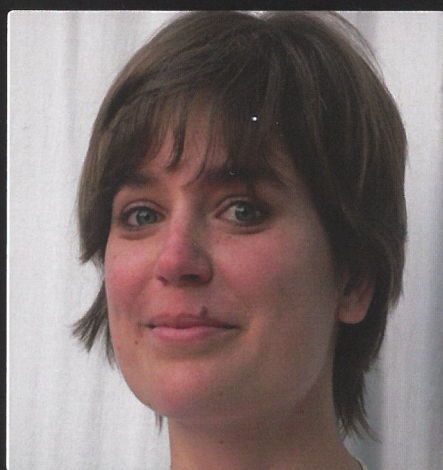


Neurofeedback for **ADHD** treatment

Professor Dr Hanna Christiansen is changing the face of attention deficit/hyperactivity disorder diagnosis and treatment by developing a novel, quantitative and objective treatment strategy that makes use of neurofeedback and behavioural modification techniques



Could you briefly describe your professional background and explain your role in the neurofeedback study for attention deficit/hyperactivity disorder (ADHD)?

I am a trained child, adolescent and adult psychotherapist. I worked for five years at the Clinic for Child and Adolescent Psychiatry and Psychotherapy at the University of Duisburg-Essen, Germany, and was Chief Investigator in the International Multi-Center ADHD Genetics Project. In fact, my own PhD was on ADHD and comorbid disorders, and the influence of expressed emotion on comorbid conduct problems.

In 2011, as Principal Investigator, I started the neurofeedback study, comparing

neurofeedback ADHD therapy with more traditional self-management strategies in an outpatient study – measuring effectiveness under naturalistic conditions. There are currently two PhD students working with me on this project.

What is the basis of neurofeedback-based therapy, and how does it differ from self-management approaches?

Neurofeedback is a type of behaviour therapy for children with ADHD that combines behavioural and neurocognitive elements. Children learn to differentiate between active and relaxed/inactive states of mind. In essence, we train them to slow their cortical potentials. The goal is that children learn to discriminate between states and to activate themselves in situations where attention is needed, such as at school. To enhance treatment effects, we use positive reinforcement, such as token economies, where children get a reward for each correct trial. Furthermore, they get small cards showing the object they trained with, which they then take to school to enhance transfer into this environment.

Conversely, in self-management therapy, children learn to regulate their behaviour. It is based on Meichenbaum-training where the therapist first shows the strategy, ie. says aloud what the task is and verbally comments on all steps leading to task completion; then the child copies the therapist. In a second step, the therapist

models the behaviour, but only murmurs to himself – and the child repeats. Finally, the child is trained to use an inner monologue for task completion.

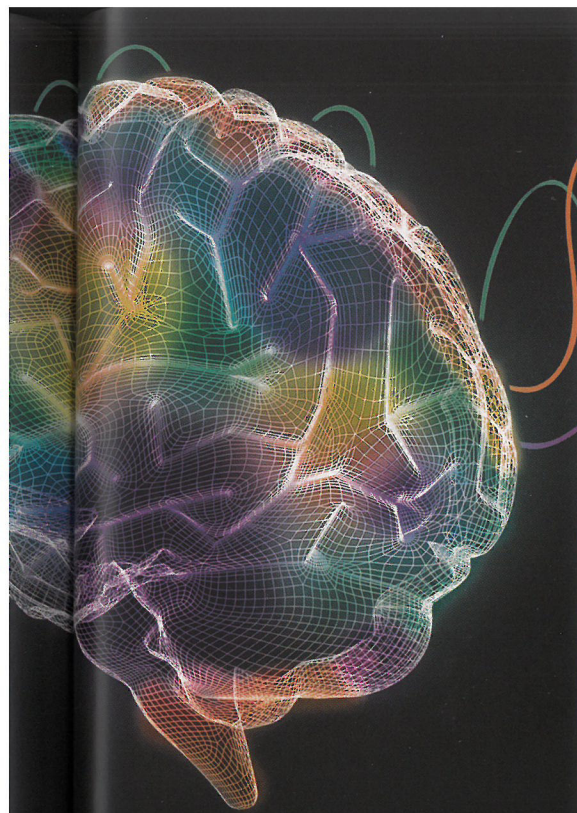
Can you outline the outcome measures that you will be assessing in this study, and how they will be quantified?

Subjects will be treated with either neurofeedback techniques of self-management for 36 sessions and assessments will be made before therapy, after therapy completion, and with follow-ups at six and 12 months. We are using the Conners-3 rating scales to seek subject assessment from their parents and teacher, quantified EEG measures, neuropsychological test scores (QbTest, test battery of attention for children-TAP), and basal cortisol levels.

There has been debate over the efficacy of neurofeedback-based techniques in recent years. How will your study address this?

The novel aspect of our study is that it is not assessing efficacy but effectiveness. So far, the vast majority of ADHD therapy studies have been performed under highly standardised laboratory conditions. Our aim is to provide care for children and families in a natural outpatient setting, in a way that doesn't exclude children with comorbidities or those on medication.

The literature concludes that a high frequency of therapy (ie. three sessions a week), with



Addressing attention deficit

For too long, ADHD has been diagnosed through subjective questionnaire-based methods that fail to account for its complexity. Researchers from the **Philipps University of Marburg** are working to change this

a minimum of 30 neurofeedback sessions, is effective for the treatment of ADHD. Children with ADHD have altered reinforcement mechanisms – they would choose to have a small reward sooner than a larger reward later. With this rationale, highly frequent training that leads to improvements in a short time period seems the only adequate treatment. Unfortunately, psychotherapy treatment in Germany usually occurs only once a week and psychotherapists are hesitant to treat children with ADHD. Thus, the vast majority are on medication, even though many parents have objections to this.

We want to establish whether treatment in a high frequency outpatient setting will lead to improvements in impairment, and whether neurofeedback offers an alternative treatment method for psychotherapists. At the moment, outpatients are most commonly treated by self-management but, because of the similarities to school work, some children have problems with this treatment approach. It is always good to have an effective alternative treatment.

What stage are you currently at in the study and what does the future hold?

We have so far assessed 50 children, but not all of them fulfilled the diagnostic and inclusion criteria. We eventually aim to include at least 96 children. Since we opened our outpatient clinic in January this year, we have offered this treatment option to children, and we also aim to test its effectiveness in adolescents and adults.

THOUGHT TO AFFLICT around 5 per cent of the global population, hyperactivity has always been a part of the human condition. As far back as 1798, it was described by Scottish physician Sir Alexander Crichton as 'mental restlessness' in his book *An inquiry into the nature and origin of mental derangement*. In its more recent and medicalised state, attention deficit/hyperactivity disorder (ADHD) was first clearly described in 1902 by the father of British paediatrics, Sir George Still. In the decades that have followed, the condition – that many argue is nothing more than an extension of normal behavior – has evolved to include a triad of characterising symptoms: impairment in attention, impulsivity and hyperactivity.

Until now, a diagnosis of ADHD has been based on subjective questionnaires that do not accurately assess all three crucial elements of the ADHD triad. This is particularly worrying when one considers that treatment is often centred on stimulant medications, such as Ritalin, whose long-term effects for children and adolescents are largely unknown.

For these reasons, Professor Dr Hanna Christiansen, from the Philipps University of Marburg, Germany, is undertaking a number of ADHD-associated studies that aim to improve understanding of this complex condition and develop more comprehensive and multi-dimensional approaches for its diagnosis and treatment.

ADHD

ADHD diagnoses have always presented difficulties for physicians: where does one draw the line between 'normal' and 'pathological' behaviour? Based on presenting symptoms, ADHD can be divided

into three subtypes – predominantly inattentive, predominantly hyperactive-impulsive, or combined if criteria for both types are met. Inattention symptoms can include being easily distracted, missing details, forgetting things, difficulty maintaining focus and frequently switching from one activity to another. Concurrently, hyperactivity typically presents in the form of physical fidgeting and squirming, and also touching or playing with anything and everything in sight.

Improved classroom management and regulation of behaviours could help mitigate the consequences of this condition for the afflicted children

This means that individuals with ADHD can often cause difficulties for those who deal with them and, particularly in the case of children, can hinder the education of both the individual and their peers in the classroom. To address this, Christiansen and her team first turned their attention to objectivising the diagnostic process by developing a method for quantifying the presentation of associated symptoms.

QUANTIFIED BEHAVIOUR

To increase the objectiveness of ADHD diagnosis, in a 2013 study published in the *Journal of*

INTELLIGENCE

NEUROFEEDBACK STUDY ADHD PROJECT OBJECTIVES

- To reduce core ADHD symptoms using neurofeedback techniques and, consequently, enhance quality of life, social support and self-concept of affected individuals
- To identify possible biomarkers of therapy response, such as quantitative EEG patterns, cortisol and genotype-dependent training effects

KEY COLLABORATORS

PD Dr Oliver Hirsch; Dr Jost Stellmacher; Professor Dr Mario Gollwitzer; Dr Daniel David Ebert; Professor Dr Winfried Rief, University of Marburg, Germany • **Professor Dr Martina Ruhmland,** PFH Private University of Applied Sciences, Germany • **Professor Dr Ricarda Steinmayr,** Technical University of Dortmund, Germany • **Dr Bernhard Kis,** University of Duisburg-Essen, Germany • **PD Dr Karen Lidzba,** University Children's Hospital Tübingen, Germany • **PD Dr Renate Drechsler,** University of Zurich, Switzerland

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HANNA CHRISTIANSEN trained in child, adolescent and adult psychotherapy at the Universities of Duisburg-Essen (DUE) and Marburg. From 2003 to 2008, she was Chief Investigator of the Multi Center ADHD Genetic Study (IMAGE) and a clinical psychologist at DUE. Following this, Christiansen moved to the Philipps University of Marburg to work as a research assistant in the Department of Clinical Psychology, before taking up her professorship.



Attention Disorders, Christiansen and her team used a neuropsychological quantified behaviour test (QbTest) – a type of continuous performance test combined with activity assessment – to study the defining ADHD symptoms.

It was found that the QbTest cannot be sufficiently described as one overall measure of performance but, instead, all three aspects of the condition must be considered separately. The researchers cross-referenced neuropsychological findings with behavioural results obtained from a Conners' teacher rating of hyperactive/impulsive behaviour and found a low correlation for some of the factors. This highlighted both the need for a review of current diagnostic tools and the dangers of using a singular test to account for correct diagnosis and treatment effectiveness.

PREVENTION PREFERABLE TO CURE

While this form of assessment will allow for a more rigid approach to both diagnosis and assessment of new alternative treatments, another key goal for Christiansen and her team has been ADHD prevention. With the objective of reducing the negative impact on the afflicted individual's school-based education, in 2011 Christiansen presented a universal preschool programme to target therapy to younger children.

The pilot study involved two groups of children with ADHD – one of which received behaviour modification, while the other received behaviour modification alongside school-based attention training therapy. As predicted, after six months they found that the preschoolers who were exposed to treatment (behaviour modification with and without attention training) showed significantly fewer ADHD symptoms than those in the control group. Contrary to their hypothesis however, children in the group receiving both types of treatment did not benefit from the additional intervention; behavioural modification alone seemed to be more effective.

TEACHER TRAINING

Concerning the management of school-age children and adolescents with ADHD, studies have shown that teachers often have limited knowledge of the condition and poor skills for managing afflicted individuals. This leads to more disruptive behaviour, less integration of the student with their peers and a poorer education record. Recognising the important role that teachers can play, Christiansen and colleagues (Professor Dr Martina Ruhmland, Dr Jost Stellmacher and psychologist Lisa Nadolny) are currently carrying out an assessment of student teachers' understanding of ADHD using questionnaires to assess knowledge of symptomatology, interventions, attitudes and experiences. "A result of the study might be to highlight that courses on ADHD need to be integrated into teaching degrees, to prepare student teachers for future activities where they are likely to encounter children with ADHD," predicts Christiansen. Improved classroom management and regulation of behaviours could

Studying ADHD in adults

ADHD is most often diagnosed in early childhood and, in this context, diagnostic tools are well validated and reliable. ADHD often persists into adulthood, at which point diagnosis is more complex and the condition can contribute to personal and professional difficulties. There is much debate about the suitability of using the same diagnostic criteria for adult ADHD as for children, in which the validation studies have been carried out.

Consequently, researchers have tried to develop specific criteria for adults that are used in self-report and observer-rated questionnaires. In English-speaking countries these are becoming well validated by experimental analysis. However, such validated tools are still rare in German-speaking countries. Christiansen led a study to evaluate a German version of the Conners adult ADHD rating scale self-report tool involving 466 adult participants with ADHD and 851 healthy controls. The study aimed to test the factor structure of the international Conners rating scale against the German version and confirmed that the structure of the original American model was valid for the German context and represented a reliable diagnosis tool for adult ADHD.

help mitigate the consequences of this condition for the afflicted children, reduce teacher stress and improve integration of pupils with ADHD.

TREATMENT

While the development and implementation of more accurate, reliable and objective diagnostic techniques has enabled Christiansen to more easily identify those children in need of therapy, the end goal of her research is to use novel and effective treatment options to battle this disruptive condition. The next step is to take the neurofeedback treatment from the clinic to the home, and the researchers recently assessed its effectiveness in a naturalistic outpatient setting. While the findings are yet to be validated by other studies, the results were promising, as moderate to large effects were observed at post-treatment assessment. That said, these effects were attenuated over time, therefore there is still work to be done to establish the longitudinal effectiveness of neurofeedback.

For now, the future looks bright for both this new treatment option and a more effective method of diagnosing and assessing ADHD in children and, eventually, adults. "While we have only tested on children at this stage, we believe that this treatment option will have potential applications in other age groups and for the benefit of other psychopathological conditions with impaired attention and self-regulation," Christiansen concludes.