HASOMED

RehaCom®

Cognitive therapy

Restoration Training

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Cognitive therapy

by RehaCom 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.

Table of contents

1 Description of the training

1.1 Training tasks

Restoration Training was designed for the training of neurologically induced visual field loss, such as hemianopsia or quadrantanopsia. Animated, large, and intensely bright light stimuli are presented, starting from the border between the intact visual field and the impaired visual field. The patient's must press the **OK** button as soon as he/she perceives the light stimulus. Based on the response behavior of the patient, the program calculates the next position at which the light stimulus will be presented.

Before the training starts, the work place has to be adjustment. The patient must sit at a defined distance from the computer screen (see Training parameters) in a comfortable but fixed position. The chin rest accessory eases this. The patient must always look at the fixation point in the middle of the screen.

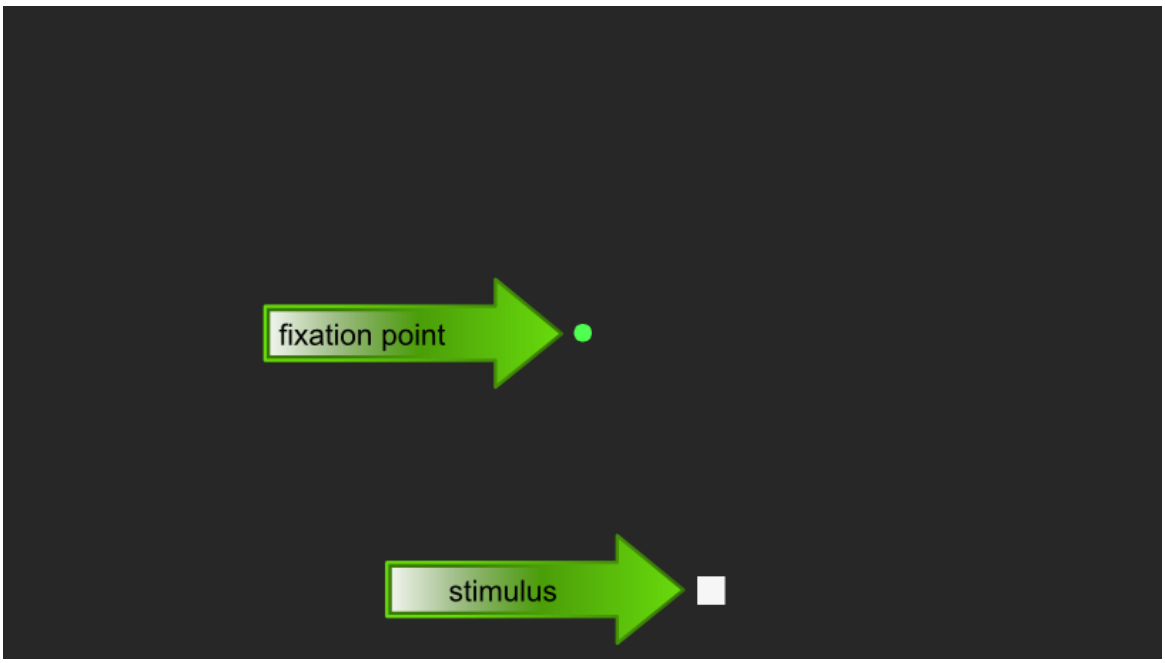

Fig. 1: Training surface w ith fixation point in the middle of the screen and bright quadratic stimulus (presentation of stimulus and fixation color changes are not displayed at the same time)

Implementation
In the center of the screen, a fixation point is visible that changes color and form intermittently. The patient must always look at this point and press the **OK** button whenever the fixation point changes. IT frequently redirects the patient to the task if he/she neglects to focus on the fixation point.

Additionally, a large white square light stimulus will be presented, starting at the border of the intact visual field and then flashing along a horizontal path into the impaired area of the visual field. The patient is required to confirm every flash of the

stimulus by pressing the **OK** button. It is essential that he/she does not follow the light stimulus with his/her eyes, but keeps them focused on the fixation point.

When the stimulus reaches the impaired area of the patient's visual field, the patient won't be able to see and confirm the stimuli. When that happens, the stimulus will change direction and move back toward the intact visual field. As soon as the patient sees it again and confirms this by pressing the OK button, the stimulus moves back to its last position where there was no response and again moves back toward the intact field until it is confirmed. This will be repeated several times, then the light stimulus appears at a new horizontal position along the edge of the intact visual field and again moves in direction of the impaired area. Due to this algorithm, the stimulation along the border between the intact visual field and the impaired area is intensely stimulated.

The patient might have difficulty initially with paying attention to two tasks: responding to the fixation control and the light stimuli at the same time. Give the patient some time to get used to the tasks. Observe him/her closely and repeat the instructions. If the patient needs additional help, you can train him/her on the two tasks separately. First, instruct him/her to ignore the light stimulus, focus solely on the fixation point and respond to the fixation control task. After this task is very well performed, the second stage is to include the response to the light stimuli.

The first training sessions should be continuously supervised by a therapist.
The therapist must intervene when:

- the patient frequently loses focus on the fixation point and moves his/her eyes to follow the light stimulus, or
- the patient often hits the response button even though no light stimulus or change to the fixation point was presented

Break with image
To maintain the patient's attention and concentration, a short break with images can be enabled in the parameter menu. When this is enabled, a picture is presented to the patient for a certain period of time. The patient can let his/her eyes relax so that the patient does not tire too much from focusing for long periods of time on the fixation point.

Before the training begins, the patient is instructed by the therapist. However, **Restoration Training** also features voice output. This option can be enabled or disabled in the parameter menu at any time (parameter: Acoustical instructions).

1.2 Performance feedback

Restoration Training features acoustic feedback.
A correct response after the presentation of a stimulus or a fixation check is affirmed by a pleasant sound.

If the patient presses the response button before stimulus is presented or after the maximum response time of a stimulus or a fixation check (= false positive response), an error sound will be presented as feedback.

If the patient misses the fixation check several times in a row or presses the **OK** button several times without being required to, a note appears along with the audio feedback: "You have lost focus. Please try again." or "You repeatedly pressed too late or too early. Please focus!".

No acoustic feedback is given if a stimulus was missed.

1.3 Levels of difficulty

The module can be used to train patients who have left- or right-sided hemianopsia or quadrantanopsia in any of the four quadrants of the visual field. For each of those six different visual field impairments, two configurations are available. One for patients whose vision is slightly affected and one for patients who are seriously affected with difficulties in attention and/or concentration, slowed motor functions, dense cataract, or disorders of the sense of color and contrast sensitivity.
The setting for more seriously affected people is characterized by larger stimuli, a high-contrast color change of the fixation point, longer presentation times and greater response time frames. It is also possible to adjust settings individually (see Training parameters).

Action-oriented training
In **Restoration Training**, those areas of the visual field that are more intensely trained are the areas that are most often used in everyday life. The following graphics show the corresponding areas with its weighting factors.

The green area is stimulated three times as often as the red area.
The yellow area (only with hemianopsia) is stimulated twice as often as the red area.

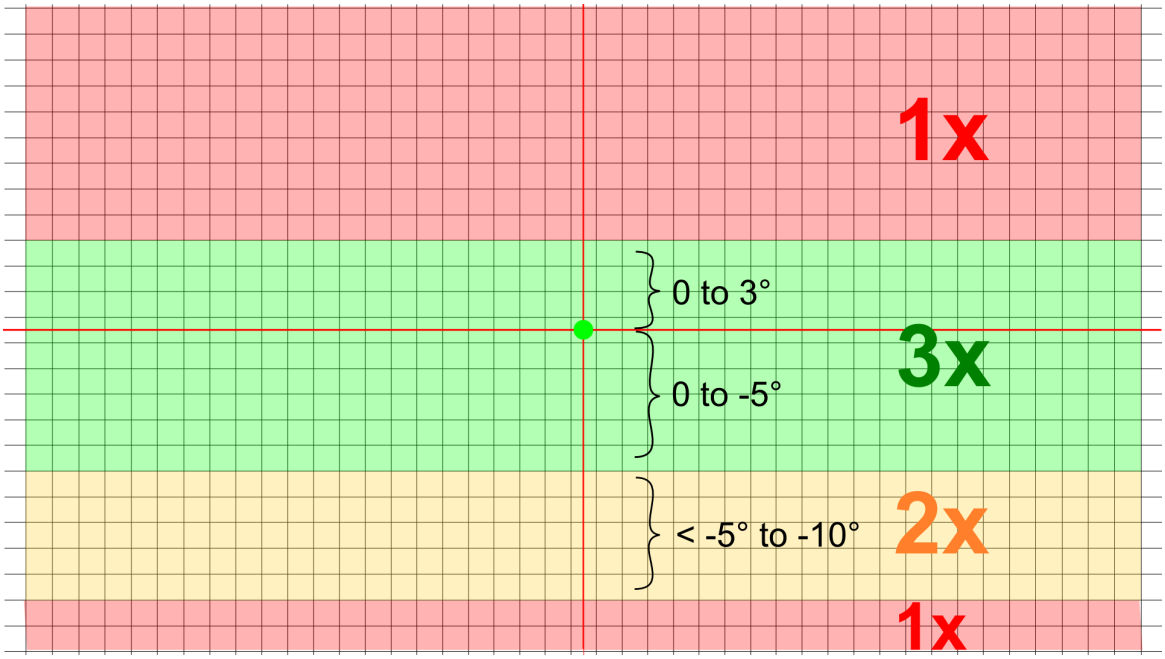

Fig. 2: Area factors for hemianopsia

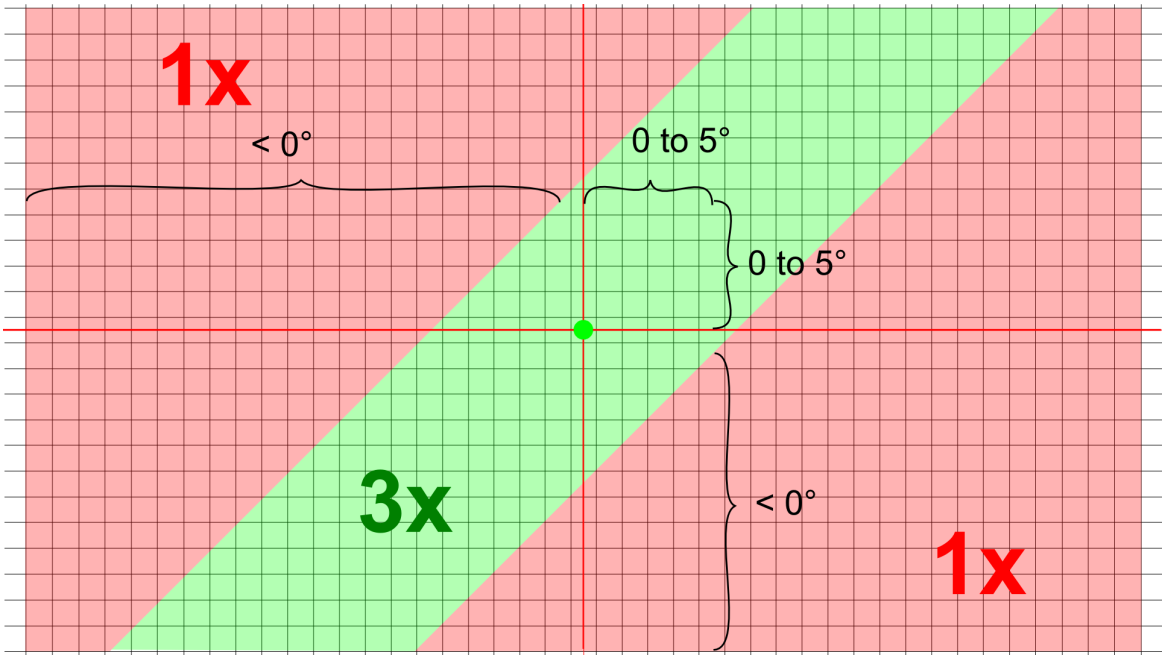

Fig. 3: Area factors for quadrant anopsy bottom left

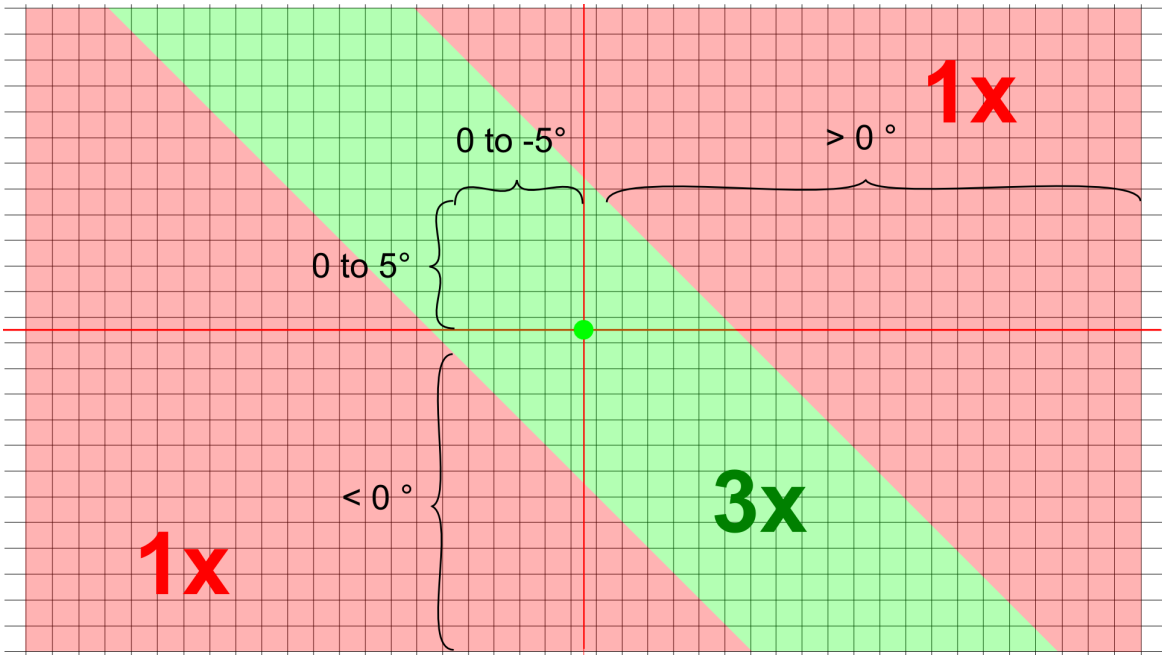

Fig. 4: Area factors for quadrant anopsy bottom right

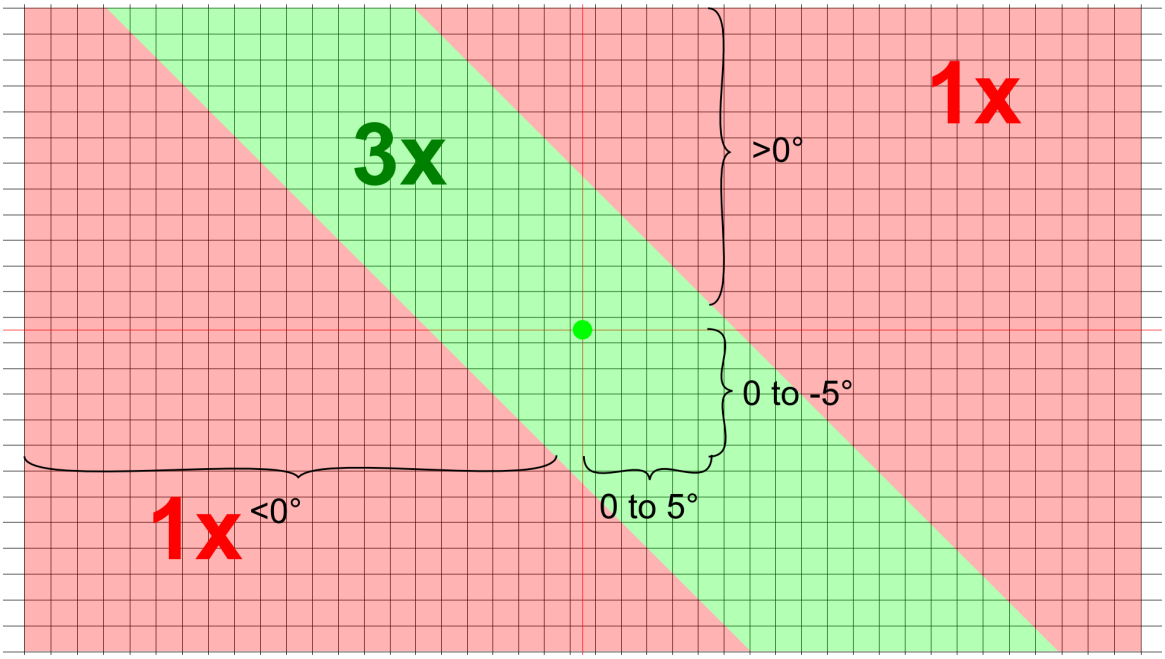

Fig. 5: Area factors for quadrant anopsy top left

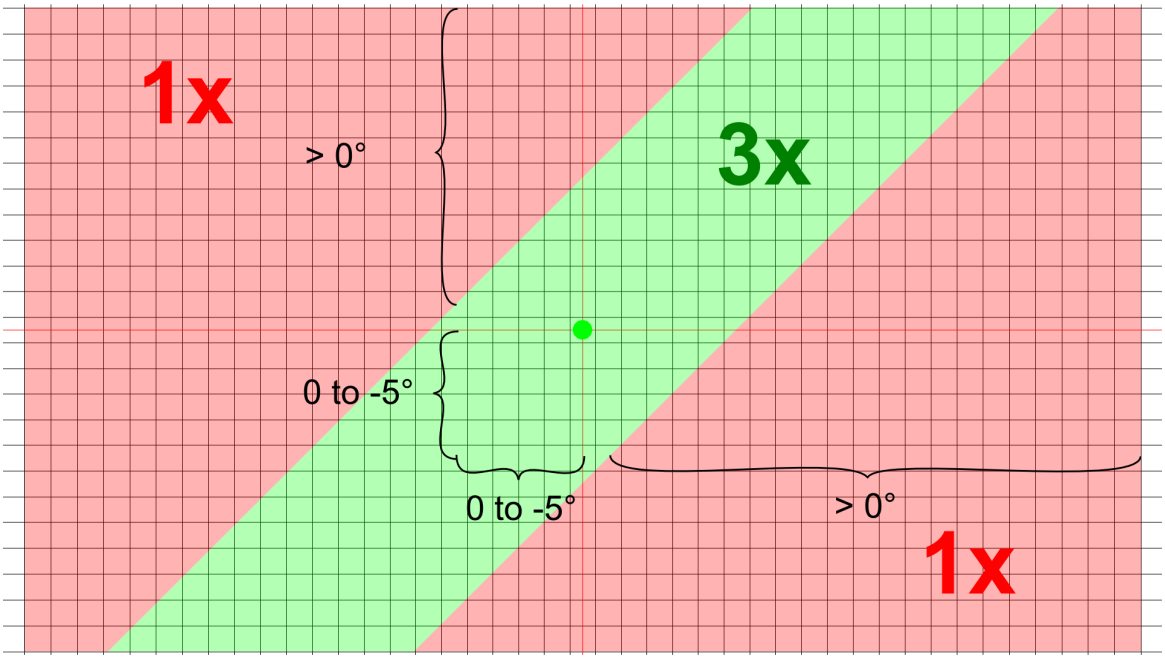

Fig. 6: Area factors for quadrant anopsy top right

1.4 Training parameter

Restoration Training has only one level of difficulty, which is why it can't be changed in the therapist menu (see Fig. 7). However, specific settings for the training module can be adjusted (see Fig. 8). This section describes each setting and explains how to adjust them.

Fig. 7: Therapist's menu

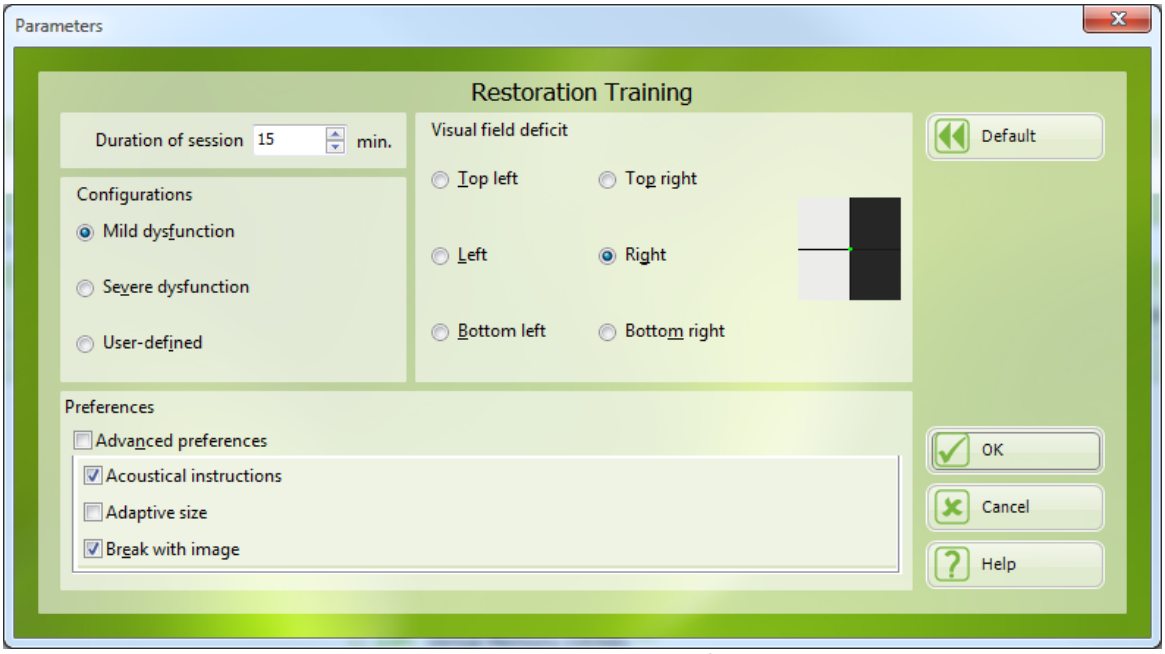

Fig. 8: Parameter menu - simple preferences

Duration of session:
We recommend a length of 15 minutes.

Parameter	Range of values
Max. test duration variant 1 - 3	5 - 30 minutes (standard: 15 minutes)

Visual field deficit:
The program provides specific training variants for the six most frequent types of neurological visual field loss – left- or right-sided hemianopia or quadrantanopia in one of the four quadrants of the visual field. The area of visual field loss can be set for each individual patient so that the training can focus on just the affected area.

Configurations:
Mild dysfunction: This setting can be used if the patient has only minor or no cognitive and/or visual impairments except for the visual field loss. The Mild dysfunction setting can also be selected for patients who have improved greatly in training using the Severe dysfunction setting and need to increase the difficulty of the module.
Severe dysfunction: This setting makes the training easier, particularly for patients with impairments in attention, especially divided attention, motor and/or perceptive slowdown, or severely limited visual acuity. Often these patients are not able to withstand stress, therefore the training duration should be 10–15 minutes.
User-defined: if special settings are required and made for the patient, then this setting is marked. It is not necessary to enable the User-defined setting and then make the changes. When changes are made that deviate from those used in either

of the other configurations, then User-defined is automatically selected. The changes that would cause this setting to automatically be selected are only available in the Advanced preferences section.

Preferences:
The settings that can be made for **Restoration Training** are exceptionally extensive. In most cases, the parameter available in the simple settings are completely sufficient. But there may be situations in which a very specific setting is needed for the patient.

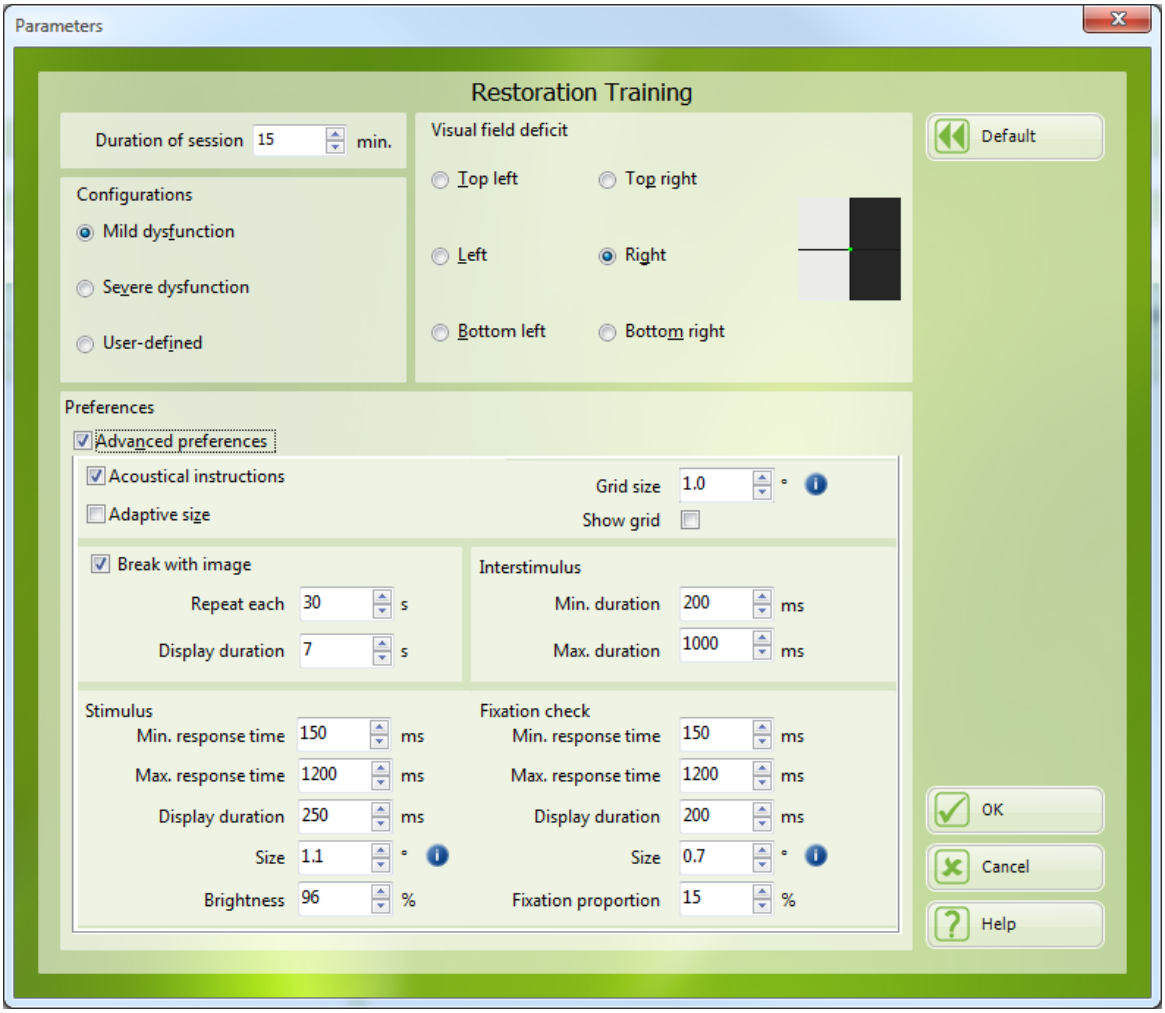

Fig. 9: Parameter menu - advanced preferences.

(i) in the blue circle
The sizes for the grid, the stimuli, and the fixation check have a special note. Studies describe sizes mostly in pixels. But this isn't accurate for recent monitors or even projectors. For this reason, visual angle degrees are used for sizes. Nevertheless, to be able to compare the data, an approximate conversion into pixels is offered when moving the mouse over the (i).

Acoustical instructions:
The module also offers to present the written instructions acoustically, so that it is possible for a patient with a severe visual field loss to follow the instructions.

Adaptive size:
Perception within the visual field is distributed unequally, so the stimuli are perceived to be weaker at the edges than in the center. Enabling the setting Adaptive size can make the stimuli appear larger at the edge to cope with weaker perception at the edge of the visual field.

Grid size:
By changing the grid size, the distance between each appearance of the stimuli can be influenced. The grid size is given in visual angle degrees (see (i) in the blue circle).
Please note that Restoration Training needs at least five grids (with adaptive size 6 grids) in the visual field of the patient. If the grid is set too large, an instruction is displayed when the module starts.
Show grid:
Note: this option must not be enabled during the patient's training! It is simply to enable the therapist to find the optimal grid size setting. If this function is enabled, the grid is shown during the training.

Break with image:
The training module can periodically insert breaks in which an image is presented to the patient for a certain time. There is no task to complete while the image is presented. Instead, the patient can relax his/her eyes from focusing on the fixation point.
Repeat each: the length of time between the image displays
Display duration: display time of the image

Interstimulus:
The minimum and maximum times between stimuli are specified. During training, a random value between the minimum and the maximum duration is chosen for each interval.

Stimulus:
Min. response time: the amount of time that must elapse during the presentation of the stimulus before pressing the **OK** button can be considered a valid reaction to the stimulus.
Max. response time: the maximum amount of time during which pressing the **OK** button is interpreted as a valid response.
Display duration: length of time the stimulus is displayed
Size: size of the stimulus in visual angle degrees (see (i) in the blue circle)
Brightness: brightness of the stimulus in the range of 0-100%

Fixation check:
Min. response time: the amount of time that must elapse during the presentation of the fixation check before pressing the **OK** button can be considered a valid reaction to the change in the fixation point.
Max. response time: the maximum amount of time during which pressing the **OK** button is interpreted as a valid response.
Display duration: display time of the fixation check
Size: size of the fixation check in visual angle degrees (see (i) in the blue circle)
Fixation proportion: amount of the fixation check from 0-50%. Because an amount of more than 50% is not useful, this parameter cannot be adjusted above 50%.

When setting up training for the first time with a new patient, the following default values are automatically set up:

Duration of session	15 minutes
Configurations	Mild dysfunction
Visual field deficit	Right
Advanced preferences	Disabled
Acoustical instructions	Enabled
Adaptive size	Disabled
Break with image	on [X]
Repeat each	30 seconds
Display duration	7 seconds
Grid size	1.0
Show grid	Disabled
Interstimulus: Min. duration	200 milliseconds (ms)
Interstimulus: Max. duration	1000 ms
Stimulus: Min. response time	150 ms
Stimulus: Max. response time	1200 ms
Stimulus: Display duration	250 ms
Stimulus: Size	1.1
Stimulus: Brightness	96%
Fixation check: Min. response time	150 ms
Fixation check: Max. response time	1200 ms
Fixation check: Display duration	200 ms
Fixation check: Size	0.7
Fixation proportion	15%

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 (see Fig. 10).

Explanation of columns in the results table or under More Details on the results page

Level	Current level of difficulty
Stimuli	Number of stimuli
Correct stim.	Number of stimuli to which the patient correctly responded
Correct stim. %	Number of stimuli to which the patient correctly responded in %
Fix. checks	Number of fixation checks
Correct fix. checks	Number of fixation checks to which the patient correctly responded
Correct fix. checks %	Number of fixation checks to which the patient correctly responded in %
Mistakes	Mistakes
Border tests	Border tests
Aver. reac. time	Average reaction time in ms
Train. time task	Effective training time in h:mm:ss
Breaks	Number of breaks caused by the patient

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

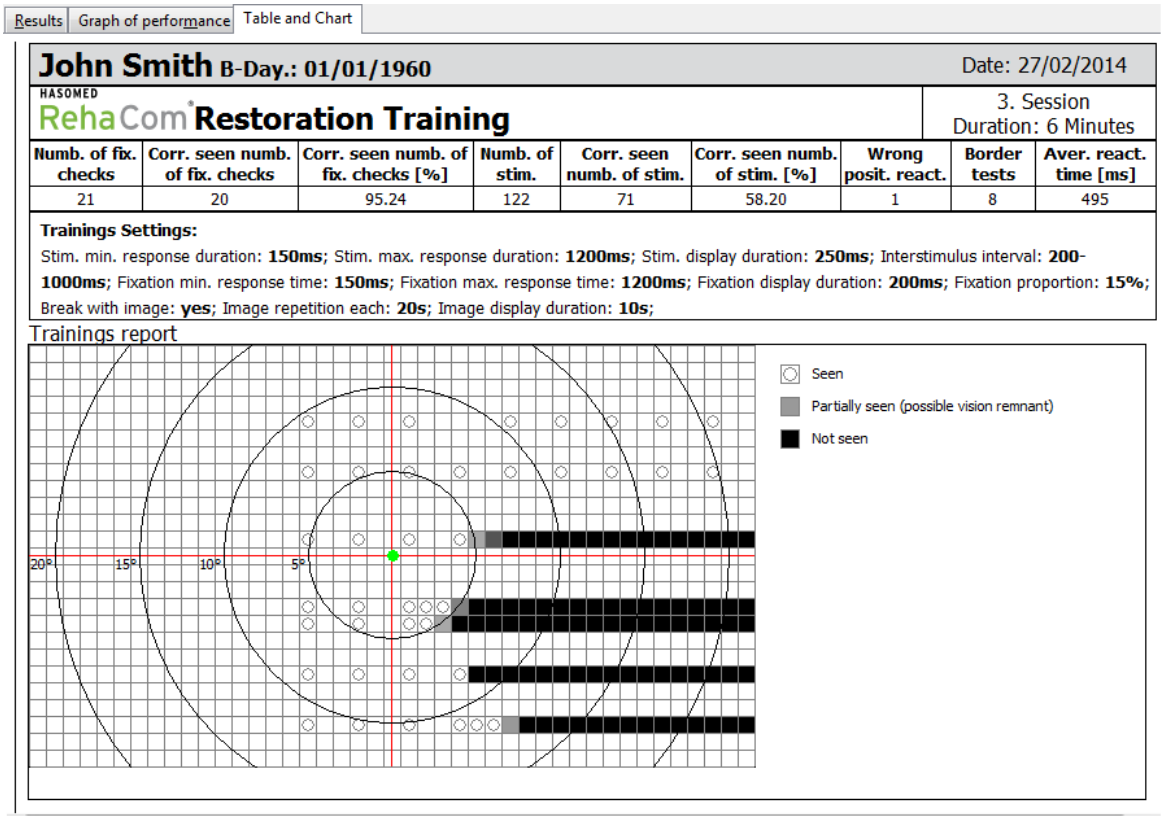

Fig. 10: Training report

The patient's responses during training are depicted by shaded cells in a grid. The meaning is as follows:

- white square without circle: "background"—no light stimulus was presented at these positions
- white with circle: one or more light stimuli were presented at these positions and every time, the patient confirmed he/she saw them by pressing the **OK** button (conclusion: visual field is intact at these positions)
- black: one or more light stimuli were presented at these positions and the patient never did not press the **OK** button (conclusion: no visual functions at these positions)
- gray: light stimuli were presented several times at these positions and the patient only sometimes pressed the **OK** button to confirm he/she saw it. The lighter the gray, the more often the patient has responded to a stimulus presented at this position. These areas in the result graph are named “transition zones” or “area of residual vision” (ARV). The basic principle of **Restoration Training** is the presumption that the visual functions are only partially damaged in the gray areas and that they still have the ability to improve visual perception and processing via targeted, highly repetitive stimulation. The primary goal of training is to excite the ARV via light stimulation in a way that visual functions become better and more reliable at processing visual information. The secondary goal is to extend the ARV further into the direction of the visual field impairment so that currently non-functioning visual areas (i.e.,

the black areas on the chart) begin to process visual information.

Please note: the area displayed in black is not necessarily tested throughout the whole periphery. Once the light stimulus reaches a position at which it is not perceived any more, the stimulus will not be presented further into the defective area. For the graphic display, it is assumed that there are no visual functions beyond this position. Positions peripheral to the ARV at the border zone are displayed completely in black.

The second graphic on the Table and Chart tab can be adjusted by the therapist. This is the lower graphic that can be found in the tab "Results" under "More details." To change the graphic, please use setting possibilities below the graph on the Results tab.

2 Theoretical concept

2.1 Foundations

Patients with neurological visual field loss can achieve improvements of the visual functions through specific, intense and high-frequency light stimulation (Schmielau et al., 1990, 1998, 2007).

The principle of **Restoration Training** is to create a training situation in which the unimpaired functional areas cannot be used to accomplish the task, but instead, require that the partially damaged visual structures are activated to complete the task.

No visual information is presented to the intact visual field. However, there is an intense stimulation in the area of the visual field border between intact and damaged visual field. Stimulation of the entire visual field border is especially intensively in Restoration Training because that is where potential for the recovery of the visual function is greatest.

The regularity of the training is particularly important; ideally, there should be two sessions each day.

2.2 Training aim

The objective of **Restoration Training** is to determine the areas with restoration potential through intense light stimulation of the entire border zone between the intact and the impaired areas of the patient's visual field and then to initiate the process of improvement and recovery of the impaired field of vision. The intense light stimuli encourage partially damaged neurological structures to take part again in the visual coping process and to re-establish their assigned perceptual functions within the visual field.

2.3 Target groups

The training is recommended for patients with neurologically-based defect of vision such as hemianopsia or quadrantanopsia.

Patients with additional cognitive impairments, such as attention and concentration deficits or a slowdown of perception and motor functions have the possibility to train using some of the advanced preferences where the parameters can be adjusted according to the patient's needs. The same applies to additional visual impairments such as a dense cataract and disorders of the sense of color and contrast sensitivity. The program is applicable even for patients who suffer from impairments in articulation or in speech and word comprehension after a thorough introduction.

2.4 Bibliography

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