HASOMED

RehaCom®

Cognitive therapy

Plan a Vacation

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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 Description of the training

1.1 Training tasks

The module **Plan a Vacation** is used to train the patient's ability to organize and plan a day. This is carried out in a very realistic manner. In that particular task, the patient has to deal with specific places and must complete certain tasks; partly under the aspect of time limits, and given points in time. The basic idea of the module was conceived by Prof. Dr. Joachim Funke, Chairman of General and Theoretical Psychology at the University of Heidelberg. The adaptive RehaCom version was then developed in cooperation with his colleagues at the University.

Every planning task consists of two stages which can be dealt with in continuous alternation:

- the **task stage**, and
- the **street map stage.**

In the task stage, the patient is shown a list of appointments to be prioritized and completed based on the task directions (see Fig. 1). The patient must make sense of each individual appointment and develop a strategy to solve the task.

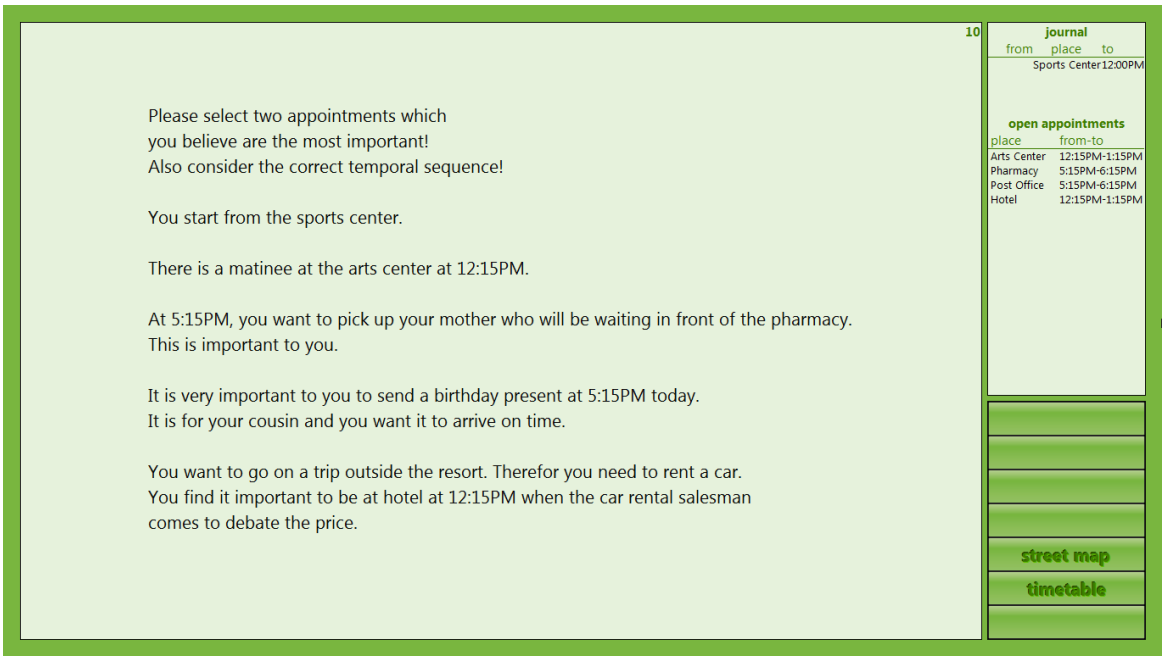

Fig. 1: Task stage at level 10

In the street map stage, the patient enters the strategy from the task stage. A small street map appears with nine buildings connected by several streets (see Fig. 2). The patient uses the RehaCom keyboard, the mouse, or the touch screen to enter the solution.

Fig. 2: Street map stage at level 10

On the left-hand side of the screen, either the appointments (task stage) or the street map can be seen. On the right-hand side, the journal shows the calendar of appointments and the open appointments list shows the remaining appointments. Below these dates are some buttons. If the cursor is placed on one of these buttons, the text becomes red. The patient can switch, as desired, between the task stage and street map stage by clicking (with the mouse) on the button for that stage.

At first, the patient must establish which buildings have to be visited and in which order. The current position is indicated by a waving, red flag. By clicking on the buildings, the patient can change the position of the red flag on the street map. The names of all buildings where there are open appointments are displayed in a light red font; all others are designated with a yellow font.

The first destination is chosen by a mouse click either on the red point below a building or onto a building itself. The red flag then moves to this building. Then, while the mouse pointer hovers over the building, the pointer changes into an arrow with a green door. To confirm the choice, the patient must click on the building again. The appointment at that building is then entered into the journal and is removed from the list of open appointments. Buildings without open appointments in the list cannot be added to the journal. After adding the appointment to the journal, the patient can click on the next building with an appointment or activate the next task with the **finish** button. All further tasks are finished in this manner. The therapists should provide the patients with suitable solution strategies.

The **back** key appears among the buttons when the first appointment is entered into the appointment book. This button can be used to correct a

mistake if the patient enters the wrong appointment into the journal. When the **back** button is used, the red flag is moved back a step (the current site), and the most recent appointment to be added to the appointment book is removed and entered again into the list of open appointments.

By using the **timetable** button, the patient can see a timeline (see Fig. 3) that displays the appointment windows (in gray), appointment durations (in red), and the travel times (in green) between appointments. When the appointments from the journal are displayed this way, the overlapping of appointments becomes obvious. This function also helps the patient to develop strategies by visualizing the appointments and travel times. The importance of the colors is explained in the instructions before the patient begins a task.

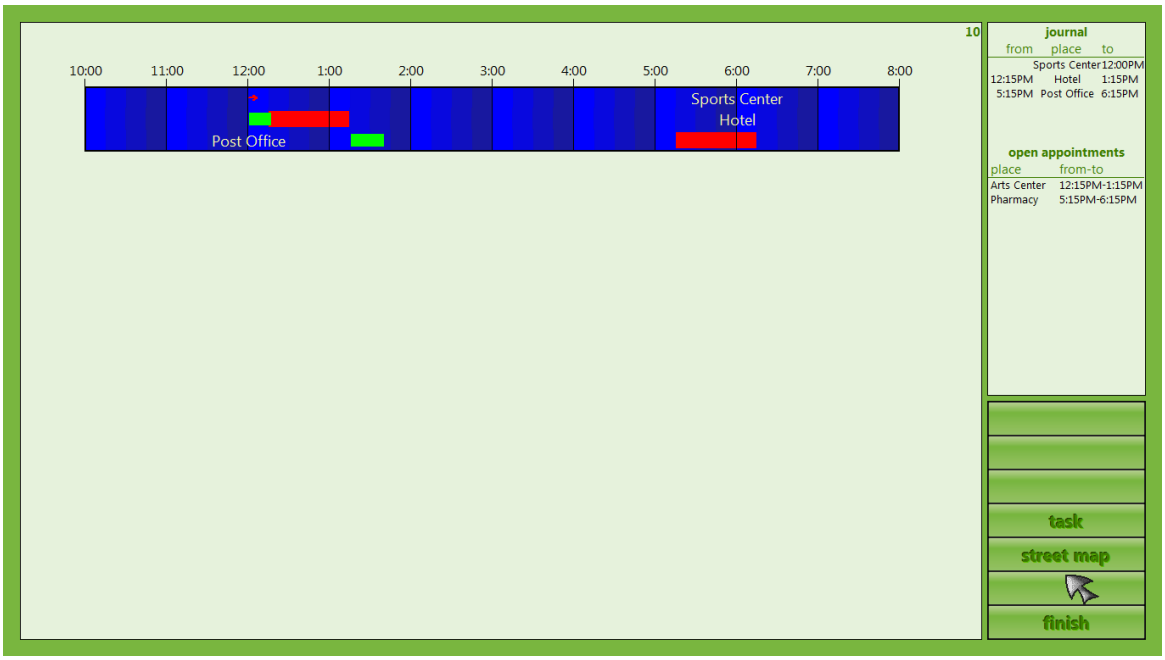

Fig. 3: Timeline at level 10

Beginning at Level 26, a taxi can be used to shorten journey times. To use the taxi, the patient should click the **taxi** button before selecting the destination. A green car appears next to the red flag on the street map, and the journey time to each individual location is reduced by half. This is to help the patient reduce journey time (see Fig. 4). The instructions before such a task explain the patient what to do.

Once the destination has been added to the journal, the green car symbol will appear next to the relevant appointment in the journal and in the timeline.

Fig. 4: Taxi symbol and route time at level 30

The patient should press the **finish** button once the task is completed. If the solution is incorrect, a message is then shown, explaining the error. The patient is given the option of correcting his/her errors. When the patient selects the **yes** button, the previous task reappears. If the patient selects the **no** button, the task is evaluated as it stands.

When using the RehaCom keyboard, the patient can switch between right and left screens by pressing the **'+'** button. The active screen has a light green frame. If the right screen is active, the arrow keys can be used to select one of the buttons on the screen, and the patient confirms the choice by pressing the **OK** button. If the left screen is active, the red flag can be moved using the **arrow keys** to the next building or the next crossroads on the street map. When the patient presses the **OK** button, the relevant appointment is placed in the journal.

Operating the module with the mouse is a lot easier and is highly recommended. Experience tells us that it is easier for patients to familiarize themselves with the task when using the mouse. If patients suffer from movement disabilities in their fingers, the patients can move the mouse with one hand and confirm their choice with the other (by pressing the **OK** button). The easiest method of operation is, of course, the touch screen.

Before every new task, the patient is given lengthy instructions that help him or her learn the new task by practicing it.

1.2 Performance feedback

No feedback occurs while the patient is working on a task. The solution and the errors made are analyzed only after the patient presses the **finish** button, and errors are differentiated as follows:

- The number of the appointments entered into the journal does not correspond to the number required for the solution.
- The appointments entered in the journal are not in the correct order.
- You entered incorrect appointments in your journal.
- For the right solution, you should have taken the taxi once.

1.3 Levels of difficulty

The module operates in an adaptive manner. The levels of difficulty are broken up in this description into groups based on the three types of heuristics used in the module:

- consideration of priorities (levels 1–19),
- minimization of route times (levels 20–27), and
- maximization of completed tasks (levels 28–55).

Within the given heuristics, the levels of difficulty are varied according to further criteria. These parameters were determined during the development of the module. The difficulty does not increase in a linear manner. Consolidation phases change with levels which require additional levels of decision. In total, 55 levels are available.

For the levels corresponding to the first heuristic, **consideration of priorities**, the appointments are characterized explicitly or implicitly as very important or important. It is these priorities which have to be considered. The number of appointments that have to be completed are mentioned in the task. The following parameters are used for illustrating the increase in difficulty for the first 19 levels (see Tab. 1):

- Clarity of statement: IMPORTANT or VERY IMPORTANT
  - salient: clear; the words *very important* or *important* appear in all capital letters on a line adjacent to the appointment
  - not salient: statement containing the appointment has the importance of the appointment contained within it (e.g., "It is very important to go to the pharmacy today.").
- Information about time: lists whether the appointments in the task are without time constraint, should occur at a point in time, or should occur during a period of time.
- Number of appointments: groups appointments in pairs or threes based on the point in time or period of time when the appointment should take place. Appointments with no time are grouped together.

- Number of solutions: shows the number of appointments that must be chosen for a correct answer.

Level	Salient	Time	No. pairs	No. threes	No. solutions
1	yes	without	1	0	1
2	yes	without	0	1	1
3	no	without	1	0	1
4	no	without	0	1	1
5	yes	point in time	2	0	2
6	yes	point in time	3	0	3
7	yes	point in time	4	0	4
8	yes	point in time	0	2	2
9	yes	point in time	1	2	3
10	no	point in time	2	0	2
11	no	point in time	3	0	3
12	no	point in time	4	0	4
13	no	point in time	0	2	2
14	no	point in time	1	2	3
15	yes	period of time	2	0	2
16	yes	period of time	3	0	3
17	yes	period of time	4	0	4
18	yes	period of time	0	2	2
19	yes	period of time	1	2	3

Tab. 1: Levels of difficulty related to the heuristic "consideration of priorities"

For the levels corresponding to the heuristic parameter **Minimization of route times**, the patient's task is to choose the order of appointments that require the least amount of time to complete. This is why a taxi should be used for the longest way in some tasks (beginning on level 26). The following parameters are used for illustrating the increase in difficulty for levels 20–27 (see Tab. 2):

- Number of tasks: shows the number of appointments to consider in the process of solving the task.
- Route time: If "yes," then route times are specified for the various locations on the street map. If "no", the route times must be estimated.
- Destination: If there is a final destination, a final destination is designated in the task stage. The destination must be selected as the final appointment.
- Taxi: For levels where the taxi is available, the taxi must be used for the longest routes. The number of possible combinations then increases.

Level	No. tasks	Route time	Destination	Taxi
20	2	yes	no	no

21	2	no	no	no
22	2	yes	yes	no
23	2	no	yes	no
24	3	yes	no	no
25	3	no	no	no
26	3	yes	no	yes
27	3	no	no	yes

Tab. 2: Levels of difficulty related to the heuristic "minimization of route times"

For the levels corresponding to the heuristic **Maximization of tasks**, the patient must complete as many appointments as possible without overlapping appointments. Some appointments have to be finished at specific points in time and some have to be dealt with over a period of time. As levels increase the number of appointments and the variety of appointment times also increases (whether perfectly or partly overlapping). The taxi may also be used. The patient's task is to find the optimal selection of appointments. It should be pointed out that the tasks at the higher levels of difficulty are demanding for those who do not suffer from deficits in executive functions, so it is probable that the patients may not be able to solve them.

The following parameters are used for illustrating the increase in difficulty for levels 28–55 (see Tab. 3):

- Number of appts.: Total number of appointments per task (includes appointments that occur at a point in time and appointments that occur over a period of time.
- Fixed: Number of appointments with a fixed time (e.g. "She must be at the doctor at 2 o'clock.").
- Variable: Number of appointments that have to be completed over a period of time. There is a variety of ways to complete the appointments and therefore it is more difficult to classify them into the time schedule.
- Unsolvable: Number of unsolvable appointments, which cannot be put into the appointment book

Level	No. appts.	Fixed	Variable	Unsolvable
28	3	3	0	0
29	3	2	1	0
30	3	1	2	0
31	3	0	3	0
32	4	3	1	0
33	4	2	2	0
34	4	1	3	0
35	4	0	4	0
36	4	3	1	1

37	4	2	2	1
38	4	1	3	1
39	4	0	4	1
40	5	3	2	0
41	5	2	3	0
42	5	1	4	0
43	5	0	5	0
44	5	3	2	1
45	5	2	3	1
46	5	1	4	1
47	5	0	5	1
48	6	3	3	1
49	6	2	4	1
50	6	1	5	1
51	6	0	6	1
52	6	3	3	2
53	6	2	4	2
54	6	1	5	2
55	6	0	6	2

Tab. 3: Levels of difficulty related to the heuristic "maximization of tasks"

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.

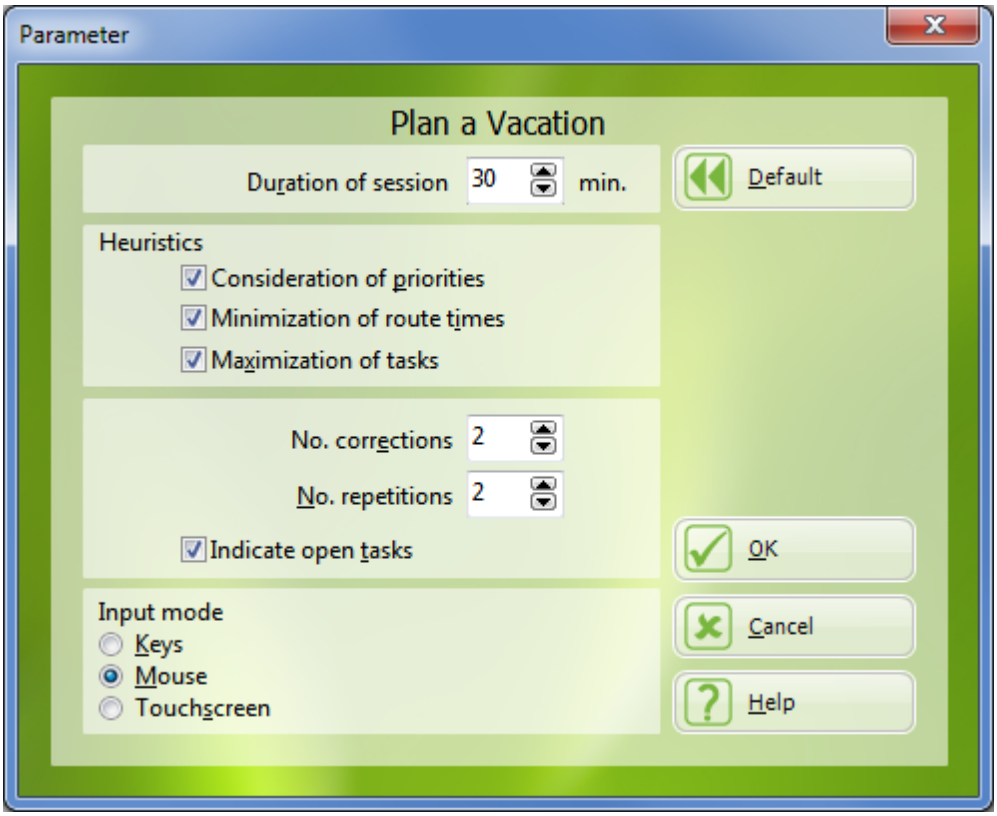

Fig. 5: Parameter menu

Duration of session:
A training period of 30 minutes is recommended.

Heuristics:
The heuristics were described in the section on the structure of the level of difficulty. These have been further broken down into sections. The sections of the heuristics can be used separately or in combination with one another.

Number of corrections:
If the patient has input an incorrect solution (ending the task by pressing the **finish** button), the patient can once again attempt to complete the task correctly. The maximum number of these attempts is determined by the parameter "No. corrections" (0–9). By allowing the patient to make corrections, he or she has the chance to learn from previous mistakes.

Number of repetitions:
The level of difficulty increases or decreases when the patient consistently solves the number of tasks that were determined by the parameter "No.

repetitions" correctly/incorrectly. 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.

Indicate open tasks:
A display of the appointments remaining is shown on the right-hand side of the screen below the appointment book. This is to help patients who have difficulty with their memory. It also places the focus of the training strictly on planning a day. To measure the patient's memory in addition to planning skills, disable this parameter.

Input mode:
The module can be operated by using the RehaCom keyboard, the mouse, or the touch screen.

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

Current level of difficulty	1
Duration of training	30 minutes
Heuristics	All enabled
Number of corrections	2
Number of reputations	2
Indicate open tasks	Enabled
Input mode	Mouse

Tab. 4: Default parameter

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. solutions actual/target	Number of completed appointments/Number of appointments that needs to be completed
Current no. correction	Number of repetitions for correction
No. dates task	Number of available appointments within a task
No. views tasks	Number of times the list of tasks is viewed
No. views planning	Number of times the street map is viewed

Total dur. task [mm:ss]	Total time spent on a particular task
No. views timeline	Number of times the timeline is viewed
Solution	Quality of the solution (*OK*, *incorrect number* [wrong number of appointments], *incorrect appointment* [wrong appointments filled in], *incorrect order* [appointments in wrong order], *taxi incorrect*)
Training time task [h:mm:ss]	Total time in session
Breaks	Number of breaks initiated by the patient

Tab. 5: Results

In the result menu there is an additional key - **show the way** - which shows possible ways available. A picture appears along with the solution for the current task. The key '**starting point**' returns the flag to the start position. The key 'run' moves the flag along the way chosen by the patient. The therapist can determine whether the task was solved precisely or through trial and error.

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.

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 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. In particular, the tasks *"Zoo visit"* and *"Six-element tests"* provide the therapist with important information regarding the impairments in the patient's ability to plan.

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.

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.

Plan a Vacation is an activity-oriented training module which makes both demands on basic and more complex cognitive abilities. It can require intensive demands on memory or it can relieve some of the demands on memory (strictly planning of actions). 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 executive functions and abilities can also be trained with the RehaCom modules **Attention & Concentration** (AUFM), **Verbal Memory** (VERB), **Memory for Words** (WORT), **Figural Memory** (BILD), or **Shopping** (EINK).

In general, an extensive neuropsychological diagnostic is a better method to establish which therapeutic modules are appropriate.

2.3 Target groups

The training module **Plan A Vacation** was developed for patients with impairments to their executive functions, particularly in action planning, and problem-solving thinking.

Disturbances to the planning of actions in patients who suffer from a form a brain damage may have many different sources. 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; Baddeley & Wilson, 1988; Shallice &

Burgess, 1991; von Cramon & Mathes-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 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.

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