



Exploration

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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 Description of the training

1.1 Training tasks

The training offers systematic, adaptive treatment possibilities for patients with impairments to their visual exploration which has occurred as a result of [impairments to the field of vision](#), [Oculomotor nerve](#) or as a result of visual neglect

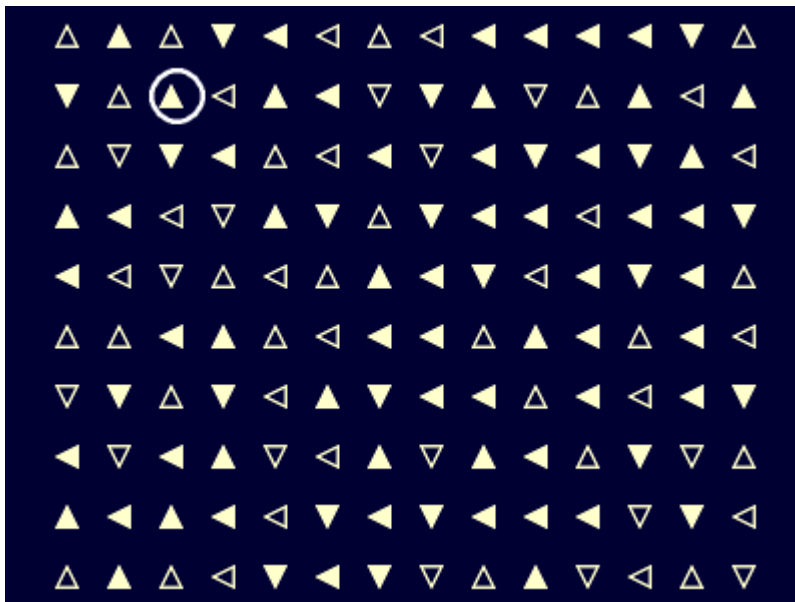
Exploration is defined as the active searching of the field of vision for particular symbols.

Varieties of abstract and concrete stimuli are projected on a dark background: Squares, triangles, circles, asterisks and other see symbols, numbers, letters, objects (flowers, cars etc.). The patient has to search the surface for these various stimuli.

The stimuli are arranged in lines and columns.


A circular cursor, which is the same size as a matrix unit, moves over the field - line by line. In this way the exploration movements of the patient can be controlled. Every time a previously defined stimulus is located the patient has to press the OK key on the RehaCom pult/keyboard.

The relevant entities are not always evenly distributed, rather they can be clustered or spread over the affected area in the field of vision. This helps to develop the exploration movements in the affected are of the field of vision.



Picture 1
Training at level19

In the example on display above, the second line is being explored (white circle moving from left to right).

The patient has to press the OK - key when the symbol  is in the circle. This symbol appears quite often in the right hand side, when a patient with a deficit in the right side of the field of vision is being treated.

The lines are completely full with symbols at levels 1 to 20. This makes the exploration a lot easier. From level 21 onwards there are spaces to be found. This increases the level of difficulty.

1.2 Performance feedback

As with all RehaCom procedures a performance feedback is available at all levels.

The current position of the exploration is specified by a moving circle (visual feedback).

At lower levels the circle is large and obvious; as the levels become more difficult the circle decreases in size.

Every reaction the patient makes is registered.

If the patient makes a correct decision then the circle briefly changes colour to "Green".

If the patient reacts to an incorrect symbol then the circle briefly changes colour to "Red".

If the patient reacts in between these extremes then the circle changes briefly to "Yellow".

In addition an acoustic feedback can also be set up - to react to incorrect decisions.

There is no immediate feedback to overlooked stimuli, as the cursor could already be has over the next stimulus - this would only cause irritation.

When the patient completes a level they are notified as to the number of overlooked symbols or incorrect decisions which they made.

Reactions in the space - before, between or after the stimuli are only brought to the patients' attention if they occur quite often (more than 3).

Finally, the number of correct decisions is then evaluated as a percentage. This percentage is the basis for a change in the level of difficulty. One also has the choice of selecting a verbal motivational feedback.

1.3 Structure of the level of difficulty

The Exploration training works in an adaptive manner.

In the adaptive strategy of the procedure the following modifications to the level of difficulty have been taken into consideration:

- the distance between and the number of lines which have to be searched,
- the width of the exploration area (Number columns),
- how recognisable one symbol is in relation to another,
- the distance between the symbols which have to be recognised and therefore the size and clarity of the cursor (large distance - > less symbols - > larger cursor)
- the variation of the symbols

An additional modification to the level of difficulty is the speed of the cursor, and therefore the speed of the exploration. The therapist can set up speed of the cursor to suit each individual patient in the [Parameter menu](#).

Structure of the levels

Level	Num. lines	Num. columns	recognition	distance	Variations
01	04	02	clear	far	4
02	04	02	indistinct	far	4
Number of lines is increased					
03	06	02	clear	far	4
04	06	02	indistinct	far	4
Number of columns is increased, fairer Exploration					
05	06	03	clear	far	4
06	06	03	indistinct	far	4
again a little less exploration, but more stimuli per line					
07	06	04	clear	normal	4
08	06	04	indistinct	normal	4
slowly the number of columns increases (Exploration-again)					
09	06	05	clear	normal	4
10	06	05	indistinct	normal	4
11	06	06	clear	normal	6
12	06	06	indistinct	normal	6
13	06	08	clear	normal	6
14	06	08	indistinct	normal	6

from here on the number of lines increases and the number of symbols increases dramatically

15	07	10	clear	normal	6
16	07	10	indistinct	normal	6
17	08	12	clear	normal	6
18	08	12	indistinct	normal	6
19	10	14	clear	normal	6
20	10	14	indistinct	normal	6

from Level 21 again more narrow but smaller distance (smaller Cursor)
empty spaces - increases the level of the training

21	10	14	clear	close	8
22	10	14	indistinct	close	8
23	12	16	clear	close	8
24	12	16	indistinct	close	8
25	15	20	clear	close	8
26	15	20	indistinct	close	8
27	18	24	clear	close	8
28	18	24	indistinct	close	8
29	21	28	clear	close	8
30	21	28	indistinct	close	8

There are three types of errors:

- overlooked relevant stimuli
- reaction to irrelevant stimuli
- Reactions in irrelevant space (are registered but not punished)

1.4 Training parameters

In the manual **RehaCom basic foundations**, general notes and references on the training parameters and their effect are given. This advice should be taken into consideration when using the procedure.

Picture 2 shows the Parameter menu.

Picture 2. Parameter-Menu.

Duration of training/Cons. in min:

A training duration of 15 to 20 minutes is recommended.

Continue to the next level:

The patient's performance is calculated by the patient's correct reaction to relevant stimuli.

The number of correct reactions (minus the number of incorrect reactions) is looked at in relation to the number of relevant stimuli. Percentage value= ((Num correct reactions - Num of incorrect reactions) / Num of relevant stimuli) * 100%. If the number of incorrect reactions is greater than the correct one (percentage value less than 0%) then the percentage value is set at 0%. The percentage value is used to evaluate if a patient should change levels.

If the value is greater or the same as that which has already been set up in the parameter menu then the level is increased.

The reactions in the space between stimuli is counted but has no effect on level change.

Repeat the previous level:

The value for "repeating the next level" is calculated in the same way as the percentage value above.

If the value is smaller than that given in the parameter menu then the patient is required to repeat the previous level.

Pause before movement:

As already clarified the patient is required to move a circle over rows of symbols. Before the movement begins the patient has firstly to locate the circle in order to move it. This period in time is calculated in milliseconds - from the appearance of the circle until the movement begins.

Speed:

In the training procedure exploration a circle is moved slowly and evenly over the screen.

The speed of the cursor can be set up in the parameter menu.

The speed is specified in the unit "seconds per screen". The time which is specified here is the time it takes the cursor to move once over the entire screen. The time it takes to scan a row (in particular at lower levels) is beneath this value as the entire screen is not being scanned.

In setting this parameter up one clearly affects the level of difficulty. The standard of 30 sec./screen may vary from patient to patient. For particularly slow patients, this parameter must be increased.

At higher speeds the aspect of "reaction ability" is added.

Pause after movement:

As already clarified the patient is required to move a circle over rows of symbols. After a line has been scanned, the cursor makes a short pause before jumping to the next line.

This pause serves as feedback for the patient - notifying the via the completion of an exploration movement.

Acoustic feedback:

Alongside the [visual feedback](#) (cursor changes colour in relation to reactions) the acoustic feedback can also be activated. Various error tones are sounded as a result of incorrect reactions and reactions in between stimuli (given that the PC has a sound card). There is no acoustic feedback for correct decisions.

Starting point of the exploration:

In the training exploration the cursor moves over the screen from line to line.

However, you can also choose if the movement flows from left to right or right to left.

In addition the jump from line to line can not only be set up to flow backwards but also from bottom to top.

The therapist should choose the starting point which best suits their patient - ie. that which best suits their particular impairment.

Impairments to field of vision:

In this training procedure, impairments to field of vision in specific quadrants and half fields are considered.

You can select your patient's affected area in the parameter menu. In the case of half field impairments 2 quadrants can be selected at the same time.

When these affected areas are selected then the stimuli appear a lot more in these quadrants. This naturally increases the level of exploration which has to take place in these areas.

Please note that in particular at lower levels with less stimuli a statistical evaluation is not always possible.

New from RehaCom ver. 5.00***Speed return cursor:***

Speed of backward cursor movement. Multiplier of forward speed.
If set to "0", the backward movement is a jump.

Acoustic start signal:

Acoustic start signal at every line. A sound, if the cursor is at start-position.

Linenumbers:

A number in front of every line.

Border mark:

A vertical bar from top to bottom on the screen marks the start-point of exploration.

New from RehaCom ver. 5.01***Large items:***

For patients with strong visual defects the size of symbols at the screen is doubled. From level 21 you can use only small symbols for reason of free space on screen.

Coloured items:

If the patient has big problems to distinguish symbols, you can improve the difference of symbols by use of color.

Blinking cursor:

If the patient has strong disturbances in fixation (e.g. Balintsyndrom), you can improve the visibility of cursor (circle, moves across the screen) by this parameter.

Constant targetitem:

Patients which have strong disturbances in memory (additional to visual defects) often can't remember frequent changed target symbols. In this case you can setup a fixed target item (a circle in every case).

Default-Parameter:

Duration period:	15 Minutes
Continue to the next level:	80%
Repeat the previous level:	60%
Pause before movement:	3000 ms
Speed:	30 sec./screen
Pause after the movement:	1000 ms
acoustic feedback:	on
Start point of the Exploration:	above left
impairment to the field of vision:	Quadrant above left
Speed return cursor	3
Acoustic start signal	off
Linenumbers	on
Border mark	off
Large items	on
Coloured items	off
Blinking cursor	off
Constant targetitem	off

1.5 Evaluation

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

In the graphics as well as in the tables, and along with the set up in the [Training parameters](#), the following information is also available:

Level	current level of difficulty
Training time (effective)	effective Training time
Pauses	number of pauses by the patient
Num. total symbols	how many symbols were on the screen in total
Num. relevant. symbols	how many symbols were relevant stimuli
Num. total reactions	how many times did the patient press the OK-key
Num. reactions to rel.	how often did the patient react to correct stimuli (correct reaction)
Num. reactions to irrel.	how often did the patient react to incorrect stimuli (incorrect reactions)
Num. reactions between	how often the patient react to spaces in between stimuli (before,between or after stimuli)
Correct Reactions. [%]	percentage value as evaluation (see Training parameter , "continue to the next level")

In this way, it is possible to advise the patient on particular shortcomings.

2 Theoretical Concept

2.1 Basic foundations

Two main reasons for a loss in the visual exploration (or which have a negative influence on visual exploration), in one or in both halves of the brain caused by injuries to the head, lead to:

- impairments to field of vision and
- visual neglect.

Impairments to the field of vision are responsible for the highest cases of sensory disturbances which often occur after injuries to the brain.

The restrictions in the visual range caused by deficits to the field of vision generally lead to a reduction in visual exploration.

Clinical discoveries have shown, that only 9% of the patients with homonymous Hemianopsia and approximately 15% of the patients with Quadrantenanopsia (total group 10%) show a residual field of vision of more than 10% and therefore have a presumably sufficient visual range and an unimpaired visual exploration.

On the other hand, patients with a residual field of vision under 10 degrees have

been shown to have a clear disability caused by the loss in the field of vision. The reason for this is that the spontaneous eye and head movements do not compensate for what is lacking in the field of vision. [\(Zihl & von Cramon, 1986\)](#).

Patients with unilateral Neglect, according to definition, are incapable of reacting to stimuli which present themselves in a contra lateral position to those areas in the brain where the lesion occurred [\(Heilman, 1985\)](#). These patients are greatly affected by this in all areas of their everyday life. As a result, all aspects of these patients everyday lives are greatly affected. They find it difficult to negotiate their general environment, bumping into objects on their visually weak side and injuring themselves, as they are incapable of registering any sort of a threat on this side. Patients with unilateral Neglect are also greatly restricted, because they, in the case of simultaneous Stimulation, both field of sight halves, are incapable of reacting to contra lateral Stimuli, when the ipsi-lateral is stimulated at the same time. This is known as the extinction phenomenon. [\(Heilman, 1985, Poeck, 1989\)](#).

As most problems occurring in connection with unilateral Neglect can be traced back to visual degradation phenomena, the emphasis in the training is on a purposeful functional training of compensatory strategies in order to improve the visual exploration (Säring, 1988). Due to the everyday relevance and nature of these abilities, which are damaged by hemianoptical impairments and Neglect, the necessity for compensatory training is then quite clear.

A possible treatment of the disturbances to visual exploration lies in the enlargement of the 'saccadic searching motion' (scanning ability) of the eye. An increase in the amplitude of the scanning ability leads to a noticeable increase in the searching areas of the affected half of the visual field. (Zihl, 1988).

For successful treatment the following factors should be taken into consideration:

Heading movements must be prevented since these have a direct affect on eye movement. On a day to day basis head movements are not a recommended compensation for eye movement, in that they are generally too slow. In order to prevent head movement during the training, we recommend that the HASOMED GmbH chin support accessory be used.

It is recommended that you diagnose Anosognosia/Anosodiaphoria before the training.

This can seriously affect essential aspects of the training and lead to a reduction in motivation.

Additional cerebral impairments to vision like, Neglect, impairments to the Oculomotor nerve and hazy vision can also have a negative affect on the therapy.

2.2 Aim of the training

The procedure offers treatment for impairments to visual exploration in the case of homonymic deficits to the field of vision and visual Neglect. The patient is required to slowly search for a series - in locating these precise objects a detailed analysis is possible.

The initiation and the 'over looking' of objects should be reduced. After the training the patient should have less of an orientation problem. The exploration training can also be used as a preparation for reading training (treatment of a hemianoptic reading deficit).

The training is successful if:

- the eye movement is practised in the blind or neglected area.
- the therapist assists with searching strategies and increases the tempo of the training accordingly.

At least a 19"monitor is necessary for the training, in order to guarantee a correspondingly wide field of vision.

In the practice the use of a projector can be used instead of the computer screen. The patient sits in a dark room in front of a wall which incorporates his entire field of vision. the training program is projected on to the wall. It is recommended that the head be fixed in order to reduce head movement (see [Grundlagen](#)).

2.3 Target groups

The training is recommended for patients with homonymic deficits to the field of vision, impairments to their visual exploration, visual Neglect, Balint syndrome or as a result of n injury to the head.

The use of non-verbal material which helps with speaking difficulties and lapses in vocabulary can also be used with this procedure.

Serious memory problems (forgetting strategies) can have a negative affect on the training.

The training can also be used with children from 8 and up. However, more research has to be carried out in this area.

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