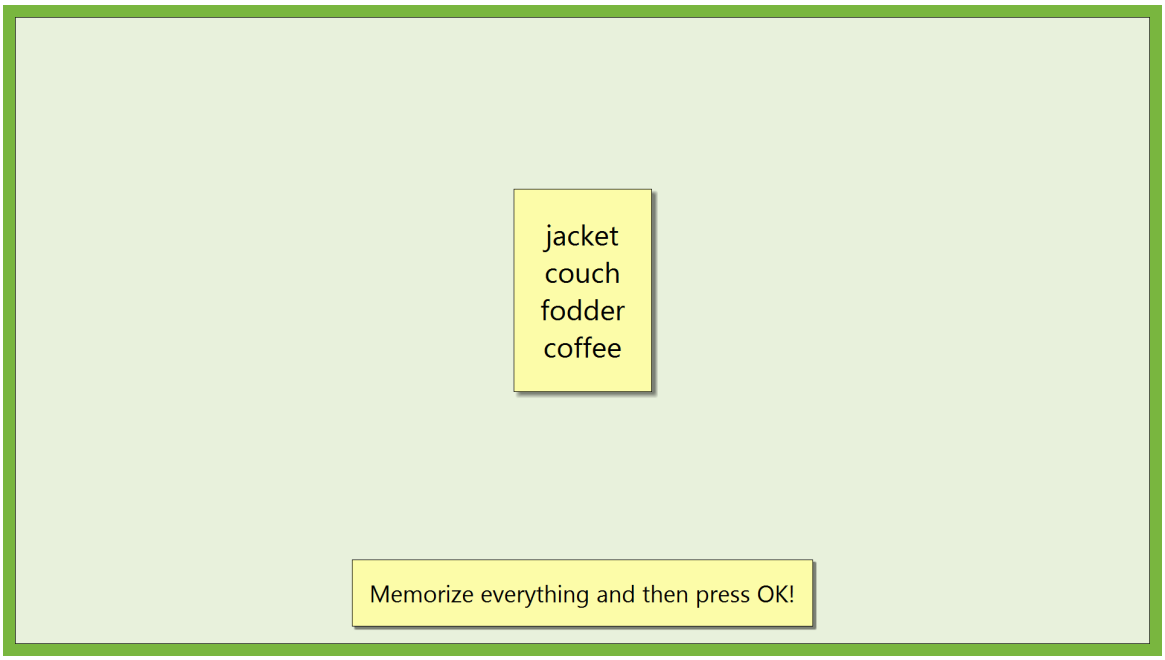

Fig. 1: Acquisition phase at a difficulty level of 10.
There are four very easy words to remember.

In the ***acquisition phase*** (see Fig. 1), a list of nouns is shown to the patient. The number and complexity of the words in the list depends on the level of difficulty. The length of the acquisition phase is determined by the patient. Once the patient has memorized all the 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 nouns from the acquisition phase from a series of nouns. The nouns scroll across the screen from one side to the other. By pressing OK on the RehaCom keyboard, the patient can select the correct words from the series when the target word reaches the red marked area. Selecting a word can be made from the time when the first letter of the word enters the red area until the last letter leaves the red area. If one of the memorized words is selected, the scrolling text pauses for a moment signaling the correct choice. In addition, further modes of feedback (see performance feedback) are available. The reproduction phase ends when all words in a task have been shown. After this the performance is then evaluated, and the 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.

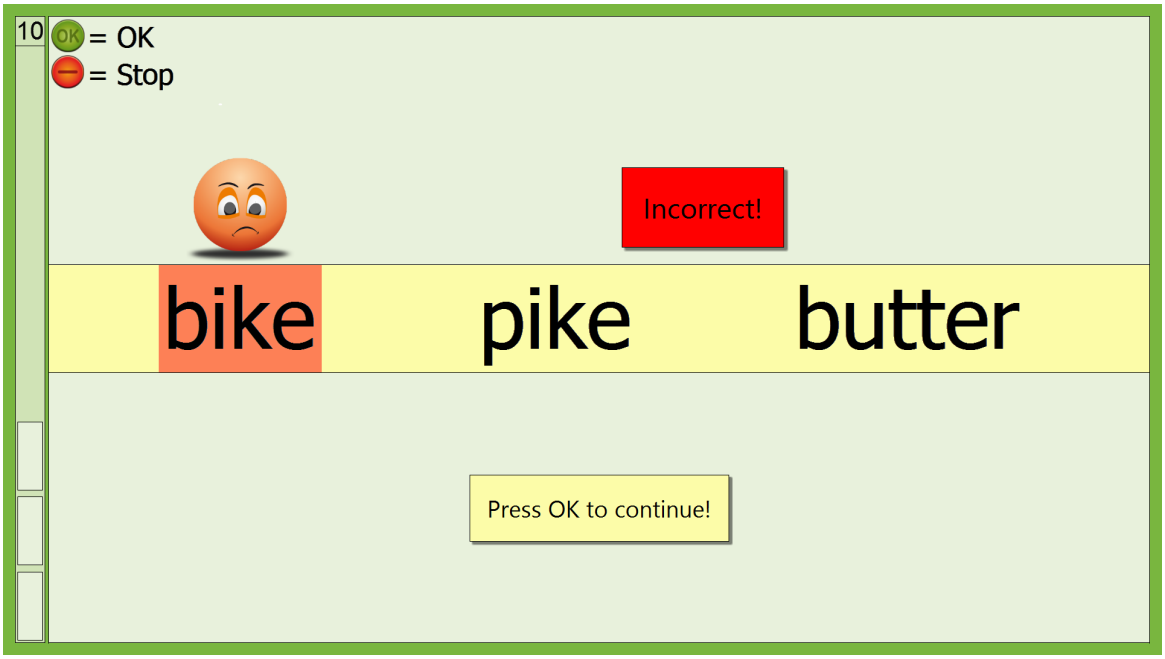

Fig. 2: Reproduction phase at difficulty level 10
at the moment of an error notification - textual feedback.

The speed at which the 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.
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.

When visual or acoustic feedback is enabled, each of the patient's responses is evaluated.
The ***acoustic feedback*** plays a pleasant sound when the patient answers correctly; incorrect decisions prompt another appropriate sound to be played.
When using ***visual feedback***, a yellow cartoon happy face appears to indicate a correct choice. When an incorrect decision is made, a red cartoon face appears. With children, a small man nods his head to correct decisions and shakes his head to incorrect ones.

If the ***Text / autostop feedback*** is enabled, then the patient receives advice as to

which words he has overlooked (see Fig. 2). The training then stops to display this feedback, and to continue, the patient just has to press **OK**. When the error text displays "Incorrect!" then the patient has selected a word from the series that was not presented during the acquisition phase. If the patient selects a correct word, the message "Correct!" is displayed.

A performance bar displays on the left side of the screen, showing the performance level during a task (see Fig. 2). When the bar reaches the top in the process of training, then the current task is evaluated as solved correctly. The column measures the quality of the patient's reactions. Incorrect decisions reduce the level and correct ones increase it.

1.3 Levels of difficulty

The training module uses a pool of over 600 words in 3 different levels of difficulty. This three types of words are divided into:

A ***simple words***: approx. 200 simple one or two syllable words (e.g., milk, sugar),
B ***medium words***: approx. 200 compound words, which are formed from two nouns (handbag, doorknob etc.) and
C ***difficult Words***: approx. 200 difficult combinations of words (feedback, earthenware, earthquake), which are not used that often in everyday language.

When using the training module for children up to the age of 14, one can use a pool of approx. 600 words which can be found in the word range of an average 10-year-old.

Despite careful selection, it is probable that some words may not be relevant to the English-speaking world. For this reason, the therapist can replace the particular word. The therapist will need a text editor program that will not generate additional control characters (e.g., notepad.exe in Windows). However, any files that are changed by the therapist must be backed up somewhere other than the RehaCom directory before an update of the module takes place because the update will overwrite modified files in the directory.
If required the therapist can generate his own word lists.
The words are located in the file WORT2Tenu.txt under the markers @WOS1, @WOS2, @WOS3, @KindWOS1, @KindWOS2, and @KindWOS3.

The levels of difficulty of the module are adaptive. There are 30 stages of difficulty which are determined by the number and the kind of the words to be memorized. Table 1 describes the structure of the levels of difficulty.

A task is evaluated as "solved" if the error count is below the error limit. The error limit is defined in Table 1. No error is permitted when the task consists of only 4 words. At a level that contains 5 - 8 words, it is possible to make only one mistake

and still go on to the next level. At a level that contains 9 - 10 words, up to two mistakes are permitted. After a task has been solved, the patient proceeds to the next level where a new selection of random words have to be memorized. The words which are used in the new task are different from the words used in the previous task.

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

If the error limit is exceeded during the task, the identical words are trained up to 5 times. The patient has the chance to memorize the identical words again. The order of the words in the acquisition and recognitions phases is varied. If, after the 5th repetition of the recognition phase, the patient is still not able to solve the task, the module switches to the next lower level of difficulty.

The maximum of 10 words to memorize was determined after clinical preliminary investigations. In choosing a level of difficulty, a spectrum of very easy to difficult training tasks is then possible.

Difficulty level	***number of words***	***type of words***	***error margin***
1	1	A	0
2	1	B	0
3	1	C	0
4	2	A	0
5	2	B	0
6	2	C	0
7	3	A	0
8	3	B	0
9	3	C	0
10	4	A	0
11	4	B	0
12	4	C	0
13	5	A	1
14	5	B	1
15	5	C	1
16	6	A	1
17	6	B	1
18	6	C	1
19	7	A	1
20	7	B	1
21	7	C	1
22	8	A	1

23	8	B	1
24	8	C	1
25	9	A	2
26	9	B	2
27	9	C	2
28	10	A	2
29	10	B	2
30	10	C	2

Tab. 1: Structure of the level of difficulty

The therapist should help the patient to develop strategies for memorizing and improve performance of memory. The module helps to develop and train these strategies.

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.

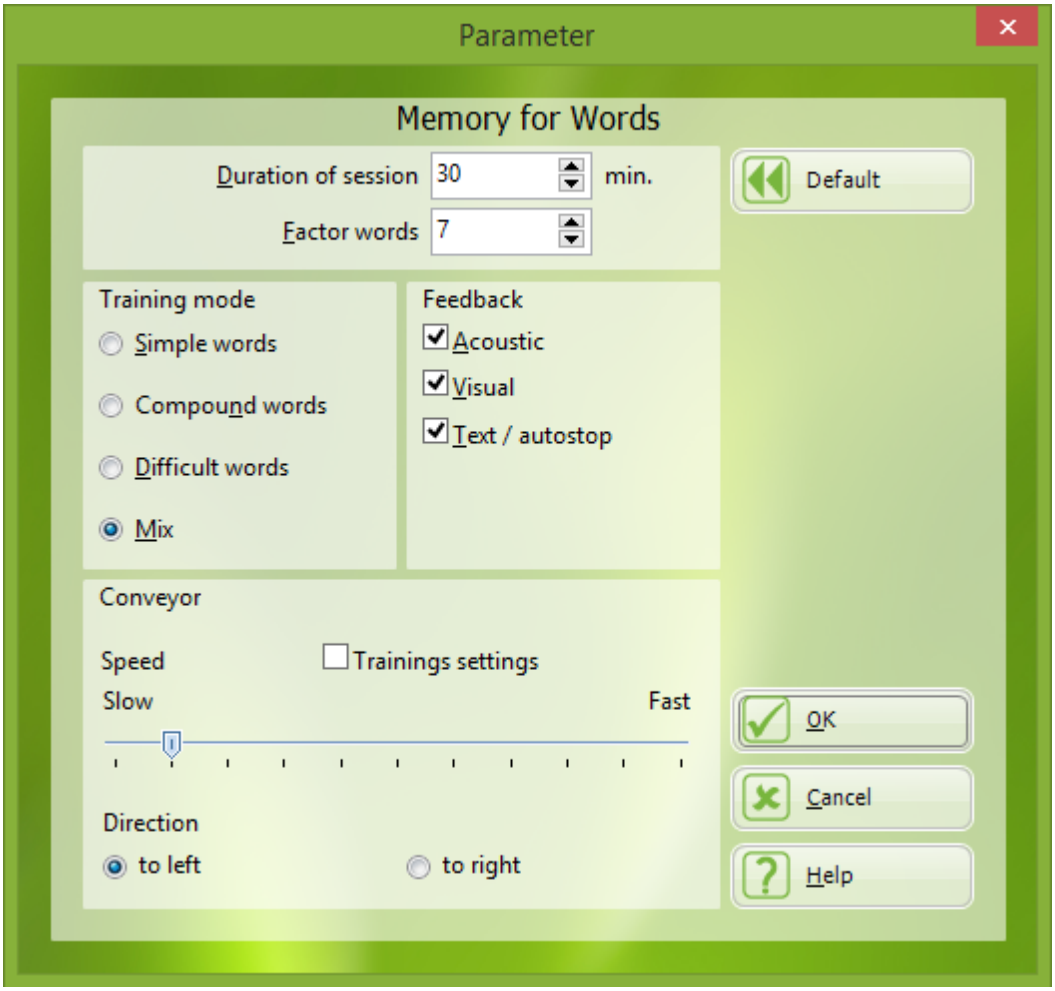

Fig. 3: parameter menu

Duration of session in min:
A duration of 25 - 30 minutes is recommended.

Factor words
The ***Factor words*** setting is used to establish the number of words that appear in the recognition phase. It is calculated by multiplying the number of words the patient has to memorize by the value in the factor words setting. However, a minimum of 10 words are 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 mode (Material used):
In practice, it turned out that a series of patients did not achieve a higher level of difficulty when the type of words were changed (e.g. from single words to word combinations, even with the same number of words). In such cases, influences on performance that affect memory should be taken into consideration (e.g., restrictions of literacy, phasic influences). For these patients, the module offers the possibilities to modify only the number of the words to be memorized and not the kind of words.

Training is only carried out with the determined type of words (see table 1). For example, if simple words is chosen, then the patient only works with levels associated with this type: 1, 4, 7, 10, and so forth up to 28.

Acoustic feedback:
If there is more than one patient working in the room, then the acoustic feedback should be disabled or head phones may be used.

Visual feedback:
The visual feedback is highly recommended with children.

Textual feedback:
In general this option should always be enabled. It can, however, be disabled for patients with a very high performance level to increase difficulty.

Trainings Settings:
If individual adjustment of the speed of the words 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 words 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 words 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. 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 words move across the screen can be changed. If ***to left*** is selected, the words move from right to left. This corresponds to a reading direction from left to right. If ***to right*** is selected, the words 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
Training mode	Mix
Acoustic feedback	enabled
Visual feedback	enabled

Text / autostop feedback	enabled

Tab. 2: Default parameters

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
No. of words	Number of words to be memorized
Mistakes	Number of mistakes
Omissions	Number of omissions
Acquis. time	Acquisition time in s
Solution time	Solution time in s
Train. time task	Effective training time in [h:mm:ss]
Breaks	Number of breaks caused by the client

Tab. 3: Results

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 (cp. 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, averages by 7 ±2 information units. The model of the **working memory** assumes that several neural subsystems are involved, which store predominantly visual-spatial 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 and cannot be recalled or described verbally (Hömberg, 1995).

Theories about the physiological and morphological correlation of memory processes have been postulated by, among others, Hebb (1949; to be compared with 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 more than a passive storage facility with processes for information acquisition, long-term storage, and recall. Rather, existing memory contents have an impact on future information processing and undergo a re-evaluation for practical behavior (Hoffmann, 1983). Therefore, they modulate a person's emotional experiences.

The diversity of the memory regions plays an important role in distinguishing memory functions. An evaluation of a person's cognitive abilities, is possible only after an 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 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 disturbances 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 more Information.

2.2 Training aim

The objective of this module is to improve the patient's memory for verbal material by exercising recognition capabilities. Demands on the patient's continuous attention are also made.
The module Memory for Words requires memorizing nouns simultaneously presented on the screen and then recognizing them when they are included in a scrolling list with irrelevant terms.

This strategy of acquiring and then recognizing words 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: forming categories of words (semantic or phonological), incorporating the words into a story or a set of tasks, or forming a new word with the first letters of all the words to be memorized. 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 with patients who suffer from amnesia and therefore represents an additional load or stress factor.

The module **Memory for Words** can be supplemented with the memory training available in other RehaCom modules: **Figural Memory** (BILD), **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

Patients with brain injuries often have difficulty learning new information and storing or recalling information from the *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 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), skull-traumas and tumours 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, or hippocampus often lead to memory disturbances.

During infarcts, the areas of the anterior cerebral artery and posterior cerebral artery as well as the polar thalamus artery are above all 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 different disorders in brain performance, such as attention and linguistic problems, which have a strong impact on memory performance. The confounding effects makes neuropsychological diagnostics complicated. Also, problems in the patient's ability to plan actions, skills in problem solving, or lack of understanding about the illness can reduce the effectiveness of therapeutic memory strategies because the use of therapeutic strategies outside the clinical setting is often inconsistent.

The training module was primarily developed for patients with disturbances to verbal short- and long-term memory. In addition this training can be used with patients who suffer from disturbances to their range of words or patients who have problems with recognition. It can also be used with patients who have aphasic problems. Patients who suffer from strong attention problems should first train with the RehaCom module Attention & Concentration, and patients with serious deficits in visual perception should also train their visual perception function before beginning thaining with this module.

Memory for Words can be also be used for cognitive therapy in the field of geriatrics and also with children 11 years and older. With children, it is advisable that a therapist be available at all times. 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 an average 10-year-old.

Höschel (1996), Puhr (1997), and Regel & Fritsch (1997) have evaluated the effectiveness of the module Memory for Words on various patient groups - which resulted in improvements in their cognitive performance (as related by the higher pre-post tests) and in part improvements in everyday life was also noticed (transfer effect).

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