

HASOMED RehaCom[®]

Cognitive therapy



Exploration 2



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

This therapy module provides systematic adaptive treatment possibilities for patients with brain damage of the visual exploration as a result of attention deficits, [impairment of the visual field](#), [impairments of the oculomotoric](#), or visual neglect.

Exploration means the active search of relevant objects within the visual field. The module is divided into four different task types, which alternate. If the training get started with instruction (see Therapist menu) a tutorial with exercises will be displayed before every task type, in which the functionality of the task will be explained. In the following the different task types will be explained in detail.

Searching missing numbers

In the task type *Searching Missing Numbers*, starting from 1 to a maximum number, which increases successively with ascending level, numbers will be displayed on the screen. Within the displayed set of number, a few single numbers are missing. The task of the patient is to identify the missing numbers within the number range and to enter them in the input field in ascending order. With increasing difficulty the display area of the numbers enlarges, while the size of the numbers decreases. Further, the amount of numbers that have to be searched as well as the number of missing numbers increase over the course of the training. In the highest levels, the numbers are not framed by the white display area anymore, but are distributed over the whole screen.

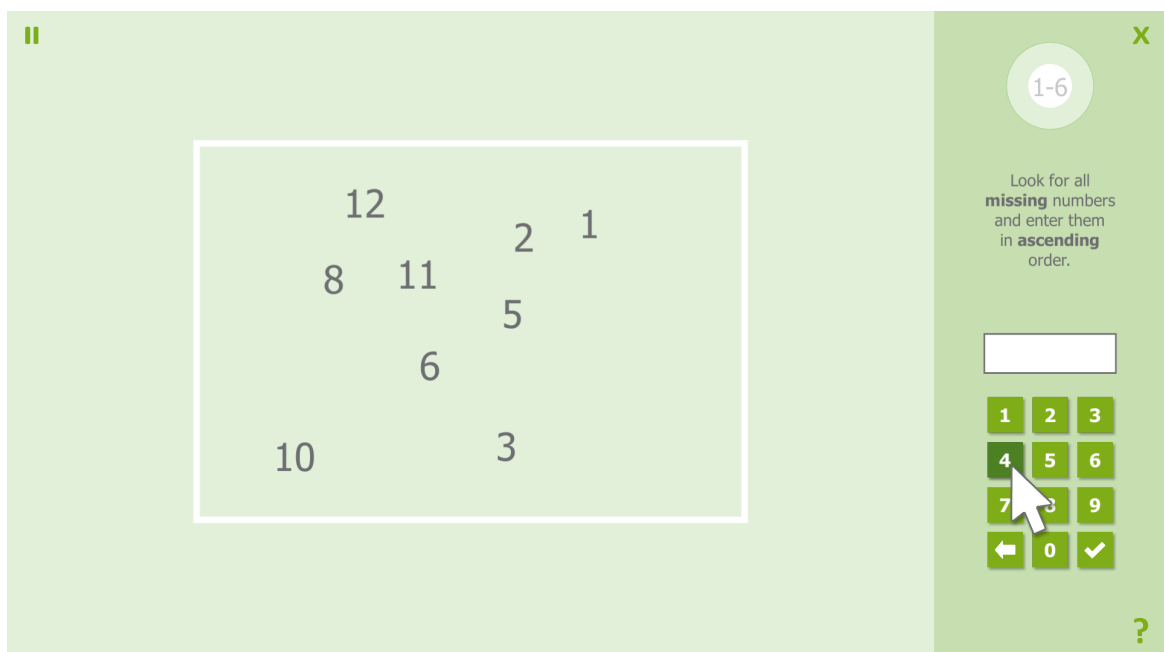


Figure1: Task type Searching missing numbers

Overlapping shapes

In this task type different shapes that are displayed on top of each other, have to be identified. At first relatively easy and different geometric figures will be used, which increase in complexity and similarity over the course of this task. In the lower part of the screen a selection of shapes will be presented, which include the ones that are displayed above. These need to be identified and selected. The overlapping shapes are slightly transparent, so that the edges can be seen and therefore enable a better identification of the shapes. In the beginning the figures are also different in color, which makes it easier to recognize them. All forms that can be selected have the same color as the displayed target shapes. This way it is ensured that the objects will be recognized due to the shape and not the color.

While in the most levels every shape has to be selected individually, sets of shapes will be displayed in the highest levels. Besides the correct set, which includes all of the three searched shapes, all other sets consist of two correct and one incorrect shape to maximize the similarity to each other and therefore to hinder the identification of the correct set..

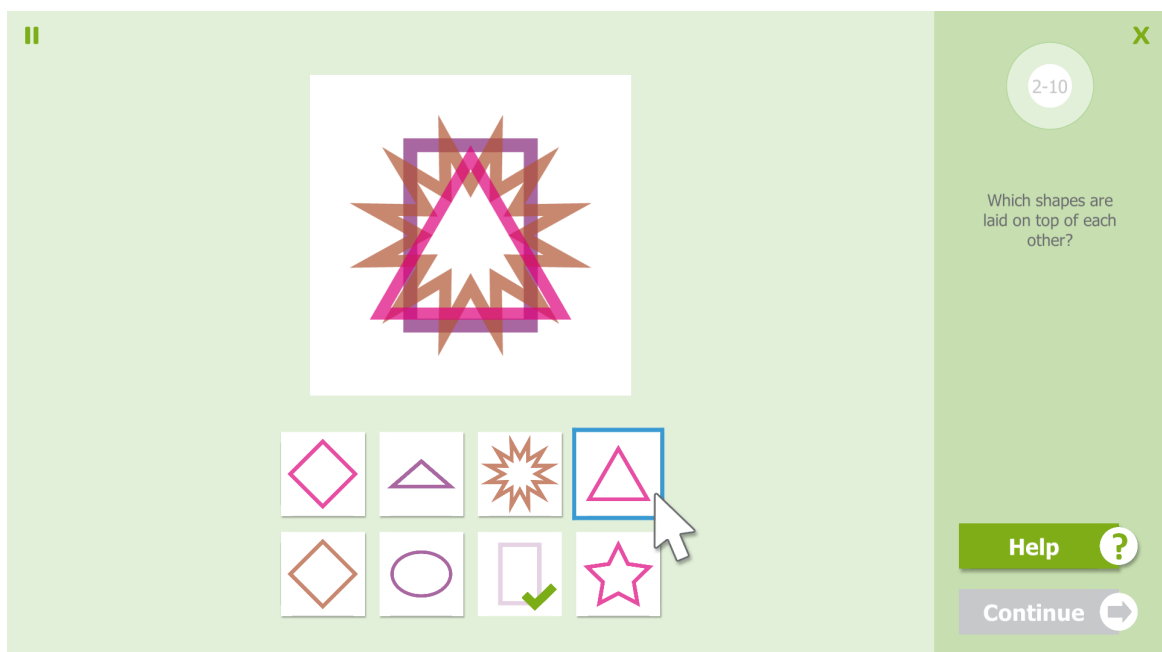


Figure 2: Task type Overlapping shapes

Searching objects

Several objects will be presented in the lower part of the screen that have to be looked for in the picture. This task type is based on “Hidden Objects”, in which specific objects have to be recognized within a large amount of objects. With

increasing difficulty, more and more objects have to be recognized from a large number of distraction stimuli. The searched objects are thematically similar and can be integrated meaningfully into the displayed scenery. For example, in a kitchen an oil bottle, conserves etc. have to be recognized. In this way a high connection to daily life is ensured.



Figure 3: Task type Searching objects

Searching and counting objects

This task type is an expansion to the task type *Searching Objects*. As in the task *Searching Objects*, objects will be presented to the patient in the lower part of the screen. But now, the object occurs multiple times in the displayed picture. The task is to search and count all objects of a type. The patient has to memorize which objects have already been found and to consider it when counting. Therefore, the patient has to develop a strategy to find the objects systematically. The order in which the object will be searched and counted is not important. At the end of the counting process the patient has to enter the number using the right number field. If multiple objects have to be counted, the objects can be selected one after the other using the selection frame.

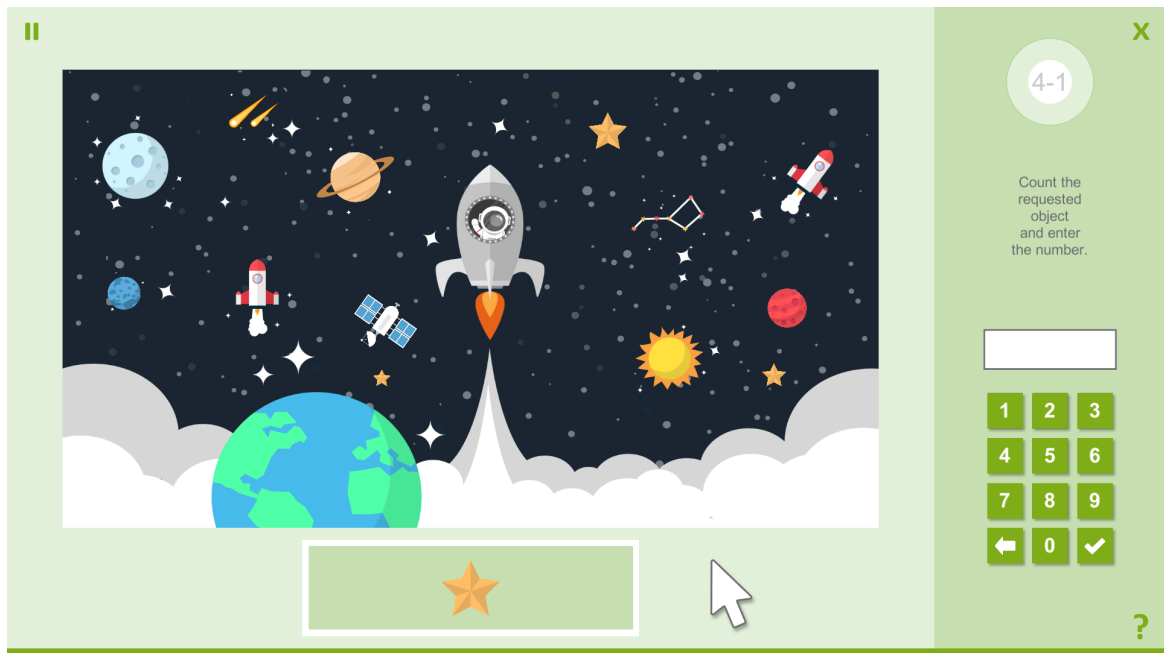


Figure 4: Task type Searching and counting objects

1.1.1 Assistance

The exploration training provides the possibility to activate a task specific assistance (see chapter [Training parameters](#)). The patient can use this assistance after a specific time. When doing so, the help button changes its logo from “?” to “!”. If the help button is pressed, depending on the task type a different assistance will be given that is explained in more detail below for the respective task types. This is used to avoid that the patient finds the task frustrating. To avoid a too easy level up, the patient then will not get promoted to the next level.

Searching missing numbers

The assistance for the task type *Searching Missing Numbers* provides the patient a new entry point for the search, if the patient does not remember the last entered number. Therefore, the number sequence starts pulsating starting from the last entered number. If no correct number has been entered yet, the number sequence starts with “1”.

Overlapping shapes

Normally, all overlapping figures have the same value of transparency. When activating the assistance, one of the shapes that has not been identified yet, loses its transparency while all others will receive an additional transparency. As a result, the non-transparent shapes sticks out and can be recognized easier.

Searching numbers

When using the assistance in the task type *Searching Objects* the focus should be directed to a specific, not yet found object. Therefore, the object that is in the first position off all objects that have to be found still, starts pulsating. Due to this small, continuous movement the object can be differentiated easier from the background and is easier to find.

Searching and counting objects

Since the used objects occur multiple times in the picture, the objects of the selected type start pulsating one after the other. This will be repeated until the patient has confirmed an entry.

1.2 Performance feedback

The feedback concerning the performance will be given to the patient in different ways. On the one hand, the patient will receive a direct visual feedback after every input that is different depending on the task type. If activated in the parameter menu, an acoustic signal will be heard at the same time. Additionally, a short textual feedback will appear on the side of the screen after every task. If a task has not been solved completely, all objects that have not been found will be marked. This happens differently, depending on the task type. For example, for the task type *Searching Missing Numbers* the numbers that are still missing will be displayed in yellow; while for the task type *Searching Objects*, the objects that still need to be found will be marked with a yellow frame. After, the patient has time to look at the picture once again and to search for the objects that have not been found yet once more.

In the following the direct feedback within the respective task type will be explained in more detail.

Searching missing numbers

When entered correctly, the entered number turns green and slides to its target position in the number display area, where it remains for the rest of the task. Additionally, the input field receives a green frame for a short amount of time. If the patient enters a wrong number, the input field will be framed red. Besides, a smiley will be put over the number field, so that the feedback can also be perceived when looking at the number range.

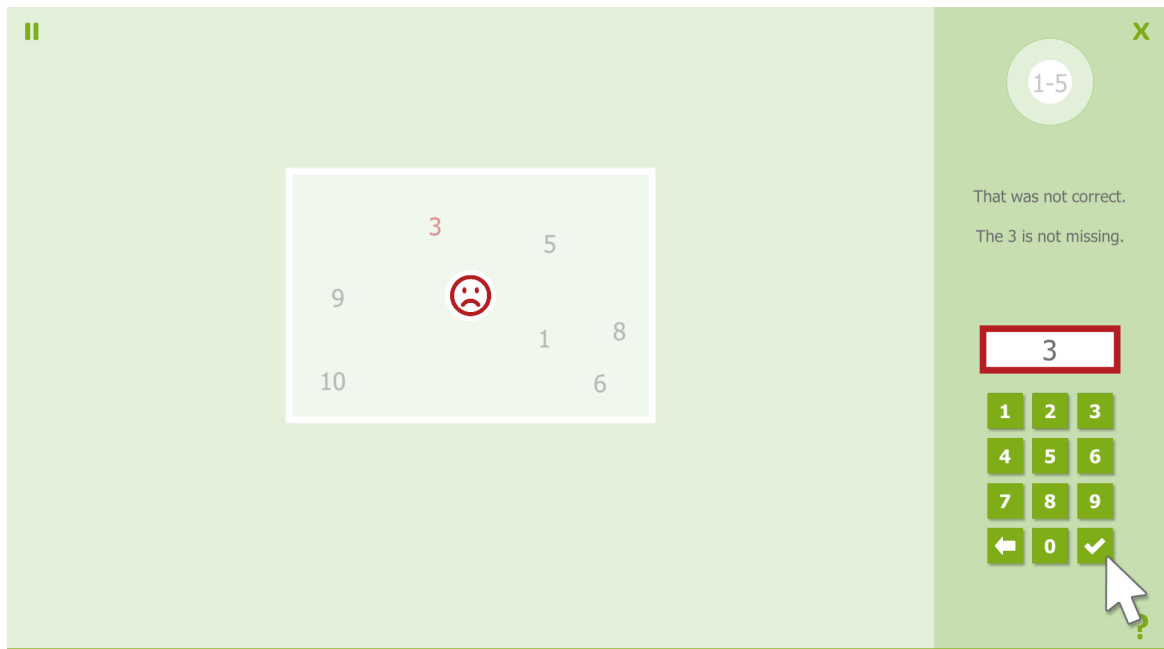


Figure 5: Feedback in task type Searching missing numbers

Overlapping shapes

If a correct shape is selected below, it fades slowly. Further, a green tick appears in the left lower corner. If the selection is wrong, a red “X” will appear instead of the tick. This will disappear again when focusing a different shape. The wrong shape remains selectable.

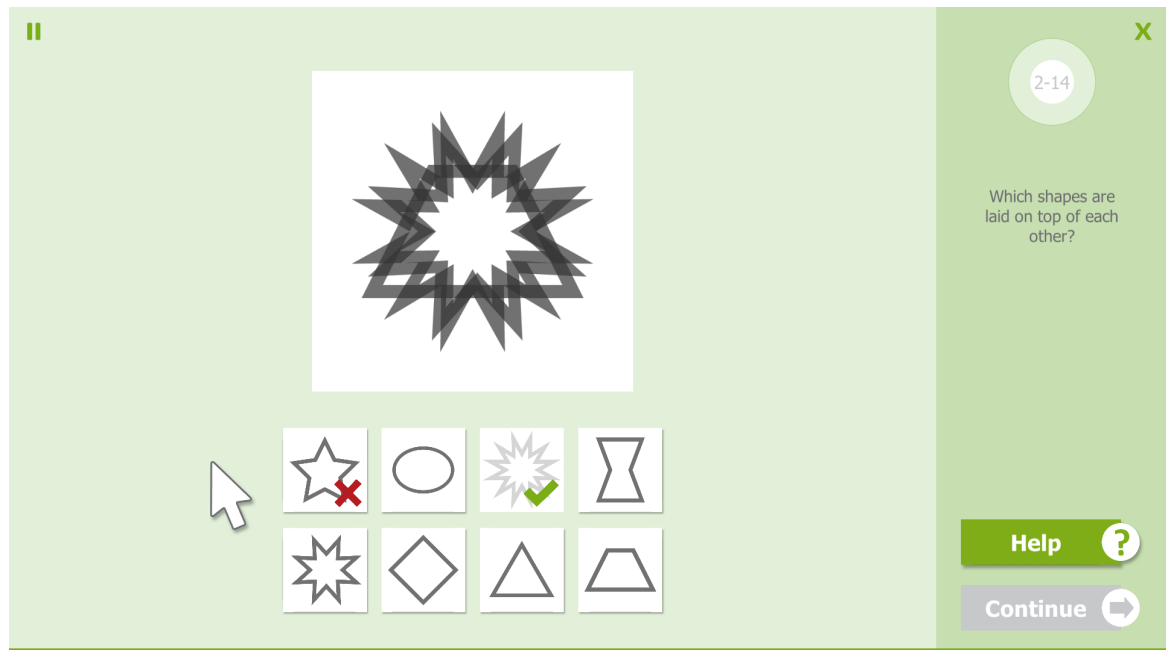


Figure 6: Feedback in task type Overlapping shapes

Searching objects

If the patient clicks on a searched object or confirms it with the selection frame, it turns green. Beside, for the task type *Overlapping Shapes* the target object, which is displayed at the lower side of the screen, will be marked with a green tick while it fades. An incorrect selection is indicated by a red frame.

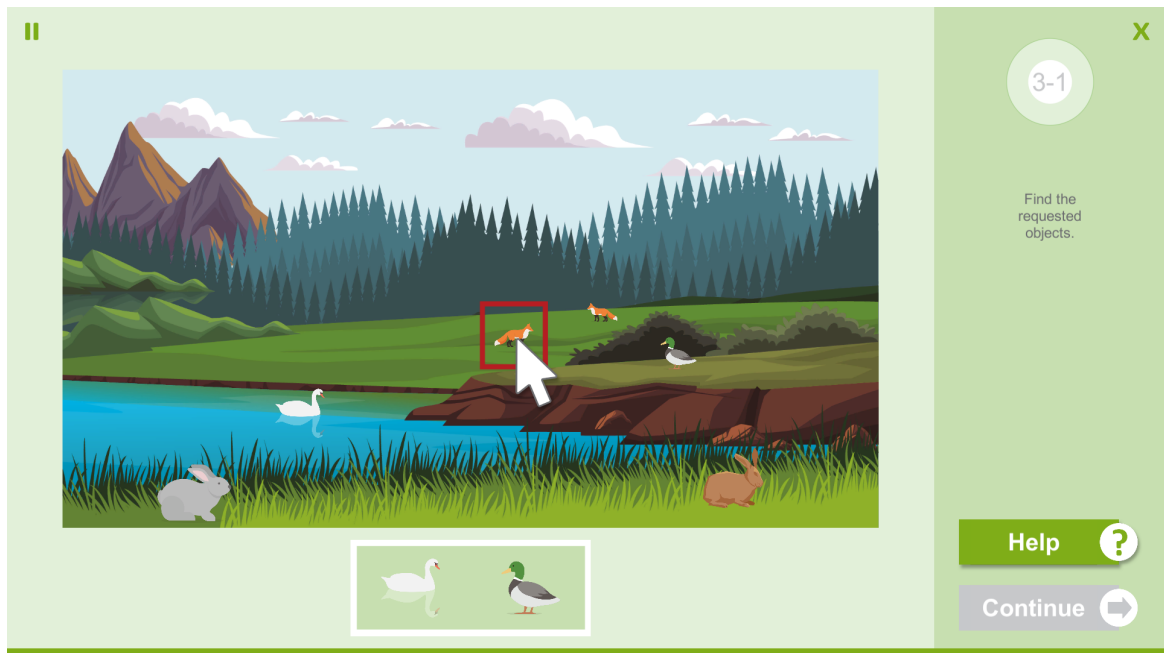


Figure 7: Feedback in task type Searching objects

Searching and counting objects

For a correct as well for an incorrect input a frame will appear around the input field at the side of the screen that is colored according to the feedback; identical to the feedback for the task type *Searching Missing Numbers*. Additionally, the target objects will be marked with a “X” for wrong decision and with a green tick when selected correctly.

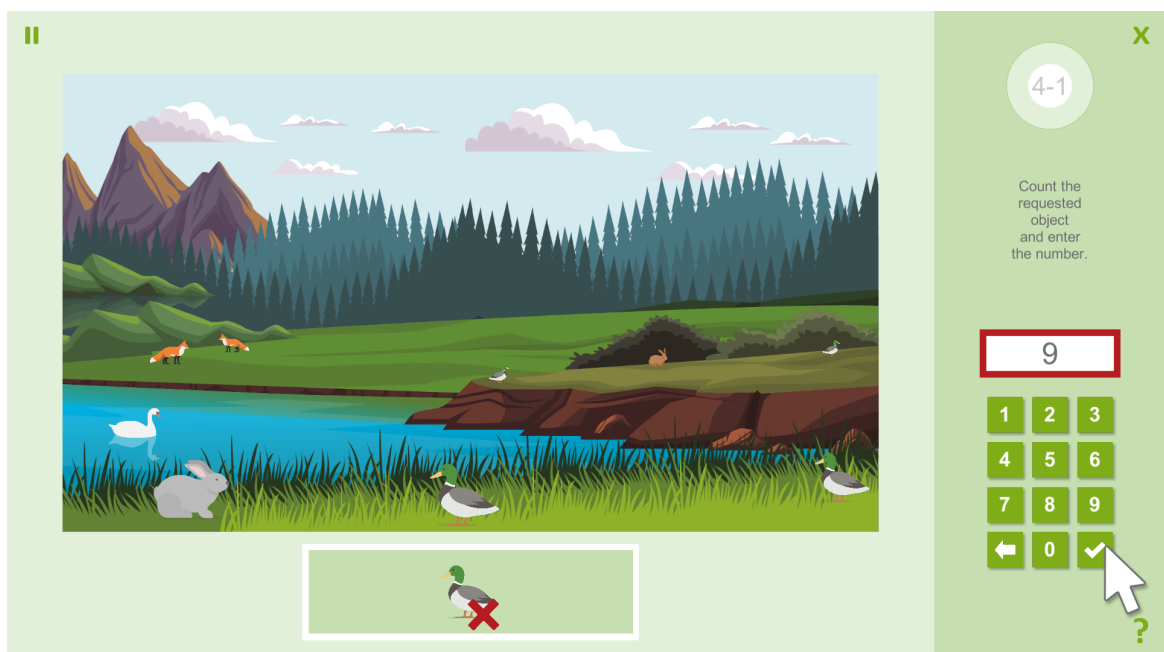


Figure 8: Feedback in task type Searching and counting objects

1.3 Level of difficulty

The exploration training works adaptively.

For every task type 18 levels are defined which increase in difficulty. If the patient successfully completes multiple levels within a task type, he/she advances to the next level, if the percentage for level up that is set in the parameter menu has been exceeded. However, the training will continue with a different task type, whereupon only the active task type will be worked on (see [Training parameters](#)). If the patient uses the active assistance, the training continues in the same level. The difficulty decreases if a task could not be solved twice within the same level; meaning the number of maximum tries has been exceeded (see [Training parameters](#)). This way it is ensured that, depending on the task type, the patient can work as close to his/her performance limit as possible. Level up/down only happens within this task type; therefore it is possible that the patient works in every task type in different levels. For example, the patient could have been progressed in *Searching Missing Numbers* to level 12 while having difficulties in *Searching Objects* and therefore only works in level 6.

At the beginning of the training the current level of difficulty will be displayed as the maximum level for the selected task type in the therapist menu. If a new level is entered here, all other task types will be set to this level. The increase of the difficulty depends on multiple, specific factors.

A level consists of a task block of each task type. Therefore, one task block can consist of multiple tasks (see table 1). A task will be considered as correctly solved if all target objects have been identified correctly. To successfully complete a level, a specific percentage of tasks of a task block need to be solved without the assistance. If the patient is able to do so, he will continue to work in the next task type; respectively the level will be increased when all task types within one level have been completed. If the percentage of tasks that have to be solved has been reached with mistakes or with the assistance, the training continues in the same task type and level. If the patient cannot solve enough tasks, the training continues in the previous task type, respectively the level will be decreased.

Level	No. of tasks per task type Searching missing numbers & Overlapping shapes	No. of tasks per task type Searching objects & Searching and counting objects
01 - 06	5	3
07 - 12	3	2
13 - 18	1	1

Table 1: Number of tasks per level and task type

Searching missing numbers

Over the course of the training the display area of the numbers increases continuously, while at the same time, the number of displayed numbers increases as well. And yet, the amount of missing numbers increases as well.

Level	Number range limit	Count of missing numbers	Numbers' display area size
01	5	1	small
02	7	2	small
03	8	2	small
04	9	3	small
05	10	3	small
06	12	3	medium
07	14	3	medium
08	16	4	medium
09	18	4	medium
10	20	4	big
11	24	5	big
12	28	5	big
13	30	5	limitless
14	35	5	limitless
15	38	6	limitless
16	40	6	limitless
17	45	7	limitless
18	50	8	limitless

Table 2: Difficulty structure of the task type Searching missing numbers

Overlapping shapes

To alleviate the differentiation of the different shapes in the beginning, each form is displayed in a different color. The training starts with two overlapping shapes with different colors. From level 5 on, no coloring will be used. At level 9 the number of overlapping shapes will be increased to three, while at first, colors will be used again. Level 17 & 18 do not work with single selectable shapes, but with sets of three.

Every incorrect set consists of two correct shapes and one incorrect shape.

Level	No. of overlapping shapes	No. of selectable shapes	Color mode	Contour type
01	2	3	colored	geometric
02	2	6	colored	geometric
03	2	3	colored	figures

Level	No. of overlapping shapes	No. of selectable shapes	Color mode	Contour type
04	2	6	colored	figures
05	2	3	black	geometric
06	2	6	black	geometric
07	2	3	black	figures
08	2	6	black	figures
09	3	6	colored	geometric
10	3	8	colored	geometric
11	3	6	colored	figures
12	3	8	colored	figures
13	3	6	black	geometric
14	3	8	black	geometric
15	3	6	black	figures
16	3	8	black	figures
17	3	4×3	black	mixed
18	3	6×3	black	mixed

Table 3: Difficulty structure of the task type overlapping shapes

Searching objects

With increasing difficulty the closeness of the objects within the displayed scene increases. Besides, more and more objects have to be found. Additionally, relevant and non- relevant objects will become more similar over the course of the level, which makes it more difficult to differentiate them.

Level	Target objects	Irrelevant objects	Complexity	Similarity between objects
01	2	4	simple	dissimilar
02	2	5	simple	dissimilar
03	3	6	simple	dissimilar
04	3	7	simple	dissimilar
05	4	8	simple	dissimilar
06	4	6	medium	dissimilar
07	5	7	medium	dissimilar
08	5	8	medium	dissimilar
09	6	9	medium	dissimilar
10	6	10	medium	dissimilar
11	7	7	complex	dissimilar
12	7	8	complex	dissimilar

Level	Target objects	Irrelevant objects	Complexity	Similarity between objects
13	8	9	complex	similar
14	8	10	complex	similar
15	10	11	complex	similar
16	10	15	very complex	similar
17	10	20	very complex	similar
18	10	25	very complex	similar

Table 4: Difficulty structure of the task type Searching objects

Searching and counting objects

In the first five levels only one object has to be searched and counted. Later on, two or three objects have to be found, while the patient can choose the order. The number of the relevant objects as well as the number of objects that have to be counted increase with ascending level. At the same time the objects become more and more similar, as in the task type *Searching Objects*.


Level	No. of objects to count	Count per object	No. of irrelevant objects	Complexity	Similarity
01	1	2 to 5	4	simple	dissimilar
02	1	3 to 6	5	simple	dissimilar
03	1	4 to 7	6	simple	dissimilar
04	1	5 to 8	7	simple	dissimilar
05	1	6 to 10	8	simple	dissimilar
06	2	4 to 7	6	medium	dissimilar
07	2	5 to 8	7	medium	dissimilar
08	2	3 to 10	8	medium	dissimilar
09	2	3 to 10	9	medium	dissimilar
10	2	3 to 10	10	medium	dissimilar
11	3	3 to 10	7	complex	dissimilar
12	3	3 to 10	8	complex	dissimilar
13	3	3 to 10	9	complex	similar
14	3	3 to 10	10	complex	similar
15	3	3 to 10	11	complex	similar
16	3	3 to 10	15	very complex	similar
17	3	3 to 10	20	very complex	similar
18	3	3 to 10	25	very complex	similar

Table 5: Difficulty structure of the task type Searching and counting objects

1.4 Training parameters

In the [RehaCom Foundations](#) general information concerning the training parameters and their effects are provided. These should be considered in the following.

Skip tutorial:

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



The screenshot shows a software window titled "Parameter" with a close button (X) in the top right corner. The main content area is titled "Exploration 2" and contains several settings sections:

- Level change:**
 - Duration of session: 30 min. (with up/down arrows)
 - Level up: 70 % (with up/down arrows)
 - Maximum tries: 2 (with up/down arrows)
- Training category:**
 - ☒ Searching missing numbers
 - ☒ Overlapping shapes
 - ☒ Searching objects
 - ☒ Searching and counting objects
- Input mode:**
 - ☒ Mouse
 - ☐ Keyboard
 - ☐ Touchscreen
- Training options:**
 - ☒ Acoustic feedback
 - ☒ Active help
 - ☐ Limited time
 - ☒ Dynamic time adaptation
- Max. time for solution:** 120 (with up/down arrows)

On the right side of the window, there are three buttons: "Default" (with a left arrow icon), "OK" (with a checkmark icon), "Cancel" (with an X icon), and "Help" (with a question mark icon).

Figure 9: Parameter menu

Duration of session in min:

The duration of session defines the length of the planned training session. A duration of session of 30 minutes is recommended.

Level up:

The set percentage defines how many percent of the tasks need to be solved correctly, in order to change to another training category and ultimately to ascend to the next level.

Level down:

For a level up at least the set percentage of tasks of the task type within a level need to be solved correctly. If the tasks are not being solved without mistakes, the training continues in the same level and task type.

Maximum tries:

Defines how many mistakes the patient can make until the task will be regarded as not passed. If a task is not passed twice, the level of difficulty for the next task will be decreased.

For a level up a task has to be solved at first try – meaning without mistakes.

An exception is the task type *Searching Missing Numbers*, for which at level 8 one mistake and level 15 two mistakes are allowed,

Task type:

To adjust the training to the patient in the best possible way, the respective task types can be activated or deactivated

Input mode:

Generally, the exploration training is controlled with the mouse. Additionally, a keyboard (patient keyboard) and a touchscreen are provided.

Acoustic Feedback:

If the acoustic feedback is activated, the selection of the patient will be evaluated with a RehaCom typical tone sequence additionally to visual feedback.

Active Assistance:

After a specific time (until level 5 30 seconds, from level 6 on 60 seconds) an assistance will be activated, which can, but doesn't have to, be used by the patient. This needs to be activated by pressing the help button. Correct input after using the assistance will be regarded as an omission and prevents a level up.

Time limit:

When this parameter is activated the training difficulty can be increased drastically. Therefore, it is only recommend for advanced patients. If *time limit* is activated a level up is only possible when a task has been solved correctly within this set time limit. If the task is not being solved fast enough, the patient will be informed after the task and the training continues in the same level.

Dynamic time adjustment:

Due to the constantly increasing level of difficulty the time that is needed to solve a task increases automatically, since more and more relevant objects within an increasing number of non-relevant objects have to be found.

Due to the *dynamic time adjustment* the maximum time for solution increases depending on the level in which the patient is working. This way, the increase in difficulty, which arises from the use of *time limit*, can be kept constant.

Maximum time for solution:

The maximum time for solution which must not be exceeded in *time limit* mode in

order to level up.

By default the following values are defined:

Level change

Duration of session:	30 Minutes
Level up	70 %
Maximum tries:	2

Task type

Searching missing numbers	on
Overlapping figures	on
Searching objects	on
Searching and counting objects	on

Input mode *(only single selection possible)*

Mouse	on
Keyboard	off
Touchscreen	off

Training options

Acoustic Feedback	On
Active Help	On
Time limit	Off
Dynamic time adjustment	on
Maximum Time for solving	120

1.5 Data analysis

The different possibilities of data analysis for the determination of the further training strategy are described in the RehaCom Foundations [RehaCom Foundations](#).

In the graphic and the tables, besides the setting of the [Training parameters](#), the following information can be viewed:

Level	Current level of difficulty
Category	Trained task type
No. of correct tasks	Number of correctly solved tasks
Level [%]	Percentage of correctly solved tasks
Complete	Information, if all tasks of this type have been done
Number of objects	Number of target objects
Correct objects	Number of found target objects
Omissions	Number of objects that have not been found or only with help
Mistakes	Number of incorrectly selected objects
Train.-time task	Time of the respective task [hh:mm:ss]
Breaks	Number of breaks made by the patient

The display of the most important values in a table in the evaluation area (see main window: progress data) enables the therapist to discuss the performance with the patient and to adjust the training for further sessions.

All information concerning the current, respectively all training consultations can be printed by using the Print button.

2 Theoretical Concept

2.1 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 homonymic 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 Training aim

The module 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 [Foundations](#)).

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 an 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 module.

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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