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The effect of cognitive remediation therapy on neurocognitive and psychosocial functioning in (partly) remitted depressed adults

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Für meine Kinder

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1 Theoretical Background

1.1 Neurocognitive performance and depression

Depressed patients complain frequently about their inability to follow movie plots, problems to read more than a few lines on a book page, or having difficulties to learn new work processes. Research shows that these subjective impairments are in fact measurable. Cognitive impairments such as the diminished ability to think or concentrate are both listed as a diagnostic criterion in the International Classification of Diseases (ICD-10, 9th ed.; Dilling, Mombour, & Schmidt, 2014) as well as the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, 5th ed.; American Psychiatric Association 2013) in the acute state of a major depressive disorder (MDD). However, cognitive dysfunction (Conradi, Ormel, & De Jonge, 2011; Fava et al., 2006) and functional impairments (Fava et al., 2006; Zimmerman et al., 2006) as mentioned above are not only present in the acute state but are two of the most common residual complaints among patients with remitted depression as well. Relatively little research has been conducted that sheds light into this subject in (partly) remitted depressed patients and the effect and possible treatment options. Until 2012, only three RCT-studies had been published on the effect of cognitive remediation therapy in unipolar depression and only two other studies focusing on bipolar patients.

Although remission appears to positively influence cognitive functioning, it is far less known that these impairments can persist into remission (Hasselbalch, Knorr, & Kessing, 2011; Rock, Roiser, Riedel, & Blackwell, 2014). Depending on the population, 30 to 50% of (partly) remitted patients show sustained cognitive deficits (Bhalla et al., 2006; Reppermund, Ising, Lucae, & Zihl, 2009; Rock et al., 2014; Zimmerman et al., 2006). Ninety-four percent of patients who had suffered from cognitive deficits during late life depression also had persisting cognitive impairments in the remitted state (Bhalla et al., 2006). But to this date no comprehensive neuropsychological profile has been found for either the acute nor remitted state of depression (Konrad, Losekam, & Zavorotnyy, 2015). Type and severity of the cognitive impairments vary from patient to patient, conjecturally depending on the type of depression, numbers of episodes, age, intelligence, education and so forth. Evidence of impaired cognitive abilities is regularly found in several domains, i.e., psychomotor function (Reppermund et al., 2009; Reppermund et al., 2007; Weiland-Fiedler et al., 2004; Yuan et al., 2008), attention (Baune et al., 2010; Paelecke-Habermann, Pohl, & Leplow, 2005; Roca et al., 2015; Rock et al., 2014) memory and learning (Baune et al., 2010; Preiss, Shatil, Cermakova, Cimermannova, & Flesher, 2013; Rock et al., 2014), and executive functioning (Douglas, Porter, Knight, & Maruff, 2011; Nakano et al., 2008; Paelecke-Habermann et al., 2005; Preiss et al., 2009; Reppermund et al., 2009; Rock et al., 2014; Schmid, Strand, Årdal, Lund, & Hammar, 2011). For a short overview on cognitive impairments along the course of depression see Table 1.

Attention. Attention deficits are a common impairment in acutely depressed patients and were found to improve somewhat in remitted MDD patients (Baune et al., 2010; Reppermund et al., 2007). Roca et al. (2015) conducted a longitudinal investigation of acutely depressed subjects (Hamilton Depression Scale: HAM-D ≥ 17) with a baseline and a six-month follow-up-measurement. At six-months, patients in clinical remission (HAM-D ≤ 7) were found to be significantly less impaired regarding neuropsychological measures of attention compared to non-remitted subjects (HAM-D > 7).

Similar observations were made by Baune et al. (2009) who compared current MDD patients, previous MDD patients, and a healthy control group pertaining to several neuropsychological functions. The study revealed significant discrepancies in attention between the acute and remitted participants. Further, there were also significant differences in attentional deficits found between the remitted patients group versus the healthy control group. Another longitudinal study assessed neuropsychological

Table 1

Change sensitivity of cognitive abilities with regard to depression severity

	Acute Depression	(Partly) Remitted Depression
Affected Domain	Symptoms	Change sensitivity
Attention	Impairments in - Immediate memory span - Selective attention - Sustained attention - Divided attention	Some improvement, however tendency towards persistent impairment of attentional capabilities
Information Processing Speed	- Psychomotor retardation - Slow speaking and reading rate - Delayed motor and response inhibition	Improved processing speed
Executive Functioning	Impairments in - working memory - cognitive flexibility - planning capabilities - response inhibition - verbal fluency	Some improvement, however tendency towards persistent impairment of executive functioning (response inhibition and working memory)
Memory and Learning	Impairments in - list learning - free recall - declarative memory - visual memory - short-term memory (ambiguous results)	Improved memory and learning, but mnestic deficits persistent into remission

performance in inpatients at the time of admission and prior to discharge (Reppermund et al., 2007). It was found that measures of selective attention can significantly improve between admission and discharge, yet 16% and 39% of subjects remained to be impaired in selective and divided attention, respectively (Reppermund et al., 2007).

These results were confirmed by Paelecke-Habermann et al. (2005) who compared attentional abilities, indicated by visual and sustained attention, between previously depressed subjects and healthy controls, yielding considerable deficits in the previously depressed sample. In a recent systematic review and meta-analysis Rock et al. (2014) found that significant moderate deficits in attention were found to persist in patients whose depressive symptoms had remitted. In view of this evidence it appears to be reasonable to expect impairment of attentional capabilities beyond the clinically depressed state of patients.

Information Processing Speed. Impaired information processing speed is typically characterized by reduced reaction time, a slow speaking and reading rate, delayed motor and response initiation (Tsourtos, Thompson, & Stough, 2002). Information processing speed decline in depression can be assessed through various objective measures, for example reaction time, information processing speed, as well as writing and drawing tasks (Marazziti, Consoli, Picchetti, Carlini, & Faravelli, 2010). Psychomotor functioning in depressed patients has been found to improve with remission of mood symptoms (Baune et al., 2010; Douglas et al., 2011; Reppermund et al., 2007; Roca et al., 2015) and is often thought to be associated with the clinical state of depression (Lee, Hermens, Porter, & Redoblado-Hodge, 2012). In a meta-analysis investigating currently depressed subjects, Lee et al. (2012) revealed that a decline of psychomotor functioning, as indicated by processing speed, is significantly correlated with inpatient status. As inpatient status tends to be associated with a more severe presentation of depressive symptoms (Porter, Bourke, & Gallagher, 2007), this relationship indicates psychomotor functioning to be correlated with symptom severity and is, therefore, dependent on the depressive state of the patient (Lee et al., 2012). This finding is consistent with longitudinal research on MDD inpatients receiving treatment over a period of six weeks (Douglas et al., 2011). Measured by a simple reaction time task, psychomotor speed of successfully treated patients was found to improve to the same level as of their healthy comparison group, thus supporting the notion that psychomotor retardation is related to the mood state.

Executive Functioning. Executive functioning is typically regarded as considerably different from more distinct cognitive functions. There is a strong interaction between every other cognitive function and executive functioning; therefore executive impairment is more likely to have a global impact on individuals (with possible deficits in the areas of planning, judgment, decision-making, anticipation or reasoning, control of attention, and task management; Porter et al., 2007). Several executive processes were shown to be impaired during the acute state. Consistent with observations regarding other cognitive domains, longitudinal research suggests an improvement of executive processes into remission. When comparing remitted and non-remitted subjects at the six-months follow-up Roca et al. (2015) found previously depressed patients to be significantly less impaired in several executive processes, including working memory, planning capabilities, cognitive flexibility, and semantic fluency, though response inhibition performance was not shown to improve considerably.

Nevertheless, executive function is commonly presumed to be particularly affected in depression, even after improved mood state (Lee et al., 2012; Reppermund et al., 2007). Empirical evidence suggests that executive capabilities are not correlated to variables like severity of disease, including euthymia or inpatient status (Lee et al., 2012). Additionally, empirical studies investigating executive processes regularly find respective cognitive functions to be impaired during remission (Douglas et al., 2011; Nakano et al., 2008;

Paelecke-Habermann et al., 2005; Preiss et al., 2009; Reppermund et al., 2007; Rock et al., 2014; Schmid et al., 2011). Longitudinal research by Schmid et al. (2011) concerning response inhibition as indicator of executive function, for instance, reveals no significant changes in executive performance between the initial assessment of acutely depressed subjects and a nine-months follow-up, despite significant symptom reduction. The comparison of MDD subjects and healthy controls at follow-up further confirms a significant impairment of response inhibition in the patient group. These results are supported by a cross-sectional comparison of medicated, previously depressed subjects and healthy controls revealing significant deficits in response inhibition (Nakano et al., 2008). Similar results could be observed when investigating working memory as indicator of executive function. A neuropsychological evaluation after six weeks of treatment did not find any significant differences in working memory performance between responders and non-responders post treatment (Douglas et al., 2011). These results are also consistent with longitudinal research suggesting the persistence of impaired working memory in MDD inpatients from the time of admission to the time of discharge, with 43% of subjects prior to discharge showing continued working memory deficits compared to healthy controls (Reppermund et al., 2009). Other measures of executive function regularly found to be impaired in remitted MDD subjects relative to healthy controls are planning capabilities and cognitive flexibility (Paelecke-Habermann et al., 2005; Preiss et al., 2009; Rock et al., 2014). Empirical research, thus, indicates impairment of executive functioning to be stable along the course of depression, and therefore largely independent of the severity of symptomatology, though remitted subjects generally show a tendency towards executive improvement.

Memory and Learning. Loss of performance in learning tasks involving sustained effort are particularly pronounced in clinically depressed patients (MacQueen, Galway, Hay, Young, & Joffe, 2002; Rock et al., 2014), but can considerably improve in remission (Baune et al., 2010; Reppermund et al., 2007). Mnestic impairment is presumed to be associated with symptom severity (Lee et al., 2012). Lee et al. (2012) found poor verbal as well as visual memory to be significantly correlated with inpatient status, hence supporting the hypothesis that the severity of symptoms may impact memory abilities. A cross-sectional comparison between remitted MDD patients and acute MDD patients additionally revealed a tendency of currently depressed subjects to perform worse in memory tasks indicating an improvement along with the course of remission (Baune et al., 2010). Several longitudinal investigations of memory capabilities further confirm the state-character of memory functions by revealing that mnestic improvement is positively correlated with the improvement of mood state into remission (Neu et al., 2005; Reppermund et al., 2007). The analysis of MDD inpatients at admission and six months post clinical remission found verbal and visual memory to be significantly worse at the time of the admission's assessment. Though, a comparison of memory capabilities in remitted subjects and healthy controls revealed considerable performance discrepancies between the patient and control samples persisting into remission (Neu et al., 2005). Similar results were observed by Reppermund et al. (2007) revealing an improvement of short-term verbal memory performance when comparing MDD inpatients at admission and prior to discharge. Though, it has to be noted that 16% of participants remained to be impaired even after their discharge. Several cross-sectional comparisons of remitted subjects and healthy controls further reported differences of mnestic performances also supporting the persistence of cognitive deficits into remission (Baune et al., 2010; Preiss et al., 2009; Rock et al., 2014; Yuan et al., 2008). Thus, memory impairment appears to continue into remission even though the studies discussed in this paragraph have reflected considerable improvement in memory and learning performance of MDD patients. This change in memory functioning along the course of depression warrants the assumption of severity of depression influencing mnestic capabilities in similar ways psychomotor functioning is impacted.

1.2 Cognitive impairments and psychosocial functioning

Psychosocial functioning can be simply understood as a person's "functioning in everyday life". Various aspects have been determined that account for the level of psychosocial functioning e.g. communication ability, mobility, interpersonal relationships, leisure time, interaction behavior and work ability. It won't surprise anybody that psychosocial functioning is influenced by depression severity (Judd et al., 2000). Cognitive impairment during depression has been identified as a meaningful predictor of the functional outcome of depression as well (Konrad et al., 2015). Beyond the impairment of health, depression is responsible for low productivity, missed work days and economic loss (Greenberg et al., 2003). Globally, depressive disorders account for 2.5% of total disability-adjusted life years and for 8.2% of total years lived with disability (Ferrari et al., 2013). After all depression is one of the most common psychiatric disorders with a lifetime prevalence of 16% (Kessler et al., 2003). Sobocki and colleagues examined the economic burden of the disorder for Europe and concluded that with an annual cost of 118 billion €, depression is the most costly psychiatric disorder, accounting for 33% of the total cost (Sobocki, Jönsson, Angst, & Rehnberg, 2006). The importance to assess not only clinical symptoms but the psychosocial functioning level as well is reflected by the fact that the two biggest diagnosis systems gather information about the patient's psychosocial functioning. Since 1980 the Diagnostic and Statistical Manual of Disorders (DSM) surveys the Global Assessment of Functioning Scale (GAF) on axis V and the WHO developed the International Classification of Functioning, Disability and Health (ICF).

Evans et al. (2013) conducted a systematic review that included literature published until June 2012 and found that the only two studies published reported an association between cognitive impairments and poorer work outcomes in currently and previously depressed individuals. Studies investigating cognitive deficits as a mediator on functional outcomes in

MDD indicate that cognitive deficits may account for the largest percentage of variance with respect to the link between psychosocial dysfunction (notably workforce performance) and major depressive disorder (McIntyre et al., 2013). In a systematic review, Evans, Iverson, Yatham, and Lam (2014) cautiously report that all eight studies directly investigating the relationship between neurocognition and psychosocial functioning found that performance in at least one cognitive domain (most commonly executive function, but also attention, psychomotor speed, and various parts of memory) was associated with functional outcome. Albeit being the methodically best studies that could be found, all studies showed considerable limitations regarding sample size, assessments and tests, as well as statistical evaluation and objectivity. Furthermore the reported results did not distinguish between the acute and remitted state of depression. The authors conclude that there is "some limited evidence that neurocognitive deficits are significant and clinically important factors related to the quality of life and lever of social and occupational functioning of individuals with MDD" (Evans et al., 2014). To date only four studies focused on the association between neurocognition and psychosocial functioning in remitted depression.

Jaeger, Berns, Uzelac, and Davis-Conway (2006) examined neurocognitive and general functioning of $n = 48$ patients in current depression and retested the same patients six months later. General functioning was assessed using the Multidimensional Scale of Independent Functioning (MSIF; Jaeger, Berns, & Czobor, 2003) that measures performance in three different environments (work, education and residential), which are subsequently aggregated into a global rating of disability. They found that neurocognitive deficits in attention, fluency, non-verbal and learning domains were strongly associated with disability in life functioning after controlling for the effect of residual depression and psychotic symptoms, as well as presence of disabling medical comorbidities at follow-up. Additionally, cognitive domains which didn't improve over the six months follow up period were predictive of level of functional recovery.

Baune et al. (2010) compared cognitive and general functioning of n = 26 acute MDD patients with n = 44 MDD patients in remission and healthy controls. General functioning was interpreted as physical and mental health quality of life, activities of daily living, and employment status. Quality of life was assessed with the MOS 36-item short form health survey (MOS-SF-36) that was developed as part of the Medical Outcome Study in the 1980s (Ware & Sherbourne, 1992). It consists of eight scales: physical functioning, physical role functioning, bodily pain, general health perceptions, vitality, social role functioning, emotional role functioning, and mental health. The assessment of activities of daily living was performed according to the Activities of Daily Living scale (ADL; e.g. bathing and dressing) by Katz et al. (1970) and the Instrumental Activities of Daily Living scale (IADL; e.g. doing finances and shopping) by Lawton and Brody (1969). The employment status was considered as an objective measure of functioning in the study and was coded as either present if the participant was employed full-time or part-time, while no employment was coded as none. In the depressed groups there was a relationship of unemployment to significantly lower scores in all cognitive domains (except attention), independently from remission state.

Shimizu et al. (2013) compared quality of life ratings as well as neuropsychological tests of n = 43 remitted MDD patients with those of n = 43 healthy controls. Quality of life was measured with the validated Japanese version of the MOS-SF-36 (Fukuhara et al., 1998). They found that one cognitive domain (delayed recall verbal memory) was related to one scale of the quality of life ratings (general health perceptions) but not to the other scales, most notably for the present study they found no association between neurocognition and the scales physical role functioning and social role functioning.

Angermeyer, Holzinger, Matschinger, and Stengler-Wenzke (2002) assessed quality of life in remitted depressed patients (N = 75) at one, four, and seven months after discharge from hospital. The sample was compared with a healthy control sample from the general population. Quality of life was assessed with the German version of the WHO Quality of Life 100 Questionnaire (WHOQOL-100; Angermeyer et al., 1999). The WHOQOL-100 comprises 24 facets of quality of life which are combined to six scales: physical health, psychological aspects, level of independence, social relationships, environment, spirituality / religion / personal beliefs. Compared to depressed patients, the remitted sample rated their quality of life higher, but still worse than the general population. There was no change at the follow-up assessments, especially in the scales “spirituality/religion/personal beliefs”, “physical health” and most notably for the present study “level of independence”. The authors however did not investigate the relationship between quality of life and neurocognitive performance.

The most recent narrative review on this topic by Lam, Kennedy, McIntyre, and Khullar (2014) concludes that there is evidence that cognitive dysfunction in MDD may mediate impairments in psychosocial and work functioning, both during acute depressive episodes and remissions. They call for (more) studies testing the hypothesis that improvement of cognitive impairments leads to improved functional outcome and for studies shedding light on therapeutic treatments that improve cognitive functioning and its impact on psychosocial functioning in MDD.

With respect to the significant influence that cognitive deficits exert on everyday life (Evans et al., 2014) and work performance (Evans et al., 2013) and the risks it exposes (e.g. suicide attempts and development of dementia, (cf. Keilp et al., 2001) the first step is the recognition of these cognitive deficits and to grant a specific treatment in the second step.

1.3 Treatment options for cognitive impairments

Whereas treatments such as psychotherapy and antidepressants have proven efficacy for improving mood, cognitive deficits often remain untreated (Keilp et al., 2001). Iosifescu (2012) proposes that cognitive impairments should also be considered as a target of treatments that have the goal to mitigate functional deficits. There are two substantially different options that could lead to this goal: Pharmacotherapy and Cognitive remediation therapy.

Pharmacotherapy. With the aim to help MDD patients to regain control over their life, the primary objective of psychotropic drugs administration in MDD is the relief of depressed mood and joylessness. However, pharmacotherapy can ameliorate cognitive dysfunctions as well. There are several studies that investigated the different ant depressive drugs with regard to the improvement of cognitive deficits.

Selective Serotonin Reuptake Inhibitors (SSRI) may hold some benefit for cognition due to regulation of the hypoactivity in the dorsal and lateral prefrontal cortex areas associated with the improvement of neurocognitive deficits (Danet, Lapiz-Bluhm, & Morilak, 2010; Nikiforuk & Popik, 2011). Hinkelmann et al. (2012) found a significant correlation between treatment with SSRI, psychopathology and improvement of the information processing speed as well as cognitive flexibility. The positive effect can however not be generalized. Several studies showed that responders and non-responders to SSRIs could already be distinguished on neuropsychological terms prior to treatment; with the latter being cognitively more impaired (Kampf-Sherf et al., 2004).

Moreover, some authors argue that drugs with anti-cholinergic properties, like tricyclic antidepressants, might even negatively affect cognitive functioning, though evidence is inconsistent (Podewils & Lyketsos, 2002). McKinnon, Yucel, Nazarov, and MacQueen (2009) found that despite antidepressant medication there was no improvement in neurocognitive deficits in most patients and that even the responders remained inferior to healthy controls.

Few studies have investigated the effect of other drugs on cognitive deficits in MDD that were beneficial in subsections. Stimulants e.g. Modafinil promoted performance in patients and healthy controls in the STROOP task that tests inhibition (DeBattista, Lembke, Solvason, Ghebremichael, & Poirier, 2004). The administration of a cholinesterase inhibitors lead to an improvement of memory performance in depressive and bipolar patients (Jacobsen & Comas-Díaz, 1999). There are inconsistent findings about glutamate modulators promoting improvement in Alzheimer disease, but until now there are only case reports for depressive patients (Goeldner et al., 2013).

Not only is the positive effect of pharmacotherapy still under discussion, unwanted side effects of antidepressant medication that often accompany the target effects have to be taken into account as well. Sleep disturbances, arousal, headache, weight gain, and sexual dysfunction among others might be too big of a concession for patients aiming to improve their neurocognitive performance. Most importantly however, there is no antidepressive medication that has been approved for the use as an cognitive performance enhancer.

Whereas pharmacotherapy may hold a benefit for MDD patients with cognitive impairments, it is surely valuable to look into non-pharmacological treatment options, where fewer and less severe side effects are to be expected. The side effects associated with non-pharmacological treatments are for example expenditure of time, fatigue, and headache due to cognitive effort. A review article that aimed to find the most beneficial pharmacotherapy for cognitive impaired patients even concludes that “a cognitive training could be useful in long-term anti-depressive treatment to prevent relapses and improve the quality of life” (Francomano, Bonanno, Fucà, La Placa, & La Barbera, 2011, p.354).

Cognitive Remediation Therapy. A promising approach to improve cognitive deficits is cognitive remediation therapy. Cognitive remediation was defined in the Cognitive Remediation Experts Workshop as “a behavioral training-based intervention that aims to improve cognitive processes (attention, memory, executive function, social cognition or metacognition) with the goal of durability and generalization (CREW, 2010 cited by Vita, Barlati, Bellani, & Brambilla, 2014). To date there is quite a range of different programs that fall under the category of cognitive remediation therapy but differ substantially from each other. According to Vita et al. (2014) there are two main models of cognitive remediation: “compensatory” and “restorative”. Compensatory methods use environmental supports and adaptions (signs, checklists, and alarms, digital and analog planners) in association with target behaviors (taking medication, buying groceries, being punctual). Strictly, the aim of compensatory treatments is functional outcome and not cognitive functioning. Restorative methods seek to restore impaired cognitive functions. This can be either accomplished with drill-and-practice with or without strategic coaching. Drill-and-practice involves the repetition of cognitive exercises over many sessions until the performance has improved. Strategic coaching means the development of mental strategies to optimize cognitive performance and task completion. Furthermore cognitive remediation programs can be distinguished with regard to the setting (individual / group), method of delivery (computer-assisted / not computer-assisted), selection of tasks (generalized / individually tailored), duration and frequency (of a single session and the training program on the whole), task characteristics (adaptive / non adaptive), targeted cognitive domains as well as a combination of all factors.

Generally, cognitive remediation therapy has been widely applied and studied most prominently on schizophrenic patients (McGurk, Twamley, Sitzer, McHugo, & Mueser, 2007; Wykes, Huddy, Cellard, McGurk, & Czobor, 2011) but also on bipolar and acutely depressed patients (Demant, Almer, Vinberg, Kessing, & Miskowiak, 2013; Torrent et al., 2013) with positive outcomes. Motter et al. (2016) published a meta-analysis comprised of nine studies investigating the effect of computerized cognitive training on neurocognitive performance and functional recovery in depressed adults. They found small to moderate effects for daily functioning and moderate to large effects for attention, working memory and global functioning. They did not find significant effects for executive functioning or verbal memory. However, the samples included acutely depressed as well as remitted patients. To illustrate the state of research for (partly) remitted depressed adults, the four studies focusing solely on this sample will be presented now in more detail (for an overview and the used psychosocial questionnaires see Table 2).

Lee et al. (2013) studied the effect of cognitive remediation (NEAR - Neuropsychological Educational Approach to Remediation) on *n* = 36 clinically stable patients with a lifetime history of a single episode of either MDD or psychosis compared to treatment as usual (TAU). The training group participated once-weekly in a two hours session for a total of ten weeks. The training consisted of one part psycho-education and one part therapist-led drill-and-practice group activities and an individually tailored computer-assisted cognitive training. The patients were assessed prior and after the cognitive remediation. In comparisons to TAU, cognitive remediation was associated with improved immediate learning as well as psychosocial functioning measured with the Social Functioning Scale (SFS; Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990). However, neither patients nor therapist were blind regarding the allocation.

Naismith, Redoblado-Hodge, Lewis, Scott, and Hickie (2010) investigated the effect of the NEAR program on *n* =16 remitted depressed patients compared to no additional treatment (waitlist). The NEAR program uses commercially available computer games, selected according to the patients’ strengths. The participants trained one hour twice a week over ten weeks. They found a significant advantage of the CRT compared with waitlist participants in improving various aspects of cognitive function, particularly verbal memory. The relationship with psychosocial functioning was not part of the study.

Table 2

Brief summary of all cognitive remediation studies with (partly) remitted depressed participants

Author/s	Sample	Training	Neurocognitive domains / subdomains	Psychosocial measures	Neurocognitive outcome	Psychosocial outcome	Comments
Lee et al. (2013)	Final sample *N* = 36 *n* = 18 clinically stable patients with a lifetime history of a single episode of either MDD or psychosis *n* = 18 treatment as usual	(Individualized) NEAR CR program + psycho-education component with compensatory strategies training 1x/week for 2 hours over 10 weeks	Processing speed Attention and working memory Immediate learning and memory Delayed learning and memory Executive functioning	Social Functioning Scale total score	Training associated with significantly improved immediate learning and memory. No other significant results.	Training associated improved psychosocial functioning	No rater blindness More psychotic participants than depressed patients (22 and 14 respectively) Young sample (mean age 22.8, S.D. = 4.3)
Naismith et al. (2010)	*N* = 16 *n* = 8 "inter-episode „depressed (unipolar and bipolar-II) patients *n* = 8 no additional treatment (waitlist)	(Individualized) NEAR CR program 2x/week for 1 hour over 10 weeks Therapist training prior to the study by the author of the training	(Primary outcome of interest) Memory Psychomotor speed Mental flexibility Non-verbal learning Verbal fluency	Psychosocial functioning not investigated	Training associated with significantly improved verbal learning and verbal memory. No other significant results.	Not investigated	Young (mean age 33.5, S.D. = 9.9) Small sample size Mild depressive symptoms (mean HAMD-17 = 9.5, S.D. = 7.3)
Elgamal, McKinnon, Ramakrishnan, Joffe, and MacQueen (2007)	*N* = 48 *n* = 12 stable patients with recurrent, long-term MDD *n* = 12 matched MDD patients *n* = 12 healthy controls	(Generalized) PSSCogReHab On average 2x/week for ¾- 1 hour over 10 weeks	Verbal learning and memory Attention Working Memory Abstract verbal reasoning Executive functioning	Psychosocial functioning not investigated	Training associated with significantly improved verbal learning and verbal memory, psychomotor speed and executive functions	Not investigated	Small sample size No randomized group allocation
Meusel, Hall, Fougere, McKinnon, and MacQueen (2013)	*N* = 16 *n* = 40 stable / euthymic depressed patients *n* = 28 stable / euthymic bipolar patients *n* = 18 healthy controls	(Generalized) PSSCogReHab 3x/week for 1 hour over 10 weeks	Attention Processing speed Learning and memory Executive functioning Working memory	Medical Outcomes Study 36-item Short Form Health Survey, Life Skills Profile, Quality of Life Enjoyment and Satisfaction Questionnaire	Training associated with significantly improved delayed recall, working memory. No other significant results.	Improvements on the Q-LES-Q subjective feelings subscale were significantly associated with overall improvement in cognition.	

Elgamal et al. (2007) administered a 10-week computerized cognitive training PSSCogReHab to *n* = 12 stable patients with long-term MDD and compared its effect with a group of *n* = 12 matched MDD patients and healthy control participants. The training involved drill-and-practice repetition in four cognitive domains: memory, attention, executive functioning and psychomotor speed. Patients who received cognitive training improved on a range of neuropsychological test. This improvement exceeded that observed during the same time period in the control groups. There was no change in depressive symptom scores over the course of the trial, suggesting improvement in cognitive performance occurred independently of other illness variables. They did not investigate the relationship with the psychosocial functioning level.

In her master thesis Meusel (2011) reports the results of a ten-week trial of cognitive remediation with PSSCogReHab for patients with major depressive disorder and bipolar disorder. Participants improved on measures of delayed recall and working memory; moreover it was observed that gains in cognitive functioning were positively correlated with psychosocial functioning, suggesting partial generalization of improvements in neurocognition to functioning.

Summarized, all four studies investigating the effect of cognitive remediation therapy on (partly) remitted depressed patients found improvements in neurocognitive performance (mostly memory and learning, working memory and executive functioning) and, if investigated, in the psychosocial functioning as well.

1.4 A step further – the present study

The published studies so far show promising support for cognitive remediation in MDD. There are however several limitations that the present study wishes to fix. The optimal design of CRT interventions is still matter of debate. Several authors have emphasized the need to adapt CRT to the individual's deficits in order to increase effects on cognition, motivation and transfer to real-world situations (Galderisi et al., 2010; Medalia & Choi, 2009). This approach contrasts with generalized training programs, which target the same broad set of functions in all patients. Despite the increasing interest in an individualized approach, procedures for adapting training to the individual patient have mostly been ill defined. One option with high face-validity is to base the training on the individual cognitive profile and to specifically train the most severely impaired functions. However, no direct comparison between individualized and generalized training programs has been conducted so far.

Furthermore the present study wishes to shed light on the effect of neurocognitive training on psychosocial functioning. For impaired patients it is less important to shine in specifically designed test but to see improvement in their daily life functioning. As was discussed above there is some evidence that neurocognitive deficits lead to impairments in psychosocial functioning. In this study we seek to investigate whether ameliorated cognitive functioning leads to a better everyday life functioning.

1.5 Objective and hypotheses

This study wishes to investigate the efficacy of a computer-based cognitive training with regard to the mitigation of cognitive impairments. Furthermore, it is studied, whether an individualization of the training program enhances the efficacy. That means, whether it is beneficial to focus on the (three) most impaired domains (individualized training) or to use a broad set of (six) training tasks (generalized training). In a second step, it will be examined whether an improvement in the ameliorated neurocognitive performance leads to an improvement of the psychosocial functioning. Both training groups are compared to a control group to be able to check for the effect of time and simple training effects due to repeated testing.

To answer the research questions above, the following hypotheses are tested:

H1a. Participation in a training group will lead to small to moderate improvement in test performance (CRT composite score, domains, subdomains) compared to the control group.

H1b. The strength of the training effect differs between the individualized training group and the generalized training group, which are both superior to the control group.

H2. Participation in a training group will lead to a small improvement in psychosocial functioning (psychosocial functioning composite score) compared to the control group.

2 Method and Materials

2.1 Study design

This is a randomized controlled trial study promoted by the German Research Foundation (Deutsche Forschungsgemeinschaft; DFG funding number: RO 3418/6-1). The design is a pre-post comparison with the within-subject factor Time and the between-subject factor Group. The participants were randomly allocated to one of three groups after the baseline testing: Individualized training, generalized training and control group. The (passive) control group did not receive any training whereas the generalized training and individualized training groups completed at least twelve (and up to 15) training sessions. The method used for randomization was the stratified permuted-block randomization with a 1:1:1 allocation ratio.

All participants were tested three times: before training reception (pre), immediately after training reception (post) as well as six months later (follow-up). For the purpose of this dissertation only pre and post testing will be discussed (cf. Figure 1).

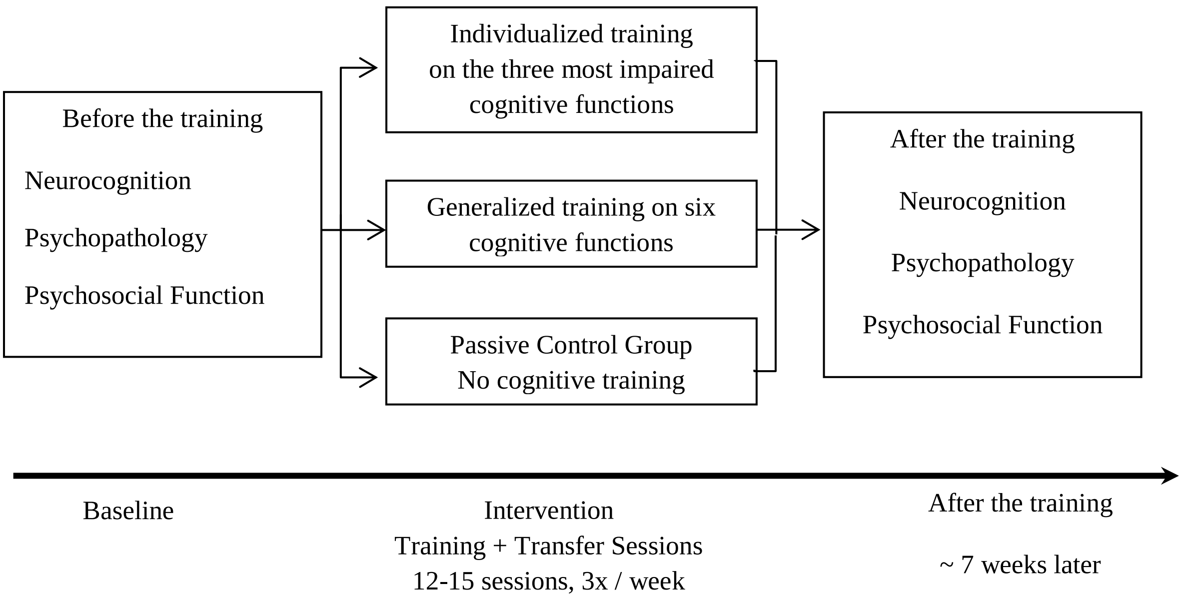

*Figure 1.*Schematic of the order of study.

At all times of testing, psychopathological assessments as well as questionnaires assessing a participant's functional outcome were administered by a trained psychologist. Unfortunately, there is no consensus on single test or test battery to assess neurocognition in MDD. Therefore the neuropsychological domains chosen were based on the MATRICS recommendation for schizophrenia and on a similar battery for bipolar disorders (Burdick et al., 2011) as well as on the constructs commonly used in research and clinical neuropsychological assessments in psychiatry. For details on the assessment see section 2.2. Training and assessment sessions were held by trained clinical psychologists in the Psychiatric Hospital of the University of Heidelberg.The study was approved by the Ethics Committee of the medical faculty Heidelberg (Ethics Committee vote number S-106/2012) and is registered with the European Union Drug Regulating Authorities (EudraCT number 2014-003943-36).

Sample. (Partly) remitted depressed adults with cognitive impairments participated in the study between April 2013 and August 2017.Participants were recruited with information leaflets sent to practicing psychiatrists and psychologists in and around Heidelberg, articles in local newspapers, a radio feature, and placards in the university of Heidelberg as well as discharged inpatients from the university psychiatry of Heidelberg. As an incentive they received 20€ for the second assessment, a free cognitive training (participants in the control group were invited to train after the completion of all assessments) and a detailed feedback about their performance. Participants had no restriction about medication or outpatient treatment, but could not be in psychiatric day care or hospitalization. Participants were informed of their right to drop out of the study at any time without consequences (see Appendix 7.2). Informed consent was given verbally as well as on paper before the first assessment (see Appendix 7.3).

Participants had to meet these inclusion criteria:

(1) History of Major Depressive Disorder or Dysthymia

(2) Age between 18 and 60 years

(3) IQ>80 according to a word recognition test

(4) Clinically stable participants (HAM-D Score < 20) to avoid confounding with severe depressive symptoms

(5) Sufficient German fluency

(6) Cognitive Deficits: scores below PR ≤ 16in at least two cognitive tests (see section 2.3)

(7) No comorbid psychiatric disorder (DSM-IV Axis 1) or history of psychosis

(8) No documented or suspected major brain damage or other neurological diseases

The sample size (*n*) was calculated based on the desired power (1-β), the significance level (α) and the effect size reported in a recent meta-analysis on Patients with Schizophrenia by McGurk et al. (2007). To calculate sample size, the program G-Power 3 was used (Faul, Erdfelder, Lang, & Buchner, 2007). For a desired power of 1-β = 0.9, and an expected moderate effect of d=0.5, a sample size of *n* =18 per group was calculated.

2.2 Assessments

A range of questionnaires as well as performance tests was conducted during the course of this study. Furthermore a reference person was kindly asked to fill out questionnaires concerning the participant’s level of functioning prior and after the intervention. Table 3 gives an overview of the tests and questionnaires used. Not all of the tests and questionnaires are equally important. For the purpose of this dissertation only a selection will be analyzed further. For a complete overview of all test and questionnaires applied in this study see Appendix 7.1. In all cases that the original publication was not published in German, translations were used.

2.2.1 Diagnostic screening and psychopathological assessment

The Mini International Neuropsychiatric Interview (MINI, German Version 5.0.0, (Lecrubier et al., 1997), a structured interview based on the Diagnostic and Statistical Manual (DSM)-IV, was used to exclude other psychiatric disorders than depression. In order to screen for depressive and/or dysthymic episodes in the past (based on DSM-IV diagnostic criteria), the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I by Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997) was applied. In addition, the Hamilton Rating Scale for Depression and the Beck Depression Inventory (HAM-D 24 - HAMD version with 24 items; Guy, Bonato, Laboratory, & Health, 1970) was applied to assess the participant's depression pathology. Each item is scored on a 3 or 5 point scale. A sum score was calculated using the first 17 items as recommended by Hamilton himself. For the 17-item version, a score between zero and seven is considered to be normal. A score of 20 indicates a moderate depression severity (Hamilton, 1960). This score is usually required for entry into a clinical trial with depressed patients. As this study investigates a (partly) remitted depressed sample, participants had to have a sum score of 20 or lower. The HAM-D served as an external assessment conducted by the experimenters whereas the Beck Depression Inventory (BDI-II; Hautzinger, Keller, & Kühner, 2006) is based on self-evaluation.

The BDI-II contains 21 questions that are scored on a four-point scale. A score of zero to eight is considered to be normal; a score of 20 indicates a moderate depression severity. To rule out low intelligence the premorbid IQ was assessed prior to intervention. A German multiple choice word recognition test (Mehrfachwahl-Wortschatz-Intelligenztest, MWT-B; Lehrl, Triebig, & Fischer, 1995) was conducted. This test assesses the crystalline intelligence in order to rule out loss of performance due to mild to moderate psychiatric illnesses. It consists of 37 items that become increasingly harder. For each item five words are presented. Only one exists in the German language, the other four are made-up words. The participant has to mark the existing word.

Table 3

Overview over the analyzed tests and questionnaires

Diagnostic tool	Short name (Author)
Diagnostic and Psychopathology	
Socio-demographic Interview	SCID I[a]
Mini International Neuropsychiatric Interview	MINI[a] (Lecrubier et al., 1997)
Hamilton Rating Scale for Depression	HAM-D (Guy et al., 1970)
Beck Depression Inventory II	BDI-II (Hautzinger et al., 2006)
Premorbid intelligence	
Mehrfachwahl-Wortschatz-Intelligenztest (multiple choice word recognition test)	MWT-B[a] (Lehrl, 2005)
Neuropsychological variables	
Trail Making Test Version A + B, LangensteinbachVersion	TMT-A[b] + TMT-B[b] (Rodewald et al., 2012)
Zahlen-Symbol-Test (Digit Symbol Coding)	ZST (von Aster, Neubauer, & Horn, 2006)
Perception and Attention functions: Alertness, Divided Attention, Selective Attention	WAF-A[b,] WAF-G[b], WAF-S[b]
Figural Memory Test	FGT[b]
California Verbal Learning Test	CVLT (Niemann, Sturm, Thöne-Otto, & Willmes, 2008)
Nback verbal	NBV[b]
Inhibition	INHIB[b]
Tower of London, Freiburg Version	TOL-F[b]
Level of functioning – self assessment	
Mini- International Classification of Functioning, Disability and Health	Mini-ICF self (Linden & Baron, 2005)
Level of functioning – external assessment	
Mini- International Classification of Functioning, Disability and Health	Mini-ICF external (Linden & Baron, 2005)
Specific Level of Function Scale	SLOF (Schneider & Struening, 1983)

Note. [a] only administered at the first time of measurement; [b] Subdomains taken from the test battery of the Vienna Test System (Schuhfried, 2012).

According to the performance standard value, percentage rank and IQ can be determined. In order to participate in the study, the participants had to reach an IQ level of 80 or higher. An IQ of 80 indicates intelligence slightly below average but implies sufficient understanding to follow instructions. Furthermore socio-demographic variables such as age, psychiatric history, employment background, relationship status and so forth were enquired.

2.2.2 Assessment of psychosocial functioning

The participant filled out a questionnaire with questions about their performance in everyday life, work place, leisure time and relationships. The Mini-ICF-A (Mini - International Classification of Functioning, Disability and Health- Rating; Linden & Baron, 2005) is designed for a systematic evaluation of the participant's level of functioning as it is supposed to be sensitive to any change in the course of the treatment. It consists of 31 items that are rated on a five-point scale (Example item: "It is difficult for me to approach strangers", 0 = "not at all" to 4 = "absolutely"). That means that lower scores represent a better psychosocial functioning level. The highest possible score is 124.

The items can be grouped into six subscales:

(1) General functioning
(2) Communication
(3) Mobility
(4) Relationships
(5) Leisure time and
(6) Interaction.

Furthermore, each participant was asked to assign a reference person as a (more) objective measure of psychosocial performance. The reference person was kindly asked to fill out two questionnaires: the Mini-ICF-P and the SLOF. The Mini-ICF-P is a short observer rating instrument of the assessment of disabilities, especially with regard to occupational functioning. It consists of 13 items that are scored on a five-point scale (Example item:

"Adjustment to rules and routines: Ability to follow rules, to keep appointments and to fit into organisational processes. This includes for example the fulfilment of daily routines, maintaining schedules and punctual appearance." 0 = no impairment to 4 = complete impairment) to assess the participants ability to fulfil the norm expectations about his or her performance in relation to his or her reference group. Again, lower scores represent a better psychosocial functioning level. The highest possible score is 52. The Specific Level of Functioning Scale (SLOF; Schneider & Struening, 1983) aims to measure directly observable behavioural functioning and daily living skills. A German research group translated three scales into German (see below; Bossert, Aschenbrenner, Weisbrod, Roesch Ely, & Westermann). It consists of 24 Items that are rated on a one to five scale (Example item: "Work life abilities: is able to exert himself / herself at work over a longer period of time (not easily distracted, can work under stress)", 1 = very uncharacteristic of this person to 5 = highly characteristic of this person). In this case, higher scores represent a better psychosocial functioning level. The highest possible score is 120. Its items are grouped on three scales:

(1) Interpersonal relationships
(2) Activities and
(3) Work ability.

Not all participants appointed a reference person, either because they were not comfortable with disclosing their study participation or because they could not think of a suitable person. Furthermore the return rate for the psychosocial functioning questionnaires, especially the external assessments was limited. This led to differing sample sizes that will be reported whenever applicable.

These questionnaires (see Appendix 7.4) are commonly used in research and in clinical neuropsychological assessments in psychiatry and were selected to match the assessment of the preceding sister study with schizophrenic participants to ensure comparability.

2.2.3 Neurocognitive assessment

Performance in the domains attention, memory, executive functions, and information processing speed was gathered within the neuropsychological assessment. If not stated differently, all tests used were part of the test battery CogBat retrieved from the Vienna test system NEURO (Schuhfried, 2012). The VTS is a computerized test battery for the measurement of various neuropsychological functions in accordance with the guidelines of the German Society for Neuropsychology. The evaluation was computerized and based on the representative norm sample provided by the company. If not stated differently, the representative norm sample consisted of *N* =149 participants (184 men, 235 women), aged between 16,2 to 80,1 years old and the survey period was 2012 to 2013.

Attention. *Alertness* was assessed by applying the test WAF-A test form S2 of the VTS. In this test, participants are instructed to fixate on a cross in the center of a computer screen and to press a button on a response panel as soon as a black dot (target stimulus) appears in the center of the screen. Each target stimulus is presented for 1500ms but disappears as soon as a response is given. A total number of 25 target stimuli were presented, whereas the time between the presentations of two subsequent target stimuli (inter-stimulus interval) varied between 3000ms and 5000ms. An instruction phase and a short practice phase preceded the actual test phase. The practice phase was repeated if necessary until participants understood the task instructions adequately (more than 80% correct responses in practice phase).The test duration was approximately four minutes.

Divided attention was assessed by applying the test WAF-G test form S2. In this test, participants were required to monitor simultaneously one visual and one auditory stimulus channel. In the visual stimulus channel, a series of stimuli (circles) were presented in consecutive order in the center of a computer screen. The participants were requested to react as quickly as possible if the circle became lighter twice in succession (in two subsequent stimuli), but not if no change occurred. Equivalently in the auditory stimulus channel, a series of identical tones was presented in consecutive order to participants. The participants were requested to react as quickly as possible if the tones became softer twice in succession (in two subsequent sounds), but not if no change occurred. The stimuli (circles as well as tones) were presented for 1500ms. After 500ms the particular change may take place. The inter-stimulus interval was 1000ms. In the task (visual and auditory information channel) a total of 85 stimuli were presented of which 21 required a response by pressing the same specified button on a response panel. The presentation order of stimuli in both information channels was pseudo-randomized. An instruction phase and a short practice phase preceded the actual test phase. The practice phase was repeated until participants understood the task instructions adequately. The test duration was approximately five minutes.

Selective attention was measured by applying the test WAF-S test form S1 using three different presentation modalities: visual, auditory and cross-modal. In this visual test, a series of stimuli (circles, squares, or triangles) is presented in consecutive order in the center of a computer screen. Each stimulus is presented for 1500ms. After 500ms of each stimulus presentation, a change may take place, i.e., the stimulus may get lighter or darker or stay the same. The participants were requested to react as quickly as possible to changes in circles and squares but to ignore changes in triangles. A response was given by pressing a button on a response panel. In the auditory test, tones in three different pitches were presented. In line with the visual presentation, the tones either changed their tone pitch or stayed the same. Participants were asked to press a button on a response panel if a change occurred in the high or low tone, but ignore changes in the middle tone. In the cross-modal test, participants were presented with circles and squares on the screen and two tones on the headphones. They were requested to press a button, when the circles got lighter or when the lower tones became louder, but ignore changes in squares and higher tones. In the uni-modal conditions (visual or auditory) 144 stimuli were presented of which 30 stimuli required a response each time. In the cross-modal condition 100 stimuli were presented of which 38 stimuli required a response. The inter-stimulus interval was 1000ms. An instruction phase and a short practice phase preceded the actual test phase. The practice phase was repeated until participants understood the task instructions adequately. The test duration was approximately 20 minutes. The representative norm sample provided by the company consisted of N = 295 participants (137 men, 158 women), aged between 16,3 to 77,10 years old and the survey period was 2005 to 2006.

Memory. *Figural memory* was assessed using the test FGT test form S11. In this test, participants were required to memorize geometric line figures that were presented five times in a fixed order onscreen and to reconstruct them immediately after each of the five presentations, after five minutes and after a 30-minute delay without repeated presentation. Finally to test for recognition, participants had to pick the memorized figures among 18 distractor figures. An instruction phase and a practice phase preceded the actual test phase. The test duration was approximately 14 minutes. The most important variable is “learning sum”, that is calculated as the number of correctly entered figures during the five presentations.

Executive Functions. *Response inhibition* was measured by applying the test INHIB test form S13. In this test, participants were instructed to press a response button, whenever a triangle appears on screen, but not when a circle appears. A total of 125 stimuli are presented, 101 triangles and 24 circles for 200ms with an inter-stimulus interval of 1000ms. Due to the frequent appearance of triangles, a dominant reaction tendency is built up in the process. In order to succeed in this task the participant has to supress his response. An instruction phase and a practice phase preceded the actual test phase. The test duration was approximately four minutes.

Planning ability was assessed using the test Tower of London, Freiburg version (TOL-F). In this test, participants are presented with a display of three balls with increasing size on a rack with three poles with increasing size (one can only hold one ball, the next ones two resp. three balls). The participants are instructed to transfer a given start position into a given target position with as few moves as possible. Only one ball can be moved at a time and only smaller balls can be placed on top of a bigger ball. The test consists of 28 tasks that become increasingly harder to solve (four three-moves-problems, and eight four-, five-, and six-moves-problems). Each task has a time limit of 60 seconds. If three consecutive tasks cannot be solved in the given time, the test is terminated. An instruction phase and a practice phase preceded the actual test phase. The test duration was approximately 16 minutes. The most important variable is called planning ability, it is calculated as the number of tasks that require four to six moves solved with the minimum of necessary steps. The representative norm sample provided by the company consisted of N = 269 participants (129 men, 140 women), aged between 16,1 to 84,0 years old and the survey period was 2011.

Working memory was assessed by applying the test NBV test form S1. In this test, participants were required to monitor letters (consonants) on the computer screen and press a button as soon as the current consonant is identical to the consonant presented second to the last.Each target stimulus is presented for 1500ms. A total number of 100 target stimuli were presented, with an inter-stimulus interval of 1500ms. An instruction phase and a practice phase preceded the actual test phase. The practice phase was repeated if necessary until participants understood the task instructions adequately (correct identification of one of the two target stimuli and no more than two false alarms). The test duration was approximately seven minutes.

To assess the cognitive flexibility the test Trail Making Test, version B (TMT-B, Langensteinbach version) test from S1. In this test, the participant is required to connect 13 numbers (1-13) and twelve letters (A-L) alternating in ascending order as quickly as possible. If an incorrect stimulus is clicked an acoustic feedback is given. An instruction phase and a practice phase preceded the actual test phase. The test duration was approximately 1 minute.

Information Processing Speed. Information processing speed was assessed with the test Trail Making Test, version A (TMT-A, Langensteinbach Version) test form S1. In this test, the participant is required to connect 25 numbers (1-25) in ascending order as quickly as possible. If an incorrect stimulus is clicked an acoustic feedback is given. An instruction phase and a practice phase preceded the actual test phase. The test duration was approximately one minute.

Information processing speed was additionally assessed using the pen-and-paper test Zahlen-Symbol-Test (ZST, Digit Symbol Coding) taken from the Wechsler intelligence scale for adults (WAIS-IV; Wechsler, 2008). In this test, the participant is required to draw as many matching symbols underneath rows of given numbers according to a presented code. The time limit is two minutes. An instruction phase and a practice phase preceded the actual test phase. The manual evaluation was based on age and the representative norm sample provided by the WAIS-IV manual.

2.3 Selection of deficits

In order to take part in the study, participants had to show deficits in at least two of the six tested cognitive subdomains: *divided attention*, *selective attention*, *alertness*, *working memory*, *planning* and *response inhibition*. A deficit was set as a performance with a PR≤16 in one of the critical variables (see Table 4). It was counted as a deficit as well, if a test was aborted by the program due to incorrect execution or an unusually high amount of errors.

Table 4

Critical variables per domain, subdomain and test used for the determination of deficits

Subdomain	**Test**	**Critical variables**
Alertness	WAF-A	Reaction time Standard deviation
Divided Attention	WAF-G	Reaction time omissions (misses) commissions (false alarm)
Selective Attention visual, auditive, cross-modal	WAF-S	Reaction time omissions (misses) commissions (false alarm)
Working Memory	NBV	Positives omissions (misses) commissions (false alarm)
Response Inhibition	INHIB	Reaction time commissions (false alarm)
Planning	TOL-F	Planning ability

Participants in the individualized training group trained the three subdomains with the lowest PR score. If a participant's cognitive functioning only showed two subdomains to be impaired (i.e., PR≤16), the next lowest subdomains was chosen. If a participant had more than three impaired subdomains, the three subdomains with the lowest PR score were chosen. Participants in the generalized training group trained all subdomains regardless of their impairments.

2.4 Experimental intervention

The participants of both intervention groups trained three times a week for a minimum of twelve (up to 15) training sessions. They trained in small groups of one to five people and every training session lasted 60 minutes. In every training session, participants trained three different subdomains for 20 minutes. All subdomains were stratified randomly so that the order of subdomains trained differed each time, but trained an equal amount throughout the training. In the individualized training group participants trained their three most impaired subdomains; in the generalized training group, they trained all six subdomains. A psychologist was present throughout all training sessions to provide instruction and support when necessary. Additionally, a 30-minute transfer session took place once a week with all participants presently training held by a trained psychologist. Five different topics were covered in these transfer sessions: 1) alertness and sustained attention, 2) divided and selective attention, 3) memory, 4) planning and 5) inhibition. The participants received working sheets at every session. The information working sheet contained theoretical background knowledge on the topic and the transfer working sheet provided ideas and training tasks about what to do and how to train the specific domain during the following week (see Appendix 7.6). The training sessions always started with a recap of the past week. Then the information working sheet was presented and the participants gave personal examples of specific impairments that bothered them in their daily routines. A discussion followed about how to target the personal impairments and the training tasks on the transfer working sheets were explained. All participants received a weekly diary with the instruction to monitor their progress and rate their performance related to the weekly topic, as well as their mood and sleep quality. The purpose of transfer sessions was to coach strategies in order to improve performance and transfer the training achievements to real-world environments. In the past years the relevance of transfer sessions has been increasingly discussed in schizophrenia research (McGurk et al., 2007; Pfueller, Roesch-Ely, Mundt, & Weisbrod, 2010). Wykes et al., (2011) conclude a study with schizophrenic patients that transfer sessions are essential for the effectiveness of a cognitive training. See Appendix 7.6 for the transfer sessions working sheets.

CRT Training System. The training was realized with the training program CogniPlus®. CogniPlus® (Schuhfried, 2007) is a scientifically based training system targeting cognitive functions and their promotion. The predecessor being the AIXTENT® training program, that is listed as a recommendation in the guidelines of "Gesellschaft für Neuropsychologie" (GNP; engl. Society for Neuropsychology) and "Deutsche Gesellschaft für Neurologie" (DGN; engl. German Society for Neurology). The trainings program is specifically designed to complement the Vienna test system (Schuhfried, 2012). The CogniPlus® training system can be used across the entire ability range of users. The program identifies an individual's ability by analysing the reaction times and mistakes to adapt the prevailing tasks difficulty. In the study, six cognitive functions were trained using CogniPlus®: *divided attention, selective attention, and alertness, working memory, response inhibition and planning*. For a summary of the training modules and the corresponding tests in the assessment see Table 5. For a detailed description of the trainings modules see Appendix 7.5.

Table 5

Subdomains and the corresponding training modules (Schuhfried, 2007) and test tasks (Schuhfried, 2012)

Subdomain	**Training module**	**Test task**
Alertness	ALERT	WAF-A
Divided Attention	DIVID	WAF-G
Selective Attention	SELECT	WAF-S
Working Memory	N-BACK	NBV
Response Inhibition	HIBIT	INHIB
Planning	PLAND	TOL-F

Methods Against Bias. The treatment allocation was randomized through a stratified randomization plan and was performed observer-blind. Due to the nature of the trial, participants and trainers could not be blinded with respect to treatment allocations. Extensive steps were taken to assure blindness of the raters. Researchers responsible for the cognitive training were not involved in the assessment of participants and vice versa. Participants were kindly instructed to remain quiet about group allocations when being assessed.

2.5 Data analysis

The goal of this study was to test, whether (partly) remitted depressed patients benefit from a cognitive remediation therapy. For this purpose it was decided to conduct per protocol analyses in contrast to intention to treat analyses. The statistical analyses were carried out using SPSS version 22 (SPSS Inc., Chicago IL). All analyses employed an alpha level of 0.05. Pre-analyses on group differences for socio-demographic, neuropsychological, clinical and socio-functional characteristics were explored using two-tailed *t*-tests and chi-square tests in case of categorical variables. Change on the cognitive and clinical measures over the intervention period was analysed using mixed-design analyses of variance (ANOVAs), treating group (training vs. control group or individualized training vs. generalized training vs. control group) as a between-subjects variable and time (baseline vs. after the training) as a within-subjects variable. Post-hoc comparisons were made using the Bonferroni procedure. Group comparisons were performed on individual neuropsychological test scores as well as z-standardized composite test scores.

Several composite scores were calculated in order to facilitate a general overview (see Figure 2). A composite score “neurocognition” included the most important variables measured in all domains (attention, executive function, information processing speed, learning and memory).This composite score was used to compare the neurocognitive performance between groups at the first time of measurement. However, as the domain Learning and Memory was not trained, another composite score “CRT” was calculated to compare the neurocognitive performance change after the training between groups. Additionally composite scores (“WAF-A”, “WAF-G”, “WAF-S”, “INHIB”, “NBV”, “PLAND”, “FGT”) for the different tasks were calculated to answer the exploratory question whether the benefit of the training is different for the different domains.

Following recent research recommendation in the sixth edition of the Publication Manual by the American Psychiatric Association (2010) effect sizes were calculated additionally to significance testing as interpretations based on effect sizes usually provide a more informative analysis of empirical results. As any effect can reach significance if the sample is big enough, effect sizes present a more reliable basis for interpretation.

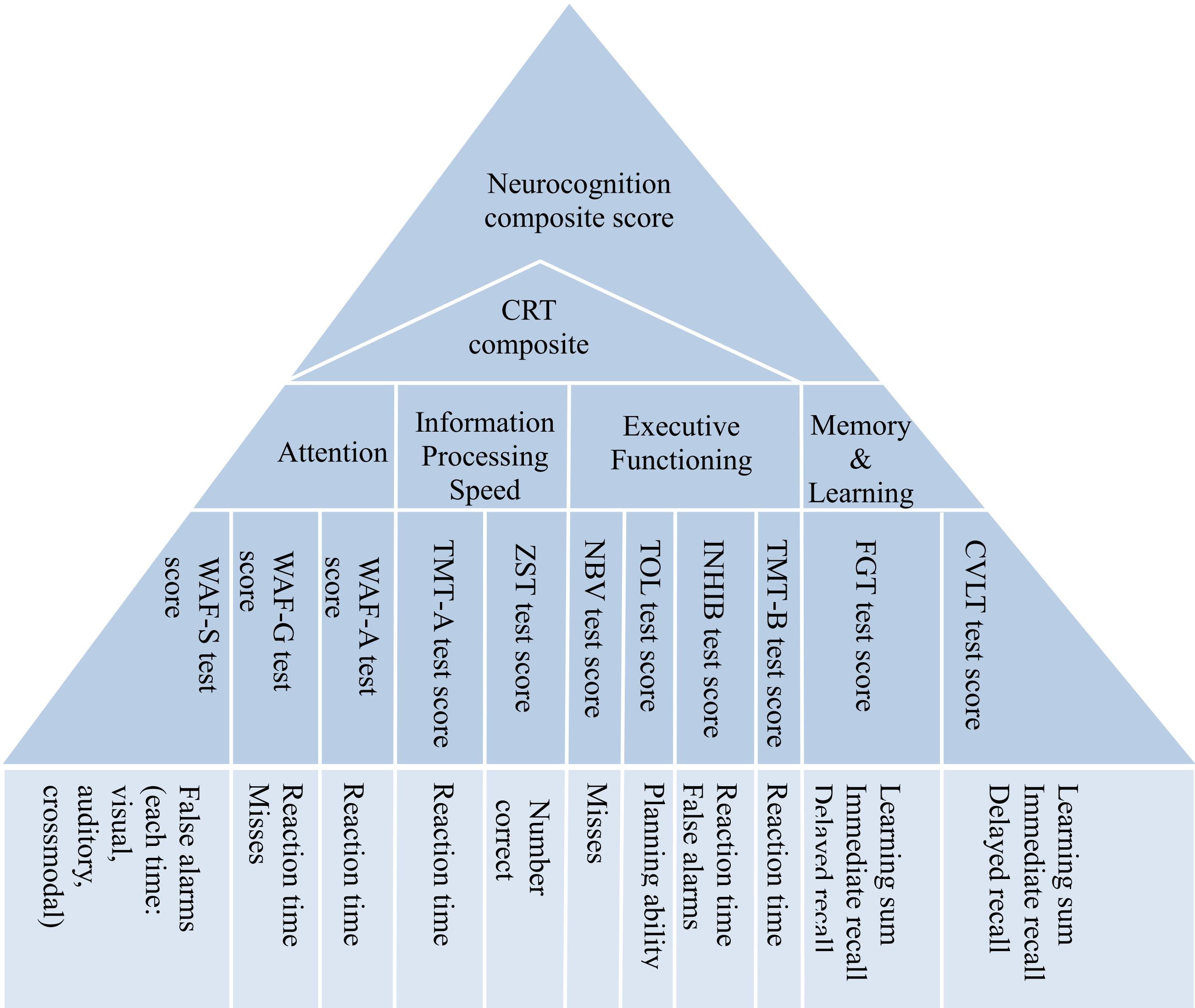

Figure 2. Composition of the neurocognition composite scores. The lowest level shows z-standardized values that were included for the calculation of the different test scores.

Standardized effect sizes as reported in this paper offer the advantage that any reader can interpret the effect size without having to be familiar with the scaling of the variables, it can be interpreted across variables. Two different effect sizes will be reported. For the repeated measures ANOVAS the effect size partial η^2 will be reported as it is the most commonly reported effect size estimate for analyses of variance (Fritz, Morris, & Richler, 2012). Partial η^2 can be interpreted as the shared variance between two variables. However the partial η^2 estimates are non-additive (i.e., they can potentially sum to greater than 100% of total variance explained; Ferguson, 2009). The interpretation follows the recommendation by Cohen (1988): small partial $\eta^2 \geq 0.02$, medium partial $\eta^2 \geq 0.13$ and large partial $\eta^2 \geq 0.26$.

The effect size calculation sensu Klauer (Klauer, 2001) was chosen for the direct comparison between the training groups and the control group. Klauer's (2001) method of calculating the effect size is specifically designed for experimental as well as interventional studies. Both, baseline and after-training effect sizes are calculated using Hedges g to, then, subtracting both effect sizes from each other. This approach takes different sample sizes and correct baseline differences into account. The effect size interpretation follows recommendation by Cohen (1988): small $d_{corr} \geq 0.2$, medium $d_{corr} \geq 0.5$ and large $d_{corr} \geq 0.8$.

Missing Data. In the neuropsychological assessment seven values (0.14%) were categorized as missing. One variable was forgotten to be written down, the other six variables were not interpretable due to not instruction conform test execution. $N = 52$ (89.66%) were complete. Analysis of the missing data of the neuropsychological assessments showed no systematic pattern (Little's MCAR-Test $\chi 2 = 285.00$, $df = 434$, $p = 1.0$, n.s.). With the psychosocial questionnaires 1118 values (14.17%) were categorized as missing. $N = 23$ (39.66%) cases were complete. This is however unevenly distributed among the self and external psychosocial assessments. With the psychosocial self-assessment questionnaires there was $n = 1$ (1.72%) case that had not filled out the questionnaire at the first time of testing, another $n =$

5 (8.62%) cases did not return their questionnaire at the second testing. The rest (*n* = 9, 15.52%) had one to four missing values. All in all 204 (5.67%) values were missing. *N* = 43 (74.14%) cases of the psychosocial self-assessment questionnaires were complete. With the external psychosocial questionnaires, *n* = 7 (12.07%) were not returned and therefore completely missing, another n = 9 (15.52%) were filled out half or less. *N* = 11 (18.97%) had one to 17 missing values. All in all 914 (21.30%) values were missing. *N* = 31 (53.44%) cases of the external questionnaires were complete. Analysis of the missing data of the psychosocial questionnaires showed no systematic pattern (Little's MCAR-Test $\chi 2 = 1322.64$, $df = 2763$, $p = 1.0$, n.s.).

3 Results

Selection of the Deficit Domains. For the participants in the individualized training group three deficit subdomains were selected based on the neuropsychological testing results. Selective attention was the subdomain to be found most often under the three most impaired subdomains whereas Planning appeared to be the least affected subdomain. Table 6 shows the frequency of how often each subdomain appeared to be one of the three most impaired cognitive subdomains (per participant). The probability for impairment varied. As can be seen the probability for a subdomain to be chosen as one of the three deficit subdomains varied. As the table portrays, the conditional probability varied between 90% for the subdomain of selective attention and 20% for the subdomain of planning.

Table 6

Frequencies of how often each subdomain appeared to be one of the three most impaired cognitive subdomains (per participant)

Subdomain	Alertness	Divided Attention	Selective Attention	Working Memory	Response Inhibition	Planning
Task	ALERT	DIVID	SELECT	NBACK	INHIB	PLAND
No.	9	12	18	6	11	4
Conditional probability	45%	60%	90%	30%	55%	20%

3.1 Sample characteristics

Figure 3 presents the participant flow throughout the study period and Table 7 a comparison between drop-outs and the final sample. The comparison was based on demographic, clinical, and neurocognitive variables. Based on these measures, the two training groups and the control were compared regarding the same three dimensions (cf. Table 7). Categorial variables were analyzed using the Chi-Square test; continuous variables were analyzed with a univariate ANOVA with the factor levels being individualized training (IT), generalized training (GT), and passive waitlist control group (CG).

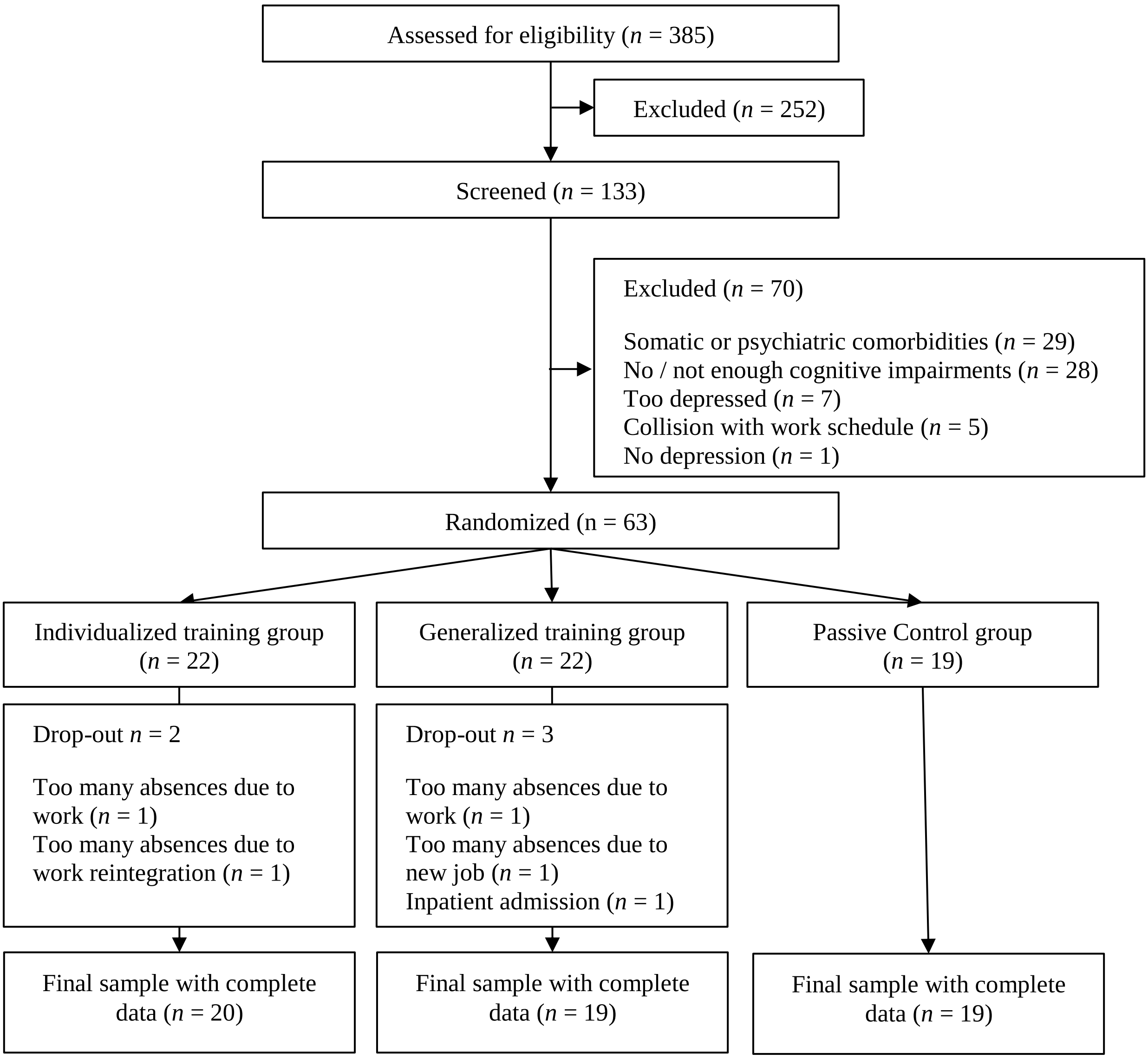

Figure 3. Recruitment flow chart throughout the study phase.

C**omplete Sample.** A total of N = 63 participants (44 females, M_{age} = 45.3 years, *SD*12.1, age range: 19-60 years) were included in the study. However, six participants (1 female, M_{age} = 49.2 years, *SD*9.3, age range: 35-60 years) dropped out after the baseline assessment. Four of them had too many absences due to circumstances at work (i.e., overlap with working time or new job / work reintegration. One patient had to be admitted to the hospital due to a depressive relapse caused by acute financial stress. A negative influence due to their participation in the study on the mental wellbeing of the patient is unlikely.

A significant effect regarding gender was found comparing drop outs to the individuals who have completed the study as men were more likely to drop out than women. As 4 out of 5 drop outs were due to work-related reasons, it is reasonable to assume a possible link between drop out and employment status. As this relation affects three out of four men, it is also in line with the most current numbers of the German Statistical Office that 50.7% men (and only 40.1% women) were employed in 2016 (Statistisches Bundesamt, 2017).This study’s sample showed an even greater gender gap regarding employment status as 53.3% of the male participants work full-time whereas only 14.3% of the female participants did. There were no differences between drop-outs and completers of the study in regard to diagnosis, educational level, group allocation, age, depression severity, and neurocognitive performance (see Table 7).

Sociodemographic, Clinical and Psychosocial Characteristics. Further analyses are based upon the data gathered from N = 58 participants (42 female, M_{age} = 44.8 years, *SD* 12.4, age range 19-60 years) who completed the study. For details about sociodemographic and clinical characteristics as well as test statistics confer to Table 8a and Table 8b. No group comparison was significant. Therefore, it can be concluded that, firstly, all three groups showed similar neurocognitive performance at baseline testing and that, secondly, all groups were comparable in sociodemographic and psychosocial characteristics. Unfortunately, one participant that was allocated to the generalized training group revealed only after the completion of the study, that she used methylphenidate irregularly. In consideration of the progressed stage of this thesis it was decided that the statistic did not have to be analyzed again. Therefore, although unlikely, it cannot be ruled out, that the results for the generalized training group appear better than it would normally be.

Table 7

Comparison of socio-demographic characteristics between drop-outs and study completers

	Drop-outs (*n* =5)		Completers (*n* =58)		Test statistics	
Categorial variables	*n*	%	*n*	%	Chi-Square	Asymp. significance
Gender					6.405	0.011*
Men	4	80	15	25.9		
Women	1	20	43	74.1		
Diagnosis					1.025	0.311
MDD	5	100	48	82.8		
Double Depression	0	-	10	17.2		
Educational level					1.298	0.523
General school	0	-	8	13.8		
Secondary school	2	40	13	22.4		
Abitur [a]	3	60	37	63.8		
Group allocation					2.656	0.265
Individualized	2	40	20	34.5		
Generalized	3	60	19	32.8		
Control	0	-	19	32.8		
Continuous variables	*M*	*SD*	*M*	*SD*	*F*-value	*p*-value
Age (years)	49.2	9.3	45.0	12.4	0.547	0.462
Depression severity[b]	12.0	1.4	9.7	4.7	1.024	0.315
Neurocognitive performance [c]	-.1351	0.2	0.653	0.5	0.761	0.520

Note. [a] German qualification for university entrance; [b] Hamilton Depression Rating Scale; [c] z-standardized composite score “Neurocognition”, * significant at a level of 0.05 (one tail)

Depression Severity. Depression severity was measured by the Hamilton Depression Rating Scale (HAM-D) and the Becks Depression Inventory (BDI). Time (at baseline vs. after the training) did not have a significant effect on the depression severity when assessed externally (HAM-D: $F(1,56) = 2.823$, $p = 0.98$). In the self-assessment (BDI: $F(1,50) = 14.805$, $p < 0.01$), however, there was a significant interaction between time and depression severity. In fact, participants reported fewer depressive symptoms at the second testing (BDI t0 $M = 18.2$, $SD = 11.4$; BDI t1 $M = 14.2$, $SD = 11.4$). A one-way ANOVA showed no statistically significant difference between neither group at the baseline testing regarding depression severity (HAM-D t0: $F(2,55) = 2.756$, $p = 0.072$; BDI t0: $F(2,54) = 0.101$, $p = 0.904$) nor at the second testing (HAM-D t1: $F(2,54) = 1.900$, $p = 0.159$; BDI t1: $F(2,49) = 1.058$, $p = 0.355$). At both times of testing, the two depression measures correlated significantly (baseline: $r = .455$, $p < 0.01$, after the training: $r = .712$, $p < 0.01$). Due to the high correlations values of the HAMD and the BDI, analyses were comprised by using only one inventory for further statistical investigations. The decision was in favor of the HAMD as it is the most used inventory for depression severity in scientific research (i.e., comparability was ensured) and the instructor assessment ensured fewer missing items than the BDI.

Table 8a

Comparison of sample characteristics between study groups at baseline

	Individualized training group (*n* = 20)		Generalized training group (*n* = 19)		Control group (*n* = 19)		Test statistics	
Continuous variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*-value	*p*-value
Age (years)	45.9	11.3	44.2	15.5	44.9	10.3	0.095	0.910
HAMD	9.2	4.1	8.6	4.7	11.8	4.8	2.756	0.072
BDI	17.9	10.2	17.6	13.6	19.2	10.8	0.101	0.904
No. of episodes (*n* =38)	2.4	1.5	3.7	5.6	2.4	2.2	0.546	0.584
MWT-B	31.2	3.3	31.6	3.8	31.4	4.1	0.065	0.937
FLEI [a]	69.4	19.8	66.3	21.9	62.7	13.6	0.614	0.545
Training sessions	14.4	0.9	14.2	0.9	-	-		
Mini-ICF Self	49.1	17.3	45.4	21.5	53.9	18.7	0.871	0.425
Mini-ICF External	12.6	9.3	14.1	9.0	11.9	10.2	0.230	0.796
SLOF External	103.1	9.4	102.9	11.9	105.2	11.6	0.150	0.861

Note. [a] Subjective mental capability.

Table 8b

Comparison of sample characteristics between study groups at baseline

	Individualized training group (*n* = 20)		Generalized training group (*n* = 19)		Control group (*n* = 19)		Test statistics	
Categorial variables	*n*	%	*n*	%	*n*	%	Chi-Square	Asym. Sign.
Gender							0.561	0.755
Men	5	25	4	21.1	6	31.6		
Women	15	75	15	78.9	13	68.2		
Diagnosis							3.390	0.184
MDD	19	95	15	78.9	14	73.7		
Double Depression	1	5	4	21.1	5	26.3		
Educational level							3.332	0.504
General school	3	15	3	15.8	2	10.5		
Secondary school	7	35	3	15.8	3	15.8		
Abitur[a]	10	50	13	68.4	14	73.7		
Employment status							11.198	0.512
Full-time job	6	30	2	10.5	6	31.6		
Part-time job	3	15	8	42.1	5	26.3		
Student	3	15	4	21.1	1	5.3		
Unemployed	2	10	2	10.5	1	5.3		
Housewife	1	5	0	-	0	-		
On sick leave	4	20	1	5.3	4	21.1		
Retired	1	5	2	10.5	2	10.5		
Relationship status							3.098	0.928
Single	5	25	5	26.3	4	21.1		
Solid relationship	6	30	5	26.3	5	26.3		
Married	8	40	6	31.6	6	31.6		
Divorced	0	-	2	10.5	2	10.5		
N/A	1	5	1	5.3	2	10.5		
Housing situation							5.999	0.647
Living alone	6	30	8	42.1	6	31.6		
With family	4	20	2	10.5	7	36.8		
With partner	6	30	5	26.3	3	15.8		
Shared flat	3	15	3	15.8	1	5.3		
N/A	1	5	1	5.3	2	10.5		
Medication[b]								
Antidepressants	13	65	13	68.42	14	73.7		
Antipsychotics	0	-	0	-	1	5.3		
Anticonvulsants	0	-	1	5.3	1	5.3		
Other[b]	4	20	12	63.2	10	52.6		

Note. [a] German qualification for university entrance; [b] multiple selection possible: Methylphenidate *n* = 1, beta blocker *n* = 2, antihistamines *n* = 8, L-thyroxine *n* = 7, nonsteroidal anti-inflammatory drugs *n* = 1, hormonal contraceptives *n* = 7.

Psychosocial Functioning. Depending on their group allocations, participants did not differ significantly in their psychosocial functioning at baseline testing (Mini-ICF self: $F(2,49) = 0.871$, $p = 0.425$; Mini-ICF external: $F(2,42) = 0.230$, $p = 0.796$; SLOF: $F(2,35) = 0.150$, $p = 0.861$). Scores of psychosocial functioning were highly correlated (cf. Table 9).

Table 9

Intercorrelations of psychosocial functioning measures at baseline

	ICF Self	ICF Ex	SLOF Ex	*n*
ICF Self	-	.420** *N* = 41	-.408* *N* = 35	47
ICF Ex	-	-	-.684** *N* = 38	43
SLOF Ex	-	-	-	37

Note. ** p<.01; * p<.05

Neurocognitive Performance. As the study's inclusion criteria already ensured, all participants displayed cognitive deficits. The computer program (Vienna Test System by Schuhfried, 2012) aborted two neurocognitive tests prematurely (WAF-A CG: $n = 1$; TOL-F IT: $n = 1$, CG $n = 1$).Test administration was aborted when the test execution did not show conformity with the test instruction, hence, when a participant made too many errors. Aborted cases were rated as missing as it remains unclear whether the individual understood instructions correctly. No significant group differences were found at baseline testing regarding test performance. Also a group comparison with a composite score "Neurocognition" as the dependent variable did not reach significance ($F(2,55) = 0.22$, $p = 0.80$ n.s.). The results of the group comparisons for neuropsychological variables can be found in Table 10. Neither group performed consistently better, or worse, than the other two groups. Overall, the three groups displayed comparable levels of cognitive performance at baseline testing.

Table 10

Comparison of neuropsychological variables between the study groups at baseline

Test variables	Individualized training		Generalized training		Control group		Test statistics	
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*-value	*p*-value
WAF-A (*n* = 57)								
Reaction time (in ms)	254.8	51.7	268.1	65.8	261.7	51.5	0.268	0.766
WAF-G								
Reaction time (in ms)	614.6	151.4	636.8	136.4	695.9	168.6	1.465	0.240
False alarms	4.6	5.1	7.1	11.4	5.4	6.6	0.460	0.634
WAF-S visual								
Reaction time (in ms)	435.4	74.1	428.9	87.0	445.9	131.5	0.104	0.870
Misses	0.9	1.2	0.7	1.3	2.7	5.2	2.330	0.107
NBV								
Misses	4.5	3.5	4.9	3.3	5.1	3.9	0.178	0.838
INHIB								
Reaction time (in ms)	326.6	77.1	322.1	37.6	351.1	75.6	1.065	0.352
False alarms	5.1	3.4	5.8	3.4	4.4	3.3	0.841	0.437
TOL-F (*n* = 56)								
Planning ability	14.3	3.3	15.8	2.4	16.4	3.2	2.526	0.090*
TMT-A								
Reaction time (in ms)	21.4	5.6	22.4	5.9	23.0	5.4	0.396	0.675
TMT-B								
Reaction time (in ms)	37.7	11.1	36.9	19.8	34.3	9.9	0.307	0.737
ZST								
Number correct	74.1	16.2	70.7	15.9	72.7	15.9	0.216	0.807
FGT								
Learning sum	26.3	9.9	25.8	8.2	26.0	7.4	0.164	0.849

Note. If not stated differently *n* = 58. All values are raw values. Lower values mean better performance for the variables reaction time, false alarm, and misses. Higher values mean better performance for the variables: planning ability, number correct and learning sum.
*Trend towards significance $p < 0.1$

Table 11 summarizes the number of participants that showed deficits in the various subdomains. This, again, reflects the comparability of impairment regarding group allocation. The subdomain *planning ability* showed impairments by the least number of participants (9%)

whereas the most affected subdomain appeared to be “selective attention” with 90% of participants showing deficits. These numbers give an indication of the neurocognitive profile, though they have to be interpreted with caution. The sequence in which the tests were presented was not randomized (e.g. the task testing selective attention was always presented last) and the test difficulty not matched (i.e., the task had different levels of difficulty, e.g. a large portion of the participants commented that the task testing selective attention was the hardest).Therefore, fatigue and individual experience of difficulty is likely to have influenced the distribution of impaired subdomains / domains.

Table 11

Number of participants with impaired subdomains (at least one critical variable PR≤16) depending on group allocation

Subdomain		Individualized training		Generalized training		Control group		Total	
		n	%	*n*	%	*n*	%	*n*	%
Alertness	at baseline	11	55%	10	53%	10	53%	31	53%
	after the training	5	25%	6	32%	8	42%	19	33%
Divided	at baseline	13	65%	16	84%	14	74%	43	74%
Attention	after the training	10	50%	9	47%	7	37%	26	45%
Selective	at baseline	19	95%	17	90%	17	90%	53	87%
Attention	after the training	10	50%	14	74%	15	79%	39	67%
Working	at baseline	6	30%	10	53%	8	42%	24	41%
Memory	after the training	1	5%	4	21%	3	16%	8	14%
Response	at baseline	10	50%	12	63%	14	74%	36	62%
Inhibition	after the training	7	35%	5	26%	12	63%	24	41%
Planning	at baseline	3	15%	0	0%	0	0%	3	5%
	after the training	1	5%	1	5%	2	11%	4	6%
Figural	at baseline	6	20%	6	32%	4	21%	16	28%
Memory	after the training	1	5%	4	21%	2	11%	7	12%
Total*	at baseline	68	49%	71	53%	67	50%		
	after the training	35	25%	48	36%	49	36%		

Note. * Interpretation aid: Total score % indicates that at baseline on average 49%, resp. 53%, and resp. 50% of the possible subdomains were impaired per participant. That means that in every study group each participant showed roughly in half of the subdomains at least one critical variable with PR≤16 at baseline. The second PR number shows the percentage of impaired subdomains after the training: E.g. for the individualized training the number of impaired subdomains nearly halved, for the generalized training and the control group the improvements were smaller (around one third).

3.2 Neurocognitive functioning

H1a. Participation in a training group will lead to small to moderate improvement in test performance (CRT composite score, domains, subdomains) compared to the control group.

H1b. The strength of the training effect differs between the individualized training group and the generalized training group, which are both superior to the control group.

To test the hypothesis H1a, three different dependent variables were examined in relation to the independent variable “Training groups vs. Control group”. The dependent variables were: (1) the global composite score “CRT”, (2) the domain-specific composite scores (Attention, Processing Speed, Executive functioning, Learning and memory) and (3) the subdomain composite scores (WAF-A, WAF-S, WAF-G, NBV, INHIB, TOL). To test the hypothesis H1b, the same calculations were repeated with only the independent variable changing to “Individualized Training vs. Generalized Training vs. Control group”. It must be noted that analyses regarding the test comparisons were solely based on participants in the individualized training group that actually trained the specific subdomain (as the participants in the individualized training group trained only three subdomains). The effect size partial η^2 for all comparisons was computed. The interpretation follows the recommendation by Cohen (1988) small partial $\eta^2 \geq 0.02$, medium partial $\eta^2 \geq 0.13$ and large partial $\eta^2 \geq 0.26$. If the effect size is at least small it will be pointed out. The results are interpreted in relation to their significance for H1a and H1b. Additionally, diagrams visualize the trainings effect. Their interpretation regarding the composite scores must be done carefully as the composite scores facilitate the understanding but remove face validity. The slope does not stand for either improvement or deterioration; it only shows ranking sequence and closeness of the groups.

First, Table 12 shows raw scores regarding the most important variables at baseline and after the training. Then, the above-mentioned analyses are presented.

CRT Composite Score. A univariate ANOVA with repeated measures and the dependent variable “CRT composite score” demonstrated the efficacy of the training. Participants of both training groups (generalized and individualized training) showed a significantly greater performance increase than the control group ($F(1,56) = 5.393$, $p = 0.012$). The effect size is small (partial $\eta^2 = 0.09$). The variable of Time alone did not reach significance ($F(1,56) = 0.623$, $p = 0.22$).

For a more detailed analysis of group differences, the training group was split into generalized and individualized groups so that both forms of training can be set into relation to each other as well as to the control group. Again, the interactions reached significance and it can be concluded that all three groups differ significantly from each other ($F(2,55) = 2.688$, $p = 0.039$; Figure 4). The effect size is small (partial $\eta^2 = 0.09$). Bonferroni corrected post-hoc tests did not reach significance. The variable of Time alone did not reach significance ($F(1,55) < 0.01$, $p = 0.49$,partial $\eta^2 < 0.01$).

Table 12

Neuropsychological raw scores of the most important variables at baseline vs. after the training

Test variables		Individualized training group *M*	*SD*	Generalized training group *M*	*SD*	Control group *M*	*SD*
WAF-A (*n* = 57)							
Reaction time	at baseline	254.8	51.7	268.1	65.8	261.7	51.5
	after the training	239.9	46.5	238.9	33.3	246.8	38.8
WAF-G							
Reaction time	at baseline	614.6	151.4	636.8	136.4	695.9	168.6
	after the training	512.7	169.4	555.9	105.7	632.3	139.9
False alarms	at baseline	4.6	5.1	7.1	11.4	5.4	6.6
	after the training	2.8	2.8	4.0	4.6	3.5	3.9
WAF-S visual							
Reaction time	at baseline	435.4	74.1	**428.9**	87.0	**445.9**	131.5
	after the training	374.1	62.8	**432.0**	85.7	**466.4**	87.5
Misses	at baseline	0.9	1.2	0.7	1.3	2.7	5.2
	after the training	0.4	1.2	0.4	1.1	1.3	2.4
NBV							
Misses	at baseline	4.5	3.5	4.9	3.3	5.1	3.9
	after the training	1.6	1.4	1.9	1.8	2.6	3.1
INHIB							
Reaction time	at baseline	326.6	77.1	322.1	37.6	351.1	75.6
	after the training	289.5	51.1	287.6	26.0	328.4	63.9
False alarms	at baseline	**5.1**	3.4	**5.8**	3.4	4.4	3.3
	after the training	**5.3**	2.8	**6.4**	4.3	3.7	3.9
TOL-F (*n* = 56)							
Planning ability	at baseline	14.3	3.3	**15.8**	2.4	16.4	3.2
	after the training	14.6	2.2	**15.4**	2.4	16.4	3.2
TMT-A							
Reaction time	at baseline	21.4	5.6	22.4	5.9	23.0	5.4
	after the training	17.9	3.1	19.2	3.6	19.3	4.3
TMT-B							
Reaction time	at baseline	37.7	11.1	36.9	19.8	34.3	9.9
	after the training	29.9	9.9	34.2	26.7	28.5	5.7
ZST							
Number correct	at baseline	74.1	16.2	70.7	15.9	72.7	15.9
	after the training	77.3	15.1	75.6	17.3	76.6	16.3
FGT							
Learning sum	at baseline	26.3	9.9	25.8	8.2	26.0	7.4
	after the training	33.5	7.2	31.4	9.3	33.7	6.6

Note. If not stated differently *n* = 58. Reaction times in ms. All values are raw values. Lower values mean better performance for the variables: reaction time, false alarm, and misses. Higher values mean better performance for the variables: planning ability, number correct and learning sum. In **bold**: performance after the training worse than before the training.

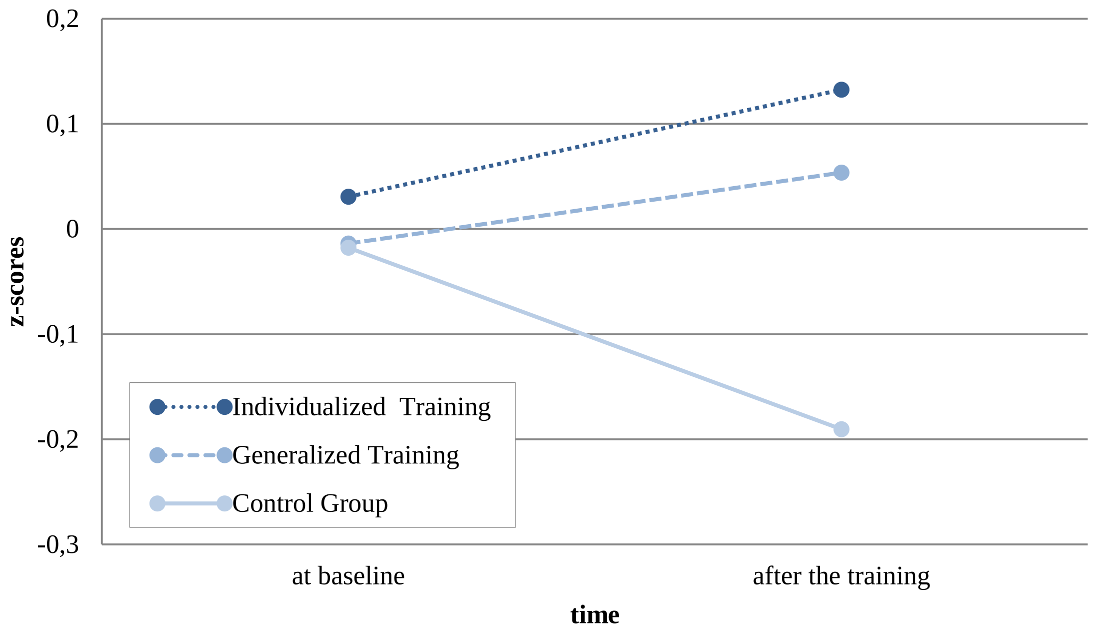

*Figure 4.*Changes in test performance in the CRT composite score depending on group allocation.

For all four cognitive domains, ANOVAs with repeated measures were conducted. First, all domains were analyzed with a between-subjects factor design comparing the training group (including both forms of training) vs. the control group. The analyses were, then, repeated with the training groups split into individualized and generalized training group and were compared to the control group.

Attention. An univariate ANOVA with repeated measures demonstrated the efficacy of the training group in comparison to the control group on the composite score "Attention" (F(1,56) = 4.94, p = 0.02). The effect size is small (η^2 = 0.081). Time alone did not reach significance (F(1,56) = 0.76, p = 0.19). The division into individualized and generalized training groups in comparison to the control group was significant (F(2,55) = 2.46, p = 0.048). The effect size is small (partial η^2 = 0.082). A Bonferroni-adjusted post-hoc analysis did not show any significant difference between the three groups, but even though significance was not reached, it revealed a tendency with the individualized training being superior to the control group (0.37, p = 0.10, 95%-CI [-0.79, 0.05]). Time alone was not significant (F(1,55) = 0.02, p =

0.45). Figure 5 shows the changes of the Attention composite score depending on group allocation. As mentioned before, only the closeness and the position of the endpoints can be interpreted. To give an example of the actual changes, Figure 6 displays the changes in the participants' reaction times in the attention task WAF-A. This task is one of the attention tasks that were used in calculating the attention composite score. Results show a decrease in reaction time across all groups at the second testing, however, the generalized training group displayed a greater decrease.

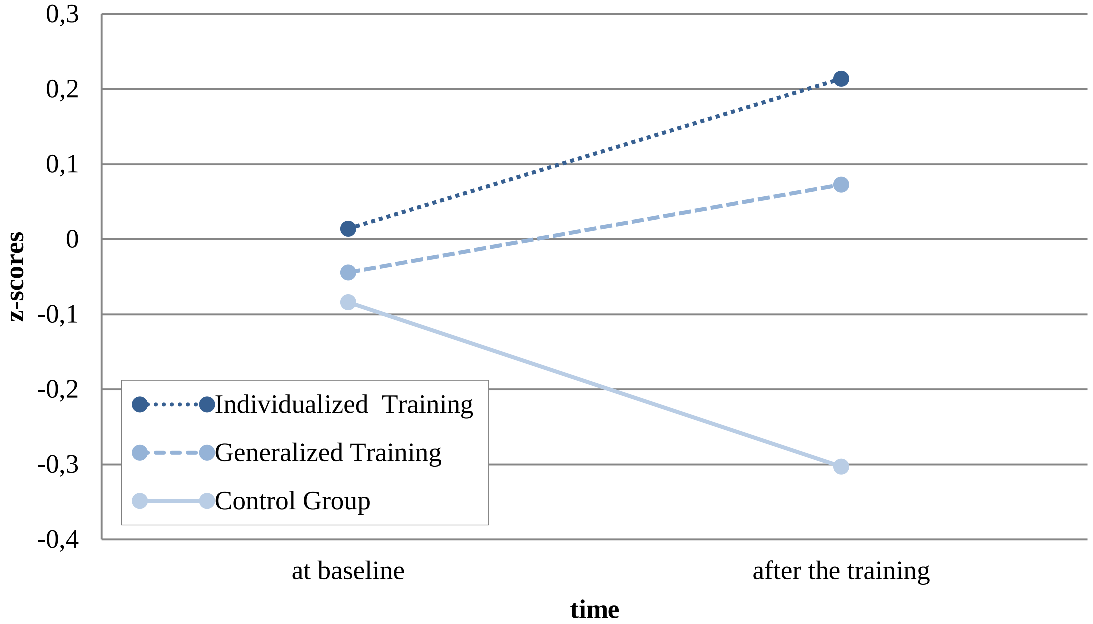

Figure 5. Changes in test performance in the attention composite score depending on group allocation.

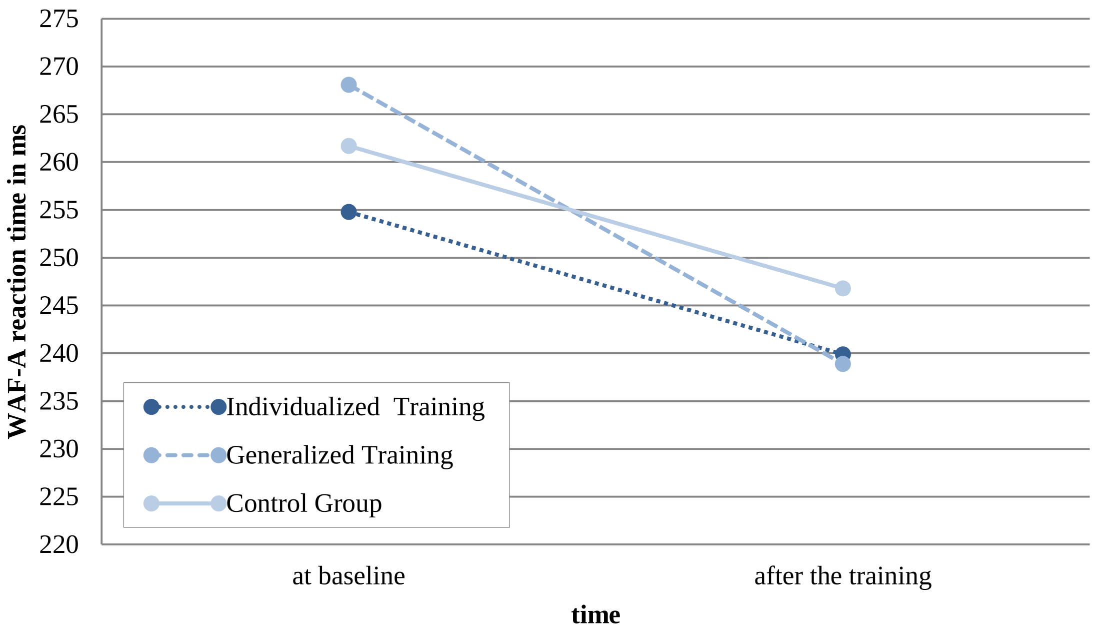

Figure 6. Changes in the reaction time in the task WAF-A depending on group allocation.

Information Processing Speed. An univariate ANOVA with repeated measures showed no significant effect between the training groups and the control group ($F(1,56) = 0.001$, $p = 0.49$,partial $\eta^2 < 0.001$). Time alone did not reach significance ($F(1,56)<0.001$, $p = 0.49$). The division into the three study groups did not show a significant effect ($F(2,55) = 0.01$, $p = 0.49$,partial $\eta^2 < 0.01$). Time alone did not reach significance ($F(1,55)<0.001$, $p = 0.49$).

Executive Functioning. An univariate repeated measures ANOVA showed no significant effect, though, it displayed a tendency with the training groups being superior to the control group ($F(1,56) = 1.82$, $p = 0.09$). The effect size is small (partial $\eta^2 = 0.031$).Time was not significant ($F(1,56) = 0.214$, $p = 0.32$). There was also no significant effect regarding the division into the three training groups ($F(2,55) = 1.587$, $p = 0.11$).The effect size is small (partial $\eta^2 = 0.055$). Time alone did not reach significance ($F(1,55) =0.001$, $p = 0.49$).

Learning and Memory. An univariate repeated measures ANOVA showed no significant effect between the training groups and the control group ($F(1,56) = 2.366$, $p = 0.15$). The effect size is small (partial $\eta^2 = 0.041$). The variable of Time did not reach significance ($F(1,56) = 0.298$, $p = 0.29$).The division into the three study groups was also not significant

($F(2,55) = 1.172$, $p = 0.16$).The effect size is small (partial $\eta^2 = 0.041$).Time did not have significant effect ($F(1,55) = 0.001$, $p = 0.49$).

Table 13 gives an overview of the analyses and the test statistics. The training appears to be effective, but only so for the CRT composite score and the attention domain. Overall, the aggregated data merely show rather weak support for hypotheses H1a and H1b, with a superiority of the individualized training over the generalized training. Looking at effect sizes, however, changes in performance become apparent. Therefore, it may be concluded that the cognitive training affects each domain differently, though a closer look at the individual subdomains and tests is needed to fully understand the underlying processes. This will be done hereinafter.

The effect of the training on the different tests only when trained

All analyses beforehand treated the groups equally, but the participants in the individualized training group only trained a recurring sample of three tasks. The analyses of the aggregated data above weakened possible results: In the individualized training group also the results of those participants were of consequence that never even trained the task. The following analyses take into account only those participants of the individualized training group who actually trained the tested ability hereafter. This procedure leads to varying sample sizes between the groups. For details confer to Table 14 (p.68). Diagrams of composite scores cannot easily be interpreted; henceforth, additional illustrations of critical variables will be presented following each section to visualize the documented effects.

Table 13

Test statistics for the composite score and the domain scores

Variable	Source	*F*-value	*p*-value	Effect size partial η^2
CRT composite score	Time	$F(1,56) = 0.62$	0.22	0.011
	Time x (TG vs. CG)	$F(1,56) = 5.39$	0.01*	0.088
	Time	$F(1,56) = 0.76$	0.49	<0.001
	Time x (IT vs. GT vs. CG)	$F(2,51) = 2.91$	0.04*	0.089
Attention domain score	Time	$F(1,56) = 0.76$	0.19	0.013
	Time x (TG vs. CG)	$F(1,56) = 4.94$	0.02*	0.081
	Time	$F(1,55) = 0.02$	0.45	<0.001
	Time x (IT vs. GT vs. CG)	$F(2,55) = 2.46$	0.05*	0.082
Processing speed domain score	Time	$F(1,56) < 0.01$	0.49	<0.001
	Time x (TG vs. CG)	$F(1,56) = 0.01$	0.49	<0.001
	Time	$F(1,55) < 0.01$	0.49	<0.001
	Time x (IT vs. GT vs. CG)	$F(2,55) = 0.01$	0.49	< 0.001
Executive functioning domain score	Time	$F(1,56) = 0.21$	0.32	0.004
	Time x (TG vs. CG)	$F(1,56) = 1.82$	0.09^+	0.031
	Time	$F(1,55) < 0.01$	0.49	<0.001
	Time x (IT vs. GT vs. CG)	$F(2,55) = 1.59$	0.11	0.055
Learning and Memory domain score	Time	$F(1,56) = 0.29$	0.29	0.005
	Time x (TG vs. CG)	$F(1,56) = 2.37$	0.15	0.041
	Time	$F(1,51) < 0.01$	0.49	<0.001
	Time x (IT vs. GT vs. CG)	$F(2,55) = 1.17$	0.16	0.041

Note. TG = Training groups, CG = Control group, IT = Individualized Training, GT = Generalized Training; * significant at a level of $p = 0.05$ (one-tail); $^+$tendency towards significance $p<0.1$

WAF-A. *n* = 9 participants in the individualized training group trained their *alertness*. An univariate ANOVA with repeated measures demonstrated the efficacy of cognitive training ($F(1,44) = 8.91, p = 0.003$). Its effect is of medium strength (partial $\eta^2 = 0.192$). Time did not reach significance ($F(1,44) = 0.01, p = 0.45$). The division into individualized and generalized training in comparison to control group reached significance ($F(2,43) = 5.11$, $p = 0.005$). The effect size is medium partial ($\eta^2 = 0.192$).A Bonferroni-adjusted post-hoc analysis did not reveal a significant difference between the groups. Time was not significant ($F(1,43) = 2.03, p = 0.81$). Figure 7 shows the changes of the ranking sequence of the WAF-A composite score depending on group allocation. To give an example of the actual changes, Figure 8 displays the changes in the participants' reaction times in the attention task WAF-A.

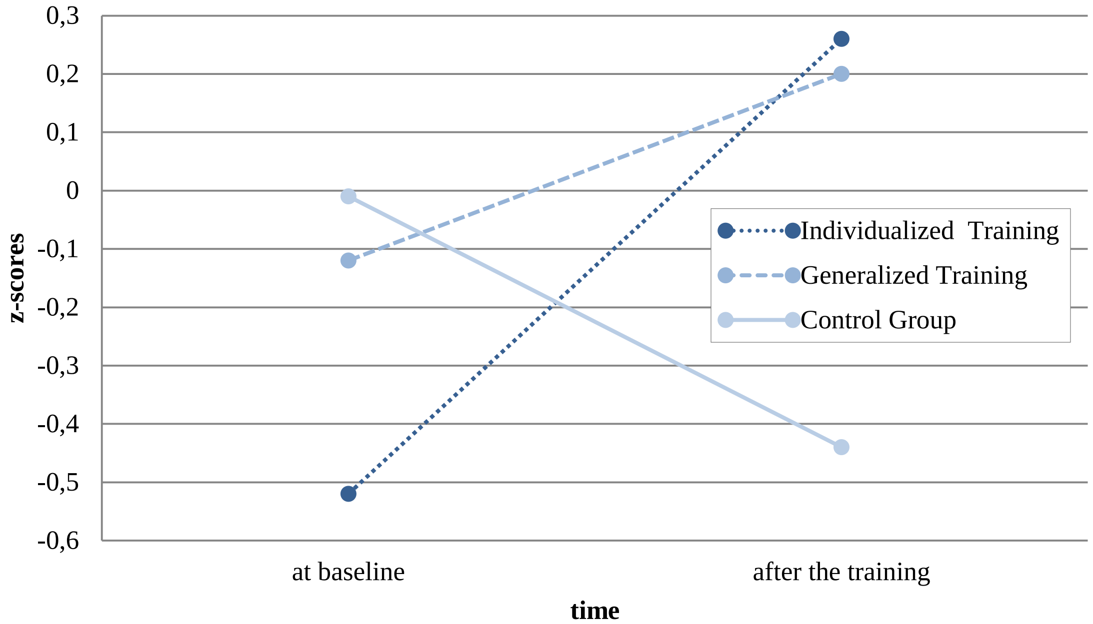

Figure 7. Change in ranking sequence of WAF-A composite score at baseline to after the training.

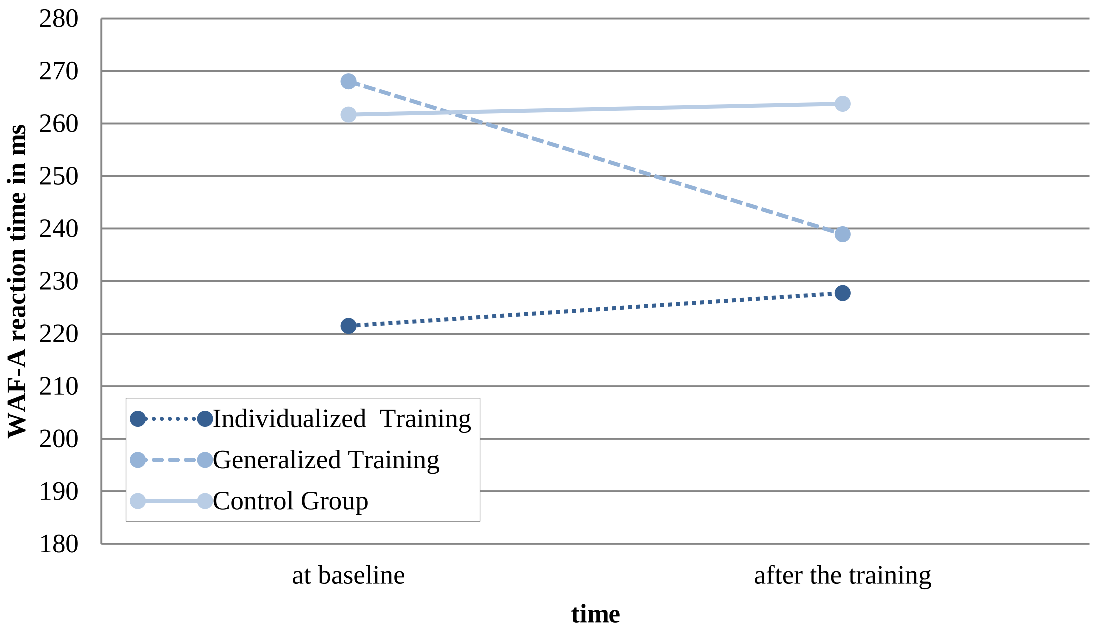

Figure 8. Change of WAF-A reaction time (in ms) at baseline to after the training.

WAF-G. *n* = 12 participants in the individualized training group trained their ability of dividing attention. An univariate ANOVA with repeated measures showed no significant difference between the two training groups and the control group ($F(1,48) = 0.81$, $p = 0.19$). The effect size is small (partial $\eta^2 = 0.017$). Time did not reach significance ($F(1,48) = 0.01$, $p < 0.001$). The division into the three study groups did also not show an effect ($F(2,47) = 0.69$, $p = 0.25$). The effect size is small (partial $\eta^2 = 0.028$). Time did not reach significance ($F(1,47) = 0.07$,$p = 0.39$).

WAF-S. *n* = 17 participants in the individualized training group trained selective attention. An univariate repeated measures ANOVA did not reveal any difference between the training groups and the control group ($F(1,53) = 1.65$,$p = 0.10$). The effect size is small (partial $\eta^2 = 0.030$). Time was not significant ($F(1,53) = 0.26$,$p = 0.01$).The comparison reached significance when the training group was split into individualized vs. generalized training before comparing it to the performance of the control group ($F(2,52) = 3.69$, $p = 0.02$). The effect size is of medium strength (partial $\eta^2 = 0.124$). A Bonferroni-adjusted post-hoc analysis revealed a tendency of the individualized training displaying superior performance to the control group (0.48, p = 0.087, 95%-CI[-0.05, 1.01]). Time was not significant (F(1,52) < 0.01, p = 0.49). Figure 9 shows the changes of the ranking sequence of the WAF-S composite score depending on group allocation. Figure 10 and Figure 11 display the changes in the participants’ reaction times and the number of false alarms respectively in the selective attention task WAF-S.

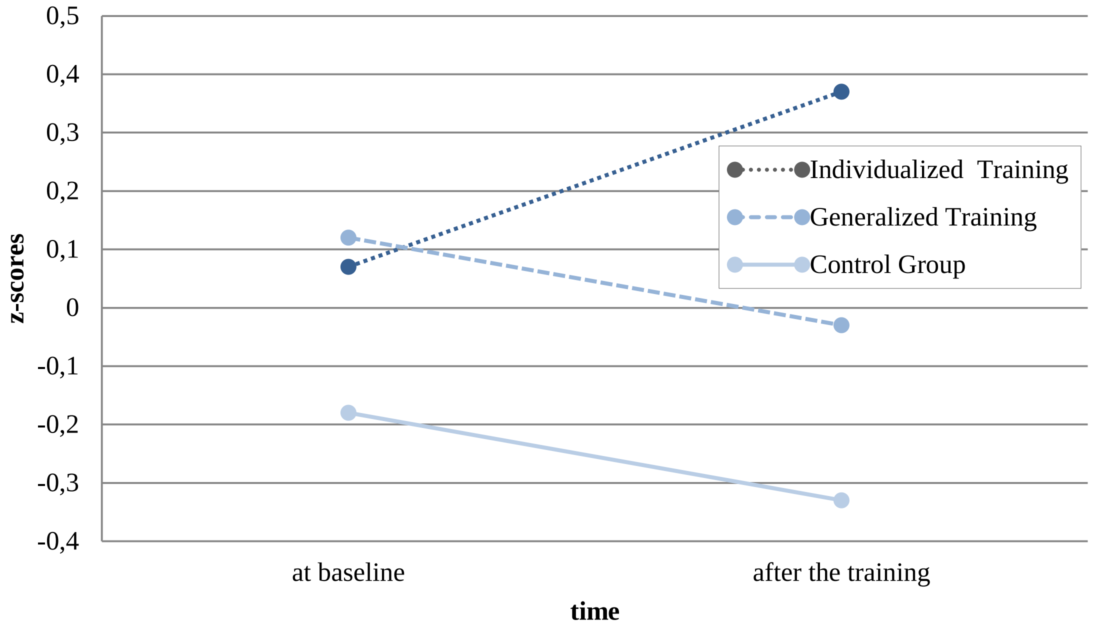

Figure 9. Change in ranking sequence of WAF-S composite score at baseline to after the training.

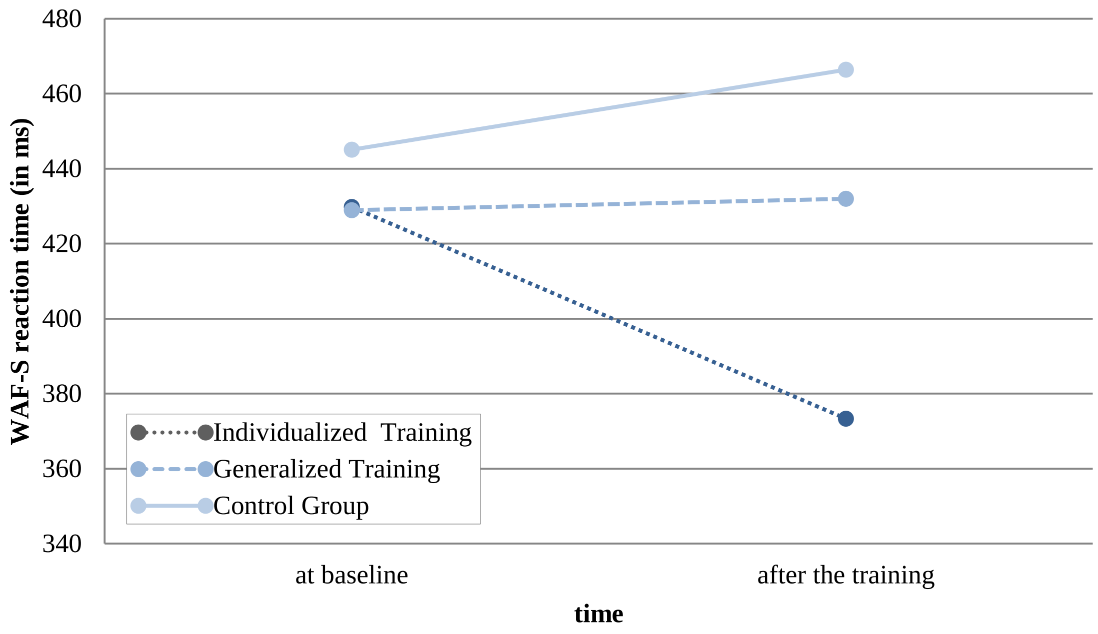

Figure 10. Change of visual WAF-S reaction time (in ms) at baseline to after the training.

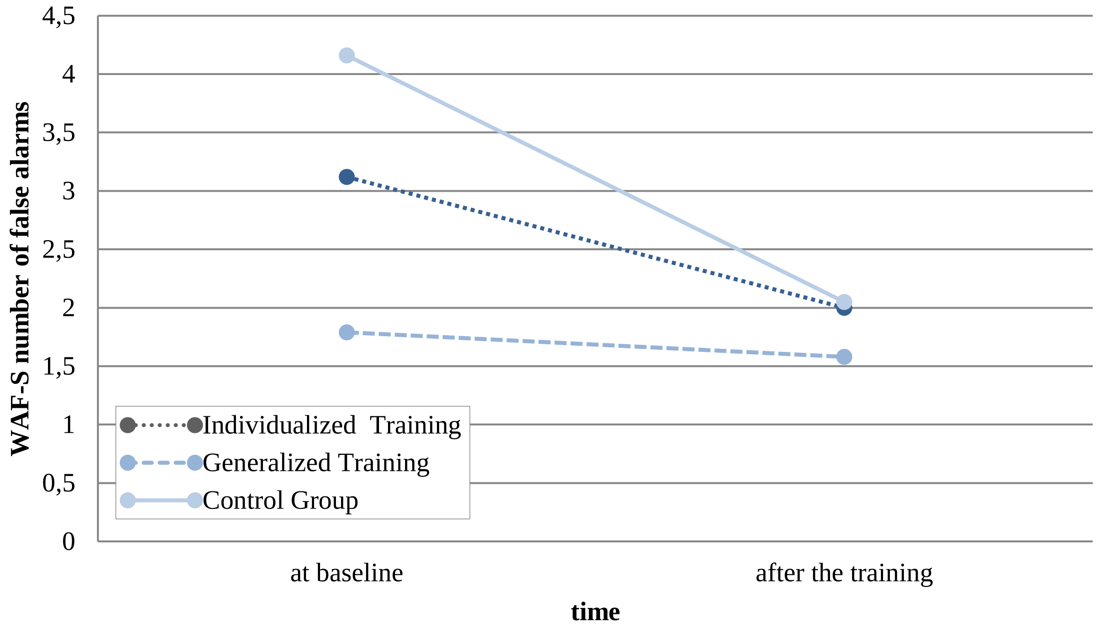

Figure 11. Change of the number of false alarms in the visual task WAF-S at baseline to after the training.

NBV. n = 6 participants in the individualized training group trained their working memory. An univariate ANOVA with repeated measures demonstrated the superiority of the training group with a small effect size $F(1,42) = 2.62$, $p = 0.057$, partial $\eta^2 = 0.059$). Time was not significant ($F(1,42) = 0.13$, $p = 0.36$). The division into individualized and generalized training in comparison to the control group reached significance with a medium effect size ($F(2,41) = 3.37$, $p = 0.02$, partial $\eta^2 = 0.141$). A Bonferroni-adjusted post-hoc analysis did not reveal any difference. The variable time was significant with a small effect size ($F(1,41) = 3.05$, $p = 0.04$, partial $\eta^2 = 0.069$). Figure 12 shows the changes of the ranking sequence of the NBV composite score depending on group allocation. Figure 13 displays the changes in the participants' number of misses in the working memory task NBV.

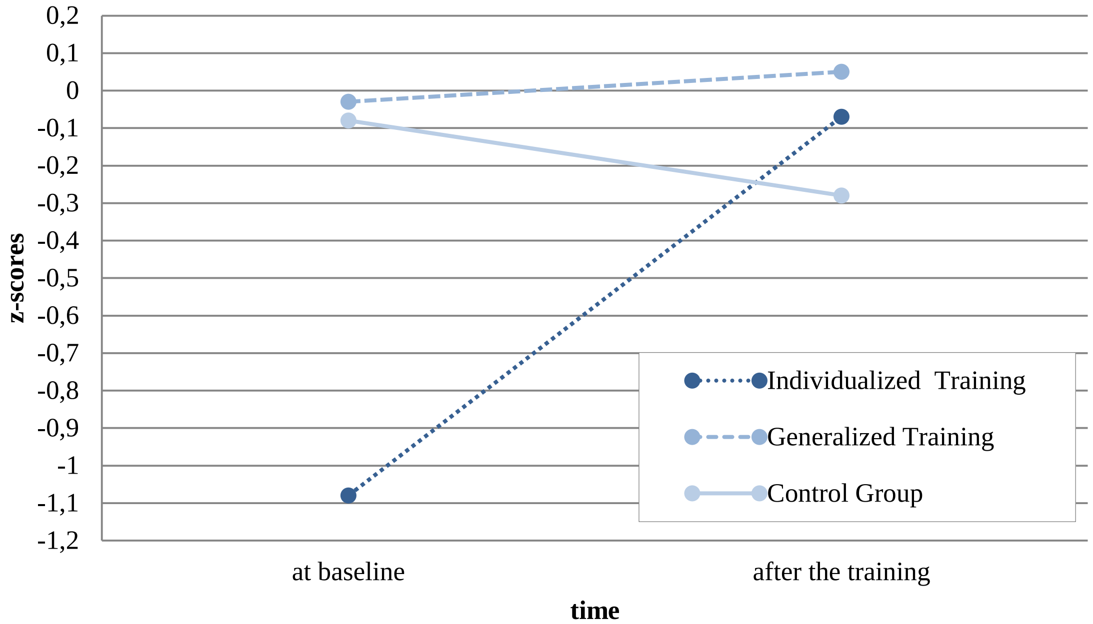

Figure 12. Change in ranking sequence of NBV composite score at baseline to after the training.

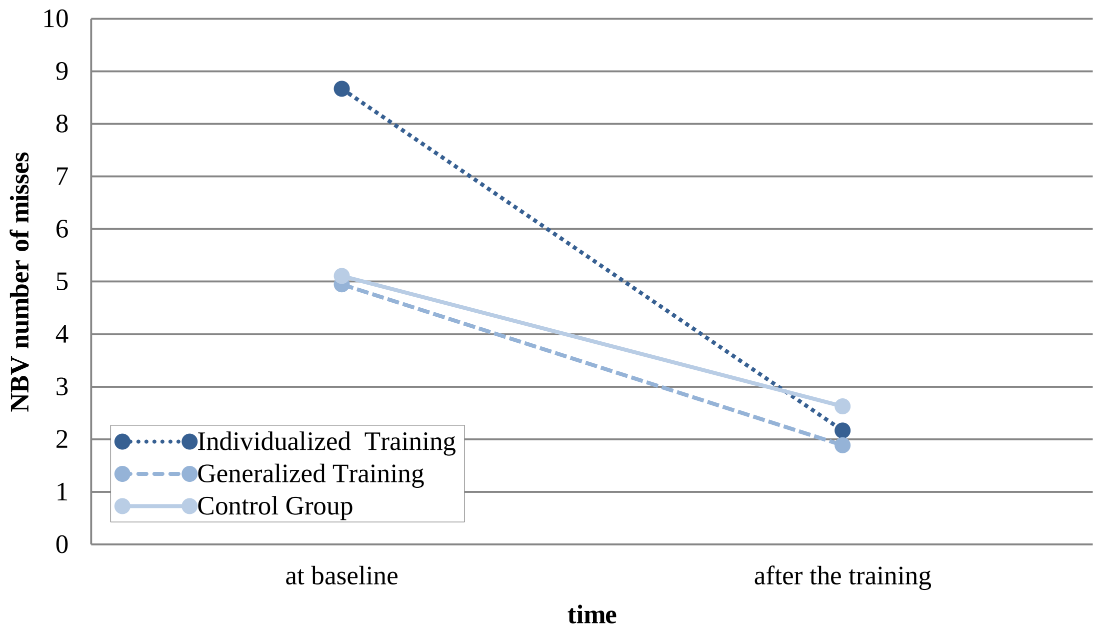

Figure 13. Change of the number of misses in the task NBV at baseline to after the training.

INHIB. *n* = 11 participants in the individualized training group trained response inhibition. An univariate ANOVA with repeated measures showed no significant difference between the training groups and the control group ($F(1,47) = 0.59$, $p = 0.22$, partial $\eta^2 = 0.013$). Time was not significant ($F(1,47) = 0.03$,$p = 0.43$). The division into the three study groups did not show a significant difference ($F(2,46) = 0.99$, $p = 0.19$). The effect size is small (partial η^2 = 0.041). Time did not reach significance ($F(1,46) = 0.49$, $p = 0.24$).

TOL. *n* = 3 participants in the individualized training group trained their planning ability. In the generalized training group and the control group the task TOL was aborted by the computer program in two cases. Hence, the data of the individualized training group will be compared to *n* = 18 participants in the generalized training group and *n* =17 in the control group. An univariate repeated measured ANOVA did not reveal any difference between the training groups and the control group ($F(1,36) = 0.04$,$p = 0.42$, partial $\eta^2 = 0.001$). Time did not reach significance ($F(1,36) = 0.26$, $p = 0.31$). The division into the three groups, however, showed a significant difference ($F(2,35) = 2.35$, $p = 0.04$). The effect size is of medium strength (partial $\eta^2 = 0.137$). Time was also significant ($F(1,35) = 4.04$, $p = 0.03$). The effect size is small (partial $\eta^2 = 0.104$). Figure 14 shows the changes in the ranking sequence of the ToL composite score depending on group allocation. Figure 15 displays the changes in the participants' planning ability in the task ToL.

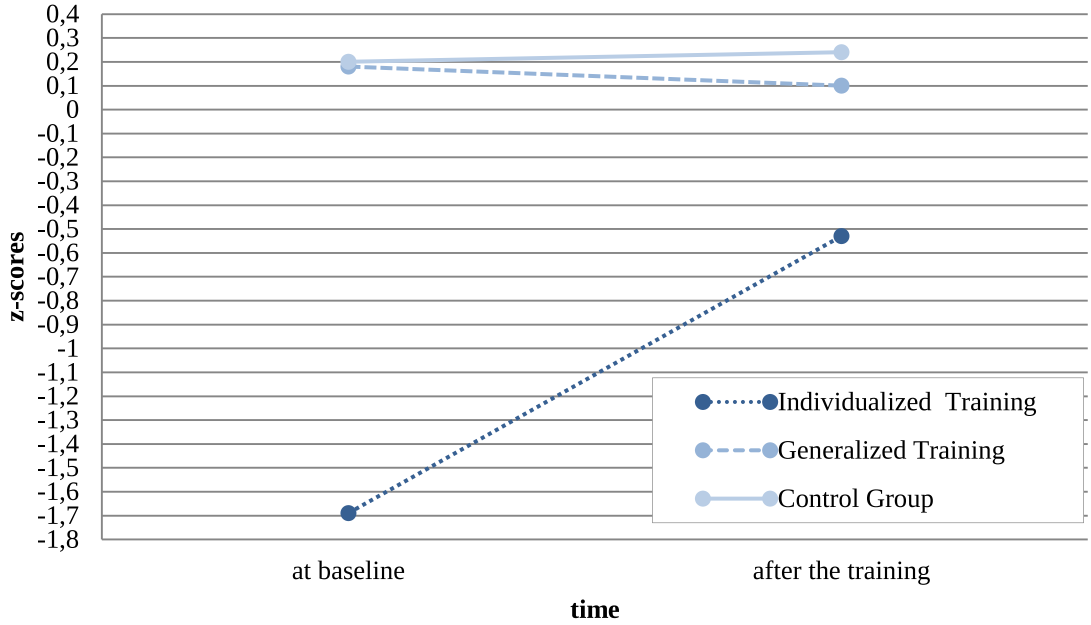

Figure 14. Change in ranking sequence of ToL composite score at baseline to after the training.

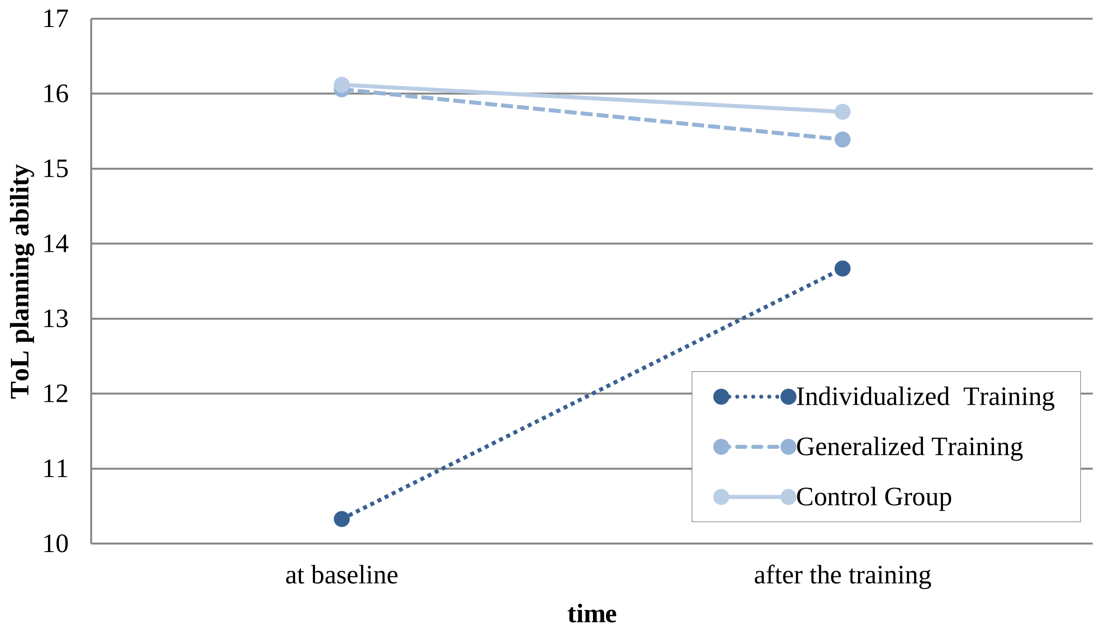

Figure 15. Change in the planning ability (sum of correct solutions) in the task ToL at baseline to after the training.

Table 14 contains an overview of all test statistics. Summing up, it can be concluded that the results are more promising when only those participants are considered who trained specific tasks then when all participants were taken into account regardless of the trained tasks. *Alertness* (WAF-A), *selective attention* (WAF-S), *working memory* (NBV), and p*lanning ability* (TOL) revealed significant effects with medium effect sizes.

Table 14

Overview of all test statistics only with those participants of the IT group, which trained the task.

Variable	Source	*F*-value	*p*-value	Effect size partial η^2
WAF-A test score (IT: *n* = 9, GT: *n* = 19, CG: *n* = 18)	Time	$F(1,44) = 0.01$	0.45	<0.001
	Time x (TG vs. CG)	$F(1,44) = 8.91$	<0.01**	0.168
	Time	$F(1,43) = 2.03$	0.81	0.045
	Time x (IT vs. GT vs. CG)	$F(2,43) = 5.11$	0.01**	0.192
WAF-G test score (IT: *n* = 12, GT: *n* = 19, CG: *n* = 19)	Time	$F(1,48) = 0.01$	0.46	<0.001
	Time x (TG vs. CG)	$F(1,48) = 0.81$	0.19	0.017
	Time	$F(1,47) = 0.07$	0.39	0.001
	Time x (IT vs. GT vs. CG)	$F(2,47) = 0.69$	0.25	0.028
WAF-S test score (IT: *n* = 17, GT: *n* = 19, CG: *n* = 19)	Time	$F(1,53) = 0.26$	0.31	0.005
	Time x (TG vs. CG)	$F(1,53) = 1.65$	0.10	0.030
	Time	$F(1,52) < 0.01$	0.49	<0.001
	Time x (IT vs. GT vs. CG)	$F(2,52) = 3.69$	0.02*	0.124
NBV test score (IT: *n* = 6, GT: *n* = 19, CG: *n* = 19)	Time	$F(1,42) = 0.13$	0.36	0.003
	Time x (TG vs. CG)	$F(1,42) = 2.62$	0.57	0.059
	Time	$F(1,41) = 3.05$	0.04*	0.069
	Time x (IT vs. GT vs. CG)	$F(2,41) = 3.37$	0.02*	0.141
INHIB test score (IT: *n* = 11, GT: *n* = 19, CG: *n* = 19)	Time	$F(1,47) = 0.03$	0.43	0.001
	Time x (TG vs. CG)	$F(1,47) = 0.59$	0.22	0.013
	Time	$F(1,46) = 0.49$	0.24	0.011
	Time x (IT vs. GT vs. CG)	$F(2,46) = 0.99$	0.19	0.041
TOL test score (IT: *n* = 3, GT: *n* = 18, CG: *n* = 17)	Time	$F(1,36) = 0.26$	0.31	0.007
	Time x (TG vs. CG)	$F(1,36) = 0.04$	0.42	0.001
	Time	$F(1,35) = 4.04$	0.03*	0.104
	Time x (IT vs. GT vs. CG)	$F(2,35) = 2.78$	0.04*	0.137

Note. TG = Training groups, CG = Control group, IT = Individualized Training, GT = Generalized Training. * Significant at the level of 0.05 (one tail) ** Significant at the level of 0.01 (one tail)

Group comparison of changes in test scores

In this following step, effect sizes were calculated to compare the groups regarding their changes in test scores. The numerical signs were selected in a way that a positive sign symbolizes greater improvement on the side of the individualized training group and a negative sign stands for greater improvement in the generalized training group. For instance, d_{corr} (IT,CG) = 1,24 would display a superior increase in performance in the individualized training group in comparison to the control group. It is independently of whether the improvement means an increase (e.g., planning ability) or a decrease (e.g. reaction time or missings) of raw or z-scores.

The groups are ranked according to their expected improvement according to the hypotheses; thus d_{corr} (IT,CG), d_{corr} (GT,CG) and d_{corr} (IT,GT). The effect size calculation sensu Klauer (Klauer, 2001) was chosen for these analyses. The effect size interpretation follows Cohen's (1988) recommendation: small $d_{corr} \geq 0.2$, medium $d_{corr} \geq 0.5$ and large $d_{corr} \geq 0.8$.

Figure 16 presents the comparison of the cognitive training groups to the control group. Figure 17 shows the direct comparison between the two training groups. For each domain, only those participants were included into the prevailing analysis if they had trained that task/domain. (cf. Table 14 for sample sizes).

In the WAF-A task (*alertness*), there were large effects for the individualized and generalized training groups being superior to the control group (IT > CG, GT > CG). In the WAF-G task (*divided attention*), there was no meaningful difference between the individualized training group and the control group (IT = CG), but a small effect for the generalized training group showing superior performance to the control group (GT > CG). In the WAF-S task (*selective attention*), there was no meaningful difference between the generalized training group and the control group (GT = CG), but a medium effect for the individualized training group showing a better performance than the control group (IT > CG).

In the NBV task (*working memory*), there was a small effect for the generalized training group in comparison to the control group (GT > CG), and a large effect for the individualized training group compared to the control group (IT > CG). In the INHIB task (*response inhibition*), no significant differences were found comparing the generalized training group with the control group (GT= CG), but analyses revealed a medium effect for the individualized training group compared to the control group (IT > CG). For the ToL-F task (*planning*), a small effect was found for the generalized training group being superior to the control group in performance (GT > CG) and a large effect for the individualized training group compared to the control group (IT > CG). However, this has to be interpreted cautiously as there were no impaired participants in either the generalized training group or in the control group. The task figural memory was not included in the training and was, hence, not trained by anyone. The FGT test in the testing battery merely served as an indicator for probable generalization effects. For this task, no significant difference was found regarding the individualized training group in comparison to the control group. The comparison of generalized training and control group revealed small, but significant effect in performance in favor of the control group. In other words, the control group appeared to be slightly better on the FGT task than participants in the generalized training group (IT = CG, GT < CG). For test statistics confer to Figure 16 and Table 15.

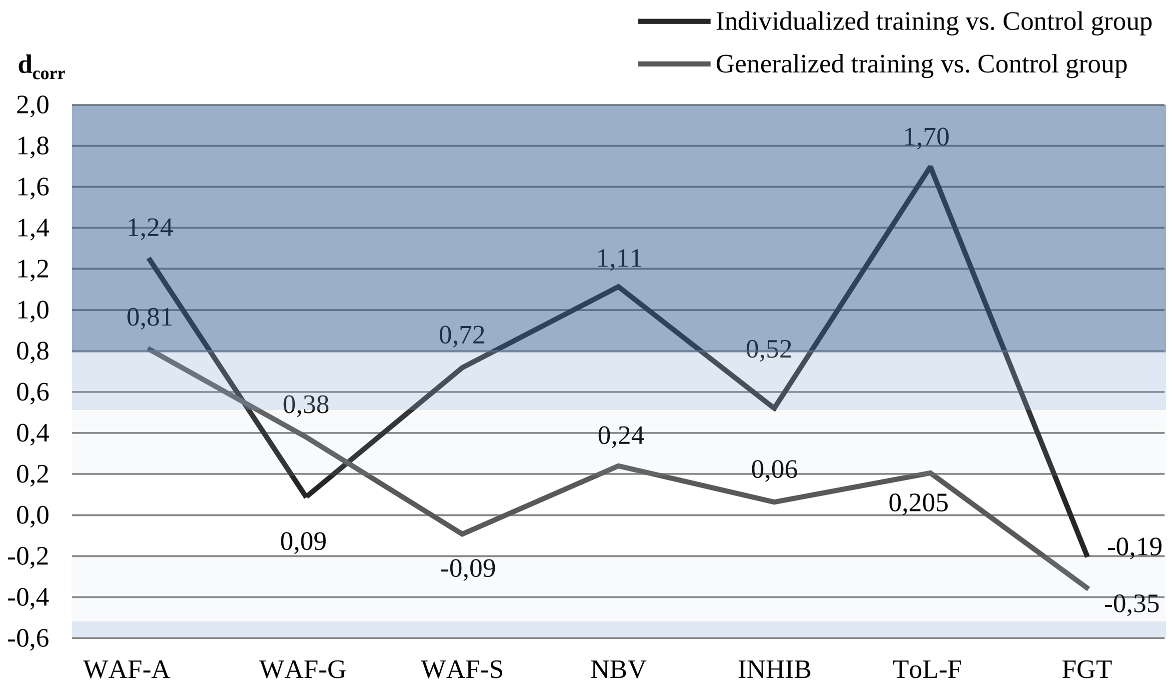

Figure 16. Effect sizes d_{corr} (Klauer, 2001) for the comparison of the training groups with the control group regarding the changes in the test scores between the first and the second time of measurement. In the individualized training group only those participants were included that actually trained the task. As no group trained memory performance, the FGT test score was included in this figure as a measure for the generalization effect. Positive values signify that the change in the training group is better, negative values signify superiority of the control group. The light blue area marks small effect sizes, the medium blue medium effect sizes and the dark blue area marks large effect sizes.

To investigate the question whether one form of training is more effective than the other one, effect sizes for the comparison of the individualized and the generalized training were calculated. Positive values represent the superiority of the individualized training whereas negative values would demonstrate the superiority of a generalized form of training. Figure 17 displays only one negative value (among the trained tasks) for the task WAF-G so that it can be concluded that the generalized training group showed superior performance in the subdomain of *divided attention* (GT> IT). The other tasks demonstrated the superiority of the individualized training program over the generalized training program. The effect sizes ranged from 0.42 (small) to 2.02 (large). For detailed test statistics confer to Figure 17 and

Table 15. There was a borderline small effect (d_{corr} (IT,GT) = 0,20) for the FGT task (figural memory) that was not trained by either training groups (IT > GT).

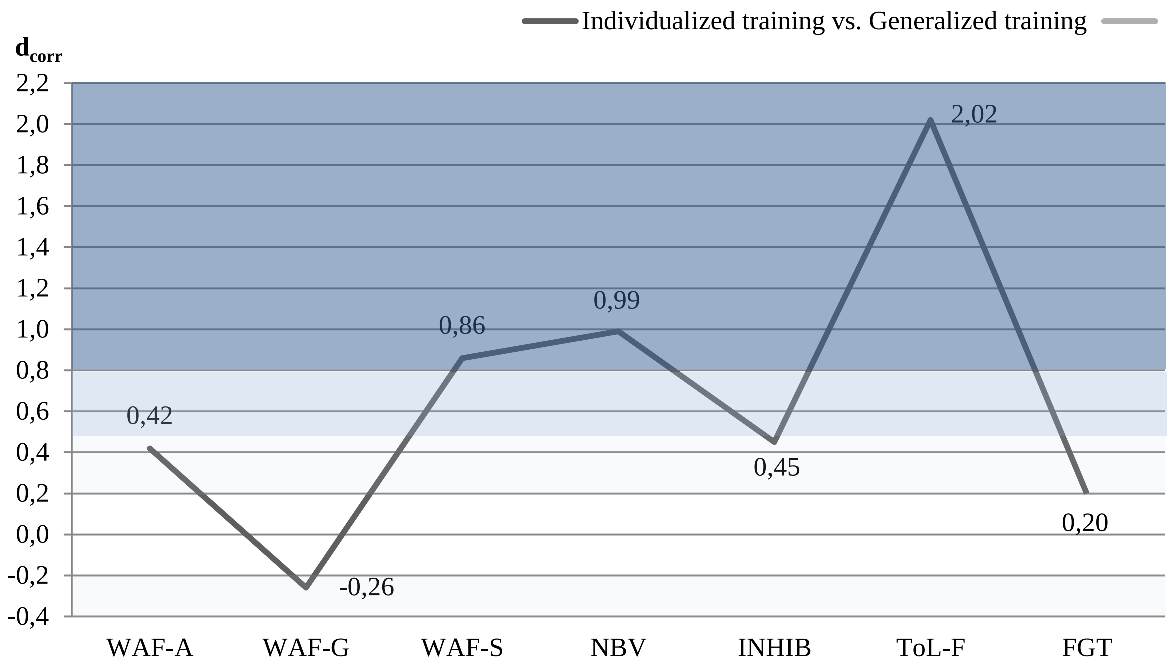

Figure 17. Effect sizes d_{corr} (Klauer, 2001) for the comparison of the individualized training group with the generalized training group regarding the changes in the test scores between the first and the second time of measurement. In the individualized training group only those participants were included that actually trained the task. As no group trained memory performance, the FGT test score was included in this figure as a measure of generalization effect. Positive values signify that the change in the individualized training group is better, negative values signify superiority of the generalized training group. The light gray area marks small effect sizes, the medium gray medium effect sizes and the dark gray area marks large effect sizes.

For clinical purposes, it may be of interest to look at the number of participants that have benefitted from the training to the extent of not being considered to be clinically impaired (PR≤16) any longer. Table 16 gives a conservative overview in this regard. The table displays those participants who showed at least one cognitively impaired domain (PR≤16) at baseline testing but who did not show any impairment at the second testing. Especially *selective attention* seemed to improve with an individualized, more repetitive form of training. Both forms of training improved performance in the subdomains of *alertness*, *working memory*, and of *response inhibition* considerably – in comparison to the control group. There were less people in the training groups, compared to the control group that benefitted from training divided attention. A total of 56.5% of the individualized group and 49.2% of the generalized group were free of impairment after the conclusion of cognitive training in the individualized training group. This stands in contrast to 38.1% participants of the control group being without any cognitive deficits.

Table 15

Comparison of effect sizes of the performance changes and interpretation with regard to the hypotheses.

		H1a		H1b
		IT > CG	GT > CG	IT≠GT
Test	**Direct comparison**	d_{corr} (IT,CG)	d_{corr} (GT,CG)	d_{corr} (IT,GT)
WAF-A	IT >GT > CG	1.24	0.81	0.42
WAF-G	GT > IT = CG	0.09	0.38	-0.26
WAF-S	IT > CG =GT	0.72	-0.09	0.86
NBV	IT >GT > CG	1.11	0.24	0.99
INHIB	IT > GT = CG	0.52	0.06	0.45
ToL-F	IT >GT > CG	1.70	0.21	2.02
FGT	CG = IT <GT	-0.19	-0.35	0.20

Note. Hypothesis H1a states that both training groups show a greater improvement than the control group. The calculations were carried out in an order that a positive sign shows support for the tested hypothesis. Hypothesis H1b evaluates the difference between the individualized training group and the generalized training group. A positive sign shows superiortiy of the individualized training, a negative sign shows superiority of the generalized training.

Table 16

Remediated subdomain (numbers of participants with at least one impairment (PR≤16) per test before training, but no impairment at post testing)

	Individualized Training		Generalized Training		Control Group	
Subdomain	%	No.	%	No.	%	No.
Alertness	**72.7**	8 of 11	**60.0**	6 of 10	**50.0**	5 of 10
Divided Attention	**38.5**	5 of 13	**43.8**	7 of 16	**50.0**	7 of 14
Selective Attention	**47.4**	9 of 19	**23.5**	4 of 17	**17.7**	3 of 17
Working Memory	**83.3**	5 of 6	**80.0**	8 of 10	**62.5**	5 of 8
Response Inhibition	**60.0**	6 of 10	**58.3**	7 of 12	**28.6**	4 of 14
Planning	**66.7**	2 of 3	**-**	0 of 0	**-**	0 of 0
Total	**56.5**	35 of 62	**49.2**	32 of 65	**38.1**	24 of 63

Exploring the effect of cognitive training further, the number of improved subdomains was set in relation to group allocation. 75% of the participants in the individualized training group benefitted from training showing at least one remediated subdomain (Table 17). The majority (*n* =9) showed two remediated subdomains. In the generalized training group, 90% benefitted from training with the majority (*n* =11) also showing two remediated subdomains. One participant, however, revealed an additional impaired subdomain upon the conclusion of training. In the control group, 74% participants showed at least one remediated subdomains at the second testing. In contrast to both training groups, the majority had only one, not two, remediated subdomains. Further, two participants of the control group showed additional impairment (i.e., one more impaired cognitive subdomain) at the second testing. In sum, the centroid for the training groups lies with two remitted subdomains whereas the centroid for the control group lies with one remitted subdomains.

Table 17

Number of subdomains with impairment per participant at baseline (PRE) and after the training (POST) depending on group allocation and number of subdomains remediated after the training

	Individualized Training			Generalized Training			Control Group		
Number of subdomains	Subdomains impaired - PRE	Subdomains impaired - POST	Subdomains remediated	Subdomains impaired - PRE	Subdomains impaired - POST	Subdomains remediated	Subdomains impaired - PRE	Subdomains impaired - POST	Subdomains remediated
0	-	3	5 (25%)*	-	1	1 (5%)*	-	2	3 (16%)*
1	-	8	4 (20%)	-	6	6 (32%)	-	1	10 (53%)
2	4	4	9 (45%)	5	5	11 (58%)	4	8	3 (16%)
3	11	3	2 (10%)	6	5		8	4	1 (5%)
4	4	1		3	2		4	2	
5	1	1		5	-		3	2	

Note. One participant in the GT group and one participant in the CG showed one more impaired subdomain after the training. One participant in the CG had two more impaired subdomains after the training. * Participants that showed no improvement. In GT one participant had even one subdomain more impaired, in the CG one participant had one subdomain and another participant two more impaired subdomains at the second testing.

Although post-hoc tests were not significant, effect sizes indicate differences between both forms of training and the control group. In sum, analyses revealed the general benefits of cognitive training as well as the superior effects of an individualized form of training over a generalized form.

3.3 Psychosocial functioning

H2. Participation in a training group will lead to a small improvement in psychosocial functioning (psychosocial functioning composite score) compared to the control group.

Questionnaires assessing psychosocial functioning were filled out by the participants themselves and a reference person of the participants' choice. Table 18 gives a descriptive overview of questionnaires' scales and scores before and after training.

Table 18

Raw scores of psychosocial functioning questionnaires and their subscales at baseline vs. after the training.

			Training groups			Control group	
Test variables			*n*	*M*	*SD*	*n*	*M*	*SD*
Mini-ICF self								
	Functioning	at baseline	37	14.7	5.7	19	14.8	4.1
		after the training	34	11.6	6.8	18	12.7	6.8
	Communication	at baseline	37	7.4	4.5	19	9.0	4.9
		after the training	35	6.9	4.3	18	8.0	4.7
	Mobility	at baseline	37	2.9	2.8	19	3.6	3.9
		after the training	34	2.6	2.9	17	3.5	3.6
	relationships	at baseline	37	8.1	4.3	18	8.6	4.6
		after the training	32	6.9	5.2	17	9.4*	4.9
	Leisure time	at baseline	38	7.8	4.3	19	9.9	3.7
		after the training	34	6.9	4.9	17	7.8	4.7
	Interaction	at baseline	38	7.7	3.3	19	7.8	4.1
		after the training	35	6.5	3.4	18	6.9	4.0
	Sum score	at baseline	34	47.2	19.3	18	53.9	18.7
		after the training	31	41.2	23.7	16	49.1	21.9
Mini-ICF external								
	Sum score	at baseline	32	13.5	9.0	13	11.9	10.2
		after the training	31	12.5	9.2	13	14.8*	10.4
SLOF external								
	Interpersonal	at baseline	32	24.7	5.9	13	24.3	6.9
	relationships	after the training	32	25.4	6.2	13	23.5*	5.9
	Activities	at baseline	32	52.4	3.3	12	52.0	4.4
		after the training	33	53.1	3.0	12	53.6	2.5
	Working ability	at baseline	28	25.3	3.7	11	26.4	3.8
		after the training	31	25.4	3.3	12	24.8*	4.4
	Sum score	at baseline	28	103.0	10.6	10	105.2	11.6
		after the training	30	103.8	10.1	11	103.8*	8.3

Note. Mini-ICF: lower scores represent a better psychosocial functioning level; SLOF: higher scores represent a better psychosocial functioning level. Maximum possible sum scores: Mini-ICF self = 124, Mini-ICF external = 52, SLOF external = 120. * Cases in which the psychosocial functioning assessment showed lower performance after the training

Overall, the participants' psychosocial functioning level did not appear to be greatly impaired at baseline testing. To facilitate the interpretation, extreme scores are presented: The best result in the psychosocial performance in the Mini-ICF questionnaires constitutes a score of zero (Mini-ICF self: range 0 - 124; Mini-ICF external: range 0 - 52), the best psychosocial performance in the SLOF would be depicted by a sum score of 120 (range: 0 - 120). As the effects were expected to be relatively small, the individualized training group and the generalized training group were clustered together as a between subject factor “Training groups” in order to draw comparisons to the control group.The descriptive analyses show that all psychosocial functioning scales and scores had improved upon the completion of cognitive training whereas the control showed an even further decline on four scales at the second testing: Mini-ICF self-relationships, Mini-ICF external sum score, SLOF interpersonal relationships as well as the SLOF sum score.

All psychosocial functioning scores correlated significantly with each other at baseline and the second testing (cf. Table 19). The negative correlations of the Mini-ICF and the SLOF represent a better level of psychosocial functioning measured by the MINI-ICF whereas the reverse applies to the SLOF.

Table 19

Correlations of the psychosocial functioning questionnaires at the both times of measurement.

Measure	1	2	3	4	5
1. Mini-ICF self at baseline	-				
2. Mini-ICF external at baseline	.420**	-			
3. SLOF external at baseline	-.408*	-.684**	-		
4. Mini-ICF self after the training	.898**	.369*	-.521**	-	
5. Mini-ICF external after the training	.456**	.716**	-.801**	.554**	-
6.SLOF external after the training	-.501*	-.564**	.831**	-.682**	-.828**

* The correlation is significant at a level of 0.05 (two tail), ** The correlation is significant at a level of 0.01 (two tail).

A univariate repeated measures ANOVA was conducted to test the hypothesis that training participation leads to improved psychosocial functioning. There was a highly significant effect of Time for the Mini-ICF self. There was no significant interaction effect for the external questionnaire SLOF with the dependent variable Training groups vs. Control group, but a significant effect was found for the Mini-ICF self questionnaire and a tendency towards significance was shown for the external questionnaire Mini-ICF (cf. Table 20). The effect sizes for both Mini-ICF questionnaires are of weak strength (following the interpretation recommendation by Cohen, 1988). The effect for the Mini-ICF self remains significant even when controlling for improvements in the BDI depression score ($F(1,40) = 3.00$, $p=0.5$)

Table 20

Overview of all test statistics (raw scores) for the psychosocial questionnaires

Variable	Source	*F*-value	*p*-value	Effect size partial η^2
Mini-ICF self (TG: *n* = 28, CG: *n* = 16)	Time	$F(1,42) = 11.405$	0.002**	0.214
	Time x (TG vs. CG)	$F(1,42) = 3.591$	0.03*	0.079
Mini-ICF external (TG: *n* = 28, CG: *n* = 11)	Time	$F(1,37) = 0.002$	0.97	<0.001
	Time x (TG vs. CG)	$F(1,37) = 2.391$	0.07^{+}	0.061
SLOF external (TG: *n* = 24, CG: *n* = 8)	Time	$F(1,30) = 0.014$	0.91	<0.001
	Time x (TG vs. CG)	$F(1,30) = 0.982$	0.17	0.032

Note. TG = Training groups, CG = Control group. ** Significant at a level of 0.01 (two tail). * Significant at a level of 0.05 (one tail). $^{+}$ Tendency towards significance <0.1 (one tail).

Hypothesis 2 that the training has a positive influence on psychosocial functioning can therefore be accepted, shown by the significantly improved ratings in the self-assessment questionnaire (Mini-ICF self) and to a lesser degree by one external assessment questionnaire (Mini-ICF external). As depression severity did not explain the correlation it can safely be assumed that the improved perceived psychosocial performance is not due to ameliorated depressive symptoms. It has to be discussed, whether the evaluation through a reference person gives useful information or whether there are other, more advantageous measures.

4 Discussion

The purpose of this study was to investigate the effect of cognitive remediation therapy on neurocognitive performance and psychosocial functioning of (partly) remitted depressed adults. This path of research is well established with schizophrenic patients but to a much lesser degree in patients with depression. Summarizing recent research, cognitive remediation therapy seems to improve neurocognitive functioning. Though, a remaining question is whether a generalized training or an individually tailored training is more beneficial to ameliorate the neurocognitive and psychosocial deficits caused by depression. For this reason and in line with recent research the following hypotheses were proposed:

H1a. Participation in a training group will lead to small to moderate improvement in test performance (CRT composite score, domains, subdomains) compared to the control group.

H1b. The strength of the training effect differs between the individualized training group and the generalized training group, which are both superior to the control group.

H2. Participation in a training group will lead to a small improvement in psychosocial functioning (psychosocial functioning composite score) compared to the control group.

The training itself was carried out using the CogniPlus program by Schuhfried (2007). To test the neurocognitive performance at baseline and after the training the Vienna test system © (Schuhfried, 2012) was used. Psychosocial functioning was measured with self-assessment questionnaires (Mini-ICF self, Linden & Baron, 2005) and external questionnaires (SLOF, Schneider & Struening, 1983; Mini-ICF external , Linden & Baron, 2005)

Summary of Results

Both training groups benefitted from the training and had improved neurocognitive performance after the training. This was shown for the analyses with the CRT composite score as well as for the domains “attention” and “executive function” and the subdomains. The improvement cannot be explained by a mere time effect as the control group showed no improvements. Further analyses concerning the reduction of impaired subdomains confirm the results. The hypothesis that the participation in cognitive training leads to a small to moderate improvement in test performance (CRT composite score, domains, subdomains), compared to the control group, can therefore be generally accepted (H1a). This is in line with previous research finding an overall positive effect of a cognitive training on neurocognitive performance (Elgamal et al., 2007; Lee et al., 2013; Meusel, 2011; Motter, 2016; Naismith et al., 2010).

Although several analyses comparing the individualized training and the generalized training with the control group reached significance (*alertness, selective attention and working memory*), the post-hoc tests did not add clarification on more specific relationships. Merely the task of selective attention did show a tendency as the individualized training demonstrated superiority over the other two groups. For this reason, the effect size partial Eta square was calculated. Effect sizes displayed that, in all but one case (*divided attention*), the individualized training was superior to the generalized training, which again was superior to the control group. The frequency analyses of remediated subdomains supports the results: On average, 56.5% of participants in the individualized training group showed remediated subdomains compared to 49.2% of the generalized training group and 38.1% of the control group. That means, that the hypothesis that there are differences between the two training approaches and that both are superior to the control group is supported (H1b). More clearly, with the exception of the task divided attention, it was found that training effect is stronger for the individualized training group compared to the generalized training group. Up to date no other study investigated the comparison of an individual and a generalized training approach. The suggested superiority of the individualized training is in line with the call from schizophrenia researchers emphasizing the need for individually tailored training programs (Galderisi et al., 2010; Medalia & Freilich, 2008).

Three different questionnaires were applied to assess changes in the psychosocial functioning between baseline and after the training. The self-assessment questionnaire (Mini-ICF self) showed a significant interaction effect: Participants in the training groups assessed their psychosocial functioning after the training better than participants in the control group. One of the external questionnaires (Mini-ICF external) revealed a trend towards significance in the same direction. Henceforth, the hypothesis that participation belonging to a training group shows a small improvement in psychosocial functioning in comparison to the control group can be accepted (H2).This is in line with the findings of two other studies investigating the effect of cognitive remediation therapy on psychosocial functioning (Lee et al., 2013; Meusel, 2011).

Discussion of Results and Methodology

The discussion of the present study's methodology will be presented chronologically. First the sample characteristics and the selection of deficit domains will be considered. Afterwards statistical methodology and the generalization of training effects will be critically analyzed before the assessment of psychosocial functioning and the transfer execution will be reflected upon.

Sample Characteristics. Different from three of four studies (for comparison see Naismith et al., 2010) investigating the effect of cognitive remediation on (partly) remitted depressed adults, the sample in this study suffered from substantial cognitive deficits ($PR \leq 16$ in at least two tasks). It was ensured that the participants had no comorbid psychiatric diagnosis except personality disorders and had only residual depressive symptoms (HAMD≤20). Due to relatively strict inclusion criteria (cf. 2.1 Study design), the sample in this study was particularly uniform. This enables the researchers to draw clear conclusions regarding the effect of cognitive remediation therapy in depressed adults.

The downside of this strict approach concerns the loss of a naturalistic sample. A total of 40% (n = 28) of the screened participants had to be excluded from the study as they were not, or not markedly enough, cognitively impaired. This is especially remarkable as all these participants wished to participate in the training as they suffered from (subjective) cognitive impairments. A neurocognitive performance threshold of PR≤16 might have caused the exclusion of several participants who might have, otherwise, benefitted from training participation. This approach is acceptable as the study was one of the first to examine (partly) remitted depressed samples as well as one of the first to look at the effectiveness of an individualized versus a generalized cognitive training approach. Revision of the current inclusion criteria should be considered in future research. More importantly so as the strict limitation of percentile rank ignores those participants that actually have measurable cognitive impairments but do still demonstrate average performance. Here, individual differences in premorbid cognitive performance should be taken into account. Additionally, it is gratifying to report a low drop-out rate of 7.9% (*n* = 5). With regards to other research in this area, a drop-out rate of about 20% was originally expected. This fact certainly reflects on the perceived usefulness of training and its entertainment factor.

Selection of Deficit Domains. All participants underwent cognitive testing before the training. For this purpose, critical variables were selected (e.g. reaction time, missings, etc.), which had to display impairment one standard deviation below the expected value (PR≤16) for inclusion. The selection of critical variables was in line with the test developers' recommendation as well as with the current research and literature. In some cases these different sources led to various numbers of critical variables on a single task. There was, for instance, only one critical variable given for the task planning (i.e., planning ability), but a total of nine critical numbers for the task of selective attention (i.e., reaction time, missings and false alarms each for the visual, the auditive and the cross-modal sub-test). Consequently, the likelihood of a subdomain to appear impaired (i.e., conditional probability) varied substantially and led to an uneven distribution among participants (conditional probability for the subdomain planning 20% and for the subdomain selective attention 90%). The uneven distribution of the impaired domains might have also been strengthened by a sequence effect. The task selective attention was always presented last in the applied test battery. Before even getting to the task assessing selective attention, participants had already completed about 1,5 hours testing time including cognitive tests, questionnaires, and interviews. Henceforth, it is possible that participants also experienced fatigue and were, therefore, not able to retrieve their actual ability to perform. The deficits were further selected solely on the basis of test results, but the participants' subjective perception on impairment was not taken into account – even though, the subjective distress as experienced by the individual may be a crucial factor to consider in this decision as well. The necessity of considering also the subjective side of cognitive impairment is also underscored by the sample characteristics presented above as the deficit selection may display imperfections.

Statistical Analysis. The calculation of neurocognitive composite scores poses very similar challenges as the selection of deficit domains. Here, the uneven distribution of critical variables also leads to an imbalance in representation of certain domains. The prevailing procedure is, however, necessary to ensure a complete presentation of the tested ability; for example: The critical variables for the task assessing response inhibition were reaction time and errors of commissions (i.e., false alarms). Merely the consideration of both variables together adequately portrays participants' skill set. This is known as the *speed-accuracy-tradeoff*. All major analyses were done using repeated measures ANOVAs. An alternative approach would be the *covariance structure model*. This statistical procedure is applied by a research colleague of this department in her dissertation.

Another statistical uncertainty is the impact of training duration. Length of training sessions were the same for both training groups, but the number of trained cognitive subdomains varied according to the form of training (i.e., individualized versus generalized approach). Consequently, the time spent training a specific subdomain varied across training groups. As participants in the individualized training group trained the three most impaired subdomains repeatedly in every session, the intensity of training in one subdomain was much higher compared to the generalized training group. Therefore, the superiority of the individualized training approach may also be due to higher practice intensity. To date, it is not certain whether training duration also has an influence. Wykes et al. (2011) concluded that training duration did not have a significant effect on cognitive outcome variables. However, this approach has high real life relevance: Patients only have limited time for cognitive remediation therapy. Therefore, it was this study's purpose to investigate to what extent cognitive training should be adapted in accordance to an individual's cognitive profile.

Comparison of the Individualized and Generalized Training Program. CRT research is much more advanced in the area of schizophrenia. Several acknowledged authors have emphasized the need to adapt CRT to the individual's deficits in order to increase effects on cognition, motivation and transfer to real-world situations (Galderisi et al., 2010; Medalia & Choi, 2009), but the optimal training administration is still unclear. To shed light on this particular issue, the present study compared a generalized training approach to an individualized training approach conformist to patient's cognitive profile. A benefit of this study is the comparability of both approaches to training. Studies investigating the same issue in schizophrenia research (e.g. Franck et al., 2013) have used different training programs to test whether an individualized or a generalized training approach draws more benefits. For instance, Franck (2013) found that both approaches to cognitive training led to improvements in neurocognitive functioning. The individualized approach, however, did so much quicker. However, the study used two different training programs (RECOS program vs. CRT) that have not been evaluated in regards to their resemblance in effectiveness. The present study, the same CRT program was used across conditions and the only variation concerned the broadness of training as either three or six modules were trained in the course of training. The present design allows drawing more direct conclusions since the effects were controlled for other possible influencing program characteristics like graphic design and user-friendliness or difficulty of the tasks. Similarly, the overall training duration was the same for both training groups, also including the transfer sessions once a week.

The calculated effect sizes lead to the suggestion of the superiority of the individualized training group in all tasks, except divided attention. This is further supported by additional analyses regarding the reduction of impairment in individual subdomains and domains. The effect of training for the individual tests is rather difficult to grasp as the tests varied in difficulty but appeared in a fixed presentation sequence (cf. above). For example: The task assessing selective attention appeared to be particularly challenging, though, this may be confounded by the order of the testing sequence as the prevailing test was always presented last. Further, special attention must be given to planning ability as its effect size shows a large effect in favor of individualized training. This relationship is particularly misleading as both, the generalized training group and the control group, did not include any participants showing a cognitive deficit in planning ability. These results must, therefore, be treated with caution. In terms of attention performance and working memory, it can be concluded that the individualized form of cognitive training had a considerable effect of improvement.

Generalization of Training Results. It is detrimental to look at the question whether the cognitive improvements found reflect ‘true’ remediation of participants’ cognitive abilities or whether they merely depict simple training effects. Motter et al. (2016) call this the “teaching to test" pitfall: "Performance gains may reflect similarity between training paradigms and neuropsychological measures" (p. 185). Thus, it is inevitable to mention that current research conducting clinical trials favors an active control group over a passive control group. The rationale behind the implementation of active controls accounts for non-specific therapist-related effects including confounding variables like demand characteristics, care or attention. In the present study, trainees regularly expressed their appreciation for the personal contact with the trainers. Many participants appeared grateful to have a structured week due to the regularity of training (1 – 1.5 hrs. 3x/week).

Motter et al. (2016) proposed an experimental design in which participants of the control group immerse in a task as equally engaging and time consuming as cognitive training. Basic computer training or cognitive training lacking improvement adaption are possibilities to also engage control groups a this may help to control for training-unrelated effects.

Assessment of Psychosocial Functioning. The mechanisms of the relationship between neurocognitive performance and psychosocial functioning remain unclear. When compared to other studies investigating this relationship in ((partly) remitted) depressed samples, some differences stand out: sample characteristics, used measures (tests and questionnaires) as well as time intervals. Although Evans et al. (2014) report in their systematic review that all studies found a relationship between neurocognition and psychosocial functioning, they stress that the quality of evidence is mostly limited due to weak methodology in most studies. Only single dimensions displayed significant effects regarding the relationship between neurocognition and psychosocial functioning. A global effect was not found. No other study excluded patients that showed no cognitive impairment at baseline testing. All studies solely looked at correlations and changes in psychosocial functioning and neurocognitive performance. One of the most important inclusion criteria in the present study were substantial cognitive impairments (PR≤16) in at least two tasks at baseline testing. Thus, there are no proposed explanations on how the existence of cognitive impairments may influence the relationship with psychosocial functioning. In a review, Porter, Bowie, Jordan, and Malhi (2013) hypothesize that a smaller deficit at baseline may translate into more clinically significant changes. This may be a possible explanation on why studies without inclusion criteria concerning cognitive impairments (and therefore are more likely to have a less impaired sample) report greater benefits and stronger correlations between neurocognitive performance and psychosocial functioning. There are also no comparable studies with depressed samples using similar psychosocial measures as the present study. Evans et al. (2014) discovered that the questionnaires used in many of the studies were not appropriate for the prevailing sample: e.g., questionnaires assessing very basic levels of functioning and questionnaires not being appropriately sensitive to change. The present study was designed following a sister study focusing on a schizophrenic sample. To ensure comparability between the studies, the same cognitive measures were adapted. In general, it appears that patients with schizophrenia suffer from more severe psychosocial impairments. Therefore, it may be the case that the implemented questionnaires assessing psychosocial functioning were not the appropriate measures for a relatively high-functioning sample of (partly) remitted depressed adults. The participants in this study did not show severe psychosocial impairments and insignificance of results may be caused by ceiling effects. Evans et al. (2014) emphasize the need for adequately sensitive and validated assessments of patients to ensure the capturing of very subtle changes in functioning. Last but not least, only two past studies (Jaeger et al., 2006; Withall, Harris, & Cumming, 2009) took a prospective approach to look at the predictive power of neurocognitive performance examining the relationship between neurocognitive and psychosocial performance in acutely depressed samples. Withall et al. (2009) found that poor prospective memory (as measured with the Prospective Memory Task by Harris, 1999) and more perseverative errors on the shortened Wisconsin Card Sorting Test at hospital admission predicted worse social and occupational functioning (as measured with the Social and Occupational Functioning Assessment Scale (SOFAS; Goldman, Skodol, &

Lave, 1992) and employment status at three months after remission and discharge. Jaeger found that selected neurocognitive domains (attention, ideational fluency, visuo-spatial ability and learning) as tested at baseline were predictive of functionality measured by the Multidimensional Scale of Independent Functioning (MSIF; Jaeger, Berns, & Czobor, 2003) at six months after baseline. The authors interpreted that neurocognitive deficits, at least for some depressed individuals, play an important role in functional recovery. The time interval of approximately seven weeks in this study between testing times is relatively short to show an improvement in psychosocial functioning through ameliorated neurocognitive performance. Both Lee et al. (2013) with a time interval of 20 weeks and Meusel (2011) with a time interval of ten weeks found significant effects of cognitive remediation therapy on psychosocial functioning. In schizophrenia research, Bowie regarded cognitive remediation as the basis facilitating the development of abilities that can be used in the work and social environment later on. They predicted that time is needed until improvements in neurocognitive performance also show in psychosocial functioning. Similarly, d'Amato et al. (2011) also their null finding with the time interval between therapy end and follow-up measurement to be too short to reveal significant effects. It is therefore especially gratifying to report significant improvements in psychosocial functioning after only around seven weeks' time interval between baseline and test. This indicates a great benefit of the training for the participants. This study implemented a six-months-follow up, which data will be part of another dissertation. It will be interesting to see, whether a greater time interval reveals an even stronger gain in psychosocial functioning and will thus help to shed more light into the specific processes that underlie the relationship between neurocognition and psychosocial performance. Merely two other studies (Lee et al., 2013; Meusel, 2011) focused on investigating the relationship between neurocognitive performance and psychosocial functioning in (partly) remitted depressed adults. Lee et al. (2013) found that participants in the training group (NEAR CR program by Medalia & Freilich, 2008) training once a week for two hours over ten weeks (plus psycho-education) showed significantly greater improvements in psychosocial functioning (as measured with the Social Functioning Scale by Birchwood et al., 1990) compared to the control group. Meusel (2011) assessed psychosocial functioning using the cognitive functioning subscale on the Medical Outcomes Study 36-item Short Form Health survey (SF-36 by Well et al., 1989), the social contact subscale on the Life Skills Profile (LSP by Rosen, Hadzi-Pavlovic, & Parker, 1989) and the subjective feelings subscale on the Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q by Endicott, Nee, Harrison, & Blumenthal, 1993). Meusel compared the follow-up data (six months after baseline) to baseline data because the gains in neuropsychological functioning were greatest at follow-up testing. The training itself consisted of 20 computer tasks from the PSSCogRehab (Bracy,1994; three times a week for one hour over ten weeks). Meusel (2011) did correlational analyses and found that improvements on the Q-LES-Q subjective feelings subscale were significantly associated with an overall improvement in cognition (R=0.50, P=.01), specifically memory. The results of the present study are in line with the results by Meusel (2011) and Lee et al. (2013). All questionnaires used in the two studies rely on self-assessment, as did the Mini-ICF self used in this study.

It remains to be discussed why the external questionnaires did only show a trend towards significance (Mini-ICF external) or no significance at all (SLOF external). The most obvious reason may be an insensitivity of the questionnaires regarding the relatively high-performing group. Additionally the low response rate for the external questionnaires in this study remained unsatisfactory. This promoted the desire for a more objective measure of psychosocial functioning level. Gupta et al. (2013) combined two objective measures of psychosocial functioning that are worth mentioning: the Advanced Finances Task and the Social Skills Performance Assessment. The Advanced Finances Tasks assesses cognitive performance or, as they call it, adaptive skills (Heaton et al., 2004). In this task, participants are asked to pay fictitious bills, deposit checks, balance a checkbook, but also leaving a set balance of funds in the account. Points are awarded for correctly paying each bill, writing checks, and filling out the deposit slip, balancing the register, and making sure that there was a final balance of at least $100 in the account. The task was designed to assess subtle to severe neuropsychological deficits in HIV patients. The sample shows similar neurocognitive impairments to a depressed sample. The authors found that depressive symptoms and neurocognitive impairments were the sole predictors of all possible indicators of psychosocial functioning. The interpersonal performance was assessed using the Social Skills Performance Assessment (SSPA; Patterson, Moscona, McKibbin, Davidson, & Jeste, 2001). The SSPA is a measure of social competence and communication. After a brief practice session, participants initiate and maintain a conversation for three minutes two situations: greeting a new neighbor and calling a landlord to request a repair for an ongoing leak. The sessions are audio-taped and scored by a blind rater who is unaware of diagnosis and other data. Dimensions of social skills scores include interest, fluency, clarity, focus, negotiation ability, persistence, and social appropriateness. The SSPA scores were significantly correlated with health-related quality of well-being and observer performance on activities of daily living, but not to a self-reported measure of social functioning. This indicates that self-assessment questionnaires may indeed not be the ideal measure for psychosocial functioning. Obviously, both approaches consume more time and effort than ordinary questionnaires (although the SSPA is completed in twelve minutes including both role play and ratings) but provide the opportunity to assess a participant’s improvement more independently from their subjective perspective and without the aid of an, oftentimes, unreliable reference person. Further, a clearer distinction should be drawn in future research between the difference: “What am I able to do?” versus “What do I do?“. This reflects the difference between the psychosocial functioning and quality of life. Notwithstanding the advantages of observational measures, self-assessment questionnaires should be applied to assess the individual’s experience. Evans et al. (2013) recommend the Multidimensional Scale of Independent Functioning (Jaeger et al., 2003) assessing not only the participants' level of role performance but also their role position as well as presence and degree of role support. This allows for clear the distinction between higher-functioning individuals with social or institutional support and lower-functioning, but still independent individuals.

Transfer. The weekly 30-minute transfer sessions prompted very different responses from trainees. Some group constellations appeared to be very active and engaged taking advantage of group exchanges whereas other constellations of participants seemed to perceive the transfer sessions as a waste of time. Through more generalizing lens, the group exchange was received positively even though there was little motivation to try out and implement the transfer tasks /diary at home as the offered diary was not generally accepted. The participants' diary was specifically designed as a note book for writing down any positive or negative observations, experiences or changes of the cognitive domain targeted in that prevailing transfer session (i.e., Attention, Memory, Response Inhibition, and Executive Functioning).In future implementation of transfer session, the design should convey an even more engaging framework. Further, the relevance of cognitive domains and therefore cognitive training should be underscored more distinctly. Twamley, Burton, and Vella (2011) used pocket calendars instead of diaries in their study. This poses the advantage that there is high face validity for daily life and it can easily be continued to use after study participation. For more ideas on transfer sessions development confer to Twamley et al. (2011). Again, schizophrenia research has progressed further. In a meta-analysis with schizophrenic patients a supplemental skills training led to a generalization of cognitive improvements into everyday functioning (Bowie, McGurk, Mausbach, Patterson, & Harvey, 2012). This could be also useful for (partly) remitted depressed samples.

Outlook and Future Research

Even though there were good reasons for the present, rather strict inclusion criteria, future research may be advised to consider inclusion criteria allowing for more naturalistic samples. As stated above, 40% of screened participants did not meet the inclusion criterion about the premise of impairment in at least two cognitive domains. Those individuals were interested in training as they also perceived their cognitive performance to be subjectively impacted compared to their abilities before the onset of depression. A slightly greater percentage of interested participants (41.4%) had to be excluded due to somatic or psychiatric comorbidities. As this representation depicts reality of depression showing comorbidities to other disorders or psychiatric conditions, it appears to narrow validity of results. Another issue of the present study concerns the individualized training group. As this group trained the exact number of three subdomains, even though some only showed two cognitive subdomains to be impaired with PR $\leq$ 16 or more than three impaired subdomains, extent of training did not vary. In research reality, such constraints are necessary to obtain an analyzable research design; however, individual adaption of training regarding the degree of impairment should be integrated. The randomization of test sequence could easily be implemented. As said before, the task of selective attention was always presented last in the present test battery possibly affecting participants' performance. However, a randomized test sequence would entail other disadvantages, e.g. the different effects of one test on the other complicating the interpretation once again. An important topic that should be extracted from this study concerns the cause-effect-relationship between cognitive impairment, cognitive training and their generalization into everyday life. It is important acknowledge and convey to participants that the training in itself is not an end, a mere "teaching to test", but that participants made subjective as well as objective gains regarding work environment and leisure time. The training showed immediate effects on psychosocial functioning, even after the short time interval of only seven weeks. Previous research indicates that a longer timer interval reveals greater improvements in psychosocial functioning. Therefore, it will be illuminating to see the impact on psychosocial functioning at the six-month follow-up assessment that will be analyzed in another dissertation. In a pre-analysis with a smaller sample, there was a negative relationship between cognitive performance at baseline testing and psychosocial functioning at the second testing. This could mean that patients with greater cognitive impairments benefit less from training.

To further enhance the efficacy of cognitive training to convey a real life effect, transfer sessions should be reconsidered and adapted to the prevailing samples' needs. Furthermore, new and better psychosocial measures should be implemented. As it was described above, techniques such as behavior observation or role play are worth looking into to complement subjective measures of participants' functioning perception of quality of life.

This study showed that cognitive remediation therapy is not only effective at improving neurocognitive performance in (partly) remitted depressed adults, but also that the improvement transfers into real-life as assessed by the psychosocial functioning questionnaire. This is great news for patients who suffer from cognitive deficits even after remission of the lead symptoms of depression. For a long time cognitive deficits were only considered as symptoms during acute depressive episodes that would "disappear" with the right medication or psychotherapy. For thirty to fifty percent of the patients this was not the case and they were left alone to deal with the impairments in their work environment and leisure time. This study not only confirms the results from previous studies, namely the effectiveness of cognitive remediation therapy for (partly) remitted depressed adults, but expands the knowledge concerning the best training set up: It could be shown that an individualized training holds potentially greater benefits for patients than a general cognitive training approach. Together with the positive effect on psychosocial functioning, this gives hope, that cognitive remediation therapy will shortly be easily accessible for all patients in need. The first study about cognitive remediation in depressive samples was published in 2007, just over ten years ago. For psychiatric research, this is a fairly short period of time further underscoring the comprehensive, enhancing effect of cognitive remediation therapy improving impaired cognitive performance. Several ideas and improvement suggestions were made to investigate the relationship between neurocognitive amelioration and psychosocial functioning on a much closer look. This new field of research is full of potential for future studies and in consideration of the suggested changes and more engaged research; a cheerful outlook for depressed patients is justified.

5 Summary

Even after remission of the main symptoms of depression, patients complain frequently about their inability to follow movie plots, problems to read more than a few lines on a book page, or having difficulties to learn new work processes. A promising approach to improve cognitive deficits and subsequently psychosocial functioning poses cognitive remediation therapy. Cognitive exercises or games are used to target specific neural networks in order to improve cognitive functioning through neuroplasticity. It often combines massed repetition and strategy training with compensatory measures.

Aim of this study was to investigate the effect of cognitive remediation therapy on neurocognitive and psychosocial functioning in (partly) remitted depressed adults and whether an individualized or generalized training approach is most effective in improving cognitive performance.

Fifty-eight (partly) remitted depressed adults with cognitive deficits participated in the study. They were randomly allocated to one of three groups: (1) Individualized training group, (2) generalized training group, (3) waitlist control group. Participants in the generalized training group trained six cognitive subdomains (*Alertness, selective attention, divided attention, response inhibition, planning ability and working memory*), whereas the participants in the individualized training group trained only their three most impaired subdomains. The training itself lasted over five weeks with one hour sessions three times a week. Additionally there was a 30-minute transfer session once a week.

It was found that 1) the training was well accepted, which was reflected by the indirect measure of motivation and confirmed by the low dropout rates. 2) The participants in the two training groups performed better in an overall composite score as well as for the domains attention and executive functioning than the control group participants. 3) With the exception

of the task divided attention, the training effect was stronger for the individualized training group compared to the generalized training group, which were both superior to the control group. 4) The participants of the training group judged their psychosocial functioning after the training significantly better than the control group participants.

In conclusion the results of this study are highly satisfactory. The effectiveness of cognitive remediation therapy on neurocognitive and psychosocial functioning in (partly) remitted depressed adults was confirmed. This study extended the understanding of cognitive remediation processes insofar as the results strongly indicate a superior efficacy of an individually-tailored approach over a generalized training. The results stem from a randomized, controlled trial study. Several ideas and improvement suggestions were made to investigate the relationship between neurocognitive amelioration and psychosocial functioning in future studies. For patients with residual cognitive impairments after a depressive episode this yields the great hope that cognitive remediation therapy will shortly be implemented as a routine treatment in the healthcare sector so that their suffering will be reduced to the absolute minimum.

Zusammenfassung

Auch nach dem Abklingen der Leitsymptomatik einer Depression klagen viele Patienten über ihre Unfähigkeit der Handlung in Filmen zu folgen, mehr als ein paar Zeilen in einem Buch zu lesen oder über Schwierigkeiten neue Arbeitsabläufe zu erlernen. Ein vielversprechender Ansatz diese kognitiven Defizite und damit schlussendlich auch das psychosoziale Funktionsniveau zu verbessern, bietet die kognitive Remediationstherapie. Dabei werden kognitive Übungen und Spiele genutzt, um kognitive Beeinträchtigungen mithilfe von Neuroplastizität zu verringern. Hierzu werden häufig massiertes Wiederholen (mass repetition) und Psychoedukation eingesetzt.

Ziel der vorliegenden Studie war es den Effekt der kognitiven Remediationstherapie auf das neurokognitive und psychosoziale Funktionsniveau bei Erwachsenen mit (teil-) remittierter Depression zu untersuchen, insbesondere ob ein individualisierter oder ein generalisierter Trainingsansatz effektiver für die Verringerung kognitiver Defizite ist.

Achtundfünfzig (teil-)remittierte depressive Erwachsene mit kognitiven Beeinträchtigungen nahmen an der Studie teil. Die Teilnehmer wurden randomisiert einer von drei Gruppen zugeteilt: (1) individualisierte Trainingsgruppe, (2) generalisierte Trainingsgruppe oder (3) Wartekontrollgruppe. Die Teilnehmer des generalisierten Trainings trainierten sechs kognitive Bereiche (*Alertness, geteilte Aufmerksamkeit, selektive Aufmerksamkeit, Inhibitionsfähigkeit, Planungsfähigkeit und Arbeitsgedächtnis*). Die Teilnehmer des individualisierten Trainings trainierten nur ihre drei am stärksten beeinträchtigten Bereiche. Das Training dauerte fünf Wochen, mit jeweils einer Stunde Training dreimal pro Woche. Zusätzlich gab es einmal pro Woche eine 30-minütige psychoedukative Einheit.

Die Studie führte zu vier wichtigen Erkenntnissen 1) Das Training wurde sehr gut akzeptiert, was einerseits durch die indirekte Erfassung der Motivation sowie andererseits durch die

geringe Dropout-Rate bestätigt wurde. 2) Die Teilnehmer der beiden Trainingsgruppen erzielten bessere Leistungen in der Neurokognition, insbesondere in den Bereichen Aufmerksamkeit und Exekutivfunktionen als die Teilnehmer der Wartekontrollgruppe. 3) Der Trainingseffekt war größer für die Teilnehmer des individualisierten Trainings als für die des generalisierten Trainings mit Ausnahme der Aufgabe zur geteilten Aufmerksamkeit. 4) Die Teilnehmer der Trainingsgruppen bewerteten ihr psychosoziales Funktionsniveau nach dem Training besser als die Teilnehmer der Kontrollgruppe.

Zusammenfassend sind die Ergebnisse dieser Studie höchst befriedigend. Die Effektivität der kognitiven Remediationstherapie für (teil-)remittierte depressive Erwachsen zur Verbesserung der neurokognitive und psychosozialen Leistungsfähigkeit konnte bestätigt werden. Darüber hinaus konnte gezeigt werden, dass ein individualisierter Trainingsansatz wahrscheinlich mit größeren Verbesserungen einhergeht als ein generalisiertes Training. Die Ergebnisse stammen aus einer randomisierten, kontrollierten Studie. Bezüglich des Zusammenhangs von neurokognitiver und psychosozialer Funktionsfähigkeit wurden Verbesserungsvorschläge für zukünftige Forschung entwickelt Für Patienten mit anhaltenden neurokognitiven Beeinträchtigungen nach einer depressiven Episode lassen diese Resultate hoffen, dass kognitive Remediationstherapie in Kürze als Routinebehandlung im Gesundheitswesen eingeführt wird, sodass das Leiden der Betroffenen auf das absolute Minimum reduziert wird.

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Kienzle, J., Listunova, L., Grützner, T., Bartolovic, M., Weisbrod, M., & Roesch Ely, D. (2017, October). *Impact of cognitive remediation therapy on neurocognitive and psychosocial functioning in (partly) remitted depressed adults.* Poster session presented at the WPA XVII World Congress of Psychiatry, Berlin.

8 Appendix

8.1 Complete overview over the tests and questionnaires used in this study

Diagnostic tool	Short name (Author)
Diagnostic and Psychopathology	
Socio-demographic Interview[a]	SCID I
Mini International Neuropsychiatric Interview[a]	MINI (Lecrubier et al., 1997)
Hamilton Rating Scale for Depression	HAM-D (Hamilton, 1960)
Beck Depression Inventory II	BDI-II (Hautzinger et al., 2006)
Temporal Experience of Pleasure Scale	**TEPS (Gard, Gard, Kring, & John, 2006)**
Motor Agitation and Retardation Scale	**MARS (Sobin, Mayer, & Endicott, 1998)**
Premorbid intelligence	
Mehrfachwahl-Wortschatz-Intelligenztest (multiple choice word recognition test)[a]	MWT-B (Lehrl, 2005)
Neuropsychological variables	
Trail Making Test Version A + B, LangensteinbachVersion	TMT-A[a] + TMT-B[a] (Rodewald et al., 2012)
Zahlen-Symbol-Test (Digit Symbol Coding)	ZST (von Aster et al., 2006)
Perception and Attention functions: Alertness, Divided Attention, Selective Attention	WAF-A[a,] WAF-G[a], WAF-S[a]
Figural Memory Test	FGT[a]
California Verbal Learning Test	CVLT (Niemann et al., 2008)
Nback verbal	NBV[a]
Inhibition	INHIB[a]
Tower of London, Freiburg Version	ToL-F[a]
Plan-A-Day	**PAD (Funke & Krüger, 1993)**
Social cognition	
Theory of Mind - Brüne's cartoon picture story test	**ToM (Brüne, 2003)**

Motivation	
Fragebogen zur Erfassung aktueller Motivation	**FAM (Rheinberg, Vollmeyer, & Burns, 2001)**
Fragebogen zur geistigen Leistungsfähigkeit (Cognitive Ability Questionnaire - Subjective Deficits)	**FLei[a]**
Reinforcement Learning Task	**RLT (Delgado, Miller, Inati, & Phelps, 2005)**
Level of functioning – external assessment	
Mini- International Classification of Functioning, Disability and Health	Mini-ICF (Linden & Baron, 2005)
Specific Level of Function Scale	SLOF (Schneider & Struening, 1983)

Note. Tests that were not analysed further for the purpose of this dissertation are printed in bold type. [a] only administered at the first time of measurement [b] Subdomains taken from the test battery of the Vienna Test System (Schuhfried, 2012).

8.2 Patient education

Patientenaufklärung

Sehr geehrte Studienteilnehmerin, sehr geehrter Studienteilnehmer,

derzeit wird in unserer Klinik eine wissenschaftliche Studie durchgeführt, die Sie interessieren könnte. Gerne möchten wir Sie für die Teilnahme an dieser Studie gewinnen. Titel der Studie ist: „K*ognitive Remediation bei Menschen mit Depression“.* Im Folgenden wollen wir Ihnen die Hintergründe kurz darstellen, die uns bewogen haben, diese Studie durchzuführen und die Untersuchungen genauer erläutern. Falls Sie beim oder nach dem Durchlesen irgendwelche Fragen haben, wenden Sie sich bitte an uns. Wir sind gern bereit, Ihre Fragen ausführlich mit Ihnen durchzusprechen.

Fragestellung der Studie

Zahlreiche Menschen, die an einer psychiatrischen Erkrankung erkrankt sind, leiden unter Einschränkungen im Denken (z.B. Aufmerksamkeit, Konzentration und Gedächtnis). Es gibt Hinweise darauf, dass diese sogenannten kognitiven Defizite einen Einfluss auf die derzeitigen und zukünftigen sozialen - insbesondere berufliche -Entwicklungsmöglichkeiten haben. Auch der Therapieerfolg hängt von der kognitiven Leistungsfähigkeit ab. Um psychiatrische Erkrankungen bestmöglich behandeln zu können, setzen wir kognitives Training ein, entwickeln es immer weiter, erproben es und überprüfen die Wirksamkeit.

Studien haben gezeigt, dass durch gezielte Trainingsmaßnahmen kognitive Leistungen verbessert werden. Bislang ist allerdings unklar, wie genau ein solches Training gestaltet werden muss, um möglichst hilfreich zu sein. Daher möchten wir der Frage nachgehen, ob kognitives Training auch in unserem Behandlungssetting mit zahlreichen anderen Behandlungsangeboten wirkt und ob unterschiedliche Trainingsinhalte (z.B. individuell an die Bedürfnisse des Patienten angepasste Auswahl der Aufgaben oder eher ein allgemeines Training) unterschiedlich wirksam sind. Daher vergleichen wir in dieser Studie zwei unterschiedliche Trainingsgruppen (Training 3mal pro Woche für 60 Minuten, einmal plus 30 Minuten Strategietraining) mit einer Gruppe von Patienten, die kein kognitives Training erhält.

Beschreibung der Studie

Im Rahmen unserer Studie werden Sie an drei Untersuchungsterminen und 15 Trainingssitzungen teilnehmen. Während des ersten Untersuchungstermins werden zum einen Interviews mit Ihnen geführt, bei dem es um Ihre aktuelle Lebenssituation, Ihre Erkrankung und Ihre aktuellen Symptome geht. Dies dient in erster Linie der Einschätzung des Ausprägungsgrades der Krankheitssymptome. Außerdem werden Sie Aufgaben am Computer bzw. mit Papier und Stift bearbeiten. Dabei geht es um die Einschätzung Ihrer kognitiven Leistungsfähigkeit (z.B. Gedächtnis, Konzentrationsfähigkeit,...). Dieser Termin wird ca. 5-6 Stunden dauern.

Anschließend werden Sie zufällig einer der drei Gruppen zugeordnet (individuelles Training, allgemeines Training oder kein Training). Um festzustellen, ob Sie vom Training profitiert haben, werden Sie nach dem 6-wöchigen kognitiven Training erneut ausführlich untersucht. Dabei werden Sie wieder Aufgaben am Computer bzw. mit Papier und Stift bearbeiten und Fragebögen ausfüllen. Dieser Termin wird etwa 90 Minuten dauern. Die meisten der genannten Tests werden im Rahmen einer klinischen Diagnostik standardmäßig eingesetzt. Nach etwa 6 Monaten werden wir Sie per Post und/oder telefonisch kontaktieren und Sie zu einem bis zwei erneuten Untersuchungsterminen einladen, um festzustellen, ob und wie Sie in der Zwischenzeit vom Training profitiert haben. Bei diesen Untersuchungen ist wieder mit etwa 3 Stunden Dauer pro Termin zu rechnen. Falls Sie stationär aufgenommen sind, möchten wir zudem das Pflegeteam bzw. Ihren behandelnden Stationsarzt während Ihres stationären Aufenthaltes sowie Ihre Bezugsperson befragen, um Auskünfte über Ihre zwischenzeitliche Entwicklung zu erhalten. Dies kann uns helfen, eine nachhaltige Wirkung des kognitiven Trainings zu prüfen. Wenn Sie nicht stationär aufgenommen sind, würden wir gerne eine von Ihnen genannte Bezugsperson zu diesem Thema befragen.

Kognitives Training

Das kognitive Training findet 3-mal pro Woche statt und wird etwa 50 Minuten dauern. Dabei werden Sie in Kleingruppen von 3 bis 5 Patienten individuell Aufgaben am Computer bearbeiten. Zu einem Termin in der Woche findet nach dem kognitiven Training zusätzlich eine 30-minütige Gruppensitzung statt, in der u.a. kognitive Strategien für den Alltag besprochen werden.

Die Gruppe, welche ein allgemeines Training erhält, trainiert z.B. die Aufmerksamkeit, das Gedächtnis und die Planungsfähigkeit. Die Gruppe des individuell angepassten Trainings bearbeitet Aufgaben, in denen sie in der vorherigen neuropsychologischen Untersuchung Auffälligkeiten zeigte. Während des Trainings wird Ihnen ein Psychologe zur Seite stehen, der Sie anleiten und bei Fragen/Schwierigkeiten unterstützen wird. Insgesamt wird das Training 5 Wochen dauern, so dass Sie an 15 Trainingssitzungen teilnehmen werden.

Nutzen und Risiken der Teilnahme an der Studie

Mit unserer Untersuchung möchten wir dazu beitragen, die Diagnostik und die Therapie kognitiver Funktionen zu verbessern. Ihre Teilnahme ist wichtig, um unsere Studie erfolgreich durchführen zu können.

Keines der eingesetzten Verfahren (Interview, Fragebögen, neuropsychologische Untersuchung und kognitives Training) ist mit irgendwelchen bekannten Risiken verbunden. Die neuropsychologischen Untersuchungen erfordern ein gewisses Maß an geistiger Anstrengung, die jedoch keine Überforderung darstellt oder negative Konsequenzen haben.

Sie können aus der Teilnahme an der Studie keinen unmittelbaren persönlichen Nutzen ziehen. Sie leisten jedoch einen Beitrag für das Verständnis von möglichen Therapie-Ansätzen, welche wir stetig zu verbessern versuchen. Außerdem erhalten Sie als Aufwandsentschädigung einmal 20 Euro direkt nach dem kognitiven Training, sofern Sie mindestens 12 Trainingstermine wahrgenommen haben, und einmal 50 Euro bei Teilnahme an der Untersuchung 6 Monate später.

Falls Sie sich nicht zur Teilnahme entschließen können, werden keinerlei Nachteile für Sie entstehen. Ihre Entscheidung für oder gegen die Teilnahme an unserer Studie hat keine über die Studie hinausgehenden Auswirkungen auf ihre weitere Behandlung. Wir möchten Sie noch einmal darauf hinweisen, dass falls Sie sich gegen die Blutentnahme entscheiden, Sie dennoch an der Studie teilnehmen können.

Freiwilligkeit der Teilnahme

Die Teilnahme an dieser Studie ist freiwillig. Sie können Ihr Einverständnis jederzeit ohne Angabe von Gründen und ohne Nachteile für Ihre weitere Behandlung wieder zurückziehen. Bei Rücktritt von der Studie werden wir, falls Sie dies wünschen, die erhobenen Daten vernichten. Sollten Sie zu einem späteren Zeitpunkt Ihre Entscheidung ändern wollen, setzen sie sich bitte mit dem Studienarzt in Verbindung. Ihre Daten werden nach 10 Jahren Aufbewahrung vernichtet.

Datenschutz

Während der Studie werden medizinische Befunde und/oder persönliche Informationen von Ihnen erhoben und in der Prüfstelle in Ihrer persönlichen Akte niedergeschrieben und/oder elektronisch gespeichert. Die für die Studie wichtigen Daten werden zusätzlich in pseudonymisierter Form gespeichert, ausgewertet und gegebenenfalls pseudonymisiert weitergegeben. Pseudonymisiert bedeutet, dass ein Nummern- und/oder Buchstabencode verwendet wird, evtl. mit Angabe eines Geburtsjahres. Eine nachträgliche Zuordnung der Daten zu einer bestimmten Person ist mit Hilfe einer Art „Schlüssel“, der in der Studienzentrale verwaltet aber niemandem außerhalb zugänglich gemacht wird, möglich. Die Daten sind gegen unbefugten Zugriff damit gesichert.

8.3 Declaration of consent

PATIENTEN-EINVERSTÄNDNISERKLÄRUNG

Ich____________________________________ stimme freiwillig zu, an der vorab beschriebenen Studie *„Individuelles versus allgemeines kognitives Training bei Menschen mit Schizophrenie oder Depression“.* teilzunehmen. Die Patienteninformation habe ich gelesen und verstanden. Darüber hinaus bin ich mündlich in verständlicher Form aufgeklärt worden. ________________________________ stand mir für Rückfragen zur Verfügung.

Im Rahmen der Studie werden neuropsychologische Daten, medizinische und persönliche Informationen von Ihnen erhoben und in der Prüfstelle in Ihrer persönlichen Akte niedergeschrieben oder elektronisch gespeichert. Die für die Studie wichtigen Daten werden zusätzlich in pseudonymisierter Form gespeichert, ausgewertet und gegebenenfalls weitergegeben.

Ich wurde darüber aufgeklärt und stimme zu, dass meine in der Studie erhobenen Daten in pseudonymisierter Form aufgezeichnet, ausgewertet und ggf. auch in pseudonymisierter Form weitergegeben werden können. Dritte erhalten jedoch keinen Einblick in personenbezogene Unterlagen. Bei Veröffentlichung von Ergebnissen der Studie wird mein Name nicht genannt.

Ich weiß, dass ich mein Einverständnis zur Teilnahme an der Untersuchung jederzeit und ohne Angabe von Gründen wieder zurückziehen kann, ohne dass mir daraus Nachteile für die Behandlung entstehen.

Ich bin mit der Kontaktaufnahme mit dem Pflegeteam/dem behandelnden Stationsarzt zwecks Datenerhebung einverstanden:

☐ ja ☐ nein

Ich bin mit der Kontaktaufnahme mit meiner Bezugsperson einverstanden:

☐ ja ☐ nein

Ich bin mit der Kontaktaufnahme mit mir nach etwa 6 Monaten einverstanden:

☐ ja ☐ nein

Bei Rücktritt von der Studie bin ich mit der Auswertung meiner bis dahin vorliegenden Daten einverstanden:

☐ ja ☐ nein

Sollten sich noch weitere Fragen ergeben, steht mir folgender Ansprechpartner zur Verfügung:

Name: PD Dr. med. Daniela Roesch-Ely Telefon: 06221-5639856

Ich habe eine Kopie der Patienteninformation erhalten.

☐ ja ☐ nein

______________________ ______________________ ______________________

Ort, Datum Unterschrift der/des Studienteilnehmers

______________________ ____________ ______________________________

Ort, Datum Unterschrift aufklärender Dipl.-Psych./Arzt

8.4 Psychosocial questionnaires (Self and reference person)

Universitätsklinikum Hamburg-Eppendorf

Institut und Poliklinik für Medizinische Psychologie
Arbeitsgruppe: Psychotherapeutische Versorgungsforschung: Diagnostik und Epidemiologie

ICF-PsychA&P

Auf den nächsten beiden Seiten finden Sie einige Aussagen über Alltag, Beruf, Freizeit und Beziehungen. Bitte lesen Sie sich jeden Satz sorgfältig durch und entscheiden Sie, wie schwer Ihnen diese Dinge aufgrund Ihrer Erkrankung fallen bzw. wie stark Sie sich in diesen Bereichen durch Ihre Erkrankung beeinträchtigt fühlen.

	gar nicht	wenig	mittel-mäßig	über-wiegend	völlig
1. Es fällt mir schwer auf Fremde zuzugehen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
2. Es fällt mir schwer mich mit jemandem zu unterhalten.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
3. Ich bin beeinträchtigt in meiner Kommunikation.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
4. Es fällt mir schwer Kontakte zu Freunden zu pflegen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
5. Es fällt mir schwer wichtige Entscheidungen zu treffen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
6. Es fällt mir schwer gegenüber anderen, die ich mag, Ärger zu zeigen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
7. Es fällt mir schwer eine Unterhaltung mit mehreren Personen zu führen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
8. Es fällt mir schwer die Aufgaben des Alltags zu bewältigen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
9. Es fällt mir schwer andere mit anstehenden Problemen zu konfrontieren.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
10. Ich bin beeinträchtigt in meiner Funktionsfähigkeit bei der Arbeit.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
11. Ich bin beeinträchtigt mich sportlich zu betätigen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
12. Es fällt mir schwer am Familienleben teilzunehmen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
13. Es fällt mir schwer Einkäufe und Besorgungen außer Haus zu erledigen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
14. Ich bin beeinträchtigt in meinen Beziehungen zu meinen Familienangehörigen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$
15. Es fällt mir schwer meine Gefühle anderen mitzuteilen.	☐$_0$	☐$_1$	☐$_2$	☐$_3$	☐$_4$

Universitätsklinikum Hamburg-Eppendorf

Institut und Poliklinik für Medizinische Psychologie
Arbeitsgruppe: Psychotherapeutische Versorgungsforschung: Diagnostik und Epidemiologie

	gar nicht	wenig	mittel-mäßig	über-wiegend	völlig
16. Es fällt mir schwer Probleme zu meistern.	☐0	☐1	☐2	☐3	☐4
17. Es fällt mir schwer eine Aufgabe zu übernehmen, durchzuführen und zu beenden.	☐0	☐1	☐2	☐3	☐4
18. Es fällt mir schwer Partnerschaften einzugehen und aufrecht zu erhalten.	☐0	☐1	☐2	☐3	☐4
19. Ich bin beeinträchtigt die geforderten Aufgaben meiner Arbeitsstelle zu erfüllen.	☐0	☐1	☐2	☐3	☐4
20. Es fällt mir schwer zu anderen "nein" zu sagen.	☐0	☐1	☐2	☐3	☐4
21. Ich bin beeinträchtigt in meiner Sexualität.	☐0	☐1	☐2	☐3	☐4
22. Ich bin beeinträchtigt in meiner Partnerschaft.	☐0	☐1	☐2	☐3	☐4
23. Ich bin beeinträchtigt mich in einer Besprechung zu äußern.	☐0	☐1	☐2	☐3	☐4
24. Es fällt mir schwer mich auf großen offenen Plätzen, in Menschenmengen oder geschlossenen Räumen aufzuhalten.	☐0	☐1	☐2	☐3	☐4
25. Es fällt mir schwer mit Bus, Straßenbahn, U-Bahn oder Zug zu fahren.	☐0	☐1	☐2	☐3	☐4
26. Es fällt mir schwer mich weit von zu Hause zu entfernen.	☐0	☐1	☐2	☐3	☐4
27. Ich bin beeinträchtigt in der Mitarbeit in Vereinen, der Teilnahme an Veranstaltungen der Kirche oder sozialen Verpflichtungen (z.B. Elternabend, Firmenfeier).	☐0	☐1	☐2	☐3	☐4
28. Ich bin beeinträchtigt meinen Hobbys und Lieblingsbeschäftigungen nachzugehen.	☐0	☐1	☐2	☐3	☐4
29. Ich bin beeinträchtigt beim Autofahren.	☐0	☐1	☐2	☐3	☐4
30. Ich bin beeinträchtigt meinen sozialen Freizeitaktivitäten (Partys, Ausgehen, Unterhaltung) nachzugehen.	☐0	☐1	☐2	☐3	☐4
31. Es fällt mir schwer das zu erledigen, was ich mir vorgenommen habe.	☐0	☐1	☐2	☐3	☐4

MINI-ICF FREMDBEURTEILUNG

0 = keine Beeinträchtigung: der Proband entspricht den Normerwartungen bzgl. seiner Referenzgruppe.

1 = leichte Beeinträchtigung: es bestehen einige leichtere Schwierigkeiten oder Probleme, die beschriebenen Fähigkeiten/Aktivitäten auszuüben, es resultieren daraus keine wesentlichen negativen Konsequenzen.

2 = mittelgradige Beeinträchtigung: im Vergleich zur Referenzgruppe bestehen deutliche Probleme, die die beschriebenen Fähigkeiten ausüben. Dies hat negative Auswirkungen bzw. negative Konsequenzen für den Probanden oder andere.

3 = schwere Beeinträchtigung: der Proband ist wesentlich eingeschränkt in der Ausübung der beschriebenen Aktivitäten/Fähigkeiten. Er kann Rollenerwartungen in wesentlichen Teilen nicht mehr gerecht werden. Er benötigt teilweise Unterstützung von Dritten.

4 = vollständige Beeinträchtigung: der Proband ist nicht in der Lage, die beschriebenen Fähigkeiten/Aktivitäten auszuüben. Sie müssen durch dritte übernommen werden.

Anpassung an Regeln und Routinen					
Fähigkeit, sich an Regeln zu halten, Termine verabredungsgemäß wahrzunehmen und sich in Organisationsabläufe einzufügen. Dies beinhaltet bspw. Die Erfüllung von täglichen Routineabläufen, Einhalten von Verabredungen, pünktliches Erscheinen.	0	1	2	3	4
Planung und Strukturierung von Aufgaben					
Fähigkeit, den Tag und/oder anstehende Aufgaben zu planen und zu strukturieren, d. h. angemessene Zeit für Aktivitäten (Arbeit, Haushaltsführung, Erholung und andere Tages- und Freizeitaktivitäten) aufzuwenden, die Reihenfolge der Arbeitsabläufe sinnvoll zu strukturieren, diese wie geplant durchzuführen und zu beenden	0	1	2	3	4
Flexibilität und Umstellungsfähigkeit					
Fähigkeit, sich im Verhalten, Denken und Erleben wechselnden Situationen anzupassen, d. h. inwieweit der Proband in der Lage ist, je nach Situation unterschiedliche Verhaltensweisen zu zeigen. Dies kann Veränderungen n den Arbeitsanforderungen, kurzfristige Zeitveränderungen, räumliche Veränderungen, neue Sozialpartner oder auch die Übertragung neuer Aufgaben betreffen.	0	1	2	3	4
Anwendung fachlicher Kompetenzen					
Fähigkeit zur Anwendung fachlicher Kompetenzen, d. h. beruflich, ausbildungsspezifisch oder aufgrund der Lebenserfahrung. Fähigkeit, Fach- und Lebenswissen oder Kompetenzen gemäß den situativen Rollenerwartungen einzusetzen und unter Berücksichtigung des Lebenshintergrunds zumutbare inhaltliche und fachliche Anforderungen zu erfüllen.	0	1	2	3	4
Entscheidungs- und Urteilsfähigkeit					
Fähigkeit, kontextbezogen und nachvollziehbar Entscheidungen zu fällen oder Urteile abzugeben. Fähigkeit, Sachverhalte differenziert und kontextbezogen aufzufassen, daraus die angemessenen Schlussfolgerungen und Konsequenzen zu ziehen und dies in erforderliche Entscheidungen umzusetzen.	0	1	2	3	4

Durchhaltefähigkeit					
Fähigkeit, hinreichend ausdauernd und während der üblicherweise erwarteten Zeit an einer Tätigkeit (im Beruf oder bei sonstigen Aufgaben) zu blieben und ein durchgehendes Leistungsniveau aufrechtzuerhalten.	0	1	2	3	4

Selbstbehauptungsfähigkeit	
Fähigkeit, in sozialen Kontakten oder auch Konfliktsituationen ohne beeinträchtigende Befangenheit zu bestehen und für seine Überzeugungen einzustehen, ohne dabei soziale Normen zu verletzen.	0 1 2 3 4

Kontaktfähigkeit zu Dritten	
Fähigkeit, unmittelbare informelle soziale Kontakte mit anderen Menschen aufzunehmen, wie Begegnungen mit Kollegen, Nachbarn oder Bekannten und mit diesen angemessen zu interagieren, wozu auch Rücksichtnahme, Wertschätzung des Gegenübers oder die Fähigkeit, Gespräche zu führen, gehören. Dazu gehört die Fähigkeit des Probanden, unverbindlich zu kommunizieren.	0 1 2 3 4

Gruppenfähigkeit	
Fähigkeit, sich in Gruppen einzufügen, die expliziten oder informellen Regeln der Gruppe zu durchschauen und sich darauf einzustellen. Die Beurteilung bezieht sich auf das Verhalten des Probanden in Gruppensituationen bzw. seine Fähigkeit zur öffentlichen Präsentation. Dazu gehören Kleingruppen wie das Arbeitsteam, der Verein oder Großgruppen wie die Firma, eine politische Gruppierung oder die Kirche.	0 1 2 3 4

Familiäre bzw. intime Beziehungen	
Fähigkeit, enge und ggf. intime Beziehungen zu einem vertrauten Menschen oder in der Familie aufzunehmen und aufrechtzuerhalten. Beurteilt wird die Fähigkeit, enge emotionale Zuwendung zu geben und zu empfangen und mit den anderen Rollenerwartungen und dem beruflichen Umfeld befriedigend abzustimmen.	0 1 2 3 4

Spontan-Aktivitäten	
Fähigkeit des Probanden, außerhalb beruflicher oder sozialer Pflichten Spontanverhalten zu initiieren, Freizeitaktivitäten wahrzunehmen und in seinen Alltag zu integrieren. Beurteilt werden Aktivitäten, bei denen der Proband selbst aktiv und initiativ werden muss und die nicht bspw. Durch eine Berufsrolle aufgezwungen werden. Dazu gehören zum einen Aktivitäten des täglichen Lebens wie häusliche Aktivitäten, z. B. die Beschaffung von Waren- und Dienstleistungen des täglichen Bedarfs, die Zubereitung von Mahlzeiten, die Pflege von Wohnung, Haus und Haushaltsgegenständen, die Versorgung von Pflanzen oder Haustieren. Dazu gehören des Weiteren kreative oder rekreative Aktivitäten, z. B. Hobbys, der Besuch von kulturellen Veranstaltungen, Erholungsaktivitäten, Sport oder künstlerische Aktivitäten. Qualität und Quantität stehen in einem sich ergänzenden Verhältnis, jemand kann ein intensives Hobby haben, dem viel Zeit gewidmet wird, oder sich vielen verschiedenen Dingen zuwenden.	0 1 2 3 4

Selbstpflege	
Fähigkeit zur Selbstfürsorge und –pflege, also die Fähigkeit, sich zu waschen, Haut, Fuß- und Fingernägel, Haare und Zähne zu pflegen, sich sauber und der Situation, dem Anlass und der Jahreszeit entsprechend zu kleiden, die gesundheitlichen Bedürfnisse seines Körpers wahrzunehmen und darauf angemessen zu reagieren.	0 1 2 3 4

Verkehrsfähigkeit	
Fähigkeit des Probanden, zu verschiedenen Orten zu gehen bzw. sich in verschiedene Situationen zu begeben und Transportmittel, wie Auto, Bus oder Flugzeug, zu benutzen. Beurteilt wird, ob der Proband ohne Probleme jeden verkehrsüblichen Platz aufsuchen und jedes verkehrsübliche Fortbewegungsmittel benutzen kann.	0 1 2 3 4

SPECIFIC LEVEL OF FUNCTIONING ASSESSMENT AND PHYSICAL HEALTH INVENTORY (SLOF)

Auf den folgenden Seiten werden Sie gebeten, verschiedene Fähigkeiten des Patienten zu beurteilen.

Bitte beachten Sie dabei, dass Ihre Einschätzungen sich auf typische Verhaltensweisen des Patienten beziehen, die er in den vergangenen Wochen am häufigsten gezeigt hat. Beziehen Sie Ihre Einschätzung nicht nur auf Verhaltensweisen, die der Patient/die Patientin gezeigt hat, als Sie ihn/sie zuletzt gesehen haben.

Beurteilen Sie die Leistung des Patienten unter Berücksichtigung der Alltagsbewältigung anderer Menschen gleichen Alters und Geschlechts. Von Interesse ist nicht wie der Patient mit der von Ihnen vorgegebenen Aktivität zurechtkommt, sondern wie er es außerhalb der Therapiesitzung handhaben würde.

Versuchen Sie die Items möglichst sorgfältig und genau zu beantworten.

Instruktion: Kreuzen Sie die Nummer an, die das typische Verhalten des Patienten für jede Frage am besten beschreibt. Seien Sie so genau wie möglich.

Vermeiden Sie Mehrfachnennungen.

SOZIALE FÄHIGKEITEN

Interpersonelle Beziehungen	In hohem Maß typisch für die Person	Im Allg. typisch für die Person	Etwas typisch für die Person	Im Allg. untypisch für die Person	In hohem Maß untypisch für die Person
1. Akzeptiert Kontakt mit anderen (zieht sich nicht zurück)	5	4	3	2	1
2. Initiiert Kontakt mit anderen	5	4	3	2	1
3. Kommuniziert effektiv (Sprache und Gestik sind verständlich und an die Situation angepasst)	5	4	3	2	1
4. Übt Aktivitäten ohne Aufforderung aus	5	4	3	2	1
5. Nimmt an Gruppen teil	5	4	3	2	1
6. Bildet und pflegt Freundschaften	5	4	3	2	1
7. Fragt nach Hilfe, wenn nötig	5	4	3	2	1

FUNKTIONEN DES ALLTÄGLICHEN LEBENS

Aktivitäten	Komplett selbst-ständig	Benötigt verbale Anweis-ung oder Unterstütz ung	Benötigt körperl. Hilfe oder Unterst.	Benötigt substan-tielle Unterstütz ung	Komplett abhängig
8. Aufgaben im Haushalt (putzen, Wäsche waschen, kochen,...)	5	4	3	2	1
9. Einkaufen (Produkte aussuchen, Einkaufsladen aussuchen, bezahlen)	5	4	3	2	1
10.Umgang mit persönlichen Finanzen (Rechnungen, Einteilung des Budgets)	5	4	3	2	1
11. Benutzung des Telefons (Nummer heraussuchen und wählen, telefonieren)	5	4	3	2	1
12. Von Zuhause aus unterwegs sein ohne sich dabei zu verlaufen	5	4	3	2	1
13. Benutzung öffentlicher Verkehrsmittel (Route aussuchen, Uhrzeit finden, Ticket lösen,...)	5	4	3	2	1
14. Freizeitgestaltung (lesen, Freunde besuchen, Musik hören,...)	5	4	3	2	1
15. Allgemeine Gefahren erkennen und vermeiden (Sicherheitsmaßnahmen bei Feuer oder im Straßenverkehr)	5	4	3	2	1
16. Medikation (versteht den Sinn, nimmt sie eigenständig, erkennt Nebenwirkungen)	5	4	3	2	1
17. Medizinische und allgemeine Dienstleistungen nutzen (weiß an wen man sich wenden muss, wann man sie beanspruchen sollte...)	5	4	3	2	1
18. Lesen, rechnen und schreiben können (ausreichend für den täglichen Gebrauch)	5	4	3	2	1
Fähigkeiten im Arbeitsleben	**In hohem Maß typisch für die Person**	**Im Allg. typisch für die Person**	**Etwas typisch für die Person**	**Im Allg. untypisch für die Person**	**In hohem Maß untypisch für die Person**
19. Verfügt über berufsrelevanten Fähigkeiten	5	4	3	2	1
20. Arbeitet unter minimaler Supervision	5	4	3	2	1
21. Kann sich bei der Arbeit über einen längeren Zeitraum anstrengen (nicht leicht ablenkbar, kann unter Stress arbeiten)	5	4	3	2	1
22. Kommt pünktlich zu Verabredungen	5	4	3	2	1
23. Kann verbale Instruktionen adäquat umsetzen	5	4	3	2	1
24. Erledigt aufgetragene Aufgaben	5	4	3	2	1

8.5 Detailed description of the training modules

CogniPlus® module: DIVID

The divided attention exercise targets the ability to perform multiple tasks simultaneously.

The participant's task is to take the role of a security official at an airport. Depending on the difficulty level, the participant observes up to three monitors displaying different airport areas (i.e., baggage claim, the entry doors, and the ticket counter). Additionally, announcements and phone calls have to be monitored. The participant must react by pressing the response key whenever there is a problem (i.e., the baggage claim stops spinning, the sliding doors do not open, or an announcement is made for a passenger's last call to get to the gate, etc.). With increasing difficulty, more stimuli (i.e., monitors, announcements, etc.) will have to be processed reacting correctly whenever a problem occurs. Also with increasing difficulty, the frequency of problems occurring rises as well as the permitted reaction times decrease.

CogniPlus® module: SELECT

The selective attention exercise targets the ability to react promptly to relevant stimuli and to restrain inappropriate responses.

The participants sees a wagon traveling through a tunnel. Various stimuli appear randomly. Depending on the difficulty level, the wagon's speed will increase the number of stimuli increase and the permitted reaction times decrease. The nature of the stimuli popping up may be optical (fantasy figures), acoustic (different pitched tones), or both. The participant's task is to only react to relevant stimuli previously defined.

CogniPlus® module: ALERT

The *alertness* exercise targets the ability to increase and sustain the intensity of attention short-term.

In this task, the participant is riding a motorbike. The purpose is to task is to carefully observe the road and to press the reaction key as fast as possible when an obstacle occurs. This exercise consists of two different forms of training. In the phasic alertness task the obstacles are preceded by acoustic and visual (warning) signals. When the participant has mastered all phasic alertness levels, these signals are omitted in the intrinsic alertness task. With increasing difficulty, the driving speed increases whereas the permitted reaction time decreases from 1.8 seconds to 0.3 seconds.

CogniPlus® module: NBACK

The exercise of the monitoring function of the *working memory* targets the ability to store information and update it continuously.

The participant is shown a sequence of pictures, one by one. The primary task is to distinguish whether the displayed picture is identical to the previous one shown. If that is the case, the participant is to respond by pressing the green reaction key, if not, the participant is to respond by pressing the red reaction key. In more detail, the participant has to correctly identify whether the displayed picture is the same one shown one, two, or three places previously. The difficulty level set the interval for the matching pictures. Corresponding to the difficulty, the similarity of the pictures also increases, their content becomes more abstract, and the time of display decreases.

CogniPlus® module: HIBIT

The *response inhibition* exercise targets the ability to suppress unwanted reactions.

This program comprises four different tasks in which the participant takes the role of a postman. In the form of Stop Signal and Go/Nogo tasks, the participant has to decide whether or not to react according to specific features. For instance, whether the envelope has a stamp on it, whether there is a confidential postmark or a “fragile” sticker shown. With higher level of difficulty the duration of the tasks increase, the percentage of Nogo-stimuli increase, the stimulus complexity increase, the presentation time decreases, the interstimulus interval decrease and the permitted reaction time decreases.

8.6 Information and working sheets for the transfer sessions

Infoblatt zur Aufmerksamkeit

In jeder Situation sind Menschen von einer Vielzahl von Objekten und Ereignissen umgeben – mehr als sie zeitgleich wahrnehmen können. Es sind daher Aufmerksamkeitsprozesse notwendig, die immer wieder aufs Neue auswählen, was wahrgenommen wird. **Aufmerksamkeit** meint also die Ausrichtung des Bewusstseins auf bestimmte Wahrnehmungsinhalte. Im Alltag wird unsere Aufmerksamkeit ständig gefordert und ist Grundvoraussetzung für die Bewältigung vieler Aufgaben. Hierbei kann man verschiedene Formen der Aufmerksamkeit mit Blick auf ihre **Intensität** und **Selektivität** unterscheiden:

Bereiche	Art der Aufmerksamkeit
Intensität	Daueraufmerksamkeit
(„Stärke", „Kraft")	Aktivierungsbereitschaft
Selektivität	Fokussierte Aufmerksamkeit
(„Richtung", „Steuerung")	Geteilte Aufmerksamkeit

Häufig verwenden wir mehrere Arten der Aufmerksamkeit gleichzeitig oder kurz nacheinander!

Verschiedene Aufmerksamkeitsleistungen sind im Alltag laufend gefordert, wie diese Beispiele zeigen:

Wenn Sie etwa bei einem Vortrag längeren Ausführungen des Dozenten/Referenten folgen sollen, benötigen Sie dazu eine entsprechend lange **Daueraufmerksamkeit**. Dies gilt sowohl für abwechslungsreiche, besonders jedoch für als monoton empfundene Reize. Ein Beispiel aus der Arbeitswelt wäre lange Kontrollarbeit am Fließband. Die Daueraufmerksamkeit können Sie dann länger aufrechterhalten, wenn ein hoher Anteil attraktiver Reize vorhanden ist, beispielsweise beim Computerspielen oder Fernsehen.

Kommt es bei einem Vortrag zu einer (überraschenden) Zwischenfrage an das Publikum, so wird eine **Aufmerksamkeits-Aktivierungsbereitschaft** (auch als Wachsamkeit, Munterkeit, Alertness bezeichnet) erfordert, um angemessen auf diesen (neuen) Reiz zu reagieren: Es sollte möglichst unverzüglich vom Zuhören zum Antwortgeben umgeschaltet werden können. Menschen mit Problemen in diesem Bereich wirken oft als „Träumer". Sie profitieren davon, wenn sie vor dem Wechsel eines Reizes „vorgewarnt" werden („Jetzt mal bitte genau hinsehen!"). Mit Alertness wird oft auch ein allgemeiner Zustand des Wachseins bezeichnet, der den Tag über natürlichen Schwankungen unterworfen ist.

Sehr häufig wird die **fokussierte Aufmerksamkeit** (auch gerichtete oder selektive A.) im Beruf oder Alltag beansprucht, z. B. beim Schreiben längerer Texte, bei der Arbeit am PC usw. Es geht um das Bearbeiten einer Aufgabe, ohne gleichzeitig über etwas anderes nachzudenken, sich von Mitbewohnern, Kollegen oder anderen Reizen stören („ablenken") zu lassen. Diese Leistung wird besonders dann gefordert, wenn ein Reiz monoton bzw. „langweilig" erscheint (z.B. Adressen in eine Datenbank übertragen etc.). Im Zusammenhang mit der fokussierten A. werden oft die Begriffe Konzentrationsfähigkeit und Ablenkbarkeit verwendet.

Wenn Sie zwei (oder mehr) Dinge gleichzeitig erledigen zu müssen, erfordert dies die **geteilte Aufmerksamkeit**, oft auch als verteilte oder parallele A. bezeichnet. Diese Art der Aufmerksamkeit wird z. B. bei Autofahren und gleichzeitigem Radiohören oder beim Mitschreiben und gleichzeitigem Zuhören gefordert. Dabei müssen Sie häufig sowohl visuelle als auch akustische Anforderungen gleichzeitig und gleichgut erledigen. Menschen mit Problemen darin neigen z. B. dazu, erst der einen und dann erst der anderen Anforderung hintereinander und nicht gleichzeitig nachkommen zu können, was dann u.a. zu Problemen bei der Steuerung des Arbeitstempos führen kann.

Aufmerksamkeit: Transfer in den Alltag

In unserem kognitiven Training trainieren Sie verschiedene kognitive Funktionen. Einige von Ihnen trainieren auch ihre Aufmerksamkeit. Da es verschiedene Arten der Aufmerksamkeit gibt, stehen hierfür auch drei verschiedene CogniPlus-Programme zur Verfügung:

Aktivierungsbereitschaft:
Motorradfahrer

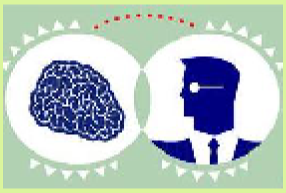
Selektive Aufmerksamkeit:
Figuren im Tunnel

Geteilte Aufmerksamkeit:
Flughafenkontrolleur

Vielleicht erkennen Sie die eine oder andere abgebildete PC-Übung wieder.

Wichtiger noch als die Verbesserung der Leistungen im Computerprogramm ist jedoch, ob es gelingt, das Gelernte auch im Alltag umzusetzen und dort anzuwenden, es sozusagen in den Alltag zu „transferieren". Unsere wöchentlichen Transfersitzungen sollen Ihnen dabei helfen. Da die Gruppensitzung jedoch recht kurz ist, möchten wir Ihnen hier auf diesem Merkblatt einige weiterführende Informationen zum Thema Alltagstransfer von Aufmerksamkeitsleistungen zur Verfügung stellen:

Training der Selbstbeobachtungsfähigkeit



Das A&O: Beobachten Sie sich selbst!

Achten Sie darauf, was Ihnen persönlich hilft, aufmerksamer zu sein, und in welchen Situationen Sie konzentrierter und aufmerksamer sind als in anderen. Hierfür haben wir Ihnen ein persönliches Tagebuch zur Verfügung gestellt, wo Sie u.a. solche Beobachtungen notieren können. Fragen Sie sich beispielsweise...

1. ...zu welcher Tageszeit es Ihnen leichter fällt, sich zu konzentrieren. Manche Menschen können vormittags besonders gut arbeiten, andere sind eher nachmittags oder abends in Hochform. Sind Sie eher ein Morgen- oder Abendmensch?
2. ...welche Hilfsmittel bei Ihnen persönlich dazu beitragen, sich besser zu konzentrieren. Fühlen Sie sich z.B. nach einer Tasse Kaffee wieder etwas wacher und aufnahmefähiger? Hören Sie beim Arbeiten gerne Musik oder brauchen Sie absolute Ruhe? Helfen Ihnen kleine Pausen oder Snacks dabei, sich wieder besser zu konzentrieren?
3. ...an welchen Orten Sie am besten aufmerksam arbeiten können. Können Sie z.B. besser zuhause arbeiten oder in Ihrem Büro? Oder hilft es Ihnen z.B., in die Bibliothek zu gehen, wo Sie von Ablenkungen (durch Familie, Kollegen, Fernseher etc.) besser abgeschirmt sind?

Anwendung mentaler Strategien

Denken Sie einmal darüber nach, ob Sie während des PC-Trainings bereits intuitiv bestimmte mentale Strategien anwenden, um besser abzuschneiden!

Häufig sind das Strategien, die Sie auch im Alltag bei ähnlichen Aufgaben oder in vergleichbaren Situationen anwenden können. Wichtig ist daher, während des Trainings hin und wieder bewusst darauf zu achten, wie genau Sie eigentlich vorgehen, welche Aufgaben Ihnen warum gut und welche schlechter gelingen, und ob Sie vielleicht Ihre Strategie geändert haben, weil sie merkten, dass eine andere besser klappt. Antizipieren Sie z.B. in der Motorradfahrer-Übung, was als nächstes passiert? Oder wie merken Sie sich eigentlich, auf welche Figuren Sie im Tunnel reagieren müssen?

Infoblatt zum Gedächtnis

Das Gedächtnis ist ein wichtiger Teil unseres Lebens. Mit „Gedächtnis" wird ganz allgemein die Fähigkeit von Organismen bezeichnet, aufgenommene Informationen mehr oder minder lange Zeit aufbewahren zu können. Daher ist ohne das Gedächtnis jede Form von Bewusstsein, Identität oder gar Lernen kaum vorstellbar. Sowohl auf der Arbeit als auch in unserer Freizeit sind wir permanent auf unser Gedächtnis angewiesen, weshalb Störungen von dessen Funktionsfähigkeit vielfältige Probleme im Berufs- und Alltagsleben mit sich bringen können. Gedächtnis ist jedoch nicht gleich Gedächtnis - grob kann man folgende Gedächtnisarten unterscheiden, welche verschiedene Funktionen erfüllen:

Gedächtnisart	Funktion
Sensorisches Gedächtnis (Ultrakurzzeitgedächtnis, sensorisches Register)	Ultrakurzer Zwischenspeicher, der sensorische Informationen direkt nach der Wahrnehmung Bruchteile von Sekunden zur potentiellen Weiterverarbeitung zu Verfügung hält; Kapazität relativ groß.
Arbeitsgedächtnis (früher: Kurzzeitgedächtnis)	Zuständig für die vorübergehende Aufnahme, aktive Verarbeitung und Speicherung, sowie den Abruf von aktuellen Informationen und Reizen (intern und extern); Kapazität begrenzt.
Langzeitgedächtnis	Dauerhaftes Speichersystem des Gehirns, das Information für die Dauer von Minuten bis zu Jahren oder sogar ein Leben lang speichern kann; Kapazität nahezu unbegrenzt.

Verschiedene Gedächtnisleistungen sind im Alltag laufend gefordert, wie diese Beispiele zeigen sollen:

Neue Informationen erreichen das Gehirn über die Sinnesorgane und werden in dem sensorischen Gedächtnis zwischengespeichert. Wenn Sie beispielsweise ein Bild betrachten und dann die Augen schließen, wird das gesamte Bild für einen ultrakurzen Moment noch im sensorischen Gedächtnis zwischengespeichert, zerfällt jedoch sofort wieder. Bei dieser Art der Erinnerung spielen zentrale, steuerbare Prozesse von Bewusstsein und Aufmerksamkeit keine Rolle. Diese sind jedoch bei der Übertragung der Informationen ins Arbeitsgedächtnis wichtig, d.h. wenn Sie etwa einen Teil des Bildes abzeichnen wollen, dann müssen Sie die Aufmerksamkeit darauf lenken, damit die Information ins Arbeitsgedächtnis übergehen kann.

Wenn Ihnen jemand eine längere Zahl wie eine Telefonnummer nennt und Sie sich diese über murmelndes Wiederholen merken, um sie in Ihr Notizbuch zu schreiben, ist Ihr Arbeitsgedächtnis aktiviert. Normalerweise wird diese Zahl direkt nach dem Aufschreiben auch schon wieder vergessen, sofern Sie sie nicht bewusst einprägen, damit sie ins Langzeitgedächtnis übergehen kann. Die Kapazität des Arbeitsgedächtnisses ist außerdem begrenzt, d.h. man kann nicht beliebig viele neue, gleichartige Informationen auf einmal dort verarbeiten, z.B. können Sie leicht drei oder vier Ziffern kurz behalten, um sie zu notieren, aber bei zwanzig wird es schon sehr schwer.

Das Langzeitgedächtnis ist kein einheitliches Speichersystem, sondern speichert verschiedene Informationen auf unterschiedliche Arten ab. Wenn Sie z.B. für eine Prüfung lernen, erleben Sie das normalerweise als anstrengend. Es ist ein dauerhaftes Üben und bewusstes Lernen erforderlich. Doch Inhalte können auch auf ganz andere Weise ins Langzeitgedächtnis gelangen: Z.B. erinnern Sie sich sicher noch gut und recht bildhaft an Ihre Hochzeit, die Geburt Ihrer Kinder usw. Dafür mussten Sie sich nichts bewusst einprägen. Auch autobiografische Erinnerungen gehören somit zum Langzeitgedächtnis, sie gelangen dorthin u.a. über Emotionen, die den Ereignissen die nötige Portion Aufmerksamkeit wie von alleine schenken.

Gedächtnis: Transfer in den Alltag

In unserem kognitiven Training trainieren Sie verschiedene kognitive Funktionen. Einige von Ihnen trainieren auch ihr Arbeitsgedächtnis. Das tun Sie im CogniPlus-Trainingsprogramm dadurch, dass Sie sich Bilder merken und mit anderen vergleichen sollen:

Arbeitsgedächtnis: *Fotos merken und auf Übereinstimmung mit anderen prüfen*

Wichtiger noch als die Verbesserung der Leistungen im Computerprogramm ist jedoch, ob es gelingt, das Gelernte auch im Alltag umzusetzen und dort anzuwenden, es sozusagen in den Alltag zu „transferieren". Unsere wöchentlichen Transfersitzungen sollen Ihnen dabei helfen.

Da die Gruppensitzung jedoch recht kurz ist, möchten wir Ihnen hier auf diesem Merkblatt einige weiterführende Informationen zum Thema Alltagstransfer von Gedächtnisleistungen und Gedächtnisstrategien zur Verfügung stellen:

Training der Selbstbeobachtungsfähigkeit

Das A&O: Beobachten Sie sich selbst!

Achten Sie darauf, was Ihnen persönlich hilft, sich Dinge zu merken oder Neues zu lernen, und in welchen Situationen Ihnen das besser gelingt als in anderen. Notieren Sie dies in Ihrem persönlichen Tagebuch! Fragen Sie sich z.B....

1. ...ob Ihre Vergesslichkeit von bestimmten Stimmungen wie Ärger oder Traurigkeit, aber auch Euphorie und Unbeschwertheit beeinflusst wird. Vergessen Sie z.B. eher Termine, wenn sie traurig sind?
2. ...ob Ihre Vergesslichkeit sich stärker auf bestimmte Inhalte bezieht als auf andere. Vergessen Sie z.B. eher Namen oder Termine? Verlegen Sie oft Dinge im Alltag, wie Ihre Brille oder den Schlüssel? Oder haben Sie mehr Schwierigkeiten dabei, Neues zu lernen? Fällt es Ihnen schwer, einem Gespräch zu folgen, weil Sie die gehörte Informationen nicht so gut aufnehmen können?

Externe Gedächtnishilfen

Erinnern Sie Ihr Gedächtnis daran, sich zu erinnern!

Damit sind alle Speichersysteme und Hinweise in der Umwelt, d.h. außerhalb Ihres Kopfes, gemeint, die Informationen zugänglich machen oder direkt für Sie speichern. Dazu zählen Kalender, Notizen, Post-Its, Wecker, Handyfunktionen und vieles mehr. Nutzen Sie solche Hilfen gezielt bei Ihren persönlichen Schwächen: Programmieren Sie z.B. Ihr Handy, damit es Sie rechtzeitig an wichtige Termine erinnert! Schreiben Sie sich eine Einkaufsliste - oder schreiben Sie sich wichtige Infos direkt auf die Hand! Führen Sie einen kleinen Taschenkalender mit sich, in dem Sie alles Wichtige notieren können! Legen Sie Schlüssel, Brillen oder andere Dinge, die Sie häufig verlegen, immer an einem festen, gut sichtbaren Ort ab! Solche externen Gedächtnishilfen können einem den Alltag enorm erleichtern - am besten Sie probieren verschiedene aus.

Infoblatt zur Inhibitionskontrolle

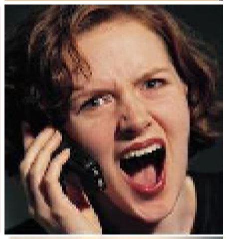
Unter **Inhibitionskontrolle** versteht man die Fähigkeit zur Inhibition bzw. Hemmung/Unterdrückung einer Handlung, eines Gedankens oder eines Gefühls(ausdrucks); und zwar besonders dann, wenn sich der Kontext überraschend verändert hat und die unterdrückte Reaktion nicht mehr angemessen wäre. Damit ist Inhibitionskontrolle eine Voraussetzung für **Selbstkontrolle** im Allgemeinen, welche sich auf die bewusste oder unbewusste Steuerung der Aufmerksamkeit, Emotionen und Handlungen bezieht. Ein Mangel an Inhibitionskontrolle wird oft mit **Impulsivität** in Zusammenhang gebracht. Besonders schwer fällt es den meisten Menschen, eine gewohnte Handlung zu unterbrechen bzw. zu hemmen, wobei Motivation und Konzentration die Inhibitionskontrolle verbessern können. Bei der Inhibition lassen sich zwei Bereiche unterscheiden:

Bereiche	Definition
Emotionsinhibition *(Hemmung von Gefühlsausdruck)*	Die Auswirkungen von Emotionen auf das Bewusstsein oder das Verhalten werden reduziert bzw. inhibiert.
Motorinhibition *(Hemmung von Bewegung/Handlung)*	Eine bereits begonnene oder geplante Bewegung bzw. Handlung wird abgebrochen/unterdrückt.

Selbstkontrolle und die Hemmung von Impulsen kann im Alltag vor allem im Umgang mit anderen Menschen wichtig sein, wie die folgenden Beispiele und Erläuterungen veranschaulichen sollen:

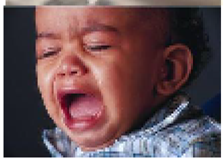
Meistens nutzen wir die Inhibitionskontrolle, ohne uns dessen überhaupt bewusst zu sein; zum Beispiel, wenn wir in einem Gespräch etwas sagen wollen, unser Gegenüber jedoch erst aussprechen lassen. Den Impuls dazwischenzureden, den jeder von uns in einer Unterhaltung wohl schon hatte, muss man also zunächst unterdrücken, weil man seinen Gesprächspartner nicht unterbrechen will, was gemeinhin als unhöflich gilt. Impulskontrolle kann aber auch lebenswichtig sein, zum Beispiel wenn wir beim Autofahren ganz plötzlich bremsen müssen, weil ein Kind unerwartet auf die Straße läuft. Da es in den beschriebenen Situationen darum geht, ein Verhalten zu unterdrücken oder abzubrechen, handelt es sich bei diesen Beispielen um **motorische Inhibition**.

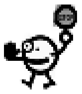
Die **Emotionsinhibition** ist immer dann beteiligt, wenn wir ein Gefühl unterdrücken, welches im gegebenen Kontext unangebracht wäre. Es wäre beispielsweise unvorteilhaft, wenn Sie im Gespräch mit Ihrem Vorgesetzten jedem Ärger und aggressiven Impuls unmittelbar nachgeben würden. Seinem Chef eine Ohrfeige zu verpassen, ist sicherlich nicht karriereförderlich, auch wenn Sie das manchmal gerne täten. In dieser Situation müssen Sie ihr Gefühl also hemmen bzw. kontrollieren, um Ihre Stelle nicht zu gefährden. Auch in vielen anderen zwischenmenschlichen Situationen muss man seine Emotionen zumindest teilweise kontrollieren, um nicht in Schwierigkeiten zu geraten, z.B. in Prüfungssituationen, in Vorstellungsgesprächen, oder auch einfach beim täglichen Smalltalk.



Die Fähigkeit der Inhibitionskontrolle wird auch wichtig im Alltag, wenn wir verschiedenen **Versuchungen** widerstehen wollen oder müssen. Diese Fähigkeit kann daher für viele Lebensbereiche und beim Erreichen unserer persönlichen Ziele entscheidend sein. Sich bremsen zu können kann gut für die Gesundheit sein, wenn wir uns davon abhalten, das zweite Stück Torte zu essen. Besonders im Umgang mit Mitmenschen ist diese Fähigkeit wichtig und kann großen Einfluss auf Erfolg und Misserfolg haben, da **Selbstkontrolle und die Hemmung von Impulsen** beim Einhalten von Normen, Regeln und Gesetzen einer Gesellschaft eine große Rolle spielen.

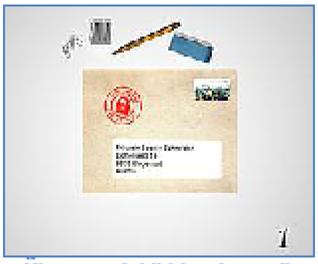
Inhibitionskontrolle ist eine Fähigkeit, die Teil unserer **Entwicklung** ist. Dies können viele aus eigener Erfahrung nachvollziehen. Kindern und Jugendlichen fällt es noch schwer, einen Impuls zu unterdrücken oder etwas Verbotenes nicht zu tun. Im Allgemeinen fällt es das im Erwachsenenalter deutlich leichter. Dennoch gibt es auch unter Erwachsenen große Unterschiede im Grad der persönlichen Inhibitions- bzw. Selbst- oder Impulskontrolle.





Inhibitionskontrolle: Transfer in den Alltag

In unserem kognitiven Training trainieren Sie verschiedene kognitive Funktionen. Einige von Ihnen trainieren sicherlich auch ihre Inhibitionskontrolle. Vielleicht erkennen Sie die abgebildete PC-Übung wieder. Wichtiger noch als die Verbesserung der Leistungen im Computerprogramm ist jedoch, ob es gelingt, das Gelernte auch im Alltag umzusetzen und dort anzuwenden, es sozusagen in den Alltag zu „transferieren". Unsere wöchentlichen Transfersitzungen sollen Ihnen dabei helfen. Da die Gruppensitzung jedoch recht kurz ist, möchten wir Ihnen hier auf diesem Merkblatt einige weiterführende Informationen zum Thema Alltagstransfer von Aufmerksamkeitsleistungen zur Verfügung stellen.



Übung zur Inhibitionskontrolle: *Briefe stempeln*

Training der Selbstbeobachtungsfähigkeit

Wann und in welchen Situationen werden Sie schwach?

Um im Alltag etwas ändern zu können, müssen Sie sich zunächst genau kennen lernen. Vielleicht wissen Sie das schon von den anderen Übungsblättern. Diesmal sollen Sie nun ihre Impulsivität, ihre Selbst- und Emotionskontrolle genauer unter die Lupe nehmen. Nur wenn Sie Ihre persönlichen Schwächen kennen, können Sie etwas ändern! Fragen Sie sich beispielsweise...

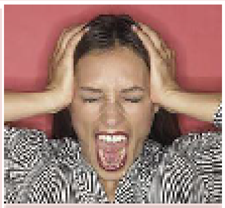
...in welchem Bereich Sie sich schlechter kontrollieren können. Sind es eher Emotionen oder Handlungen, und welche genau? Haben Sie z.B. häufig Wutausbrüche? Oder können Sie andere schlecht aussprechen lassen? Haben Sie Schwierigkeiten, schlechte Gewohnheiten abzulegen?

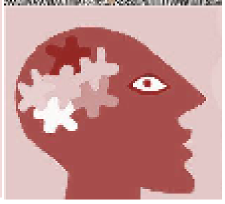
...in welchen Situationen Sie typischerweise impulsiv reagieren oder eine Handlung oder Gefühl nicht mehr kontrollieren können. Macht es einen Unterschied, ob andere Menschen dabei sind? Hat Ihre Stimmung einen Einfluss auf Ihre Impulsivität oder Selbstkontrolle, z.B. Stress? Reagieren Sie eher zuhause oder an fremden Orten ungehalten?

Wie Sie sehen, können Schwierigkeiten in der Inhibitionskontrolle von Person zu Person völlig unterschiedlich aussehen. Sobald Sie die wichtigsten Situationen für sich identifiziert haben, sollten sie darüber nachdenken, warum Sie genau in diesen Situationen die Kontrolle über ihre Reaktion verlieren. Außerdem sollten Sie bedenken, welche kurz- und langfristigen Konsequenzen ihr Verhalten für Sie selbst, und auch für Ihre Mitmenschen hat. Hierbei können Sie das bereitgestellte Tagebuch zur Hilfe nehmen.

Entwurf von Gegenstrategien

Mental Vorbereiten statt planlos Ausrasten und Agieren!





Ein Ziel der Selbstbeobachtung ist es, schwierige Situationen, die impulsives Verhalten wahrscheinlich machen, schon im Vorfeld zu erkennen und zu vermeiden oder zu modifizieren. Falls Sie z.B. festgestellt haben, dass Sie im persönlichen Kontakt Probleme haben, Konflikte sachlich zu besprechen, könnten Sie stattdessen eine E-Mail schreiben, die Ihnen möglicherweise die nötige Distanz verschafft, um sachlicher zu bleiben. Vermeidung ist jedoch nicht immer möglich und angebracht. In dem Fall sollten Sie sich gedanklich schon einmal auf die Situation vorbereiten und einen mentalen Handlungsplan entwerfen, den Sie im Vorfeld möglichst oft durchgehen. Ist ein persönliches Gespräch zur Klärung eines Konfliktes beispielsweise nötig, dann bereiten Sie Ihre Argumente und den Gesprächsablauf mental schon einmal vor, simulieren das Gespräch evtl. vorher mithilfe eines Freundes, oder bestehen darauf, eine dritte, vermittelnde Partei beim Gespräch dabei zu haben.

Infoblatt zur Planungsfähigkeit

Tagein, tagaus planen wir unser Leben – manchmal nur die nächsten Stunden, manchmal auch schon die nächsten Jahre. Wenn der Mensch plant, kreiert er einen (gedanklichen) Entwurf von zeitlich geordneten Handlungsschritten. D.h. wenn wir planen, denken wir darüber nach, welche Aufgaben wir in der Zukunft auf welche Weise oder auch in welcher Reihenfolge erledigen müssen, um ein bestimmtes Ziel zu erreichen. Planen wir ineffektiv, können wir nicht alle Aufgaben erledigen oder aber verschenken unnötige Zeit, oder - im schlimmsten Fall - erreichen unser Ziel überhaupt nicht. Die Planungsfähigkeit hat damit eine zentrale Bedeutung im menschlichen Leben. Mit ihrer Hilfe gestalten wir aktiv unsere Gegenwart und Zukunft.

Zwei Begriffe verdienen im Zusammenhang mit der Planungsfähigkeit Erwähnung:

Bereiche	Definition
Exekutivfunktionen *(="Ausführungsfunktionen")*	Als Exekutivfunktionen bezeichnet man all diejenigen Funktionen, mit denen der Mensch sein Verhalten unter Berücksichtigung seiner Umwelt steuert. Damit zählt das Planen zu den Exekutivfunktionen.
Problemlösen *(= Überführung eines Ist- in einen Soll-Zustand)*	Planen wird oft als ein zentraler Schritt beim Problemlösen verstanden. Während Problemlösen allgemein das Überführen eines Ist- in einen gewünschten Soll-Zustand mit allen damit verbundenen Anforderungen meint, wird im Planen konkretisiert, wie genau dies geschehen soll. Die Betonung liegt beim Planen also auf der Wahl der Mittel und Wege, ein Problem zu lösen bzw. eine Aufgabe zu erledigen bzw. ein Ziel zu erreichen.

Beim Planen müssen wir viele Dinge bedenken...
Haben wir ein bestimmtes Ziel oder eine Aufgabe ins Auge gefasst, stellt sich meist die Frage, welche Schritte wir in welcher Reihenfolge nehmen müssen, um dieses Ziel zu erreichen oder unsere Aufgabe zu erledigen. Oft steht uns nur ein bestimmtes Maß an Zeit und Geld zur Verfügung. Wir müssen daher genau überlegen, wie wir diese knappen Ressourcen am besten verteilen. Je komplexer unsere Aufgaben und Ziele, umso stärker wird unsere Planungsfähigkeit beansprucht. Hier ist es wichtig, sich über die persönlichen Prioritäten in Bezug auf die aktuelle Planungsaufgabe Gedanken zu machen. Dies trifft genauso auf das Organisieren von einfachen alltäglichen Anforderungen wie Einkaufen, als auch auf komplexe Organisationsaufgaben wie die Planung von Hochzeitsfeiern, Reisen oder größeren beruflichen Projekten zu.

Wenn wir unseren Alltag planen...
...erstellen wir eine mentale oder reale Liste von Aufgaben, die wir innerhalb eines bestimmten Zeitraums erledigen wollen. Im Allgemeinen haben bestimmte Termine wie Arztbesuche bereits einen festen Platz im Kalender, um die herum wir sozusagen mehr oder weniger variabel Aufgaben wie den Einkauf oder den Haushalt organisieren müssen. Beim Einkaufen etwa müssen wir uns Gedanken darüber machen, was wir in den nächsten Tagen essen wollen und welche Lebensmittel wir dafür benötigen. Routinen mit gewohnten Abläufen können uns zwar einen Teil der alltäglichen Planungsanforderungen erleichtern, uns aber auch unflexibel machen.

Für das Organisieren einer Reise zum Beispiel...
...sind effiziente Planungsfähigkeiten erforderlich: Wir müssen entscheiden, wohin wir wollen und wie wir dorthin kommen. Oft stehen mehrere Möglichkeiten zur Auswahl und der Reisende wird versuchen, die optimale Wahl zu treffen. Es müssen Finanzen, Reisezeitraum, Unterkunft, Reisebestimmungen, Vorlieben aller Familienmitglieder und vieles mehr bedacht werden, wobei an zahlreichen Stellen auch Konflikte entstehen können. Neben Zeit und Geld kostet uns das auch kognitive Ressourcen, denn wir müssen all diese Aspekte im Gedächtnis behalten, gleichzeitig die beste Option in einer Vielzahl von Alternativen finden, und dabei auch noch flexibel auf unerwartete Hindernisse reagieren. Das fordert unser Gehirn ganz schön heraus!

9 Curriculum Vitae

PERSONALIEN

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Geburtsort:	Freiburg im Breisgau
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SCHULISCHER WERDEGANG

1994 – 1998	Grimmelshausen Grundschule, Renchen
1998 – 2002	Heimschule Lender, Sasbach
2002 – 2007	Städtisches Gymnasium, Achern
21.06.2007	Abitur (Note 1,7)

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01.09.2010	Abschluss des Bachelor of Science Psychologie (Note 1,5)
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Seit 2014	Ausbildung zur Psychologischen Psychotherapeutin in Verhaltenstherapie, Zentrum für Psychologische Psychotherapie (ZPP), Heidelberg

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Während der Arbeit an der Studie ermöglichte es mir Isabelle Rek dank ihrer höchst zuverlässigen und gewissenhaften Art meine Elternzeit zu genießen. Ich hätte mir keine bessere Vertretung wünschen können.

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11 Eidesstattliche Versicherung

Bei der eingereichten Dissertation zu dem Thema „ The effect of cognitive remediation therapy on neurocognitive and psychosocial functioning in (partly) remitted depressed adults“ handelt es sich um meine eigenständig erbrachte Leistung.

Ich habe nur die angegebenen Quellen und Hilfsmittel benutzt und mich keiner unzulässigen Hilfe Dritter bedient. Insbesondere habe ich wörtlich oder sinngemäß aus anderen Werken übernommene Inhalte als solche kenntlich gemacht.

Die Arbeit oder Teile davon habe ich bislang nicht an einer Hochschule des In- oder Auslands als Bestandteil einer Prüfungs- oder Qualifikationsleistung vorgelegt.

Die Richtigkeit der vorstehenden Erklärungen bestätige ich.

Die Bedeutung der eidesstattlichen Versicherung und die strafrechtlichen Folgen einer unrichtigen oder unvollständigen eidesstattlichen Versicherung sind mir bekannt.

Ich versichere an Eides statt, dass ich nach bestem Wissen die reine Wahrheit erklärt und nichts verschwiegen habe.

Ort und Datum Unterschrift