HASOMED

# RehaCom®

Cognitive therapy

## Shopping

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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

The RehaCom module **Shopping** uses a highly realistic scenario for training. The patient performs the same tasks using the computer that he or she would have to do when going shopping in a supermarket. A shopping list is provided that contains all the items that have to be bought. The patient has to find these items on the shelves and put them in a shopping cart. When all items are collected, the patient checks out at the cash register.

The module is operated through big symbol buttons located at the bottom of the screen (see Fig. 1).

- **Shopping list**
- **Shopping cart**
- **Supermarket shelves**
- **Money**
- **Cash register**

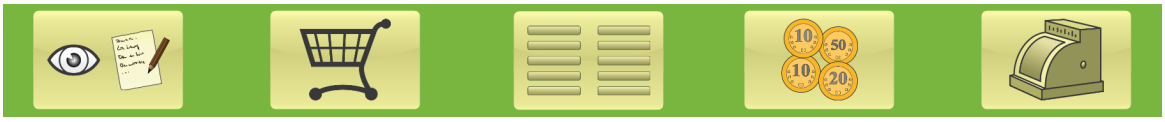

Figure 1: Buttons

To operate the buttons, move the mouse, symbolized by a big arrow, to the appropriate one, and then press the **OK** button on the RehaCom keyboard. Manually dexterous patients can click the buttons using the mouse button. Alternatively, the RehaCom keyboard with a joystick can be used. The easiest way is to use a touch screen - the button just has to be touched with a finger.

Descriptions throughout the rest of this manual assume that the patient is using a mouse.

In each session, several tasks have to be solved. Each task consists of two phases:

- the **acquisition phase**, and
- the **shopping phase.**

In the acquisition phase, the patient receives the shopping list (see Fig. 2) containing the names of the items to be bought. After memorizing them, the patient presses the button representing the supermarket shelves.

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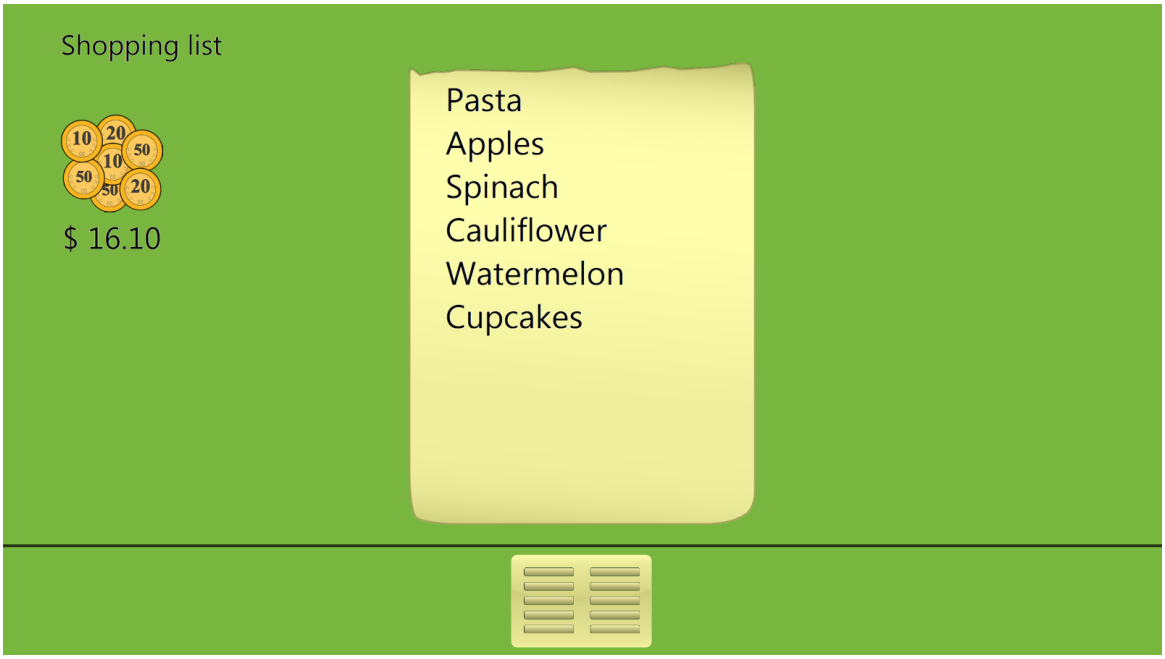


Fig. 2: Shopping list at level 14, showing money at patient's disposal

Then the shopping phase starts, and a list of the shelves in the supermarket appears (see Fig. 3).


Fig. 3: Supermarket shelves

Each shelf contains a group of goods. Clicking on a shelf displays the contents of that shelf (see Fig. 4).

Each shelf may contain multiple parts, each containing 4 items. To collect an item,

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the patient simply clicks on it. To confirm that the item "falls" into the shopping cart, the cursor changes briefly to a shopping cart symbol and a sound of something falling (as though into a shopping cart) is heard.
The patient can look at the next items on the shelf by clicking the **arrow** button. By clicking on the **supermarket shelves** button at the bottom center of the screen, the patient can return to an overview of the shelves in the supermarket. In this way the patient moves through the rows of shelves and collects the items from the shopping list.

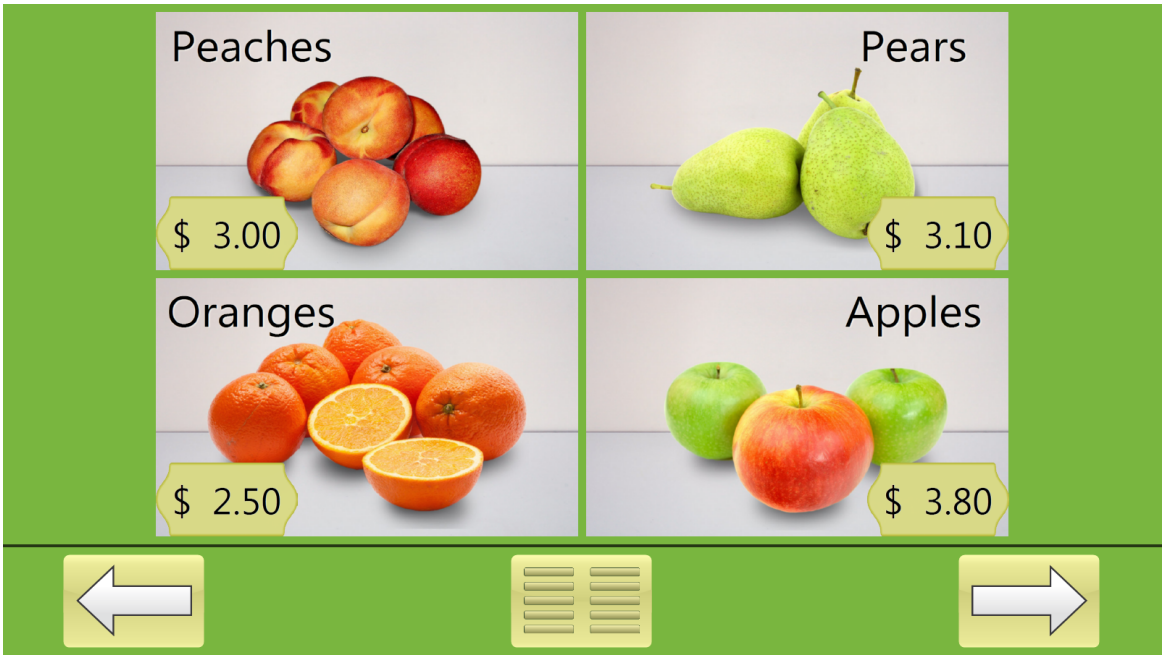


Fig. 4: Contents of a shelf, consists of scanned photos. The price is displayed starting at level 11

To have a look at the shopping list (see Fig. 2), the patient has to press the **shopping list** button.
If the New acquisition parameter is disabled, then this button is not available.

After pressing the **shopping cart** button, its contents are displayed (see Fig. 5). An item is removed from the shopping cart by clicking at it. By Pressing the **supermarket shelves** button**,** the patient can go back to the overview of the shelves in the supermarket. The shopping ends after the **cash register** button has been pressed.

Beginning with level 11, the module includes the handling of money (arithmetical thinking) in addition to the previous training elements. The shopping list then shows an amount of money that is in the patient's "wallet." In addition to the selection of items, the patient has to decide if the money in the "wallet" is sufficient. Therefore the price of each item is displayed next to it on the shelf and in the shopping cart. It's up to the therapist to decide how the patient should calculate the total of the item prices (adding up on a sheet of paper, with a calculator, or in his/her head). The therapist

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should impart appropriate strategies. When the patient has collected all items and calculated the total, the total sum and the money in the wallet have to be compared. If there is enough money in the wallet, the patient checks out by pressing the **cash register** button. If there is not enough money in the wallet, the **money** button, from level 11 onwards, must be pressed.

The module works also without a RehaCom keyboard.


Fig. 5: Shopping cart; includes price of each item (beginning at level 11)

## 1.2 Performance feedback

The **Shopping** module gives feedback on the performance only after exiting the supermarket by pressing either **cash register** or **money** button**.** This method is similar to the real-life situation: When the patient comes home from the store, the patient's wife or husband would notice if an item is missing or if too many items have been bought. Also at the cash register, the patient will see if the money in the wallet is sufficient for paying all items.

The performance of the patient is commented and a note regarding the difficulty of the following task is given. If errors are made, the patient is notified what they are.

## 1.3 Levels of difficulty

The adjustment in the levels of difficulty is carried out adaptively (see Tab. 1). There are two modes, one without money and one with money. Within these modes, the difficulty varies with the number of items that have to be bought.

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| Level | No. items | Price |
|---|---|---|
| 1 | 1 | no |
| 2 | 2 | no |
| 3 | 3 | no |
| 4 | 4 | no |
| 5 | 5 | no |
| 6 | 6 | no |
| 7 | 7 | no |
| 8 | 8 | no |
| 9 | 9 | no |
| 10 | 10 | no |
| 11 | 3 | yes |
| 12 | 4 | yes |
| 13 | 5 | yes |
| 14 | 6 | yes |
| 15 | 7 | yes |
| 16 | 8 | yes |
| 17 | 9 | yes |
| 18 | 10 | yes |

Tab. 1: Structure of difficulty

## 1.4 Training parameters

Specific settings for the training module can be adjusted (see Fig. 6). This section describes each setting and explains how to adjust them.

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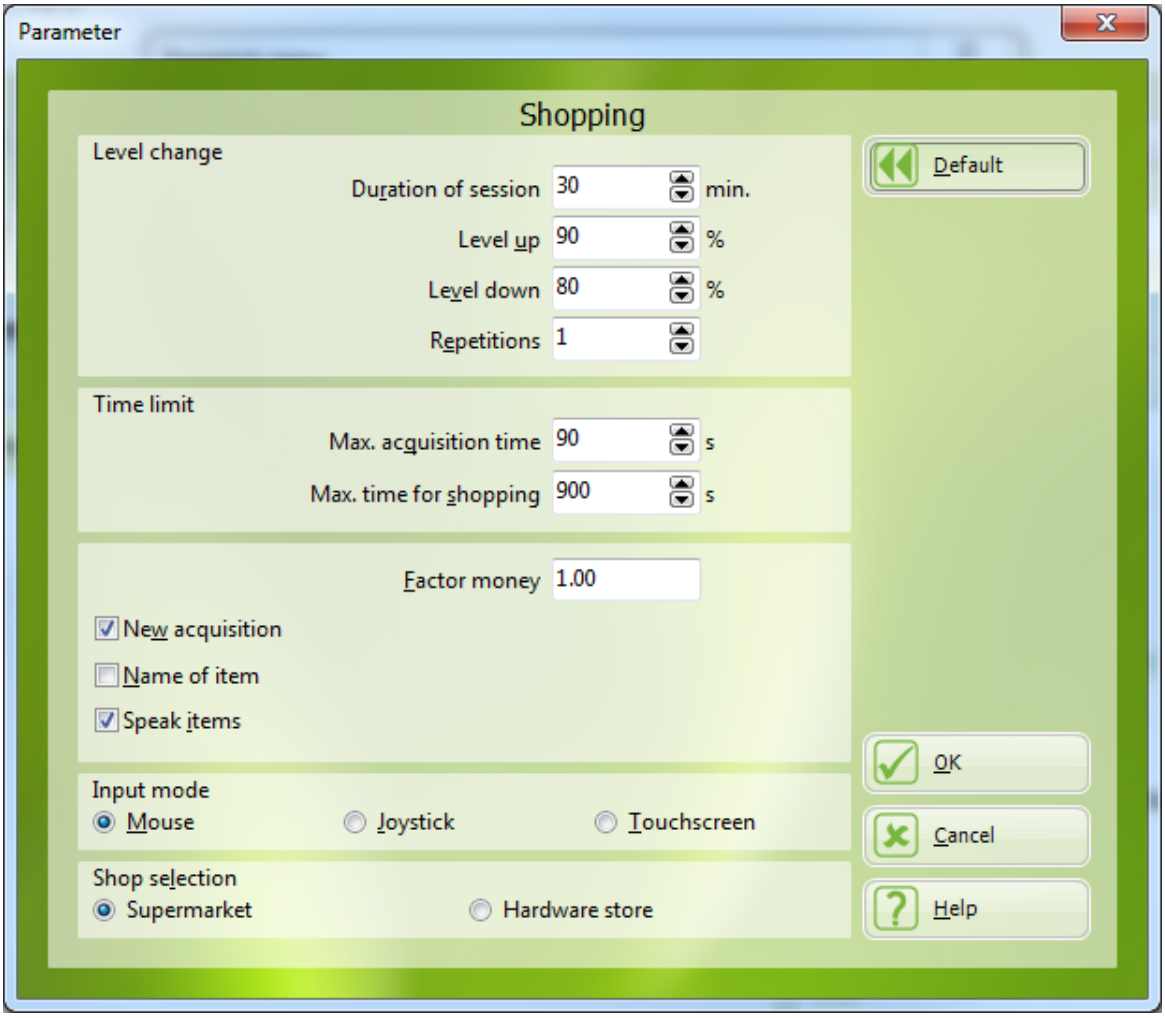


Fig. 6: Parameter menu

***Duration of session:***
We recommend a length of 30 minutes.

***Level up:***
A percentage value based on the number of correct decisions in relation to the number of items that should be bought is calculated. If this percentage value is higher than the one set for ***Level up,*** the module increases the level of difficulty for the next task. For the default value (90%), it means no errors are allowed except at level 10 and 18, where 10 items have to be bought. At that level, ***one*** incorrect decision is allowed in order to reach the next level. Beginning at level 11, the difficulty will only increase if the correct decision, regarding whether there is sufficient money, is made. Moreover, the change to the next level only happens if the patient completes the shopping task a certain number of times, set under ***Repetitions***.

***Level down:***
If the percentage correct is lower than the threshold set for ***Level down,*** the level of difficulty is decreased. A default value of 80% means that the program switches to

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the lower level if, for levels with 5–8 items, the patient makes 2 or more errors and if, for levels with more than 8 items, the patient makes 3 or more errors.

***Repetition:***
Before the level of difficulty can increase or decrease, the patient must consistently perform at an ability above the Level up parameter or below the Level down parameter, based on the number in the repetition parameter. This way a momentary better or worse performance on the task will not cause the level of difficulty to change. If the value 0 is chosen for this parameter, no repetitions are necessary for a level change.

***Maximum acquisition time in s:***
A time limit for the acquisition phase can be set as an additional stressor for high performing patients. The time limit depends on the number of items to be bought and is calculated as this number multiplied by the ***maximum acquisition time***. For the default setup, the limit is set at 90 seconds per item.

***Maximum time for shopping in s:***
For high performing patients, the shopping time can be limited as an additional stressor. The total time at the patient's disposal is made up of the value ***max. time for shopping*** multiplied by the number of items to be bought.

***Factor money:***
The prices on items (starting at level 11) correspond to the real prices in a supermarket. They can be found in the .CDS files in the subfolder **Stores**. If there is no .CDS file for your specific region you can adjust the prices using this factor.

***New acquisition:***
If repeated acquisition is allowed, the patient can have a look at the shopping list at any time by pressing the button **shopping list**. Generally, the patient's short-term memory is used at least for the time between switching from the shopping list to the shopping cart. In that time, the items have to be remembered. Adding to the difficulty is the fact that the items in the shopping cart appear in the order in which they were bought. Thus, the arrangement of the two lists may not be identical.
If repeated acquisition is not allowed, the medium-term memory is trained. A maximum of 10 items and the amount of money at one's disposal have to be memorized. After a consolidation in the patient's performance this option should be chosen.

***Name of item:***
In order to find the items from the shopping list easier in the shelves, the name of each item can be displayed when viewing the contents of a shelf. If the patient knows the names, the option should be switched off again. The associating skills are trained then.

***Speak items:***
To make the recognition of shelves and items easier for the patient, the name of the

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shelf/item when first selected is spoken (use of soundcard).
When the shelf/item is selected a second time, the decision is made.
If more than one patient works in one room, this option should be disabled or headphones used.

***Input mode:***
The training can be conducted using the mouse, the joystick, or the touch screen. The use of these input devices has been described in the section Training task.

***Shop selection:***
There is a choice between two kinds of shops for the training. Depending on the preference of the patient, the shop can be set to supermarket or hardware store.

The following default values are automatically set for a new training:

| | |
|---|---|
| Length of session | 30 minutes |
| Level up (%) | 90 |
| Level down (%) | 80 |
| Repetition | 1 |
| Max. acquisition time | 90s/item |
| Max time for shopping | 900s/item |
| New acquisition | enabled |
| Name of item | disabled |
| Speak items | enabled |
| Price factor | 1.0 for Germany |
| Input device | Mouse |
| Shop selection | Supermarket |

## 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 on the shopping list |
| Correct | Number of correctly acquired items |
| Correct % | Correctly acquired items in % |
| Mistakes | Number of forgotten or incorrectly acquired items |
| Omissions | Number of missing items due to a reached time limit |
| Correct money | Correct decisions regarding money |

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| | |
|---|---|
| decisions | |
| Incorrect money decisions | Incorrect decisions regarding money |
| Shop. list inspections | Number of inspections of the shopping list |
| Shopping time | Duration of shopping in h:mm:ss |
| Canceled due to time limit | Abort of acquisition or shopping time due to time limit |
| Decisions concerning money | With or without cash register / purchase amount |
| Missing items | Number of missing items |
| Incorrect items | Number of additionally bought items |
| Acquisition time | Acquisition time in s |
| Train. time task | Effective training time in h:mm:ss |
| Breaks | Number of breaks by the patient |

The parameter settings used during the training are displayed directly below the table. The graphical presentation of the results (e.g., percent correct, omissions) is also displayed on the Table and Chart tab.

Because of this detailed analysis of the training, it is possible to indicate deficits to the patient and to draw conclusions for further training.

Specific information about the current session or about all sessions can be printed out.

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# 2 Theoretical concept

## 2.1 Foundations

Everyday actions mostly require a range of motor and cognitive capacities consisting of several interdependent skills.
The underlying ability to develop plans and then implement them is one of the most complex of all cognitive human abilities.

Reasonable and independent actions are only possible if behavior can be planned, organized, and prioritized in case of competing tasks. It requires the skill to initiate actions, control them, reflect upon them, and adapt them should the need arise (Alderman & Ward, 1991; Burgess & Alderman, 1990; cf. Wilson, Alderman, Burgess, Emslie, & Evans, 1998). The term *planning* means to explore and coordinate in advance all variables affecting the objective. Mental planning sequences are planned actions with flexible and reversible components. The individual actions are studied regarding their consequences and put together as a series of actions which are once more tested for possible consequences (cf. von Cramon & Matthes-von Cramon, 1993). Extensive problem analyses require generating hypotheses and recalling a range of heuristics: a wealth of information has to be kept in mind (memory) and processed simultaneously.

The ability to plan and carry out actions belongs to the executive functions. Lezak (1983; cf. von Cramon & Matthes-von Cramon, 1993) defines it as the skill enabling a person to care for him/herself sufficiently, go to work, and take part in social life. For this purpose, it is necessary to:

- formulate one's own goals,
- execute plans with a particular goal in mind, and
- have control over one's motor skills so that a particular goal can be achieved.

Stuss & Benson (1984) distinguish the executive functions from basal cognitive systems such as attention, visual-spatial capacities, memory, speech, motion, and others, and differentiate them into the components *anticipation*, *choice of objective*, *planning*, and *control*. In their hierarchically organized feedback-feedforward model (Stuss, 1992) of brain functions, there are three functional levels:

- sensory-perceptual level (perception, automatic processes),
- level for the frontal controlled executive control,
- level for self-reflection and the relation between self and environment.

The *central executive*, as postulated in the model on the *working memory* by Baddeley & Hitch (1974) and the *supervisory system* according to Shallice (1982; cf. Shallice & Burgess, 1991), is similar to the functions of the executive control as considered by Stuss (1992).

Karnath (1991) summed up facts that different theories about the involvement of

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frontal structures in mental planning processes (Pribram, 1987; Berstein, 1975; Shallice, 1988; and Luria 1966; cf. Karnath, 1991) have in common:

1. information analysis, exploration
2. planning process
   a. designing action models / a structure of action sequences
   b. anticipating (if there is no idea how to solve the problem after the information analysis)
3. automatic recall of available plans for routine situations
4. execution of actions
5. control of the actions through feedback process

A conclusive theoretical model about the morphological basis and the functioning of frontal neural networks has not been found yet. According to clinical experience, however, it can be assumed that the human frontal brain is involved in mental processes generating the skills mentioned (cf. Stuss & Benson, 1984).

Because these skills are important for independence in everyday life, patients with disturbances of the executive functions often suffer from serious handicaps in their professional and private life. The clinical picture of the disturbance is inconsistent and can selectively affect certain cognitive, emotional, and behavioral regions. 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.

Patients with deficits in their executive functions can achieve results in standard diagnostic procedures that suggest there is no deficit, but still have problems with typical daily activities. Some procedures have been developed by orienting the planning situations closer to reality, and therefore claiming a higher ecological validity. The *Behavioural Assessment of the Dysexecutive Syndrome* (BADS; Wilson, Alderman, Burgess, Emslie, & Evans, 1998) contains tasks that, when combined with behavior observation during the test, can very distinctively register the symptoms mentioned above.

Therapeutic approaches to the treatment of impairments to executive function should take into account a number of approaches:

- re-establishing lost functions
- learning internal strategies (e.g., self- instruction)
- establishing external help (e.g., notes)
- controlling behavior through the environment

In a therapy program developed by von Cramon & Matthes-von Cramon (1992), both cognitive and behavioral aspects of this complex of disturbances are considered.

The chapters Training aim and Target groups provide further information.

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## 2.2 Training aim

The module aims at improving executive functions, particularly action planning and competence in everyday life. The module puts demand on memorizing specific sequences and continuously controlling the individual steps.

The module helps the therapist to interact with the patient, and develop strategies for improving cognitive functions and self-control. For patients that suffer from disturbances that affect self-control and self-regulation (monitoring), the module helps to establish and to practice behavioral therapeutic techniques (e.g., self-expression). When the behavioral therapeutic techniques have been practiced, more complex planning processes, such as very unstructured realistic situations, can be addressed to find various available components and choose the right or most efficient one.

When memorizing the items on the shopping list, memory strategies should be used: associating items (and their names) with existing memories, forming categories of the items (semantically or phonologically), or forming a new word with the first letters of the 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 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.

**Shopping** is a highly realistic training module requiring *basal* as well as *more complex cognitive skills*. It can require intensive demands on memory or it can relieve some of the demands on memory: the patient may or may not be allowed to look at the shopping list after the acquisition phase. Still, information regarding which items have been placed in the shopping cart and which items still have to be found on the shelves have to be kept in short-term memory. Verbally presented items (shopping list) have to be found - like in everyday life - visually. In higher levels of difficulty, the prices of all items have to be added up, and the sum compared to the amount of money at the patient's disposal. Patients with primary and secondary acalculia need support at that point (pocket calculator).

A significant advantage is that single action sequences are comprehensible and thus the patient can control the process at all times.

Before the patient begins training with this module, basic skills can be trained with the RehaCom modules **Verbal memory** (VERB), **Memory for Words** (WORT), **Figural Memory** (BILD), **Topological Memory** (MEMO) or **Attention & Concentration** (AUFM).

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Altogether, a subtly differentiated neuropsychological diagnosis should be prerequisite for creating a therapy plan containing computer-aided cognitive rehabilitation.

## 2.3 Target groups

The application of the module **Shopping** is recommended for patients with impairments to their executive functions, particularly in action planning, problem-solving thinking, and short-term or working memory.

In particular, after uni- or bilateral frontal injuries, the brain suffers *cognitive, emotional*, and *behavioral* disturbances, which based on their functions is known as *Dysexecutive Syndrome* (Baddeley & Wilson, 1988; (Stuss & Benson, 1984; Duncan, 1986; Shallice & Burgess, 1991; von Cramon & Matthes-von Cramon, 1992; Stuss, 1992).
These may include:

- attention disorders (selection, focusing),
- vigilance disorders,
- increased distraction/interference vulnerability,
- memory disturbances,
- decreased learning ability,
- disorders in aim-oriented action,
- disturbances to the logical problem solving ability,
- decreased abstraction,
- inability to distinguish important from unimportant (information selection),
- decreased ability to initiate actions and organize them in sequences,
- tendency to perseverate
- incorrect notion of temporal sequences,
- impulsiveness or loss of initiative,
- difficulty understanding and using feedback,
- inability to locate and correct errors,
- dissociation between knowledge and action,
- incorrect anticipation of consequences of action (foresighted thinking),
- incorrect self-regulation and self-perception,
- inadequate social behavior, and
- lack of insight into the illness, anosognosia.

Luria (1966, cf. von Cramon & Matthes-von Cramon, 1993) describes this kind of disturbance of thinking and action as a kind of *disconnection syndrome*: "... the patients have difficulty analyzing the conditions of a problem and recognizing important connections and relationships. The sequence of specific operations seems to be fragmented and unsystematic; they ignore the phase of preparative

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studying of preconditions and limitations of a problem and replace purely intellectual operations with unrelated, impulsive actions..."

Such 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.

Patients often have problems organizing their everyday life because of deficits in their abilities or as a result of dysexecutive syndrome. Because the syndrome itself is a combination of impairments to attention, memory, behavior, and motor skills, it constitutes a particular challenge to therapists in the field of neuropsychology. This is complicated by the fact that patients' basic cognitive functions (*attention, visual spatial performance, memory, speech, and motor skills*) are often more or less impaired and these deficits lead to more complex types of impairments.

The module can also be applied to patients who suffer from memory problems, especially in impairments of the short-term and working memory, under the precondition of an undisturbed capacity to action planning.
The training of relevant single components is worthwhile only when specific abilities are no longer or only partly available (memory, ordering, adding and subtracting). In addition to neuropsychological rehabilitation, the module can also be applied for cognitive treatments at an educational level as well as in the field of geriatric study.

In order to use the module sensibly, the patient needs a largely undisturbed linguistic ability and to have the attention capacity to fulfill the tasks. Seriously amnestic patients with massive deficits of the short-term and working memory should seek a different type of therapeutic treatment or should use less complex modules.

The module supports the use of the application for children 11 years or older. Up to the age of 14, child-friendly instructions are used. A touch screen is the recommended input device for children.

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