Reconfiguratie van functionele neurale netwerken bij dyslectische lezers die in behandeling zijn voor hun leesproblemen.

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1. Quantify changes in structural and functional brain networks within dyslexic readers, induced by an intervention with known and established behavioural effects.2. Examine whether short brain activity acquisition (5-8 minutes) of the resting state...

Ethische beoordeling	Goedgekeurd WMO
Status	Zal niet starten
Type aandoening	Overige aandoening
Onderzoekstype	Observationeel onderzoek, met invasieve metingen

Samenvatting

ID

NL-OMON35622

Bron
ToetsingOnline

Verkorte titel
Ontwikkelingsyslexie, interventie en het adaptieve brein

Aandoening

- Overige aandoening

Synoniemen aandoening
Ontwikkelingsdyslexie, woordblindheid

Aandoening

specific learning disability

Betreft onderzoek met
Mensen

Ondersteuning

Primaire sponsor: Radboud Universiteit Nijmegen
Overige ondersteuning: Ministerie van OC&W,Regionaal Instituut voor Dyslexie

Onderzoeksproduct en/of interventie

Trefwoord: Complexe netwerk analyse, Complexiteit, Fractale fysiologie, Ontwikkelingsdyslexie

Uitkomstmaten

Primaire uitkomstmaten

1. Measures derived from complex network analysis, spectral analysis of

different frequency bands, and recurrence quantification analysis are generally

expected to converge on:

- less scale-free organization in dyslexic readers' brain networks when

compared to average reading peers.

- deviations from 1/f noise (f.i. towards white noise or Brownian noise) in the

time series of dyslexic readers' brain activity when compared to average

reading peers.

- more random or laminar attractor dynamics of the functional network of

dyslexic readers when compared to average reading peers.

2. The expected organization characteristics sketched in 1 are hypothesized to

be present most clearly in the tasks that require most integration of component

processes.

3. Within-subject analyses over the three measurement occasions are expected to

reveal more scale-free organization in those participants who benefit from the

intervention. Moreover, for those participants the observation of scale-free

organization is expected to increase in tasks that require highest level of

integration of component processes.

Secundaire uitkomstmaten

na

Toelichting onderzoek

Achtergrond van het onderzoek

The study is set up against the background of three emerging theoretical fields in neuroscience: complex network analysis of brain activity, the brain as part of a complex dynamical system (brain-body-environment system) and the analysis of resting state brain activity. Related to developmental dyslexia the following

1. Variability in repeated measures of cognitive performance in developmental dyslexia are indicative of impaired coordination dynamics at the micro-scale level of emergent (neuro-)physiological synchronization.

2. A wide range of structural anomalies in the organization of brain networks have been associated with developmental dyslexia. Intervention induced changes in structural connectivity have been reported.

3. A wide range of functional anomalies in patterns of activation of brain networks have been associated with developmental dyslexia. Intervention induced changes in functional connectivity have been reported.

4. Synchronization and coordination of physiological processes in body and brain have been shown to develop naturally from independent component dynamics towards interdependent scale-free, interaction dominant dynamics. Such dynamics signify health and wellbeing of body and mind, fuency and proficiency of (cognitive) performance. Change towards metastable dynamics can be induced by means of medical and behavioural intervention. Change away from metastable dynamics can be induced by disease and constraints of structural system organization and the environment.

5. Studying the changes in structural and functional complex brain networks induced by an intervention program known to cause behavioural changes in developmental dyslexia allows for the study of micro-to-macro scale emergence

of behavior, as well as the macro-to-micro constraining of structural and functional networks induced by an intervention program: An inquiry into learning and plasticity.

The three major hypotheses derived from the framework above are:

1. Based on results obtained in our fuency and dispersion studies of impaired reading: Complex networks obtained from resting-state activity of dyslexic readers should show deviations from scale-free network organization.

2. Based on our studies showing that practice improves emergent coordination dynamics: Within subject comparison of measurement occasions should reveal network reconfiguration associated to behavioural improvement.

3. Based on our studies showing trade-offs across multiple scales of coordination that depend on low-level principles of energy minimisation and high-level task constraints: A hierarchy of connectivity changes associated with component processes of reading is expected with processes demanding highest integration and coupling between components to be the most resistant to change.

Doel van het onderzoek

1. Quantify changes in structural and functional brain networks within dyslexic readers, induced by an intervention with known and established behavioural effects.

2. Examine whether short brain activity acquisition (5-8 minutes) of the resting state can reveal structural differences between dyslexic and average readers.

3. Examine whether a characterisation of the structure*function interaction or coupling of such networks within dyslexic readers provides insight into differences in resistance to intervention between dyslexic readers.

4. Examine bi-directional association of micro-scale changes in brain networks to macro-scale behavioural changes.

Onderzoeksopzet

Three groups of 15 participants aged 10-12 years of age, will take part in the study:

1. ListEnter: Clients who enter the waiting-list, that have just been diagnosed with developmental dyslexia.

2. ListLeave: Clients who are leaving the waiting-list and are about to start the intervention program.
3. Classroom: A control group of children sampled from the classrooms of the participants diagnosed with developmental dyslexia.

All groups (total N=45) will be measured at least three times, the ListLeave group ideally start the first measurement within the same month as the ListEnter group and thus serves as a natural *no-intervention* control group to the ListLeave group. As soon as a client in the ListEnter group leaves the waiting-list to start the intervention program, their second measurement will be performed.

Records of brain activity will be acquired using Magneto Encephalo Graphy (MEG). After each measurement occasion a structural image will be acquired (for co-registration purposes), using Magnetic Resonance Imaging (MRI). This is warranted by the developing brains of the young participants in this study.

Structure: Resting-state
Analysis of resting state brain-activity enabled a majority of the reported complex brain network studies to distinguish between experimental groups (hypothesis 1). The proposed design allows for the first time assessment of within subject structural changes induced by intervention (hypothesis 2). Acquisition of resting-state activity is straightforward and involves the participant closing his or her eyes for 5 to 8 minutes. The present study will sample resting-state MEG at the beginning of each experimental session, at all three measurement occasions. Additionally, a functional
MRI resting state will be acquired. This involves little additional burden, as it can be obtained after acquisition of the structural MRI and does not involve any activity on behalf of the participant. These measurements will be used to analyze the structural brain connectivity with greater spatial resolution than that of MEG. MEG on the other hand has superior temporal resolution allowing for accurate analysis of functional connectivity.

Function ~ Behaviour: Phonology, reading and spelling
Recent studies of complex brain networks compare qualitatively different states of activity, or associate cognitive performance to resting-state network characteristics. The proposed study will do both in that resting-state network characteristics will be associated with behavioural measures recorded during diagnosis and various stages of the intervention. Additionally, measurements of four important component processes that are also part of differential diagnosis and progress assessment. These are the reading of a short story; the reading of words and pseudo words; letter-sound identification and speech sound manipulation by deletion. Each task will be performed inside the MEG scanner and takes about 5 minutes to complete. The tasks have been adapted to enable performance during brain activity acquisition and require a button press, or no

response at all.
The total duration of the experiment amounts to less than 30 minutes in the MEG, followed by a 10 minute MRI scan to acquire a structural volume and functional resting-state measurements.

Inschatting van belasting en risico

na

Contactpersonen

Publiek

Radboud Universiteit Nijmegen

Montessorilaan 3
6500 HE Nijmegen
NL

Wetenschappelijk

Radboud Universiteit Nijmegen

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NL

Locaties

Landen waar het onderzoek wordt uitgevoerd

Netherlands

Deelname eisen

Leeftijd
Kinderen (2-11 jaar)

Belangrijkste voorwaarden om deel te mogen nemen (Inclusiecriteria)

Gediagnosticeerd met ontwikkelingsdyslexie door een erkend instituut en bij hetzelfde instituut op de wachtlijst voor behandeling. (i.e. conform de criteria van het dyslexie besluit VWS, 2 juli 2008, voor dekking van diagnose en behandeling binnen het basispakket)

Belangrijkste redenen om niet deel te kunnen nemen (Exclusiecriteria)

Overige leerstoornissen, co-morbiditeit met ADHD, Dyscalculie (i.e. conform de criteria van het dyslexie besluit VWS, 2 juli 2008, die geen dekking binnen het basispakket geven);Exclusie criteria gerelateerd aan metingen met een MRI en MEG scanner.

Onderzoeksopzet

Opzet

Type:	Observationeel onderzoek, met invasieve metingen
Onderzoeksmodel:	Anders
Toewijzing:	Niet-gerandomiseerd
Blindering:	Open / niet geblindeerd
Controle:	Actieve controle groep
Doel:	Algemeen wetenschappelijk

Deelname

Nederland

Status:	Zal niet starten
Aantal proefpersonen:	45
Type:	Verwachte startdatum

Ethische beoordeling

Goedgekeurd WMO

Datum:	08-03-2012

Soort:	Eerste indiening
Toetsingscommissie:	CMO regio Arnhem-Nijmegen (Nijmegen)

Registraties

Opgevolgd door onderstaande (mogelijk meer actuele) registratie

Geen registraties gevonden.

Andere (mogelijk minder actuele) registraties in dit register

Geen registraties gevonden.

In overige registers

Register	ID
CCMO	NL37502.091.11