

# DONDERS

## INSTITUTE

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# *CityLab: the knife that cuts both ways*

In the muZIEum, visitors can experience what it feels like to be blind or partially sighted. This popular Nijmegen museum will now team up with the Donders Institute in the CityLab initiative, through which visitors can experience behavioural experiments as part of their visit. The collaboration will make the Donders Institute more visible for the general public, and create options for enhanced scientific research.

The CityLab evolved from the desire of the institute to be more embedded in society, says Alan Sanfey, coordinator of the CityLab scientific committee. He says that the neuroscience institute “has an excellent scientific reputation. But I think we can do better in terms of our visibility in society. I also believe that we have a social responsibility to show how interesting and relevant much of the work that we do actually is.”

MuZIEum gets a lot in return, according to director Heleen Vermeulen. She thinks that the scientists add more quality, interaction, education and entertainment to the museum. “Through the experiments and lectures that the scientists will give, our visitors can learn more about science. We have the firm belief that visitors simply are better educated and have more fun when there is more action and interaction involved,” says Ver-





meulen, who feels that this is only the beginning of a promising friendship. “We’ve been working together for a year now on this project. We’ve learned a lot about each other’s organizations, but I am sure there are many opportunities which we haven’t yet discovered. The quality of the experiments and the technology at the Donders Institute are at such a high level. At the muZIEum, we by no means know everything about all the possibilities.”

### LINKING TARGET GROUPS

The CityLab will provide visitors with examples which show how experiments are conducted. It also allows visitors to find answers to broad questions about science and the senses. Another advantage of the collaboration between the muZIEum and Donders is the variety of research participants. In a typical experiment that

researchers conduct at the Donders Institute, most of the sample population consists of students from Radboud University. “This is a rather narrow cross-section,” says Sanfey. “In the future, the CityLab should help us to have access to a much broader set of potential participants, so that we can increase the diversity of the people that we study.”

On the other hand, the collaboration might help muZIEum in achieving its ambitious goals. In the last non-Covid year (2019), the museum welcomed 42,000 visitors. In the future, the annual goal is 55,000 visitors. Vermeulen: “You can say that we link both of our target audiences. For us, the student population is very interesting. And I think it is fair to say that this cooperation is also good for Nijmegen, which considers itself to be a city of knowledge and science.”

### MAKING SCIENCE OUT OF EXPERIENCE

Sanfey wants to ‘offer a path’ to researchers who are interested in doing experiments in the muZIEum. One of the main attractions in the museum is the dark experience, in which visitors experience how it is to be blind in a supermarket or on the streets. “We can measure heart rate, look at how people’s senses are adapting to pitch blackness, and how they feel when they emerge. Eventually, we hope to be able to assess visitors multiple times in the muZIEum, asking different sets of questions, and even offer follow-up studies at a later date.”

Although the ambitions of muZIEum and the scientific committee are big, Sanfey knows it’s good to start small. Before the data can be used in research, the CityLab will enter a pilot phase of several months. According to Sanfey, the main challenge is to adapt the experiments to a broad range of people, from young to old. The language must be accessible, the visuals compelling. “For example, our current experiments will run on touch-screen kiosks and the muZIEum is a semi-public space. At the Donders Institute, we often give very detailed and time-consuming instructions in private, but you simply can’t do that with our muZIEum set-up. We have to tailor experiments to a very different type of environment.”

To make this work, the CityLab team has drawn inspiration from other ‘experience museums’, such as the Nemo science museum in Amsterdam, to learn how to utilize this type of data collection. There’s also another crucial point of interest: the quality of the data itself. “While we want this to be an informative and hopefully fun experience for the visitors, we also want to ensure that people take the experiments seriously. So, the pilot phase will allow us to assess the data we are collecting and give us some opportunities to trial diverse ways of interacting with the participants.”

*Daan Appels*

# Ageing, ultrasound, PTSD, Parkinson's, and retrieval of words

Five Vidi projects across the institute show Donders' diversity

What has the ageing brain to do with post-traumatic stress disorder? And how does the retrieval of words relate to ultrasound or Parkinson's disease? The keyword is *Donders*. In 2021, five Vidi grants were awarded to Donders researchers, all across the institute.

## Parkinson's disease



Neurologist and researcher Rick Helmich investigates what happens in the brain that causes Parkinson's disease to worsen over time. In his Vidi research he focuses on the influence of stress. Besides the Vidi grant, Helmich received a European grant (JPND) to find out how Parkinson's disease can be diagnosed earlier in patients.

Parkinson's disease is caused by a loss of dopamine cells. By the time it manifests itself in the typical trembling or slowness of movement, more than 50 percent of these cells have already died. This is preceded by 10 to 20 years during which the disease has not yet been diagnosed. "During that time, people experience symptoms that you don't immediately go to the doctor for, such as loss of smell, constipation, living out dreams during sleep, or depression. This means that the disease can travel through the brain via different routes. We aim to identify subtypes of Parkinson's disease, which start with different symp-

toms and are associated with different brain abnormalities, to make the diagnosis earlier." In the clinic Helmich sees that stress aggravates the symptoms: more trembling and more freezing in stressful times. Moreover, many Parkinson patients suffer from chronic stress. He wants to find out if chronic stress also leads to faster progression of the disease. He asks: "Does chronic stress accelerate it? And, if so, can we slow it down by reducing that stress?"

The Covid-19 crisis, stressful for many, presented an opportunity. Before the pandemic, Helmich and a team of Parkinson's researchers had already started to closely follow the course of the disease in hundreds of patients. In April 2020, when the first Covid wave hit the Netherlands, an online stress questionnaire was added to the study. "We now know from 350 patients how much stress they had during the first and second wave and we will continue to follow them for a few years. By comparing patients with little stress to those with a lot of stress, we learn about its influence on Parkinson's disease."

## ULTRASONIC NEUROMODULATION

Another Donders Vidi recipient, Lennart Verhagen, also aims to help Parkinson's patients. But from a completely different perspective. Verhagen will pioneer novel brain-inspired protocols for the use of a brand-new technique: ultrasonic neuromodulation. This technique uses high frequency sound waves and has the potential to modulate deep brain regions precisely and safely, which is useful for new forms of treatment.

## Retrieval of words



How do we translate our thoughts into words? Language and brain researcher Vitoria Piai studies this, in healthy people and in people with a brain disorder that leads to a language impairment. "This

is a two-way street: by studying this process in healthy people, we can hopefully contribute knowledge that will help people who have difficulties finding words. Conversely, by seeing what goes wrong, we can improve our theories."

Her Vidi research compares the retrieval of words with the retrieval of memories. Is searching for words the same as searching for other information, for example about childhood memories? And how does a damaged brain adapt to maintain that ability?

Piai is particularly looking for the specific moment when certain areas in the brain are used to produce language. "This is more informative than just pinpointing brain areas. In healthy people, retrieving words is known to be supported by the left hemisphere. Suppose a patient with left-hemisphere damage cannot name a picture. Then you sometimes see that the right hemisphere becomes involved, but it's not clear when. Perhaps that hemisphere became involved after the patient had already given up, instead of during the attempt to retrieve the name. Timing is relevant to learn about these processes."

## Stress susceptibility



Marloes Henckens is looking for the differences between people with and without post-traumatic stress disorder (PTSD), because not everyone is equally susceptible. "Between 80 to 90 percent of the

population experiences a severe trauma, but only a small proportion develops PTSD.

What are the differences between the brains of people who are susceptible to PTSD and of those who are not?"

Henckens studies mouse brains to learn about PTSD. "Just like in humans, most mice cope well with stress. Stress causes a temporary disturbance, from which they usually recover. We are investigating how this response differs from what happens in the brains of animals that suffer permanently from stress exposure."

With her Vidi grant, Henckens will focus on the theory that PTSD is caused by an abnormal memory of the trauma. She will zoom in on the cells that store memories. "The assumption is that people who are vulnerable to PTSD store the trauma memory in a different way. In mice, we're able to see which brain cells are active during trauma. Then we can isolate them and study – at the cellular level – whether they indeed behave differently from cells in mice that recover well."

## Ageing brains



Linda Geerligs studies the ageing brain.

"Ageing is often dismissed as decline: memory loss, slower information processing. But in society, the most important decisions are not made by 20-year-olds. Experience is needed

for the better jobs, and for good reason.

I think this side of ageing is hugely undervalued."

With her Vidi grant, Geerligs will study the neural mechanisms of how older people make use of their knowledge and experience in lifelike situations. Her hypothesis is that experience allows older people to make more informed predictions of what will happen next and that they rely on these predictions more. For example, during conversation we often already know what the next word will be before it is spoken. This prediction is based on many conversations earlier in life.

Geerligs will investigate this process by measuring the brain activity of people listening to a story, with MEG or EEG. Geerligs: "Based on brain activity we can look for signs of a word even before it is spoken in the story. How do these predictions differ between younger and older participants? And do older adults indeed rely more on their predictions than younger adults?"

*Roeland Segeren*



# Newsflash



- **Peter Hagoort receives the SNL Distinguished Career Award**  
Peter Hagoort has received the 2021 Distinguished Career Award. This award is given to researchers who have made an outstanding and enduring contribution to research in the neurobiology of language. Hagoort is Professor of Cognitive Neuroscience at Radboud University. He has served as the Director of the Max Planck Institute for Psycholinguistics (MPI) in Nijmegen since 2006 and the Director of the Donders Centre for Cognitive Neuroimaging (DCCN) since 1999.

- **Meeting friends and family triggers brain areas that make you feel better**  
Regular contact with close friends and family is important for mental and physical well-being. This age-old folk wisdom finds proof in brain activity, and even in the shaping of brain structure. Social interactions trigger the same brain areas that play a role in empathy, attentiveness, health satisfaction, smoking behaviour, mood swings and emotional stability or instability. Donders researcher Matthias Schurz and colleagues published these findings in *Cerebral Cortex*.
- **Families that have a child with ADHD can benefit from mindfulness training**  
Families with a child suffering from ADHD can benefit from family-based mindfulness training, as is shown in a study by Donders researchers and colleagues from Radboudumc, University of Amsterdam and Karakter. The researchers found that, while symptoms of the children with ADHD decreased after mindfulness training, on average this effect was small. However, the mindfulness training had a positive impact on mindful parenting, symptoms and the well-being of the parents, in the short and longer term after training. The findings were published in the *Journal of Child Psychology and Psychiatry*.
- **Daily skin-to-skin contact can extend breastfeeding time**  
Daily skin-to-skin contact lasting one hour between mother and a new-born baby can prolong breastfeeding. Breastfeeding provides both mother and child with various health benefits, but the percentage of women who breastfeed for a long time is low worldwide. Researchers in the Baby & Child Research Centre measured the effect of one hour of uninterrupted skin-to-skin daily contact between healthy mothers and their full-term babies, during the first five weeks after birth. The team compared this with the care a mother typically gives to a baby. The results were published in *Maternal & Child Nutrition*.
- **Transfer RNA: a new drug for peripheral neuropathy?**  
A team of scientists led by Erik Storkebaum at the Donders Institute have deciphered the molecular mechanism underlying a form of Charcot-Marie-Tooth (CMT) peripheral neuropathy. This disease affects both motor and sensory nerves and this scientific breakthrough provides the basis for a new form of treatment for this incurable disease. Their findings were published in *Science* in September.

## PhD defences 2021

- **Kaldewaij, R.,** *Resilient control: neural emotion-regulatory circuitries predicting acute and long-term stress-responses.*
- **Wang, Y.,** *E-health in Epilepsy and Parkinson's Disease.*
- **Seeliger, K.,** *Convolutional Neural Networks in Vision Neuroscience.*
- **Vogt, K.,** *Sound localization in children with congenital conductive hearing loss using acoustic implants.*
- **Li, T.,** *Heterogeneity in neurodevelopmental disorders.*
- **Todorova L.,** *Language bias in visually driven decisions: computational and neurophysiological mechanisms.*
- **Mishra A.,** *Multiscale Microstates. Uniform spatiotemporal analysis across spatial scales.*
- **Zeetsen, C.,** *Substance-Induced Neurocognitive Disorders: detection, prevalence, and course during treatment in addiction health care.*
- **Bertana, A.,** *Computational basis of human confidence in vision.*
- **Spyropoulos, G.,** *Aspects of variability in gamma oscillatory activity in awake macaque visual cortex.*
- **Bovy, L.,** *From Dusk to Dawn: On sleep, memory, and bias in depression.*
- **Keyser, J.,** *(Multi)sensory processing for planning and feed-back control of reaching movements.*
- **Richter, D.,** *Predicting what we see: How the brain uses statistical regularities to predict sensory input.*
- **Singgih, E.,** *Biological insights into candidate genes for ADHD and related neurodevelopmental disorders: lessons learned from Drosophila.*
- **Beerten-Duijkers, J.,** *Self-regulation in Dual Diagnosis.*
- **Van Os, N.,** *Ataxia-telangiectasia: disease course and management.*
- **Guo, C.,** *Partially impairment of stimulus generalization observed in rats lacking the function of serotonin transporter.*
- **Armeni, K.,** *On model-based neurobiology of language comprehension.*
- **Dijkstra, K.,** *Exploiting the N400 signal for Brain Computer Interfacing.*
- **Hashemi, M.,** *Defensive freeze-fight-flight reactions in humans: from adaptive defence to stress vulnerability.*
- **Brolsma, S.,** *Neural mechanisms of negative learning bias – a transdiagnostic approach to mental health.*



## JOSI DRIESSEN 500TH PHD CANDIDATE

The 500th PhD candidate of the Donders Institute – Josi Driessen – has added her thesis to the Donders Thesis Series. She investigated Psychopathic traits and mechanisms of antisocial decision-making in the research group ‘SAMBA’ – led by Inti Brazil. She is currently continuing her scientific career as a postdoctoral researcher at Utrecht University.

In 2007 the first PhD candidate published her dissertation within this series and in 2017 we celebrated the 250th Donders thesis of Anke-Marit Albers. “Now four years later, we are very proud to celebrate the 500th PhD thesis,” says Annemiek Barsingerhorn, coordinator of the Donders Graduate School.

- **Rietveld, A.**, *Anti-cytosolic 5'-nucleotidase 1A autoantibodies in inclusion body myositis, clinical application and molecular correlations.*
- **Bramson, B.**, *Rhythmic control - Prefrontal cortical mechanisms of emotional-action control.*
- **Van Dijsseldonk, R.**, *Step into the future: Mobility after spinal cord injury.*
- **Cillessen, L.**, *Unravelling the effects of face-to-face and internet-based Mindfulness-Based Interventions for cancer patients: moderating and mediating factors.*
- **Catinozzi, M.**, *Molecular and genetic characterization of the diverse roles of cabeza, the Drosophila homolog of human FUS.*
- **Hofmans, L.**, *Modulating motivation and cognitive control.*
- **Song, Q.**, *Noradrenergic effects on the neural mechanisms underlying memory detailedness.*
- **Van Lieshout, L.**, *Why so curious? The cognitive and neural mechanisms of information seeking.*
- **Vacaru, S.**, *To Affiliate or Not To Affiliate: Investigating Facial Mimicry in Early Development.*
- **Przedzick, I.**, *Investigations into cognitive systems with resting-state functional connectivity.*
- **Alingh, J.**, *Effect of robotic gait training on the post-stroke gait pattern.*
- **De Haas, N.**, *Mapping space, episodes and values in the hippocampus.*
- **Glimmerveen, J.C.**, *In the eye of the beholder: An individualised approach towards (mal)adaptive behaviour in psychopathy.*
- **Driessen, J.M.A.**, *Psychopathic traits and mechanisms of anti-social decision-making.*
- **Elshout, J.**, *Recovery potential in hemianopia: Extent, impact on daily life and predictive neural correlates.*
- **Marques, T.**, *Discriminating parkinsonian disorders using fluid biomarkers to improve early diagnosis.*
- **Bergman, A.**, *Negative attentional bias as a transdiagnostic psychiatric marker.*
- **Wiegertjes, K.**, *Ischemic and hemorrhagic MRI markers of cerebral small vessel disease. Two sides of the same coin?*
- **Ter Avest, M.**, *Mindfulness-Based Interventions for Depression: How does it work and for whom?*
- **Mossink, B.**, *The cell-type specific contribution of EHMT1 to neuronal network dysfunction in Kleefstra Syndrome.*
- **Brehl, A.K.**, *“Who’s Afraid: Red, Yellow and Blue A three-biomarker model to capture neural heterogeneity in the anxious”.*
- **Yun, X.**, *Perceptual appearance: Effects of features, structure and knowledge.*
- **Smedinga, M.**, *Diseased without symptoms . The moral desirability of Alzheimer biomarker testing.*
- **Snijders Blok, L.**, *Let the genes speak! De novo variants in developmental disorders with speech and language impairment.*
- **Runhart E.**, *Stargardt disease - ABCA4 and beyond.*
- **Van Oort, J.**, *The stressed brain in health and psychopathology: A transdiagnostic approach.*
- **Arends, R.**, *Impulsivity and transmission risk behavior in the ongoing HIV epidemic.*
- **Ward, E.**, *Predictive processing accounts of autism and early development.*
- **Jäkel, R.**, *On the Pathophysiology and Prevalence of Cerebral Amyloid Angiopathy.*
- **Lauwen, S.**, *Age-related macular degeneration: From GWAS to functional effects.*
- **Dam, S.**, *From belly to brain: investigating the role of gut bacteria in neurodevelopmental disorders using rodent models.*
- **Zuure, M.**, *The Origins of Response Conflict Theta: An Adventure in Source Separation.*
- **Van Heukelum, S.**, *How cingulate cortex mediates pathological aggression in mice.*
- **Wassenberg, T.**, *Monoamine neurotransmitter disorders – from biochemical aspects and clinical observations to recommendations for management.*

## THE MACHINE

# Staring at an app to see better

We've all encountered it at some point in our lives, that 'C' on the wall of the optician or ophthalmologist. Where is the notch, they would ask: on the right, left, top or bottom? The answers not only indicate how good our vision is but can also be used to train visually impaired individuals to see better. This technique forms the basis of the PLING app, a digital aid designed to improve sight.

It's actually remarkably simple: the app shows a number of twisted Cs and the user has to indicate the notch as quickly as possible. This is repeated hundreds of times in a row. Our eyes and brains will train their collaborative systems to see details. Just like athletes, who train their perception skills through endless repetition predicting the speed of a ball.

### FUN TO DO

The PLING app has been developed by perception researcher Bianca Huurneman. "We had it tested by children aged 7 to 18 with infantile nystagmus, a condition in the eye that causes involuntary, oscillating eye movements and therefore impairs vision. Many participants actually found it fun to do, as it is just like a game."

Huurneman has been studying eye conditions such as nystagmus for the past few years. She was mainly looking for ways to tackle the consequences of the condition. "At first we worked with an exercise on paper. That proved to be effective, but this kind of eye training works even better on a screen. Test subjects noticed improvements in their near and far vision. They also appeared to be able to read better, both faster and more accurately."

The app is not yet available in the usual app stores for tablets and smartphones. "We are working hard on that now", says Huurneman. "But there are still some hurdles to overcome. For example, we first need to get it registered and certified as a medical device. But, in principle, it's ready for use. Many participants have let us know that they are eager to continue training with it."

*Roeland Segeren*

### DONDERS INSTITUTE Newsletter

The Donders Newsletter is published twice a year by the Donders Institute for Brain, Cognition and Behaviour, which brings together research groups at Radboud University and the Radboudumc as well as the Max Planck Institute for Psycholinguistics. Its purpose is to keep you informed of developments within the Donders Institute and the wider field of neuroscience.

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