HASOMED

RehaCom®

Cognitive therapy

Working Memory

www.rehacom.com

HASOMED RehaCom®

Cognitive therapy

by Hasomed GmbH

This manual contains information about using the RehaCom therapy system.

Our therapy system RehaCom delivers tested methodologies and procedures to train brain performance.
RehaCom helps patients after stroke or brain trauma with the improvement on such important abilities like memory, attention, concentration, planning, etc.

Since 1986 we develop the therapy system progressive. It is our aim to give you a tool which supports your work by technical competence and simple handling, to support you at clinic and practice.

User assistance information:

Please find help on RehaCom website of your country. In case of any questions contact us via e-mail or phone (see contact information below).

Germany / Europe / Worldwide:
HASOMED Hard- und Software für Medizin Gesellschaft mbH
Paul-Ecke-Str. 1
D-39114 Magdeburg

Tel: +49 (391) 610 7645
www.rehacom.com
info@rehacom.com

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

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

1 Training description

1.1 Training task

Development

The therapy module **Working Memory** was developed in cooperation with Dr. DP Angelika Thöne-Otto, medical faculty of the University of Leipzig, Dipl.-Psych. Juliane Weicker, Max Planck Institute for Human Cognitive and Brain Science, Leipzig and Dr. Stefan Frisch, clinic of the Johann Wolfgang Goethe-University Frankfurt am Main.

Basic statements on the theoretical foundations of the Working Memory module's training method can be found in the Foundations section.

Material

The Working Memory improves patients' working memory in a playful way by means of a card game. A full deck of cards (52 cards) with optional French, German, or color deck is used. The training material is complemented by a complex progression of difficulty and appealing visuals to enhance the Performance feedback. Additionally, the training can be customized with different modifiers (see Training parameters).

At the beginning of training the program's interface is introduced and operating it is practiced. Working memory processes aren't occupied yet during this. The concept of the exercise is to memorize certain cards shown by the "fellow player" (in the upper part of the monitor), then to choose from the "player's" own hand of cards (lower part of the monitor) and to put them on the "table" (centre of the monitor) via "drag and drop" or double clicking.

Modules

The training is divided into three different "modules" (see chapter Levels of Difficulty). Every module is represented by a distinct task the "player" is asked to perform: memorizing all cards (Storage systems), memorizing cards selectively (Selective attention) and sorting cards (Central executive):

- In the **module "Storage systems"** the fellow player's cards will be hidden again after a short presentation time. The player's task is to memorize the cards, then choose the same cards from his own hand and put them on the table.

- In the **module "Selective attention"** the patient's task is to only memorize the cards of one or two colours (or suits). The colours are announced by the narrator before each exercise (e.g. "only memorize the hearts of the fellow player"). Then the patient is to put the cards matching the announced colour(s) and the fellow

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

player's cards in the centre.

- The **module "Central executive"** is divided into two variants, analogous to neuropsychological short term and working memory tests (e.g. digit and block spans). For the task variant "sort forwards" the player puts the cards on the table in the same order as the fellow player. For the variant "sort backwards" he or she has to do it in reverse order. To do this the patient drags the cards in order from his hand to the marked areas in the centre of the monitor.

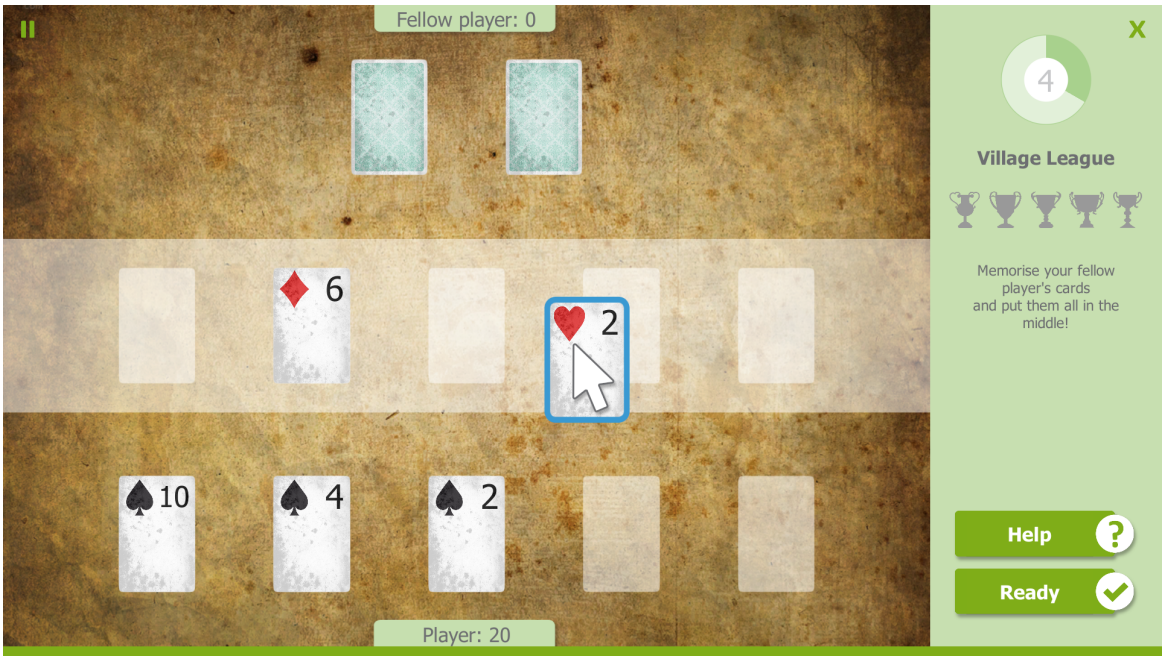


Fig. 1: Working Memory Training level 4

Fig. 1 The task is to memorize the upper two cards of the "fellow player", to choose them from the cards of the "player" and to place them in the centre of the monitor.

Optional motivating elements

The therapy module **Working Memory** has two additional components with the purpose of motivating the patient. Those optional (see Training parameters) components are the **Joker System** and the **Bonus Game**. If the respective parameters are activated, the Bonus Game is available starting from level 17 and the Joker System from level 18.

The ***Joker System*** rewards the player for very good performances by giving him joker cards. As the game progresses those cards can be exchanged for several aids to lessen the difficulty of the tasks.To collect a joker a set amount of tasks have

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

to be solved perfectly and consecutively. In the village league 10 tasks are needed. With every promotion this number is reduced by one task, so nine tasks are needed to get a joker in the town league, 8 in the district league, up until the world league, where jokers are given after five accurately solved tasks already.
The progress in gaining a joker is visualized as a filling joker card.

Fig. 2: Joker system

Fig. 2 The **Joker display** can be seen in the margin on the right. The part of the joker card that's coloured in shows the progress to collect a joker. When the card is filled in completely, the player gets a joker.

Any jokers collected are placed in a stack in the margin and can be played by dragging and dropping them in the playing area. They can be used for the following effects:

- As a stand in for any desired card. If the player has forgotten a card or he isn't sure of it he can play the joker instead of the card. The task will be marked as correct in this case.
- If the player places the joker on top of the hidden cards of the fellow player they will flip over again for the set duration of time.
- From the country league onwards, if the player is able to collect at least five joker cards he can promote to the next highest league by clicking a button in the margin. That means he can now play with the nicer cards and better table of the higher league. The level and difficulty of the tasks remain the same. At the same time relegation to a lower league can be prevented by using five jokers as well.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

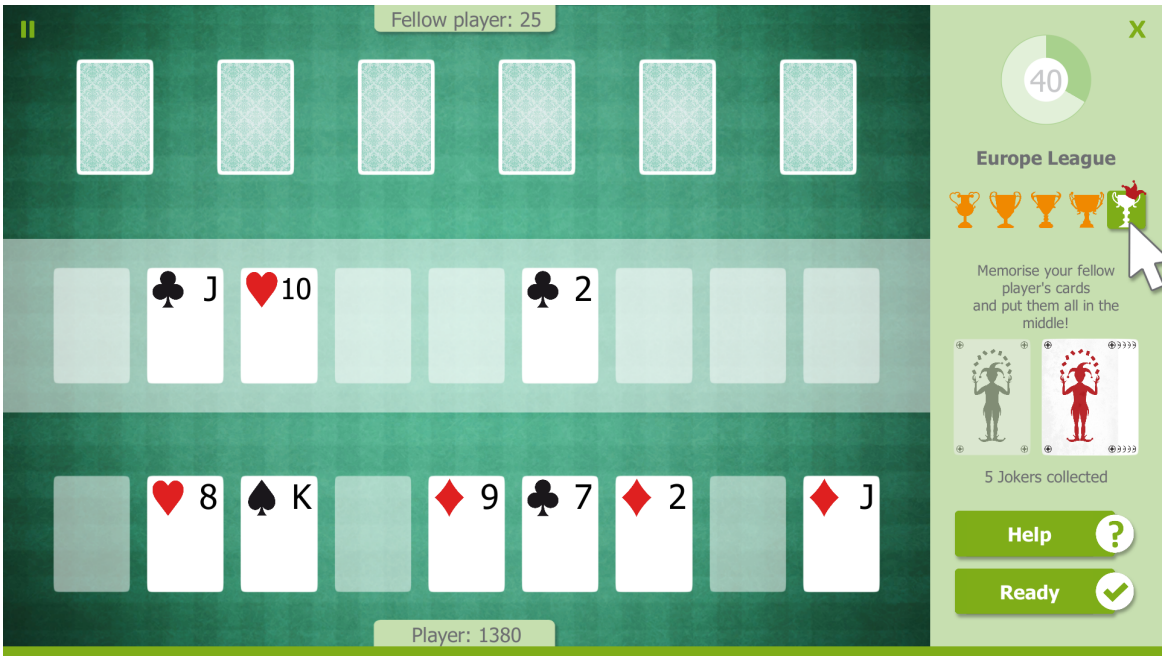


Fig. 3: League progression

Fig. 3 After collecting five or more jokers, the **League Upgrade Button** (where the cursor is pointing at on the upper right) can be used to be promoted the next league.

The **Bonus Game** is another level of the game in which the player can collect extra points. When it is activated the player is allowed to drag one of the cards played into the bonus card deck in the margin after every successful task.
Every card that gets collected like this is available by switching to the bonus game (clicking the "bonus game" button on the lower right). However, for every failed task the fellow player will choose a card to drag into his deck. In the bonus game window the player combines cards in threes to exchange them for points. To do this the cards have to be dragged to the centre individually before clicking the "Trade In" button.
The number of points won depends on the combination of cards. A triplet of successive numbers of the same colour will win more points than a such a triplet of random numbers for example. The points for the combination of cards played are distributed like this:

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

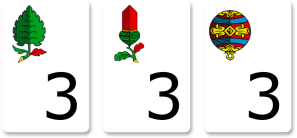
Combination of Cards	Example	Points
3 random numbers of the same colour		5 Points
3 same numbers of a random colour		10 Punkte
3 successive numbers of a random colour		20 Punkte
3 successive numbers of the same colour		50 Punkte
3 identical cards		50 Punkte

Table 1: awarding of points in the Bonus Game

If the fellow player collects a minimum amount of cards he will automatically start trading in cards in the bonus game to gain extra points. The challenge for the player is to gain as many points as possible by making smart choices in collecting the bonus cards and doing well in the main game.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

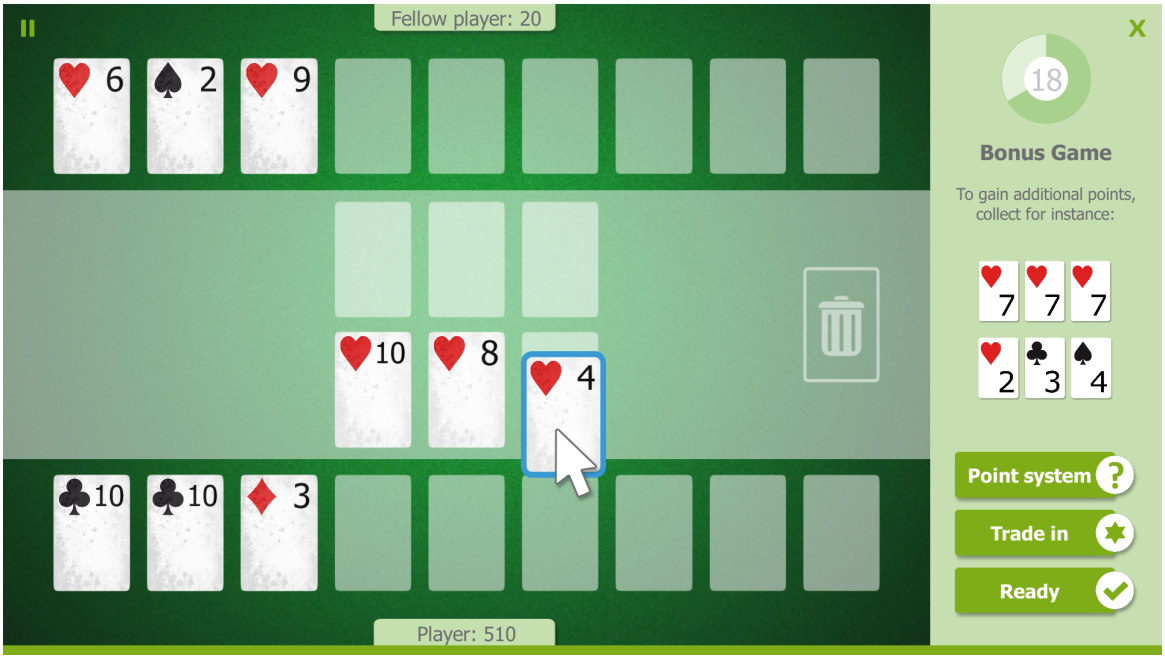


Fig. 4: Bonus Game

Fig. 4 After all 3 slots of the player tray are filled with cards, the selected cards can be traded for points by pressing the **"Trade in"-Button** (lower right).

1.2 Performance feedback

The patient receives feedback on his or her performance in various ways.

Solution of the current task. After solving the current task the patient receives descriptive feedback of his own performance.

- In the margin on the right of the table a written assessment appears.
- Above it a smiley face demonstrates a visual evaluation of the solution (there are several grades for "good" and "bad" depending on whether the task was solved immediately or there were mistakes repeatedly).
- Green tick marks (correct card), red crosses (wrong card), or yellow tick mark (forgotten card) appear on the cards to give detailed feedback.

Level of difficulty. The current degree of difficulty is displayed in the top of the meta area on the right. The pie chart shows the progress within the current level. If the circle is 100% full, the player has reached the next level and the difficulty of the training increases. If the circle is empty and the player makes mistakes, he will be relegated a level and the difficulty will consequently lessen.

League system and trophies. The structure of difficuly correlates with a league system. The current league and the number of trophies won can be seen on the right of the monitor.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

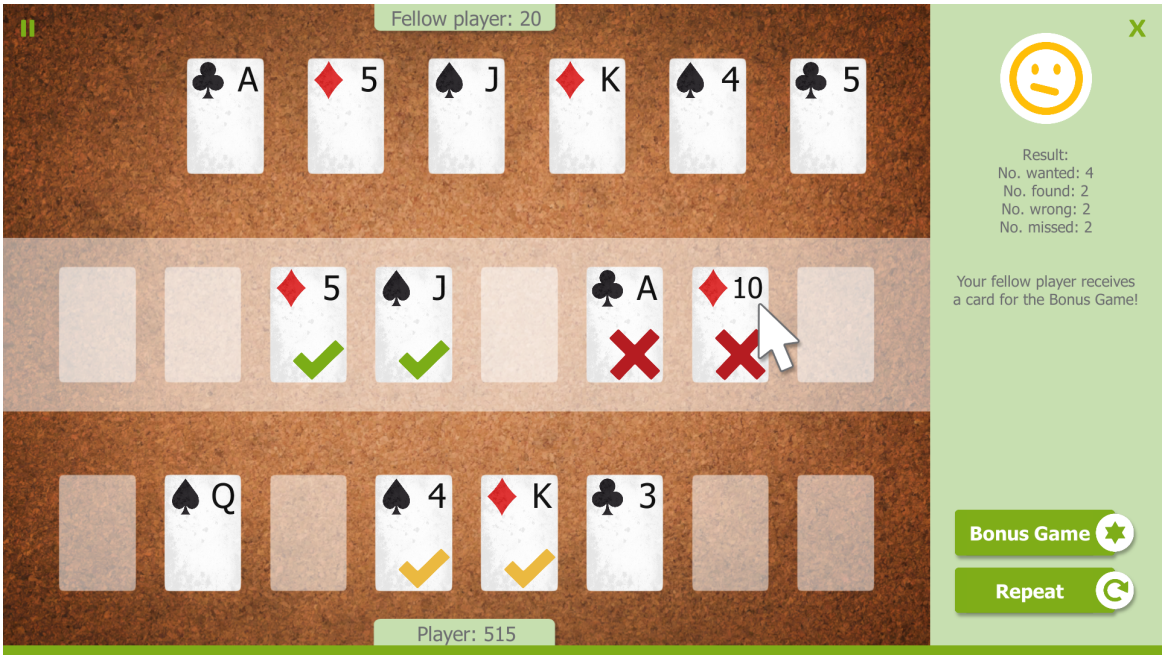


Fig 2: Performance feedback in case of an error

1.3 Levels of difficulty

Automatic Adaptivity

Setting the level of difficulty happens auto-adaptively, meaning the difficulty of a task automatically adjusts to the performance of the patient. At the beginning of each level the achievement chart already has one point in it. If the player is able to complete the task in one try, he will gain one more point. If he makes a mistake, no points are given for completing the repeat. If he is unable to complete the task after multiple attempts, a point is deducted. If the player completes the required number of tasks per level, which are preset in the training parameters, he reaches the next level of difficulty. If the player has fewer than zero points because of point deduction, the level of difficulty is lowered. Due to this the tasks always remain a suitable challenge, neither over- nor underwhelming the patient. To gain this individual range of difficulty as quickly as possible and to use the time spent in training effectifely, only two points are needed to get to the next level during the first session. If the patient makes mistakes repeatedly the program detects that the limit of performance has been reached for the time being. The program now automatically switches to the mode of training chosen by the therapist.

Levels of difficulty

The training has 69 *levels of difficulty*. The setting of the level of difficulty is adaptive, automatically adjusting the difficulty to the performance of the patient. The adjustment is made via the parameter "Number points per level" (see Training parameters).

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

(The training has a total of 69 levels whose increase in difficulty is sensitive and linear due to a variation of features and parameters. The structure of difficulty correlates with a league system. This system visualizes the graphic value of the cards and table and helps with motivation (see Foundations). The critical parameter always indicates the number of cards to memorize.)

The following table shows the course of difficulty for the training:

Training parameters

Level	Task	No. cards to play	No. cards presented by fellow player	No. distracting cards	visual quality (League)
1	introduction	**2**	2	2	Village League
2		**3**	3	2	Village League
3	memorize all cards	**2**	2	2	Village League
4		**2**	2	3	Village League
5		**3**	3	2	Village League
6		**3**	3	3	Village League
7	memorize selectively (1 colour)	**3**	5	3	Village League
8		**3**	5	4	Village League
9		**3**	6	4	Town League
10	memorize selectively (2 colours)	**3**	5	2	Town League
11		**3**	5	3	Town League
12		**3**	6	3	Town League
13		**3**	6	4	Town League
14		**3**	6	5	Town League
15	sort (forwards)	**3**	0	0	Town League
16		**4**	0	0	Town League
17	sort (backwards)	**3**	0	0	District League
18	memorize all cards	**4**	4	1	District League
19		**4**	4	2	District

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

					League
20		**4**	4	3	District League
21		**4**	4	4	District League
22		**4**	4	5	District League
23	memorize selectively (1 colour)	**4**	7	3	District League
24		**4**	7	4	District League
25		**4**	7	5	Country League
26	sort (forwards)	**5**	0	0	Country League
27	sort (backwards)	**4**	0	0	Country League
28	memorize all cards	**5**	5	1	Country League
29		**5**	5	2	Country League
30		**5**	5	3	Country League
31		**5**	5	4	Country League
32		**5**	5	5	Country League
33		**5**	5	6	Europe League
34	memorize selectively (2 colours)	**5**	8	3	Europe League
35		**5**	8	4	Europe League
36		**5**	8	5	Europe League
37		**5**	8	6	Europe League
38	sort (forwards)	**6**	0	0	Europe League
39	sort (backwards)	**5**	0	0	Europe League
40	memorize all cards	**6**	6	3	Europe

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

					League
41		**6**	6	4	Europe League
42		**6**	6	5	Europe League
43		**6**	6	6	World League
44	memorize selectively (2 colours)	**6**	9	3	World League
45		**6**	9	4	World League
46		**6**	9	5	World League
47		**6**	9	6	World League
48	sort (forwards)	**7**	0	0	World League
49	sort (backwards)	**6**	0	0	World League
50	memorize all cards	**7**	7	3	World League
51		**7**	7	4	World League
52		**7**	7	5	World League
53		**7**	7	6	World League
54	memorize selectively (2 colours)	**7**	9	3	World League
55		**7**	9	4	World League
56		**7**	9	5	World League
57		**7**	9	6	World League
58	sort (forwards)	**8**	0	0	World League
59	sort (backwards)	**7**	0	0	World League
60	memorize all cards	**8**	8	3	World League
61		**8**	8	4	World League
62		**8**	8	5	World League
63		**8**	8	6	World League
64	memorize selectively (2 colours)	**8**	9	3	World League
65		**8**	9	4	World League
66		**8**	9	5	World League
67		**8**	9	6	World League
68	sort (forwards)	**9**	0	0	World League
69	sort (backwards)	**8**	0	0	World League

It is possible to choose whether all components are worked on or whether levels with certain types of tasks should be skipped. The corresponding settings can be changed in "Parameters" under "Working memory components" (see Training parameters).

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

For a detailed explanation of the individual components of the working memory and theoretical background see Training aim. For an explanation of the specific tasks see Training tasks.

1.4 Training parameters

In the RehaCom - Basic manual general tips for using training parameters and their effects can be found. Those tips should be considered in addition to this chapter.

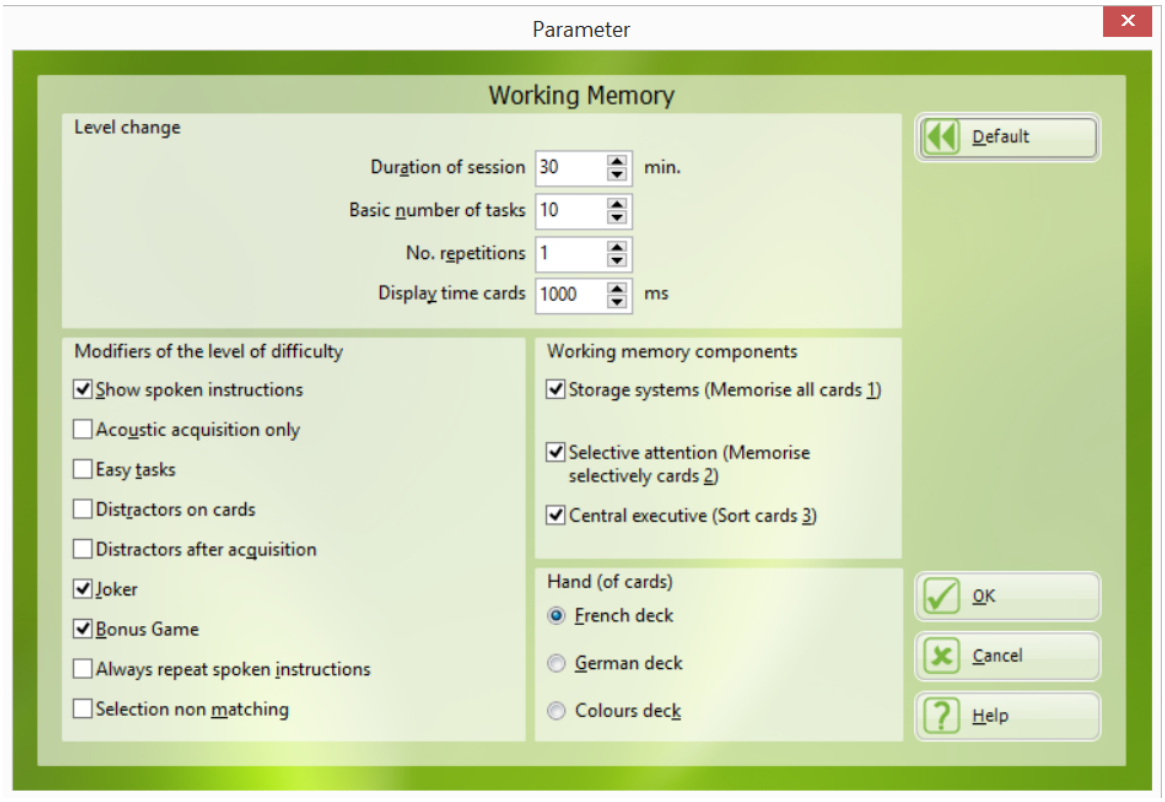


Fig 3: Parameter menu of the w orking memory training

General settings

***Duration of session*.** The parameter *Duration of session* sets the length of the training session. A training session of 30 minutes is recommended. The session time should be decreased or a break should be integrated if the patient has problems with attention and concentration.

Basic number of tasks. The parameter *basic number of tasks* indicates how many points are necessary to reach the next level. This setting influences the auto-adaptivity of the training (see chapter Levels of difficulty): The fewer points are set, the faster the difficulty increases (if the solutions were correct). A high score enables a longer time training at the same level of difficulty. Ten points per level are

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

recommended as default.

***No. repetitions*.** If a task is solved incorrectly, the patient can get the chance to solve the same task again. The parameter *number of repetitions* indicates how often a patient can repeat the same task. The fewer repetitions are set, the better the degree of difficulty can be adapted to the performance level of the patient. A higher number of repetitions strengthens the motivation. As a compromise, one repetition is recommended.

***Display time cards*.** The parameter *display time cards* regulates the presentation time in milliseconds (ms) per card before it is hidden again. By default, this is set to 1000 ms. For patients who need more time (e.g. in case of visual impairment or to verbalize/rehearse the cards), the presentation time can be extended. However, extending the time to memorize the cards will also extend the time necessary to retain the information before the information is recalled.

Working memory components

By default it is recommended to work through the entire training. Should a specific working memory component need training you can set this here. In individual cases leaving out certain taining modules can be helpful (e.g. if a patient doesn't understand a task or is repeatedly unable to solve it). By un-ticking a box the corresponding module will be skipped during training. The description and function of the individual components can be found in Training aim.

Hand (of cards)

The appearance of the cards should be chosen according to the patient's taste, habit, and capability. You can choose between a French deck (diamonds, hearts, spades, clubs), a German deck (acorns, leaves, hearts, bells), or a simple colours deck (red, yellow, green, blue). The colours deck is recommended for patients who don't have experience with card games, patients who have difficulties learning or verbalizing colour names, as well as for children.

Modifiers

The normal training tasks can be varied by enabling modifiers. Depending on the modifier, the difficulty of the training will vary and/or a specific working memory component will be trained more intensely (for a better understanding of the described working memory functions see Foundations and Training aim).

Modifiers of difficulty levels

***Show spoken instructions*.** By default the spoken instructions presented during a task are also displayed in writing in a text window. Disabling this modification increases the difficulty because the task will only be presented acoustically and cannot be looked up later.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

***Acoustic acquisition only*.** When this modifier is enabled, the cards are not presented visually but only named acoustically. As a result the storing of relevant information occurs only in the phonological loop, which is in turn trained more specifically. In addition the overall difficulty of the training increases significantly through this unimodal presentation. Furthermore this modifier is useful for patients with severely limited eyesight, who are therefor able to use the working memory training with the help from a therapist.

***Easy tasks*.** Usually, some cards on the side of the dealer will have the same values. They only differ in color. This is to encourage the patients to memorize all information on the card and not just individual values. By enabling this parameter, no cards on the side of the dealer will the same value anymore. The task is made easier. This setting is recommended for more heavily affected patients or patients who repeatedly show difficulties during training.

***Distractors on cards*.** When this parameter is enabled, symbols/colours of other card types appear on the lower part of the card. Those symbols increase the difficulty of encoding the cards, stimulate the active interference defense processes, and train the patient to focus only on relevant information. The difficulty can thus be increased slightly without changing the amount of cards to memorize or choose from.

***Distractors after acquisition*.** When ticking this checkbox, a trivia question will appear on the screen immediately after the cards of the fellow player were presented. This increases the time in which relevant information has to be kept in working memory, but it also generates interferences because the new information (the question) competes with old information (the cards). By means of active inhibition processes, the patient must prevent the distractor from displacing relevant content in working memory, and focus on the goal of the task using selective attention.

Joker. If the patient immediately solves multiple consecutive tasks, he wins a joker card, which he can later use to his advantage. Incorporating jokers encourages the player's motivation in various ways (see Foundations) and is therefor generally recommended. However, heavily affected patients may be overwhelmed by the joker or get too distracted from the main task. In those cases disabling the joker is recommended.

Bonus Game. After each completed task the player will be allowed to put aside one card to collect extra points. This process happens in the background of the main task. The bonus game is an element encouraging the player's motivation, especially during longer training units (see Foundations). This game may be too complex (instruction, function, meaning) for heavily affected patients, who may not understand it or get too distracted from the main task. In those cases disabling the bonus game is recommended.

***Always repeat spoken instructions*.** When this modification is enabled, the

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

instructions are read out again each time a new task begins.

***Selection non matching*.** When this modification is enabled, the patient must select the cards from the player's side that the fellow player has *not* shown. For this task an increased cognitive flexibility is required and is more difficult than the default setting. Since this is not the case if the amount of distracting cards in the player's hand is smaller though, the initially linear structure of difficulty gets considerably modified. Therefor this modification is to be seen as an alternative to provide variation, but not as a permanent setting.

When setting up a new training the system automatically chooses the following **standard parameters:**

Level change	
Duration of session	30 minutes
Basic number of tasks	10
Number of repetitions	1
Display time cards	1000 milliseconds
Modifiers of the level of difficulty	
Show spoken instructions	on
Acoustic acquisition only	off
Easy tasks	off
Distractors on cards	off
Distractors after acquisition	off
Joker	on
Bonus game	on
Always repeat spoken instructions	off
Selection non matching	off
Working memory components	
Storage systems	on
Selective attention	on
Central executive	on
Hand (of cards)	French deck

Tab. 1: Standard parameters

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.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

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

Level	Level of difficulty
No. of tasks	Number of solved tasks in this level of difficulty
Correct	Number of correct answers
Mistakes	Total number of errors
Repet.	Number of repetitions
Sol. time Q1	Solution time quartile 1 in ms
Sol. time Med	Median of all solution times in ms
Sol. time Q3	Solution time quartile 3 in ms
Train. time task	Effective duration of the training (without cover and breaks) 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. The graphical presentation of the results (e.g., percent total mistakes, acquisition time per task) is also displayed on the Table and Chart tab.

Through a detailed analysis of the training, it is possible to indicate deficits to the patient and to draw conclusions for the further training.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

2 Theoretical concept

2.1 Foundations

Working memory is used to store and manipulate information which no longer exists in the external environment[1]. According to Baddeley's model, the working memory consists of different storage systems (phonological loop, visual-spatial notepad and episodic buffer) and the central executive, which monitors these systems and coordinates the resources to be divided. Additionally to the components described by Baddeley, the selective attention plays an important part because it is necessary to filter relevant information and to keep it in focus. Similarly, it is necessary to shield the stored information from other competing stimuli and to pursue an overriding objective. Therefore, resistance to interference is also a central concept in working memory processes[2].

Often people with acquired brain injuries (e.g., by stroke or traumatic brain injury) or mental disorders (e.g., children with attention deficit/hyperactivity disorder) are affected by working memory deficits[3]. The functionality of the working memory, however, provides a basis for many higher cognitive functions such as problem solving, speech comprehension, arithmetic, and intelligence achievements[4]. Therefore, deficits in working memory performance often limit the functionality in everyday life and, as a consequence thereof, the subjective well-being[5].

The ability of the brain to adjust to new conditions and, depending on the current requirements, to change (neuronal plasticity[6]) makes it possible to improve the performance of the working memory by intensive training[7]. The RehaCom training module Working Memory supports both the storage and the manipulation components of working memory and increasingly involves selective attention and inhibitory processes at the same time.

2.2 Training aim

The training module Working Memory is divided into several hierarchically organized task types that are based on the current theoretical findings of the structure of working memory (see Fig. 4). Each type of task trains a specific working memory function. In the following, those working memory functions are described. For a concrete explanation of the corresponding task types, see Training task.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

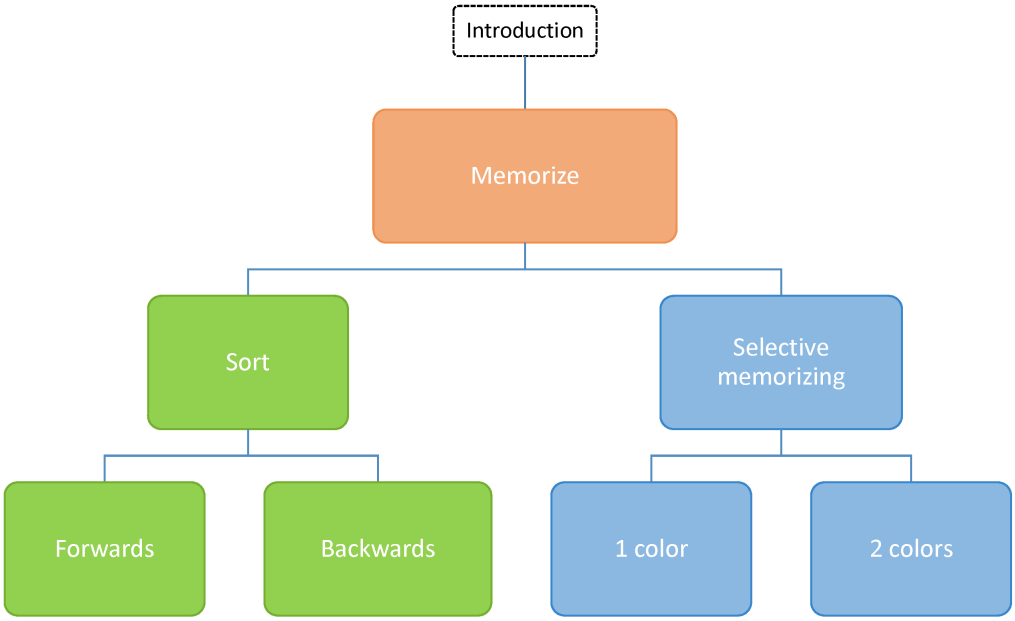


Fig. 4: hierarchical structure of the w orking memory training

In the introduction, the patient becomes familiar with the structure of the training program and learns how to interact with the cards on the screen. In this process, working memory processes are not yet being trained.

The task type **"Memorize"** trains the basic memory function of working memory. Due to the parallel presentation of visual (cards) and acoustic (reading out the card) stimuli, both the visual-spatial notepad and the phonological loop are used. By enabling modifiers (see Training parameters), a focus for training can be determined as well.

The task type **"Selective memorizing"** also trains the memory function of the working memory, but the aspect of selective attention is now added (focusing on cards of one or two colors or suits). Added to this are inhibitory processes because both when encoding the information (presentation of the cards of the "dealer") and when recalling (selection of the memorized cards on the side of the "player"), irrelevant stimuli (cards of other colors) have to be suppressed.

The task type **"Sort"** requires the mental manipulation of information in addition to the basic memory function of working memory. Especially in the task "sort backwards," the processing components of working memory are used.

In addition to the regular working memory training, the game "17 + 4" is provided, which can primarily be used for motivation purposes or to bridge breaks. It combines the working memory processes of memorizing and manipulating information at a low

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

to medium level of difficulty.

The regular working memory training is designed in such a way that the difficulty continuously increases over the course. The difficulty of any given level is determined by the number of cards to memorize and the type of task (see Fig. 4 for the hierarchical structure of the modules). Once a patient has shown that he or she can memorize a certain number of cards, then the patient performs the tasks "selective memorizing" and "sort" using the same number of cards. Once all modules have been processed successfully with a certain amount of cards, the patient starts the tasks over again with an additional card, first memorizing all cards, then selectively memorizing specific cards, and finally sorting this increased number of cards. In this way, the most important functions of working memory can be trained on all levels of difficulty. Because changing the task type and varying the number of cards are quite large dimensions to change the difficulty, a finer gradation is used within the modules: the gradual increase of additional cards on the player's side, which serve as distractors. The described increase in difficulty is firmly integrated into the level structure of the training (for the detailed structure, see Levels of difficulty). Additionally, it is possible to focus on certain working memory processes by enabling specific modifiers. The description of the available parameters can be found in the Training parameters.

2.3 Target groups

The target group for working memory training consists primarily of patients with disorders affecting working memory. The training is designed in a way that both patients without a severe loss in performance and severely affected patients benefit. Also, using this module with children is possible (e.g. children with attention deficit/ hyperactivity disorder) as soon as single-figure numbers are mastered. Due to the wide range of difficulties, the use of the training of healthy elderly adults or others persons that want to increase their working memory performance is possible as well.

To effectively train using the Working Memory module, patients should have the basic functions of memory retention and selective attention as well as the ability to recognize simple symbols and numbers. Moreover, the patient must be able to understand simple instructions, and to be able to verbalize perceived information. In patients with aphasia, it is necessary to check whether the linguistic performances are sufficient to manage the basic requirements. Patients who suffer from strong attention problems should first train with the RehaCom module Attention & Concentration.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

2.4 Bibliography

[1] Baddeley, A. (2003). Working memory and language: An overview. *Journal of Communication Disorders, 36*, 189–208.

[2] D'Esposito, M., Detre, J. A., Alsop, D. C., Shin, R. K., Atlas, S., & Grossman, M. (1995). The neural basis of the central executive system of working memory. *Nature*, *378*(6554), 279–281.
Awh, E., & Jonides, J. (2001). Overlapping mechanisms of attention and spatial working memory. *Trends in Cognitive Sciences*, *5*(3), 119–126.

[3] Vallat, C., Azouvi, P., Hardisson, H., Meffert, R., Tessier, C., & Pradat-Diehl, P. (2005). Rehabilitation of verbal working memory after left hemisphere stroke. *Brain Injury*, *19*(13), 1157–1164.
Klingberg, T. (2010). Training and plasticity of working memory. *Trends in Cognitive Sciences*, *14*(7), 317–324.

[4] Kyllonen, P. C., & Christal, R. E. (1990). Reasoning ability is (little more than) working-memory capacity?!. *Intelligence*, *14*(4), 389–433.
Daneman, M., & Merikle, P. M. (1996). Working memory and language comprehension: A meta-analysis. *Psychonomic Bulletin & Review*, *3*(4), 422–433.
Adams, J. W., & Hitch, G. J. (1997). Working memory and children's mental addition. *Journal of Experimental Child Psychology*, *67*(1), 21–38.

[5] Johansson, B., & Tornmalm, M. (2012). Working memory training for patients with acquired brain injury: effects in daily life. *Scandinavian Journal of Occupational Therapy*, *19*(2), 176–183.

[6] Stroemer, R. P., Kent, T. A., & Hulsebosch, C. E. (1998). Enhanced neocortical neural sprouting, synaptogenesis, and behavioral recovery with D-amphetamine therapy after neocortical infarction in rats. *Stroke*, *29*(11), 2381–2395.

[7] Klingberg, T., Fernell, E., Olesen, P. J., Johnson, M., Gustafsson, P., Dahlström, K., ... & Westerberg, H. (2005). Computerized training of working memory in children with ADHD-a randomized, controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry*, *44*(2), 177-186.
Houben, K., Wiers, R. W., & Jansen, A. (2011). Getting a grip on drinking behavior training working memory to reduce alcohol abuse. *Psychological Science*, *22*, 968–975.
Brehmer, Y., Westerberg, H., & Bäckman, L. (2012). Working-memory training in younger and older adults: Training gains, transfer, and maintenance. *Frontiers in Human Neuroscience*, 6.

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0

Index

- Q -

- R -

- S -

- T -

- V -

© 2025 HASOMED GmbH - RehaCom Version 7.0.0.0