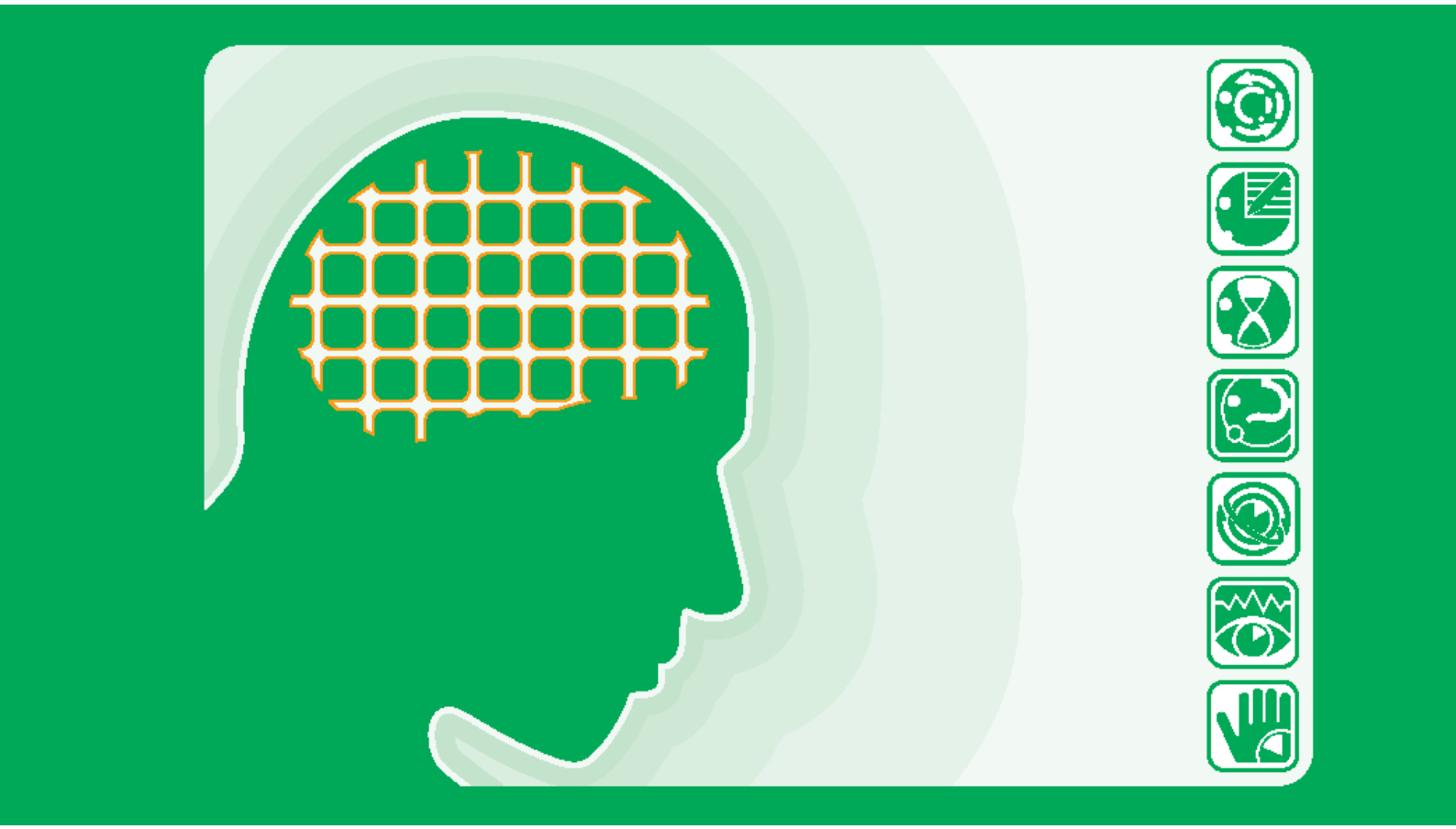
RehaCom

computer-assisted cognitive rehabilitation - brain performance training



Physiognomic memory

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HASOMED®

Hard- und Software für die Medizin

RehaCom®

computer-assisted cognitive rehabilitation

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.

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1 Training description

1.1 Training task

The training with the procedure **Physiognomic memory** is a very realistic form of training.

In the **acquisition phase** the patient is shown several faces of different individuals on the computer display (Picture 1). The reference "memorise" appears in the upper right of the training screen. In addition at higher levels of dificulty the face must also be associated with a name, a type of profession and finally a telephone number.

The patient's task is to memorise faces and at higher levels - jobs, names and telephone numbers too. Using the Cursor-keys "Arrow up" and "Arrow down" the patient can skim through the selection. When all the pictures, as well as the names, jobs and telephone numbers have been considered, the acquisition phase can be ended by pressing the OK-key.

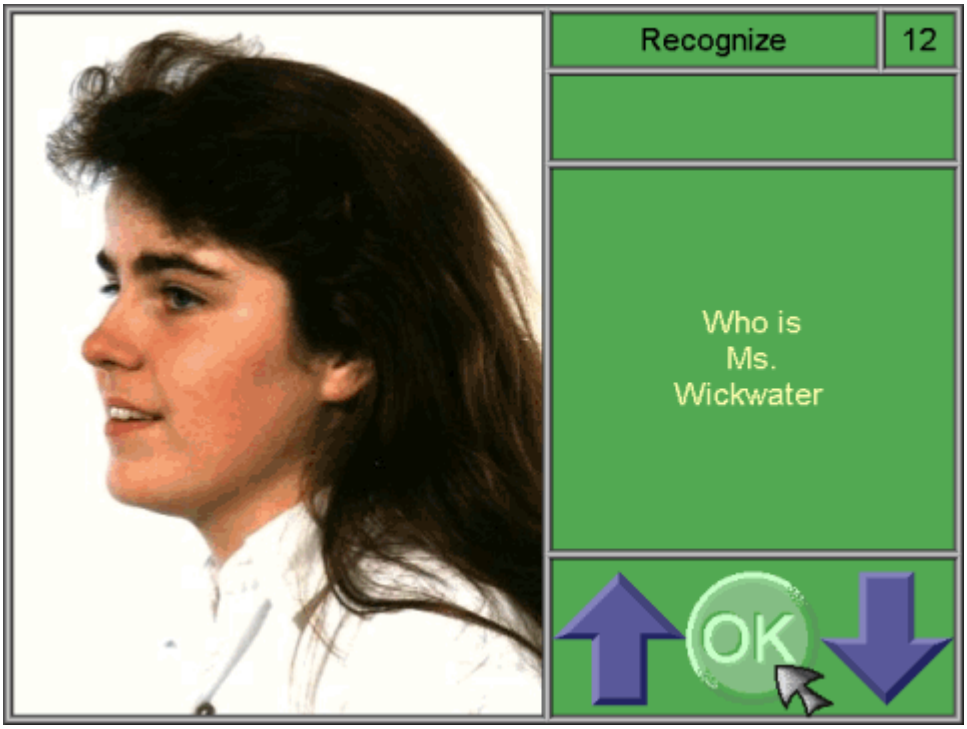
Picture 1. Acquisition phase at level 12. Here the face and the associative name and job have to be memorised. The quality of the pictures in the help manual are not the same as in the training. In the training the pictures are of photo quality.

There then follows the ***Reproduction phase***. On the screen the notice "recognise" appears.
At the levels of difficulty from 1-6 only the faces have to be selected from a large

range of pictures. Here ones memory for faces is exclusively developed. The patient uses the cursor keys to flick between pictures. When a picture appears which the patient thinks is the same as the one which he had to memorise in the acquisition phase then he presses the OK-key. The decision is then evaluated as"correct" or "incorrect".

At the level 7 additional information is assigned to the shown person (name, job, telephone number). There then follows, according to which set up is used (see Parametermenue) the reproduction phase:

- by means of question *"Who is ... ?"* and/or
- by means of *"Multiple Choice"*.



Picture 2. Reproduction mode "Who is ...?".

In the reproduction phase ***'Who is ... ?"*** (Picture 2) the following types of questions

"Who is Mr Schulze?",
"Who is a nurse?" or
"Who had the telephone 342256?"

are suggested, in order to find the required individual. The patient then flicks through the selection of pictures until he feels that he has found the correct picture. He confirms this by pressing the OK-key. The pictures can be considered in an arbitrary way.

In the mode "multiple Choice" (illustration 3), several names, professions and/or telephone numbers appear in addition to the picture, from which the correct information is selected (cursor keys) and then confirmed by pressing the OK-key. In the first position the term "unknown" is always to be seen. **This is chosen if the patient cannot associate the face to any of the names, of the professions or of the telephone numbers.** In this mode one cannot skim through the selection is not possible, as in the mode "Who is...?". Every picture is shown only once.

Picture 3. Reproduction mode showing "Multiple Choice".

When the reproduction level is completed the patient is then informed as to whether a change of level is recommended. In changing the recognition tasks by adding addition acquisitions like name, job and telephone number, special advice is given.

As an alternative to the RehaCom-Panel the procedure **Physiognomic memory** can also be used with a mouse, a touch screen devise or the keyboard. The procedure can also be used without the RehaCom-Panel.

1.2 Performance feedback

When a correct decision is made a green **correct**-field lights up for one second. If an incorrect decision is made a red **incorrect**-field is shown and when the acoustic feedback is activated a typical error tone can be heard.

On the training screen the level of difficulty is displayed on the top right- hand corner.

1.3 Levels of difficulty

An adaptive set up of the levels of difficulty is available. Table 1 shows the levels of difficulty with the 4 different types of recognition.

- Recognition of faces.
- Recognition of faces and connection with names.
- Recognition of faces and connection with names and jobs.
- Recognition of faces and connection with names, jobs and telephone numbers.

Table 1
Structure of the level of difficulty.

Level	Number of faces to acquire	Number of decisions	Types of recognition
1	1	1	face
2	2	2	face
3	3	3	face
4	4	4	face
5	5	5	face
6	6	6	face
7	2	2	face, name
8	3	3	face, name
9	4	4	face, name
10	5	5	face, name
11	6	6	face, name
12	2	4	face, name, job
13	3	6	face, name, job
14	4	8	face, name, job
15	5	10	face, name, job
16	6	12	face, name, job
17	2	6	face, name, job, telefon number

18	3	9	face, name, job, telefon number
19	4	12	face, name, job, telefon number
20	5	15	face, name, job, telefon number
21	6	18	face, name, job, telefon number

The data in the column "Number of decisions" is used for performance evaluation . The number of decisions is doubled if the reproduction mode 'both' is used.

For the procedure a collection of approximately 50 male and female portraits, of all ages, has been produced. Every person has been photographed from 4 different angles

a) Looking right at circa. 45°,
b) Looking at the camera (0°),
c) Looking left at circa. 30° and
d) Looking left at circa. 60°.

Eyeglasses were also omitted. The patient must memorise the qualities of the face only and cannot base their physiognomic memory skills on irrelevant information like a coloured tie or a specific garment. The influence of head position on recognition is eliminated by the using of 4 different pictures for a person. The specifics of the respective face must be recognized. The abstraction capability is stipulated (for exceptions see parameter menu - identity pictures).

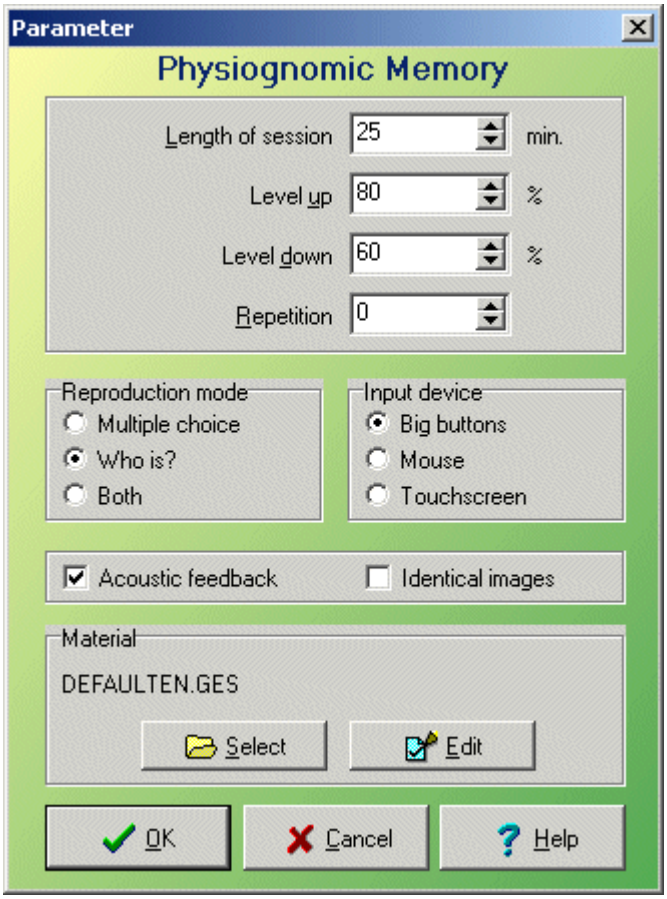
The assignment of a person to a name, a profession and/or a telephone number is always identical. In this way, in the process of the training the long-term effects can be set up which allow early recognition of individuals. In order to avoid interference in the **training consultation**, faces which have already been recognised no longer appear in the reproduction phase - as long as this is possible with the number of the available pictures.

If required new pictures can be used for the physiognomic memory procedure (e.g. people in the rehab centre or people connected with the patient). To integrate these pictures into the procedure one should use the effective Editor.

1.4 Training parameters

In the **RehaCom basic foundations,** general notes on training parameters and their effect are given. Furthermore, the following references should be considered.

Picture 4 shows the Parameter-Menu.



Picture 4. Parameter-Menu.

Current level of difficulty:
The level of difficulty can be set up in the therapist menu from level 1 to 21.

Duration of the training/Cons. in mins:
A training duration of 25-30 minutes is recommended.

Continue to the next level:
After each exercise a percentage value is calculated from the number of correct decisions in relation to the number of possible decisions (Table 1). If the patient exceeds the percentage threshold (very few errors) then they continue to the next level of difficulty. For patients with a weaker performance level it may help, at

first if this 'pass' level is reduced. This increases the motivation level for such patients. However, if the patient's performance improves the original parameters should be restored.

Repeat previous level:
If the patient doesn't achieve a value higher than the percentage threshold 'repeat previous level' then the patient must return to the former level for further training. Again for weaker patients at the beginning of the training it may be helpful to reduce this level. Therefore it is easier to qualify for a higher level. Only a higher level of errors is the patient then asked to repeat the previous level.

Repetition of pictures:
During repetition of task work at a level of difficulty (where the percentage threshold is between '**conitnue to next level**' and '**repeat previous level**'), it is clearly established in how many consecutive tasks the identical faces are shown. In this way, the possibility exists for patients with a weaker performance level to work repeatedly with the same faces and to memorise the specifics of **these faces**. New faces appear according to the adjusted number of repetitions as well as after a change in level. If new faces are to be used in every task the parameter has to be set to 0.

Reproduction mode:
The reproduction modes **"Who is...?"** and respectively the **"Multiple choice"** mode have already been described (see Training tasks). In addition there is the mode "**both**" - which starts with the reproduction mode "**Multiple choice**" and then the "**Who is..?**" mode follows. The "**both**" mode puts a higher demand on the memory and should be used with patients who have a high performance level.

Input mode:
An alternative mode of input to the RehaCom-panel is the mouse or the touch screen. When using the mouse one must click on the large arrows in order to flick through the pages or click on the OK-key symbol to confirm during the acquisition phase. In the reproduction mode "**Who is...?**"he same applies. In the "**Multiple choice**" the patient must click on the desired choice. When using the touch screen the patient simply uses their finger.

Acoustic feedback:
If the acoustic feedback is activated then a typical error tone can be heard every time the patient makes an incorrect decision. If there are a few patients training in the room the acoustic feedback can cause interference. In this case the acoustic feedback should be turned off.

identical pictures:

If this option is activated the pictures appear in the reproduction phase in the same head position as in the acquisition phase(see Structure of the level of difficulty). The pictures in the acquisition phase and in the reproduction phase are identical. For patients who have difficulty with this task this lightens the load. However after improvements in performance the option should be switched off.

Picture material:
The organization of entire training occurs through a control file, which contains the picture - and the additional information that the person has to remember (names, professions, telephone numbers). Used after installation of the procedure physiognomic memory the control file DEFAULTen.GES is also used in order to validate the procedure. However, it is possible to integrate further pictures into training with corresponding information. When persons are used from the daily environment (personnel of the rehabilitation centre, relatives and acquaintances), then a very patient specific type of training is possible. With the editor switch is turned on an Editor is activated , with which one can modify the available control file and/or a new control file can be made.

When setting up the training for a new patient the following defaults are set up automatically:

Current level of difficulty	1
Duration of training/Cons	25 Minutes
Continue to the next level	80 %
Repeat previous level	60 %
Repetition of pictures	0
Reproduction mode	"Who is ...?"
Input mode	Keys
Acoustic feedback	on
identical pictures	off
Picture material	DEFAULTen.GES

1.5 Data analysis

The diverse possibilities of the data analysis for the determination of the further training strategy are described in the (RehaCom) **basic foundations**.

In the pictures as well as the tables, alongside the setting for the trainings parameter the following information is available:

Level	current level of difficulty

Training time (effective)	effective Training time
Pauses	Number of breaks by the patient.
Acqui.-time	Acquisition time in seconds
Repro-time	Reproduction time in seconds
% of total errors	Total errors as % in relation to the decisions
Total errors	Total number of errors
Picture errors	Number of error decisions - face
Name errors	Number of error decisions - name
Job errors	Number of error decisions - job
Telephone errors	Number of error decisions - telephone numbers

In this way it is possible to give the patient advise on their short-comings.

Specific information or indeed all of the training help material can be printed.

1.6 Editor physiognomic memory

The information which controls which picture should be used and which name, profession and telephone number is used in relation to which person is all found in the control files.

These files can with the help of the physiognomic memory procedure be changed or newly defined. In this way very personal type of training can be offered in which individuals from the patients circle can be used in the training (relations, friends, people from the rehab centre etc.).

For this reason there are 2 strategies available:

- Integration of more people in the current control file; (this is recommended)
  or
- The setting up of a new control file.

If a new control file is set up the a minimum number of photos are required in order to maintain an adaptive type of training. Table 2 shows that a minimum number of 14 pictures are required in order to train a level with up to 4 people to select from the series. If there are not enough pictures available then restrictions occur. In order to make up the numbers to a possible 18 people it is recommended that the staff of the rehab centre should also be included in a personal control file for an individual patient. These pictures could be used in a future set up for other patients. They can then be supplemented with patient specific pictures (Wife, Children, Mother, Father, Friend etc.).

In order to avoid confusion names and telephone numbers and jobs are not repeated.

Number persons	Number possible levels	possible levels
10	5	1,2,7,12,17
12	9	1-3,7,8,12,13,17,18
14	13	1-4,7-9,12-14,17-19
16	17	1-5,7-10,12-15,17-20
18	21	1-21

Table 2: Minimum requirements for a patient specific control file.

However, before a specific type of training becomes possible, photographs of the people to be integrated must be procured. They should show the face of the person clearly and they should be of good quality. It is also possible to use the entire figure of the person for training. In order to correspond to the basic idea of training (see picture material) 4 different photographs from every person should be available. If this is not possible, pictures are used in the editor repeatedly.

The photographs must be scanned in the JPG format with a suitable scanner. The scanned picture ought to have a size from 352 x 468 pixels. Other screen sizes can influence the quality of the picture during training. The JPG files must be stored in the list ...\REHACOM\GESI.

After the above has been done the editor parameter menu for physiognomic memory can be started. The contents of the current control file are shown. By selecting menu file/new, an empty control file can be made again or the current file can be stored under another name. The file DEFAULTen.GES, which represents the one validated standard, can not be modified. The file must first be stored under another name.

Editor physiognomic memory.

The editor shows the file cards

- relevant and
- irrelevant people.

Relevant people are associated with pictures, names, professions and telephone numbers. They are used in acquisition. The information for irrelevant people serves as "filling" in the reproduction mode "multiple choice". In the two tables, identical information may never re occur. E.g., if in the table "relevant persons" the profession roofer is used, then the editor prevents that this profession is used in the table for "irrelevant persons". The same applies to names and telephone numbers.

The user himself is responsible for the selection of the correct pictures. The generation of patient specific control files for the procedure physiognomic memory seems more complicated than it really is. The best thing to do is to try it yourself! The procurement of suitable pictures with sufficient quality and the scanning of these pictures is the most difficult aspect.

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2 Theoretical concept

2.1 Foundations

Memory is understood to be a process, which ends in an relatively stable variation of behaviour. (Kolb & Wishaw, 1985)

Impairments in memory performance with patients who suffer from injuries to the brain have in many cases very different origins. This can lead to vast hindrances in both professional and private life. The clinical appearances of such dysfunctions are inconsistent and can effect specific areas of memory, particularly in reference to duration and specific characteristics of the learning. When we talk about memory dysfunction we have to differ **retrograde Amnesia** from the **anterograde Amnesia**: the first defines the incapacity to remember a specific time frame before the illness; hilt the latter defines the inability (after a brain lesion) to hold or describe new information.

The first endeavours to understand and examine to complex function system of memory had already started at the beginning of the nineteen hundreds. In the foundational research and in the clinical everyday life the **short-term memory** and the **long-term memory** (Atkinson & Shiffrin1968, Warrington 1982); the procedural and the declarative (Cohen & Squire 1980), the semantic and the episodic (Tulving, 1972), the verbal, the non-verbal or the figurative memory, and the explicit and the implicit (Graf & Schacter, 1985) memory functions had been contrasted.

One of the classification systems of memory, with reference to recording and *storing of information*, follows from the results of the interdisciplinary foundational research:

- Sensory Memory (less than 100 ms)
- Short-term Memory (Broadbent, 1958; Wickelgreen, 1970) and Working Memory (cp. Baddeley 1990) with one second to one minute disposability of information.
- Long-term Memory with a retention time from minutes, to hours, weeks or years.

The capacity of the **short-term memory**, the memory span, averages by 7+-2 information units. The model of the **working memory** assumes that it works from various parties of neurological subsystems, which record predominantly visual-spatial and also to a large extent acoustic-linguistic information (Hömberg,

1995). In addition to the short-term "retention"of the information, the parallel processing of the contents is taken for granted. Indications of a functioning working memory are for example repeating and counting backwards or reproducing in reverse a previous visual memory span.

For a description of the **long-term memory** functions multiple differences must be dealt with in:

- the **explicit emery**, the knowledge data bank (semantic knowledge) and biographical data (episodic knowledge) were information is stored, which can be directly accessed and labeled, and
- the **implicit (procedural) memory** in which learned co-ordination and rules are stored, which cannot immediately be recalled or described verbally.(Hömberg, 1995),

Theories for *physiological* as well as *morphological* correlations of memory processes like long-term potentiality have been postulated by, amongst others, Hebb (1949; to be compared with Kolb & Wishaw). Model conceptions of the standard encoding, storage and accessing of the contents, resp. the organisation of which, is still very controversial.

An important result of research into memory is the current treatment of the memory as an integrative element of cognitive abilities. Memory functions are in this sense not just the process of **recorded information**, the long-term **storage** and procedures of **re-call** (in a sense a passive storage facility); but rather the means by which the content of memory has an effect on the future recording of information and the experience needed for the practical treatment of **side affects** (Hoffmann, 1983). And consequently modulate the emotional experiences of the individual.

The multi-variance of the memory area plays an important roll in the gathering of information for the memory function. The evaluation of the status of the cognitive abilities, is only possible after an extensive **analysis**, which includes the modularly-specific phase of memory, the short or long-term retention, as well as the re-call of new and old contents of memory (with or without help, and to recognise). Possible inferences could impair the storage and access of information, which should be taken into account in patients with unusual disturbances. The **Rivermead Behavioral Memory Test** (RBMT, Wilson 1992 is an example of a strong behaviour-orientations test, which test different areas of memory. Furthermore, the WMS-R (**Wechsler Memory Scale**) is a sophisticated diagnostic instrument in the cognitive realm.

Four ground breaking methods of rehabilitation of disturbances to memory distinguished as follows (cf.von Cramon, 1988):

- Repeated performance of learning material,
- Learning memory strategies,
- Use of external aids and
- Teaching of particular knowledge via the memory and possible disturbances (Glisky & Schacter, 1989).

During a visual perception performance a restitution seems possible by direct stimulation of the faulty functional area, it has now been discovered that in the case of memory processes, that a restitution is hardly possible in the case of a damaged function (Sturm1989).

That means that a neuropsychological training of memory functions should concentrate on *substitution* and *compensation* strategies.

The section Aim of training as well as Target groups provides more Information.

2.2 Training aim

With the help of the RehaCom-procedure **physiognomic memory** specific functions of memory are systematically practiced - the storing and recognition of faces and the pairing of information with these faces.
The aim of the training is to improve the physiognomic memory by using re-call and recognition as well as the improvement in **face-name association**. At higher levels of difficulty the faces have also to be associated with jobs and telephone numbers. Names and therefore name-face association is very difficult for amnesic patients because, at first, many names represent insignificant words and accordingly no connection to a semantic concept occurs.

The procedure **physiognomic memory** offers the therapist ways to help the patients improve strategies for performance of memory in an interactive way. The patient works with the procedure and improves through practise.

While memorising faces or names, as well as the formation of *face-name connections*, the following "internal" strategies proved to be beneficiary: (cp. Schuri, 1990):

In dealing with the face:

- Affective evaluation and judgment through spontaneously associated personality features
- Arrangement according to types and arrangement with known faces

. Description and searching for characteristic features

In dealing with the name:

. Affective evaluation
. Searching according to known persons with same or similar name
. Searching according to a meaning within the name
. They learn to recall first letters as well as shaping and sound features of names

Connection of faces and names:

. Affective evaluation of the face-name combinations (Does the name fit the person?)
. Verbal connection of relevant features between faces and names
. Connection of relevant features with the aid of visual ideas

Individual strategies inserted spontaneously by the patients should be dealt with. It should be kept in mind that the processing of information, which take place automatically in healthy individuals, is consciously a difficult process for patients who suffer from amnesia. These additional strategies may then represent additional demands on the patients.

Complementary training procedures to the procedure **Physiognomic memory** (GESI) are as follows: **Verbal memory** (VERB), **Figural memory** (BILD) and **Topological memory** (MEMO). The procedure **Shopping** (EINK) contains additional training for short-comings in memory - the planning of actions and calculation abilities.

2.3 Target groups

Patients who suffer from a form of brain damage often find it difficult to learn new information and they have problems storing or re-calling this information from the *long-term memory*.

In combination with an increased level of distraction and other *attention troubles*, it is difficult for these patients to remember a summary of the information when confronted with by larger amounts of information. They also have difficulties coding information in order to support a more durable type of retention. Inefficiencies in the working memory and disturbances in attention prevent a transfer of the information content into a longer-term form of retention.

Such disturbances of memory can appear after numerous different types of

injuries to the brain (primary- and secondary-degenerative illness of the brain, Hypoxie, infections and so forth) as well as in the case of vascular cerebral injuries (infarcts, hemorrhages), skull-traumas and tumours with subsequent lesions which occur unilateral or on both sides of the brain. Also following a neurosurgical intervention, for example in the case of epilepsy, there are often disturbances to memory. After incurring damage the medial temporal or thalamic areas, mamillary body or basal front brain structures, gyrus parahippocampal or hippocampus are structures which, almost always result in disturbances to memory. 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, when we talk of disturbances to memory.

In relation to prosopagnosia it has been proven that injuries to the right hand-side temporal of the brain are critical (Morris et al. 1995).

Disturbances in memory are more often accompanied by different disorders in brain performance, like attention and linguistic problems, which through the 'blending effect' complicate neuropsychological dagnostic and have a negative effect on memory performance in everyday life (Coding, re-call). Also problems in the patient's ability to *plan actions*, and their *problem solving skills* or a *lack of insight into the illness* can complicate therapeutic measures because an independent use of strategies often occurs at an inadequate measure.

The training procedure was specifically developed for patients who suffer from disturbances to their memory for faces as well as the closely associated problem face-name association.

The ability to associate faces with pictures is in most cases not as problematic as the ability to associate the person with names, professions and telephone numbers. The latter ability is often seriously affected if the patient's memory for verbal memory also lacking.

The short-term and long-term storing of names and faces is highly relevant in everyday social situations:
e.g. in social situations and the participation in conversations; in dealing with information on a day-to-day basis etc. One of the possible results of a such a disturbance in memory is that patients are often insecure in the presence of other people and also experience other social fears.

Alongside the use for neuropsychologischen Rehabilitation the procedure can also be used for additional training of a cognitive nature i.e. cognitive training of school children and it can also be used in the field of geriatrics.

This type of training can be also be used to assist in the improvement in the

performance of memory for verbal contents with children from approx. 11 years. It is advisable that a therapist is available at all times. The procedure can be used for child patients younger than or just 14 years of age for when instructions and words are used form the linguistic range of a 10 year old.
From a diagnostic point of view patients with serious attention problems and considerable deficiencies in the visual perception functions should be excluded (perhaps previous training of these deficiencies should be carried out with the RehaCom procedure **attention & concentration**).

Data from the evaluation studies with this procedure are not yet available; on consideration the reality aspects of the procedure are helped by a high ecological validity.

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