HASOMED

RehaCom®

Cognitive therapy

Memory Strategy Training

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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).

Germany / Europe / Worldwide:
HASOMED GmbH
Paul-Ecke-Str. 1
D-39114 Magdeburg

Tel: +49 (391) 610 7645
www.rehacom.com
info@rehacom.com

USA:
Pearson Clinical Assessment
19500 Bulverde Road, Suite 201
San Antonio, TX 78259-3701

Phone: 1-888-783-6363
www.pearsonclinical.com/RehaCom
rehacominfo@pearson.com

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 Learning and Memory Training consists of two training modes: "**Mode Nonverbal Learning Disorder**" and "**Mode Verbal Learning Disorder**". In the mode verbal learning disorder, visual memorization is connected with verbal reproduction. In the training nonverbal learning disorder, verbal memorization is connected with visual reproduction. Both modes provide additional **learning strategies**.

Each task consists of an acquisition and reproduction phase, which are separated from each other by a distraction task.
The purpose of the distraction task is to ensure that not only the short time memory is trained but also, and primarily, the long term memory.
During the memory training the clients task is to acquire and apply learning strategies in order to memorize and recall a certain number of objects. These learning strategies should be instructed additionally by the therapist at the beginning of the training session. During the training the respective learning strategy can be viewed again by using the help function.

Mode Nonverbal Learning Disorder (memorize words - reproduce images)

In the acquisition phase a number of words that have to be memorized will be presented to the client (see fig. 1). The time span for memorizing will be determined by the client him/herself. The client can finish the acquisition phase by pressing the "continue" button.

Fig. 1: Acquisition phase for nonverbal learning disorder

After a distraction task, the client enters the **reproduction phase**. Pictures of objects are being presented on the screen (the words are being visualized). See fig. 2. The task is to look for the memorized words and click on the corresponding images with the mouse.

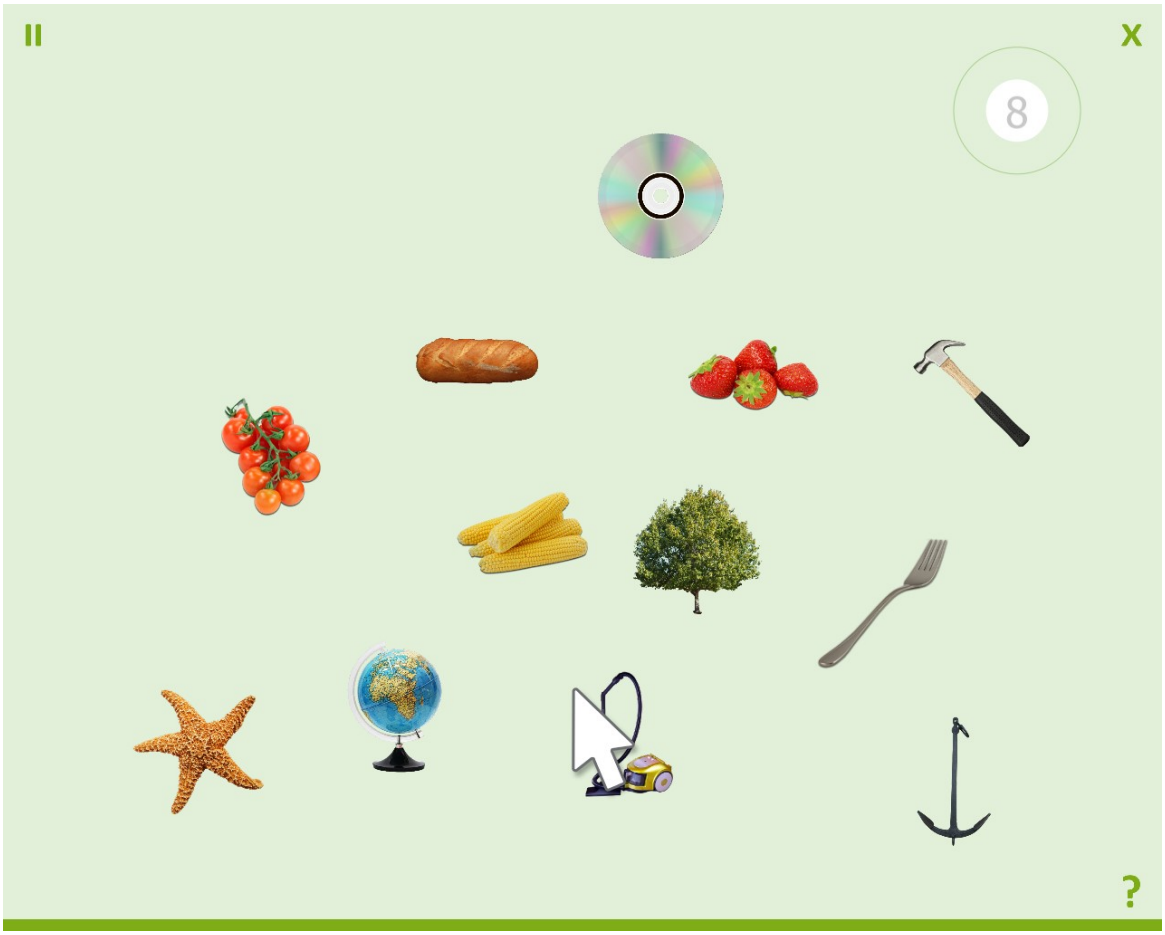

Fig. 2: Reproduction phase for nonverbal learning disorder

The reproduction phase is finished when all terms have been found or the maximum permissible number of mistakes has been exceeded.
Then, the performance will be evaluated and the client will be informed whether or not he/she will continue working at the current level or move on to a higher level of difficulty.

This mode works adaptively. If the client solves a task at first try, the next level of difficulty will begin.

Mode Verbal Learning Disorder (memorize images - reproduce words)

In the mode **verbal learning disorder** a list of objects that are displayed as images need to be memorized by the client (see fig. 3). The time span for memorizing will be determined by the client him/herself. The client can finish the acquisition phase by pressing the "continue" button.

Fig. 3: Acquisition phase for verbal learning disorder

After working on the distraction task, the client enters the **reproduction phase** and has to recognize the memorized terms from a larger number of words. The words will be distributed over the whole screen (see fig. 4). The task is to scan the screen for the memorized terms and click on the corresponding words with the mouse.

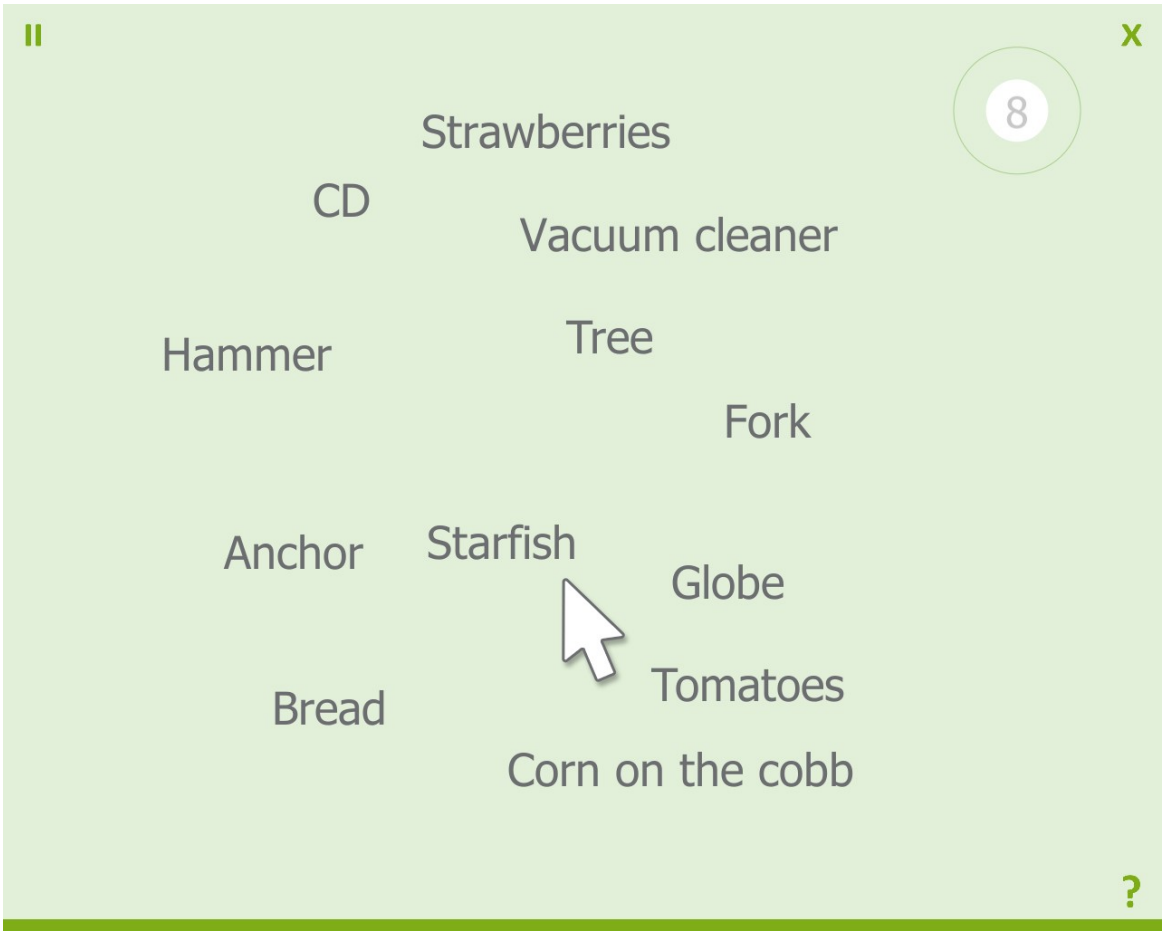

Fig. 4: Reproduction phase for verbal learning disorder

The reproduction phase is finished when all terms have been found. Then, the performance will be evaluated and the client will be informed whether or not mistakes were made and if he/she will continue working at the same level or move on to a higher level of difficulty.

Distraction Task

The **distraction task** aims to transfer terms of the memory training from the short time memory to the long term memory.

The client has to react to a visual stimuli (a fruit is falling off a tree) by pressing a key or a mouse button. The time span of this task can be adjusted in the parameter menu and can reach from 10 up to 90 seconds (default: 90 seconds). If the patient does not react within 10 seconds, the training will be paused.

Fig. 5: Distraction task betw een acquisition and reproduction phase

Learning Strategies

The **learning strategy** is part of the instructions and will be adapted depending on the respective mode. During the instructions the learning strategy will be explained briefly (see fig. 6 and 7). A more detailed explanation can be viewed in the Details section.

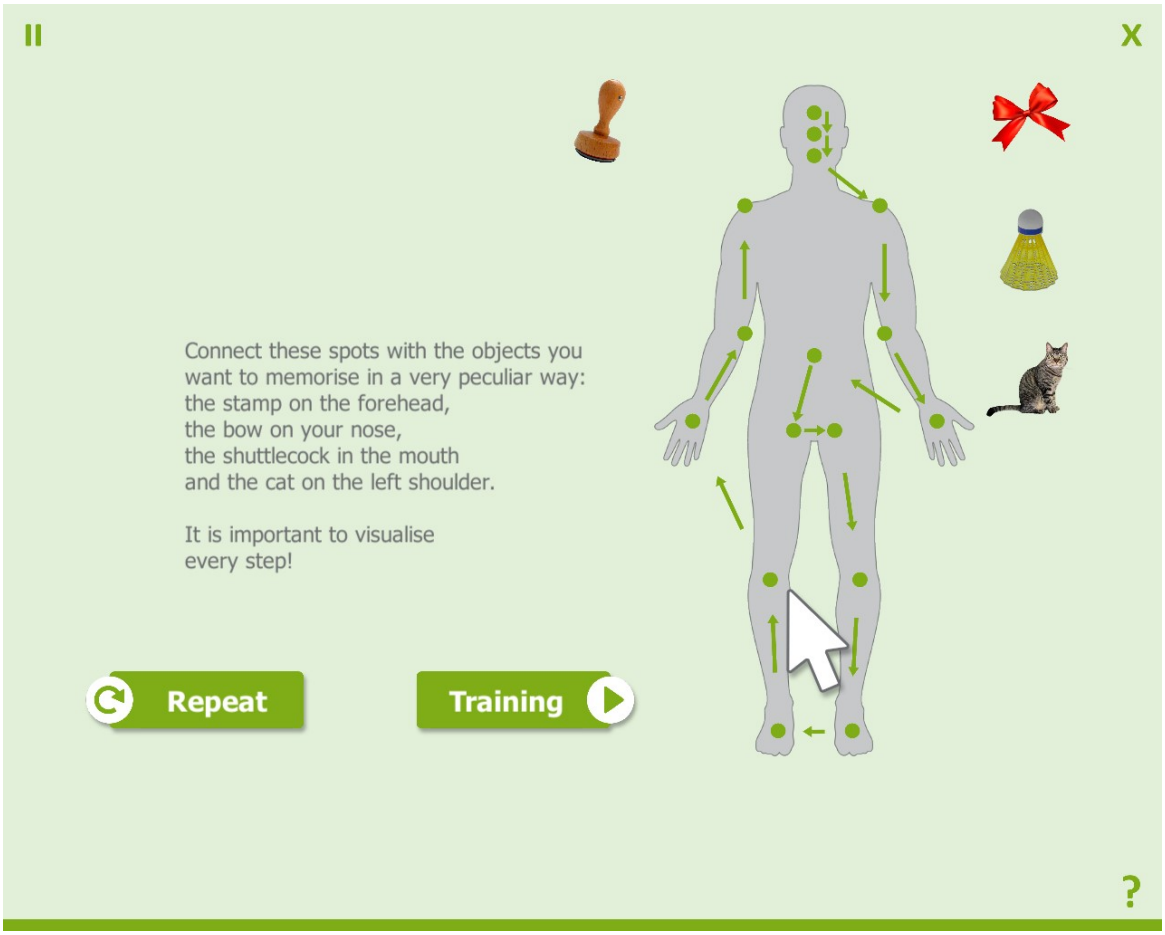

Fig. 6: Learning strategy Body Route for nonverbal learning disorder

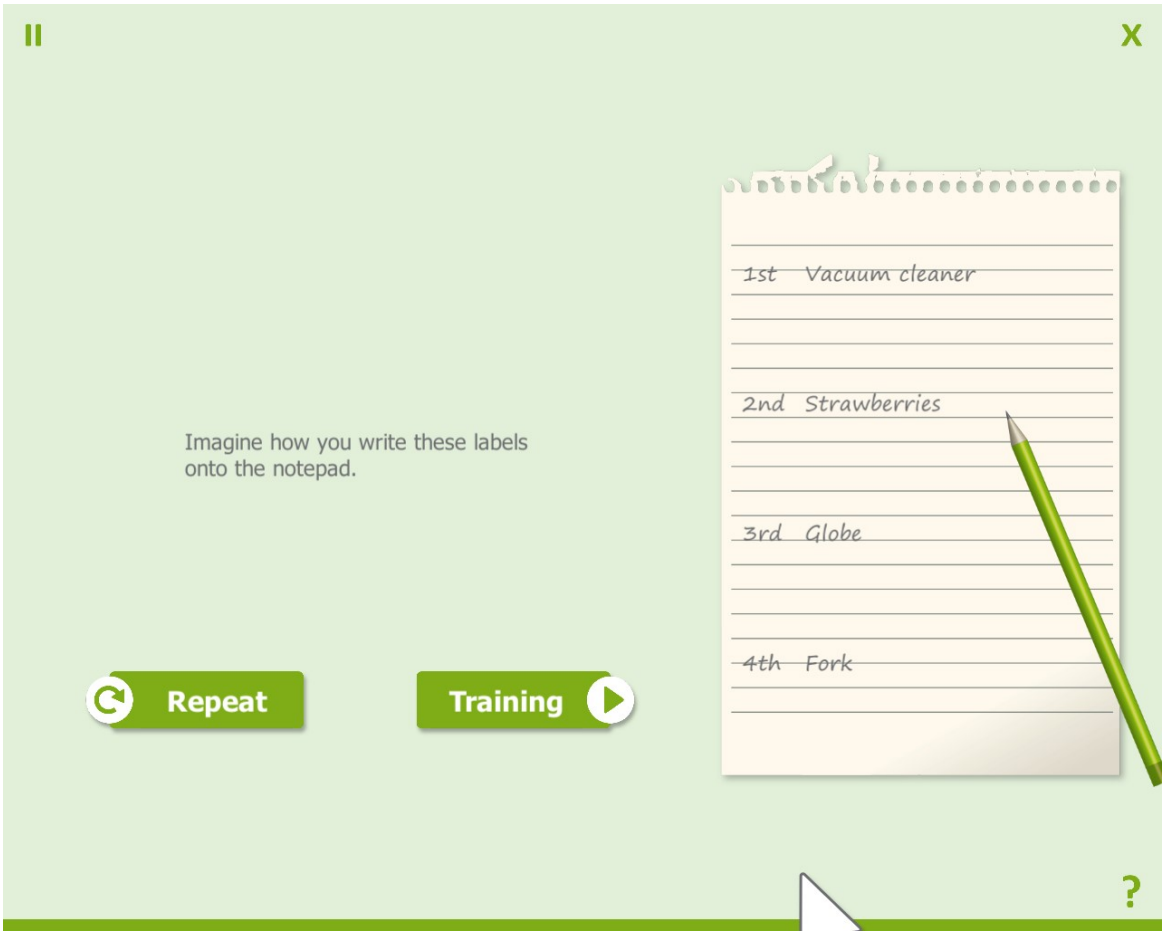

Fig. 7: Learning strategy Notpad for verbal learning disorder

1.2 Performance feedback

Feedback is realized on multiple levels. In the reproduction phase of the learning and memory training the client receives direct visual and acoustic feedback after the selection of an object.

If the client **correctly** selects an object, a **green frame** will appear around the image or word (see fig. 8) and a **positive feedback sound** can be heard. After that, the object disappears.
If the client **wrongly** selects an object, a **red frame** will appear around the image or word (see fig. 9). In addition, an **error sound** will be heard.

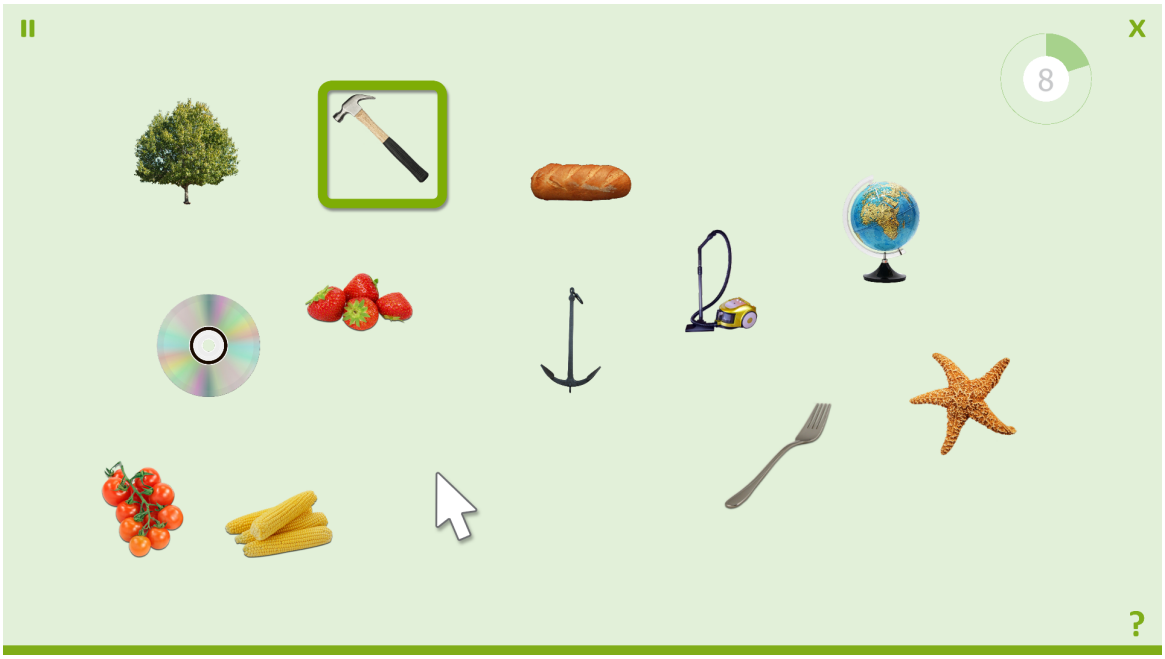

Fig. 8: Feedback for a correct selection

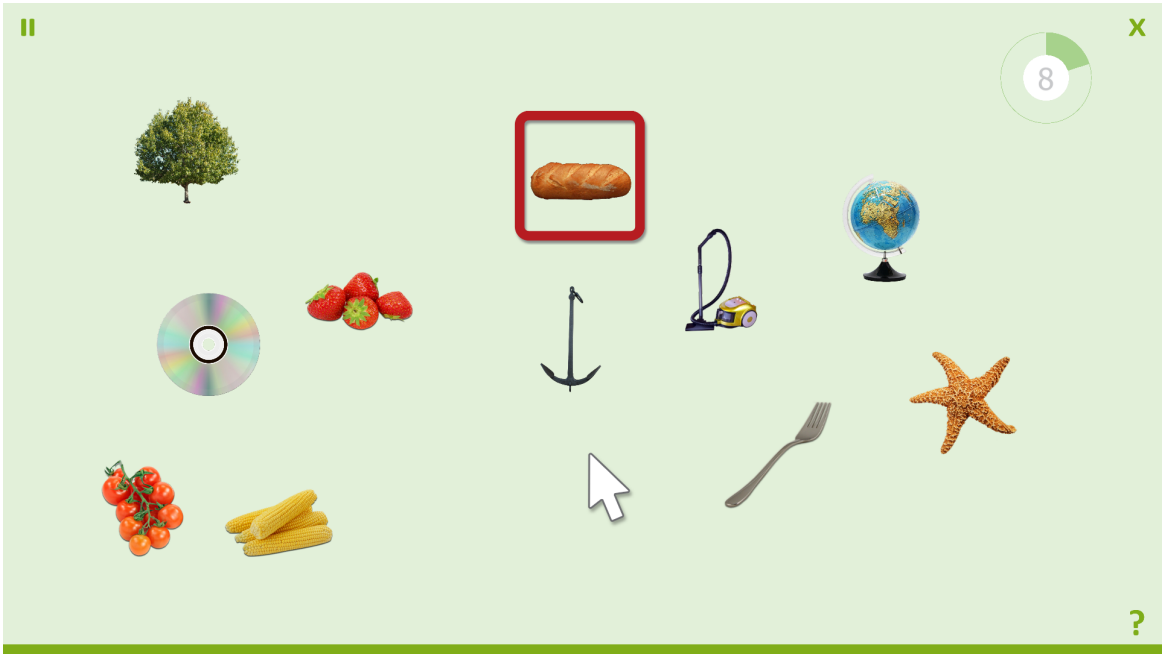

Fig. 9: Feedback for an incorrect selection

The task is finished when all terms have been found or the maximum permissible number of mistakes has been exceeded. If the client solves the task at first try, the level of difficulty will be increased. If the client does not find all the terms, the task will be repeated. The client continues at the same level of difficulty.

During the training, the current level of difficulty will be displayed in the **level display**

in the upper part of the screen (see fig.10). The fill level of the outer ring indicates the progress within the current level of difficulty.

Fig. 10: Level display: level 8 with 40% solved tasks

After finishing a task, the **performance feedback** (see fig. 11) will appear in a verbal and visual form.

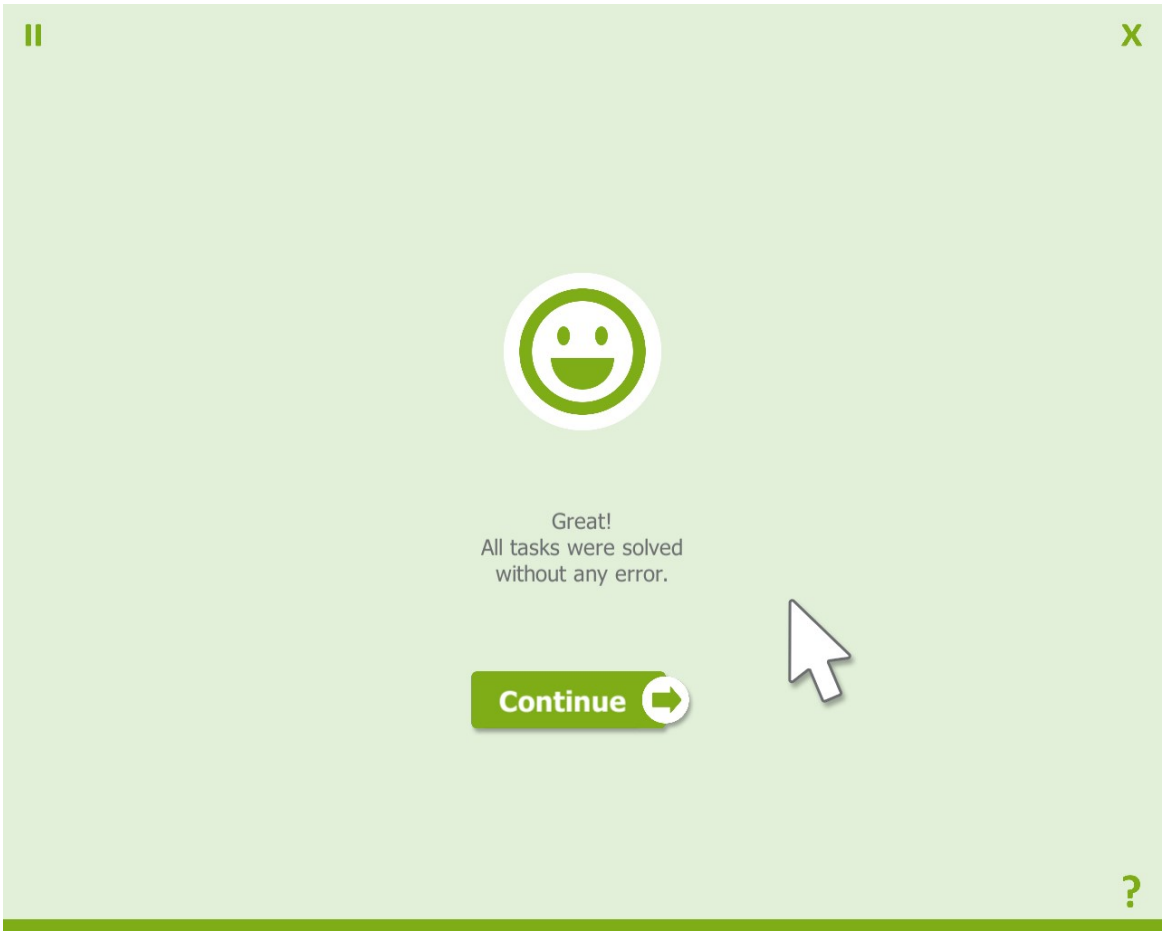

Fig. 11: Feedback screen

1.3 Levels of difficulty

This module works adaptively. If a task has been solved without any mistakes at first try, the level of difficulty will be increased. If the client makes mistakes, the task will be repeated. If the task has been solved without any mistakes in the repetition run, the next task will still be of the same difficulty. The level of difficulty remains the same until the client is able to solve a task at first try without any mistakes.

Level of difficulty	Number of items to memorize	Number of additional objects in the reproduction phase
01	2	3
02	2	4
03	3	4
04	3	5
05	4	5
06	4	6
07	5	6
08	5	7
09	6	7
10	6	8
11	7	8
12	7	9
13	8	9
14	8	10
15	9	10
16	9	11
17	10	11
18	10	12

Tab. 1: level of difficulty structure

1.4 Training parameters

In the Foundations RehaCom general information concerning the parameters and their effects can be viewed.

Skip tutorial:
The integrated tutorial can be skipped by the therapist if necessary. Therefore, the lower corner button  or button 0 (zero) can be used.

Fig. 12: Parameter menu

Consultation time in min:

A training time of 30 minutes is recommended.

Mistakes until task stop:

Determines the number of maximum permissible mistakes in the reproduction phase. A number of 3 mistakes until interruption of the task and repetition of the acquisition phase is recommended.

Duration of the distraction task:

For the recall of the memory contents from the long term memory, a duration of 90 seconds is recommended for the distraction task.

Reproduction mode:

memorize word, find image (nonverbal learning disorder)

memorize image, find word (verbal learning disorder)

Input mode:

In general, the learning and memory training is controlled with the mouse. In addition, an operating keyboard (patient keyboard) and a touchscreen are available.

The navigation using the keyboard or touchscreen is performed with the help of a

selection frame (blue frame around the active image, see fig. 13) or a selection color (word is highlighted in blue, see fig. 14).

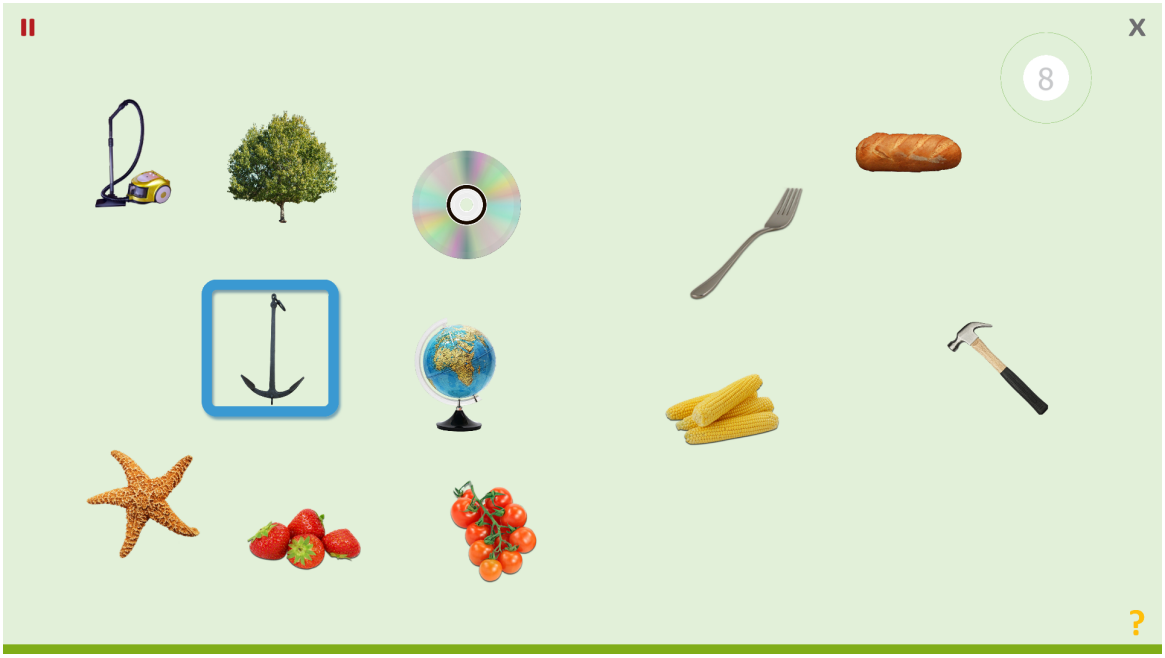

Fig. 13: Navigation with keyboard (selection frame)

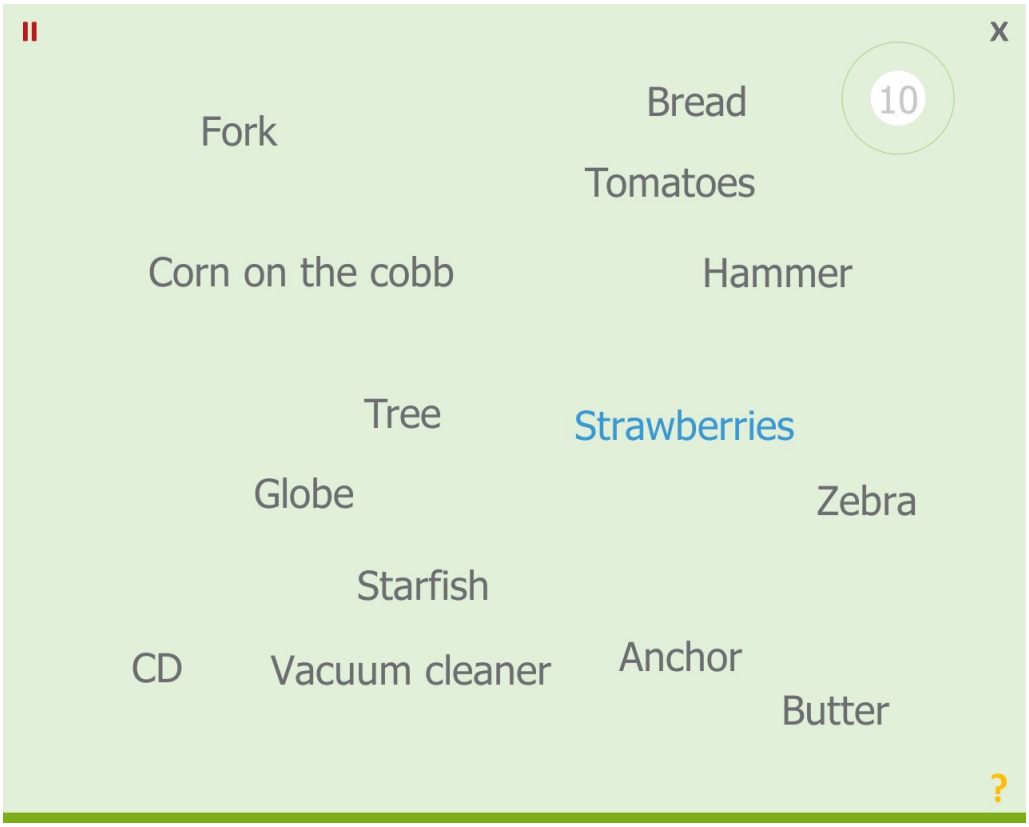

Fig. 14: Navigation with keyboard (change in color for selection)

Standard values:

Duration of training/consultation	30
Mistakes until breakup:	3
Duration of distraction task :	90 s
Type of task:	nonverbal learning disorder
Input mode:	mouse

Impairment of the visual field:

The option Impairment of the visual field in the client record (fig.15) can be activated if a client with an impairment of the visual field or a neglect uses RehaCom.

If the option is activated, the terms that have to be memorized in the module learning and memory training will not be placed in the exterior area of the affected side (see fig.16).

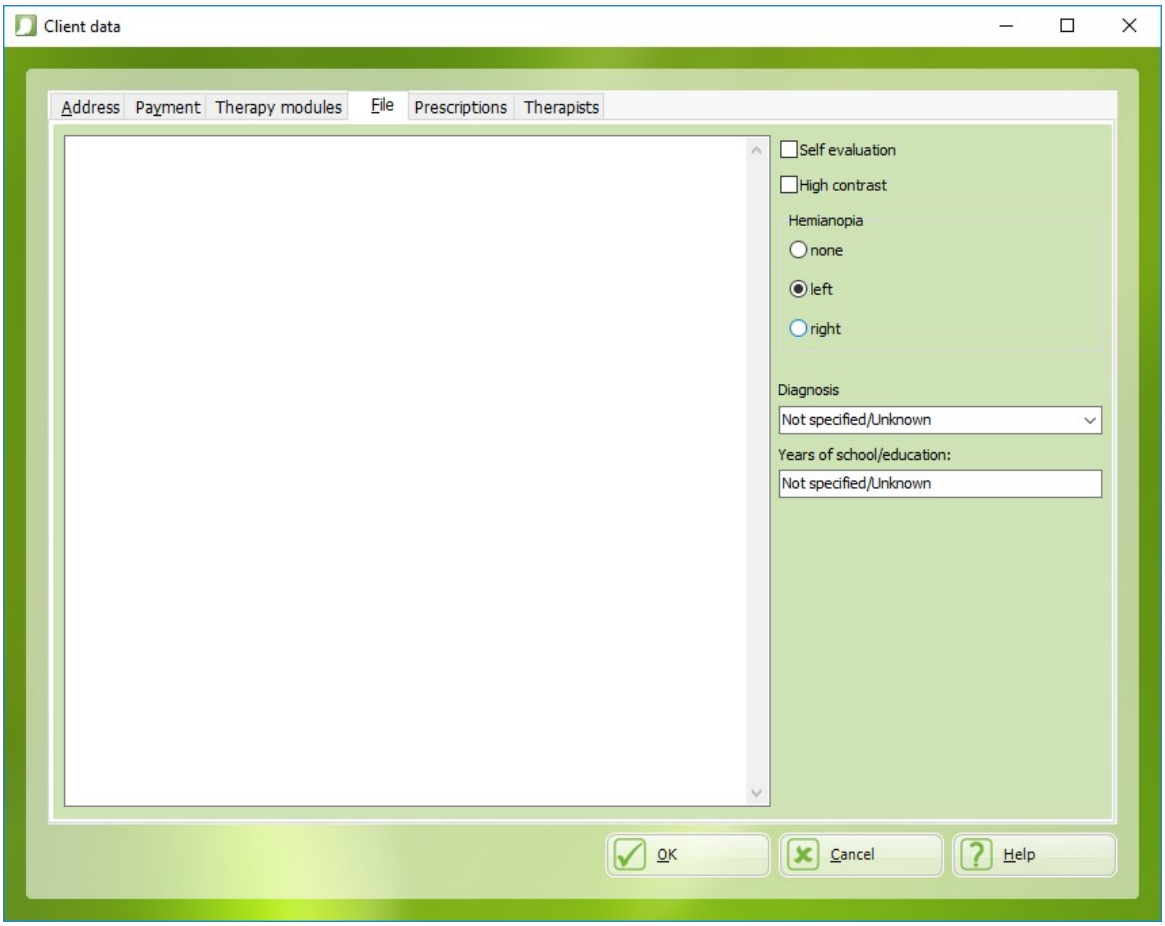

Fig. 15: Patients file with the option impairment of the visual field left.

Fig. 16: Distribution of elements for impairment of the visual field

1.5 Data analysis

In the graphic and tables, besides the settings of the training parameters, the following information are available:

level	current level of difficulty
mistakes	total number of wrongly selected items in the reproduction phase
mistakes left	number of wrongly selected items on the left half of the screen.
mistakes right	number of wrongly selected items on the right half of the screen.
mistakes distraction task	number of mistakes in the distraction task
correct	number of correctly selected items in the reproduction phase.
correct left	number of correctly selected items on the left half of the screen in the reproduction phase.
correct right	number of correctly selected items on the right half of the screen in the reproduction phase.
median reaction time	median over all reactions to relevant stimuli in the reproduction [ms]
training time task	training time of the respective task [h:mm:ss]
breaks	number of breaks by the patient

Specific information concerning the current and respectively all training consultations can be printed.
The diverse possibilities of the data analysis are explained in the Foundations RehaCom.

2 Theoretical concept

2.1 Foundations

Memory is considered as a process which leads to a relatively stable change in behavior (Kolb & Wishaw, 1985).

Impairments of the memory can often be found in patients with brain damage of different convalescence and can lead to severe limitations in professional and private life. The clinical appearance is inconsistent and can selectively affect specific memory areas. In case of an impairment of the memory, a differentiation between a retrograde and anterograde amnesia has to be made: the former describes the inability to remember a specific period in time before the disease, while the latter describes the inability (after a lesion) to memorize new information.

The first efforts to understand and examine the complex functional system of memory were already made in the beginning of the 19th century.
When doing fundamental research and in clinical contexts the short term memory is compared to the long term memory (Atkinson & Shiffrin 1968, Warrington 1982), the procedural to the declarative (Cohen & Squire, 1980), the semantic to the episodic (Tulving, 1972), the verbal to the nonverbal or figurative as well as the explicit to the implicit memory (Graf & Schacter, 1985).

A classification of the memory in regard to the duration of the information storage results from interdisciplinary fundamental research:

- sensory memory (a few 100ms)
- short term memory (STM) (Broadbent, 1958; Wickelgreen, 1970) and working memory (see Baddeley, 1990) with a few seconds up to one minute accessibility of the information
- long term memory (LTM) with an accessibility of minutes, hours, weeks or years

The capacity of the short term memory, also called memory span, adds up to 7 plus/ minus 2 information units for healthy individuals. The concept of the working memory is based on the assumption that there are multiple neuronal subsystems involved that receive, on the one hand, primarily visual - spatial and on the other hand, primarily acoustic - verbal information (Hömberg, 1995). Besides the short term "holding" of information, parallel working processes of the contents are assumed. Indicators for the functioning of the working memory are for example the repetition of numbers backwards or the backwards reproduced visual memory span.

In regard to the functions of the long term memory one has to differentiate between:

- the explicit memory, which stores knowledge data (semantic knowledge) and biographic data (episodic knowledge) that can be recalled and named directly, and
- the implicit (procedural) memory, which stores acquired movement processes and rules that cannot be recalled and verbalized directly (Hömberg, 1995).

Theories concerning physiological as well as morphological correlations of memory processes, such as the long term potentiating effect, have been postulated by Hebb (1949; see Kolb & Wishaw). Conceptions regarding the principles of the encoding, storage and recall of information and respectively their organization, are still subject of a controversial debate.

A very important result of memory research is the current assumption that the memory is an integrative part of cognitive skills.
In this respect, memory functions are not only processes of the reception of information, the long term storage and recall processes (in the sense of a passive storage), but it is also important to consider that memory contents have an effect on future information reception and undergo a new evaluation when applied in a practical context ((Hoffmann, 1983). Therefore, they also affect the emotional experience of an individual.

The diversity of the different aspects of memory plays a major role in the identification of memory functions. The evaluation of the status of cognitive abilities is only possible after an extensive diagnostics, which detects the phase of memorizing, of short and long term memory as well as the recall of new and old memory contents (with and without help, recognition) in a modal specific way. Possible interference effects may affect the storage and the accessibility of information, which needs to be considered when working with patients with an attention disorder.
The Rivermead Behavioral Memory Test (RBMT; Wilson et al., 1992) is an example for a strong behavior oriented test, which aims to test different aspects of memory. The WMS-R (Wechsler Memory Scale) is a differentiated diagnostic instrument in the cognitive field.

Four fundamental methods are differentiated in the **rehabilitation** of memory disorders (see Cramon, 1988)

- repeated presentation of learning material
- acquisition of memory strategies
- use of external help and
- teaching of specific knowledge about the memory and possible disorders (Glisky & Schacter, 1989)

While restitution through direct stimulation of the impaired functions appears to be possible for visual perception processes, it has been said that, for memory processes, the restitution of impaired functions is rarely possible (Sturm 1989). Consequently, a neurological training of memory functions should concentrate on substitution and compensation strategies.

The sections Training aim and Target groups provide further information.

2.2 Training aim

The aim of this training is the acquisition of **learning strategies** in regard to verbal and nonverbal memory disorders.

During the acquisition and reproduction the client becomes acquainted with different memory strategies that can be consolidated through continuous practice.

Currently, the **body route** and the notepad are provided as learning strategies. When using the body route, the client follows an imaginary path along his/her body and puts the terms on different positions. For the reproduction the client follows that path once again and recalls the memorized terms. The notepad can be used to write down the labeled terms of the image presentations.

2.3 Target groups

Patients with brain damage often have difficulties in containing new information and storing and recalling them in the long term memory. In combination of increased distraction and attention disorders these patients have problems to keep an overview and to organize information as the basis of encoding to enable the long term storage, when confronted with a large amount of information. Deficits in the working memory as well as attention disorders inhibit the transfer of the contents to the long term memory.

Such memory disorders may occur after several diffuse brain damages (primary and secondary degenerative brain diseases, hypoxia, infections, and so on..) as well as vascular cerebral damages (infarcts, bleedings), traumatic brain injury and tumors with subsequent bilateral or unilateral lesions.
Memory disorders may also be the result of a neurosurgical intervention, for example to treat epilepsy. Medial temporal or thalamic regions,
mammillary body or basal forebrain, gyrus parahippocampalis or hippocampus are structures that, when damaged, generally result in memory disorders. In case of an infarct, primarily the supply areas of the arteria cerebri anterior and posterior as well as the polar thalamus arteria are of specific importance in the context of memory disorders.

The memory for verbal content is often impaired after a stroke in the left hemisphere and therefore linked to aphasia. Disorders of the visual memory are more likely to occur after damage to the right hemisphere. Impairments of the memory are usually accompanied by other brain disorders such as attention and language disorders. This leads to confounding effects that complicate neuropsychological diagnostics and severely affect memory tasks (encoding, recall) in daily life. Therapeutic treatments are often hindered by impairments of planning abilities and logical thinking as well as the patients unwillingness to recognize the necessity of treatment, because a self-reliant use of strategies is often performed in an insufficient manner.

This module has been primarily developed for patients with **impairments of the**

long term memory. Furthermore, this training is suitable for patients with an **impaired word and visual span, reduced recognition ability** and for patients with aphasic disorders as well. Severe attention disorders (training of these deficits with RehaCom module Attention & Focus) and severe deficits of visual perception processes need to be excluded diagnostically.

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