

Behavioural Science Institute



Children grow up in a world of advertisements, which may lead to unhealthy eating behaviour and parent-child conflicts.

The Behavioural Science Institute (BSI) conducts research on human behaviour. The aim of the Institute is both fundamental ('to understand behaviour') and applied to societal challenges ('to influence behaviour'). A distinctive feature of the BSI is an integrative approach to human behaviour that transcends the traditional disciplinary boundaries of psychology, education and communication science.

The BSI, which is the largest research institute of the Faculty of Social Sciences, is accredited as a research school by the Royal Netherlands Academy of Arts and Sciences (KNAW). A two-year Research Master's programme in Behavioural Science (www.ru.nl/education/masters/behavioural-science) is taught within the BSI Graduate School, which is officially recognized by the Netherlands Organisation for Scientific Research (NWO).

BSI researchers investigate the nature and development of human behaviour. They study the ways in which it is influenced by i) individual factors (cognitive, affective, motivational and psychophysiological processes), ii) social-contextual factors (home, school, peer groups, work and the media), and iii) the dynamic interplay between these factors. In addition, they study reverse associations and explore how human behaviour influences individual factors and the social context. Both 'normal' behaviour and psychopathology are the subject of research, which involves laboratory experiments and field studies, large-scale longitudinal studies and randomized controlled trials. Studies include behavioural, self-report, psychophysiological, neuroscience, genetic and virtual reality measurements.

BSI research takes place the following seven research groups: *Communication Science, Developmental Psychopathology, Experimental Psychopathology and Treatment, Learning and Plasticity, Social Cognition, Social Development, Work, Stress and Health*. These groups all work on the three main themes of BSI research.

Development and Learning

We all keep developing and learning new things throughout our lives. Within BSI, the biological, cognitive, and behavioural processes related to *life-long learning* are investigated. Fundamental research in this theme adds to knowledge on how people learn, revealing the underlying processes (e.g., plasticity) that support cognitive, social, emotional, and motor development. The focus is on the development of infants, motor learning, language acquisition, peer relations, teaching, coaching and training. Researchers look at various contexts and factors that shape development, including family, school, workplace, community, culture, media, and also at physiological and genetic influences. Many of these factors are investigated using longitudinal designs that monitor target groups over several months or even years. This research has implications for primary and secondary education, prenatal consulting and early child care, interventions in schools, and assistance for students with special needs or developmental disabilities. The aim is to produce insights that directly and indirectly help all members of society (young and old) to live fulfilling and productive lives.

Psychopathology, Health and Well-Being

Physical and mental health are influenced by a combination of genes, nurture and lifestyle. At the BSI research focuses on encouraging behaviours that lead to a healthier lifestyle and a feeling of well-being on the one hand and treatment of mental disorders on the other. Researchers look at both internalising and externalising psychopathologies, such as anxiety, depression, burnout, ADHD, addictive behaviours (smoking, alcohol, drugs) and eating disorders. Genes, neurobiological processes, behaviour and environment are all taken into account. Promotion of health and well-being involves looking at food choice, self-control, coping strategies, need satisfaction, mindfulness, sport and exercise, work-life balance, sleep and recovery. For psychopathologies the roles of implicit and explicit processes, cognitive bias, motivation and reward are also considered. Both preventive and curative interventions are developed and tested. Behaviour and interventions are not only studied in a clinical setting, but also in families, schools and at work. Research interests cover the whole lifespan: from babies, children, adolescents, students, families and working life to the elderly.

Social Processes and Communication

Because much behaviour is altered by external factors, it is important to examine interpersonal relationships, group dynamics and media influences. Researchers working on this theme investigate how social interactions, whether face-to-face or via electronic media communication, are related to individual mental health and well-being. Interaction between automatic and controlled aspects of social behaviour is studied, for example in face perception, decision-making and creativity, and attitudes toward others. One goal is to define the key factors that distinguish the positive and negative features of close relationships (e.g., social support

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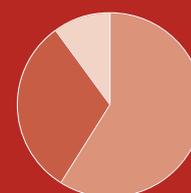
Tenured

| | |
|----------------------|----------|
| Full Professors | 9.5 FTE |
| Associate Professors | 5.5 FTE |
| Assistant Professors | 20.6 FTE |
| Researchers | 0.5 FTE |

Non-tenured

| | |
|---------------------|----------|
| Researchers | 13.4 FTE |
| Doctoral candidates | 74.8 FTE |

Research funding



Core Grants Contracts

and conflict). This is studied in the family context, in schools and in the workplace. Another topic of interest in this theme is exploring group processes relating to aggression, social status, leadership, prejudice and social norms. Another focus is on the efficacy and impact of media campaigns (i.e., advertising and marketing) and social media. This information is used to promote healthy and effective behaviour via both the social environment and the media environment that target groups operate in.

Research facilities

The BSI has excellent research facilities:

- A Virtual Reality Lab for immersive, three-dimensional computer-generated environments
- A Mobile lab to accommodate various experimental setups outside the university
- A Physiological Measurements lab, shared with the Donders Centre for Cognition, for measuring neurocognitive and biomechanical data
- Different types of Eye-trackers for measuring visual attention and eye movements

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- Stabilometric platforms for research on freeze-approach-avoidance behaviour
- Observational labs with one-way screens and multiple cameras
- A computer lab with 22 identical cubicles for computerized experiments
- A Bar Lab for observational studies of social behaviour in a natural setting
- A Sport Lab for behavioural and psychophysiological measures during exercise
- Through its participation in the Donders Centre for Cognitive Neuroimaging (DCCN), the BSI has full access to neuroimaging facilities.

An increasing number of BSI researchers use mobile technology to collect data. These tablets, smartphones and wearable devices enable the researchers to do many things outside the classic lab setting.

Collaboration

Researchers within the BSI collaborate with numerous national and international partners. The Institute's strategy is to link a number of these renowned scholars to Nijmegen as international fellows. They visit at least once a year to give workshops, lectures and to work on joint publications. Some of the PhD students working at the BSI conduct part of their projects in the labs of these fellows. BSI fellows in 2014 were Profs. Charles Perfetti (Pittsburgh), Alex Todorov (Princeton), Mitchell Prinstein (North Carolina), Marcel Brass (Ghent), William Bukowski (Concordia), Stefan Hofmann (Boston), Jasper Smits (Austin) and Goran Kecklund (Stockholm).

There are formal collaboration arrangements with numerous universities (*e.g.*, University of Cologne, Australian Catholic University, Indiana University, University of Virginia, University of Southern California), research laboratories (*e.g.*, Addiction Swiss, Haskins Laboratories in New Haven), multiple Dutch Universities, and various institutes for applied research (*e.g.*, Trimbos Institute, TNO, NJI, Juridical Youth Institute). Within Radboud University there are formal collaboration arrangements with the Radboud University Medical Centre, the Donders Centres for Cognition (DCC) and Cognitive Neuroimaging (DCCN), and the Max Planck Institute for Psycholinguistics. The BSI also employs two Principal Investigators at DCCN (Prof. Alan Sanfey and Prof. Karin Roelofs).

The BSI hosts the ZonMw funded centre of excellence 'Academic Centre Youth Nijmegen', which is a consortium of 14 knowledge, policy and clinical institutions in the Nijmegen region. The aim is to improve the prevention and care of 'internalising problems' in youth.

Awards and acknowledgments

- Dr Emmanuel Kuntsche received an NWO Vidi grant for a project on the influence of parental alcohol consumption on children's knowledge about and attitude towards alcohol.
- Dr Willem Frankenhuis, Dr Arne Nieuwenhuys, Dr Simon Ritter and Dr Esther Rozendaal each received an NWO Veni Grant.
- Dr Willem Frankenhuis received the New Investigator Award from the European Human Behaviour & Evolution Association (EHBEA).
- Prof. Ludo Verhoeven received an NWO NRO grant for the project *Fostering English reading skills in early secondary education*.
- Prof. Bert Steenbergen received a ZonMw Revalidatie III grant for the project *Co-creation at hand: The road to independence*.
- Prof. Isabela Granic and Prof. Rutger Engels received an NWO Creative Industry grant for the project *Development, testing and dissemination of video games that prevent and treat anxiety and depression in children and adolescents*.
- Dr Ron Scholte and all partners involved in the Academic Workplace Youth received a ZonMw grant for the extension of the project.
- Dr Roel Hermans received an NWO Food, Cognition and Behavioural grant for the project *Take it slow: The use of feedback and persuasive technology to reduce eating rate*, and a grant from the province Limburg to stimulate healthy behaviour in primary school children.
- Dr Anna Lichtwarck-Aschoff received a ZonMw grant for the project *It takes two to tango* on the therapeutic alliance between child and therapist in the treatment of anxiety disorders.
- Prof. Rutger Engels, Prof. Alan Sanfey, Dr Maartje Luijten and Dr Kathrin Schuck received a grant from the Dutch Cancer Society for the project *Environmental tobacco exposure as a pathway to youth addiction*.

Research results

With regard to foetuses, it was found that maternal stress adversely affects early child development. The mechanisms underlying these relations are largely unknown, but necessary for developing preventive intervention programmes. A review revealed less well known and even surprising pathways, *e.g.* the intestinal microbiota, through which a mother's stress can affect her foetus. The neural mechanisms in motor learning in children with cerebral palsy and the cognitive mechanisms in behavioural learning in children with intellectual disorders have been identified and built into therapeutic interventions.

With respect to learning, it was shown that word learning facilitates children's phonological awareness, that there is competition from unheard or unseen novel words in cross-modal lexical learning, that testing helps children to remember words from memory, and that, in the case of bilingual children, linguistic overlap between items in language 1 and language 2 helps to learn words in language 2.



In 2014, Drs Arne Nieuwenhuys, Esther Rozendaal, Willem Frankenhuis and Simone Ritter (left to right) each received an NWO Veni grant. Dr Esther Rozendaal – Assistant Professor of Communication Science – explores an innovative method that is helping children to become more resistant to advertising.

In learning literacy and maths, it has been shown that word repetition fosters early word decoding and early numeracy abilities, and that executive functions and working memory have a great impact on both word decoding and text comprehension. Reading in dyslexic and non-dyslexic readers was found to be qualitatively similar. The results of these studies are used to build ICT-based interventions.

Risky behaviour: it was found that adolescents may be more impulsive than adults, not because they take more risks, but because they value the present more than adults do. Other researchers showed that a tailored smoking cessation programme for parents was highly effective in persuading parents of primary school children to quit.

In clinical psychology, psychological and neural processes underlying risky decisions made by children, adolescents, and adults were investigated, as were cognitive biases in anxious children, and decision-making in novel and experienced clinicians. Treatments reduced relapse rates in abstinent alcoholics (thanks to an alcohol-avoidance training), and socially anxious individuals were trained in automatic social approaches. It was found that 1) patients with social anxiety disorder show decreased cortical-amygdala crosstalk during social stress anticipation, 2) social threat automatically transfers to instrumental behaviour, and 3) it is possible to cause a shift from social avoidance to a more social approach by administering testosterone.

Four randomized controlled trials (RCTs) on the effectiveness of serious games in reducing anxiety and depression in schools and clinical agencies were completed. One of these RCTs was the first to validate a game for clinically anxious children. The studies also suggested that both 'serious' and commercially-available games hold immense promise for improving children's emotional well-being, while imparting no stigma and keeping children motivated and engaged in playful learning.

People suffering from burnout often report cognitive problems, but little is known about their cognitive performance. To investigate this, a clinical burnout group, a non-clinical burnout group, and a healthy control group were compared on cognitive test performance, on self-reported cognitive problems, and on the subjective 'costs' associated with cognitive performance. Clinical burnout patients reported most cognitive problems. Whereas there were only mild differences in cognitive performance between the groups, the clinical burnout patients had to invest more effort in maintaining their performance. This study thus provides evidence for impaired cognitive functioning in burnout.

On communication, it was found that the widely accepted 'risk-framing' hypothesis is not supported by empirical evidence. It was also found that food advertising is hard for impulsive children to resist, increasing the risk of obesity, but that communication tools promoting health behaviours can be used to prevent obesity. The information researchers showed that media multitasking reduces recall and comprehension of news. Furthermore, it was found that arousing news messages are not appreciated by elderly people. Culture research showed that evaluations of morally ambiguous drama depend on media users' moral subculture (law enforcement, medicine, psychology) and the theme of the drama (crime, love, health, ...).

Research involving reverse correlation techniques showed that mental images of in-group members are more likeable than mental images of out-group members, demonstrating that group differentiation and stereotyping takes place at a very fundamental level. Research on agency (the capacity of an agent to act in a world) showed that prior priming of an action does not always lead to an increased sense of agency. In fact, it can reduce feelings of agency, and also of responsibility. Various fMRI projects demonstrated the importance of the neural default mode network (in contrast to the task-positive network) in the generation of creative ideas. Finally a highly cited paper, in which a recipe for optimal social psychology replication studies was provided, was published.

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Key publications

Cauwenberge, A.M.R. van, Schaap, G.J. & Roy, R. van (2014). "TV no longer commands our full attention": Effects of second-screen viewing and task relevance on cognitive load and learning from news. *Computers in Human Behavior*, 38, 100-109. 10.1016/j.chb.2014.05.021.

Cillessen, A.H.N., Lansu, T.A.M. & Berg, Y.H.M. van den (2014). Aggression, hostile attributions, status, and gender: A continued quest. *Development and Psychopathology*, 26(3), 635-644. 10.1017/S0954579414000285.

Defoe, I.N., Dubas, J.S., Figner, B.C. & Aken, M.A.G. van (2015). A Meta-Analysis on Age Differences in Risky Decision Making: Adolescents Versus Children and Adults. *Polish Psychological Bulletin*, 141(1), 48-84. 10.1037/a0038088

Folkvord, F., Anschutz, D.J., Nederkoorn, C., Westerik, H. & Buijzen, M.A. (2014). Impulsivity, "Advergaming", and Food Intake. *Pediatrics*, 133(6), 1007-1012. 10.1542/peds.2013-3384.

Goch, M.M. van, McQueen, J.M. & Verhoeven, L.T.W. (2014). Learning Phonologically Specific New Words Fosters Rhyme Awareness in Dutch Preliterate Children. *Scientific Studies of Reading*, 18(3), 155-172. 10.1080/10888438.2013.827199.

Granic, I., Lobel, A.M. & Engels, R.C.M.E. (2014). The benefits of playing video games. *American Psychologist*, 69(1), 66-78. 10.1037/a0034857.

Hanewinkel, R., Sargent, J.D., Hunt, K., Sweeting, H., Engels, R.C.M.E., Scholte, R.H.J., Mathis, F., Florek, E. & Morgenstern, M. (2014). Portrayal of Alcohol Consumption in Movies and Drinking Initiation in Low-Risk Adolescents. *Pediatrics*, 133(6), 973-982. 10.1542/peds.2013-3880.

Holden, J.G., Greijn, L.T., Rooij, M.M.J.W., Wijnants, M.L. & Bosman, A.M.T. (2014). Dyslexic and skilled reading dynamics are self-similar. *Annals of Dyslexia*, 64(3), 202-221. 10.1007/s11881-014-0094-3.

Jongbloed-Pereboom, M., Nijhuis-Van der Sanden, M.W.G., Saraber-Schiphorst, N., Crajé, M.C. & Steenbergen, B. (2013). Anticipatory action planning increases from 3 to 10 years of age in typically developing children. *Journal of Experimental Child Psychology*, 114(2), 295-305. 10.1016/j.jecp.2012.08.008.

Oosterholt, B.G., Maes, J.H.R., Linden, D. van der, Verbraak, M.J.P.M. & Kompier, M.A.J. (2014). Cognitive performance in both clinical and non-clinical burnout. *Stress – The International Journal on the Biology of Stress*, 17(5), 400-409. 10.3109/10253890.2014.949668.

Radstaak, M., Geurts, S.A.E., Brosschot, J.F. & Kompier, M.A.J. (2014). Music and Psychophysiological Recovery from Stress. *Psychosomatic Medicine*, 76(7), 529-537. 10.1097/PSY.000000000000094.

Ratner, K.G., Dotsch, R., Wigboldus, D.H.J., Knippenberg, A.F.M. van & Amodio, D.M. (2014). Visualizing Minimal Ingroup and Outgroup Faces: Implications for Impressions, Attitudes, and Behavior. *Journal of Personality and Social Psychology*, 106(6), 897-911. 10.1037/a0036498.

Sanfey, A.G., Stallen, M. & Chang, L.J. (2014). Norms and expectations in social decision-making. *Trends in Cognitive Sciences*, 18(4), 172-174. 10.1016/j.tics.2014.01.011.

Vrijen, J.N., Oostrom, I.I.H. van, Arias Vasquez, A., Franke, B., Becker, E.S. & Speckens, A.E.M. (2014). Association between genes, stressful childhood events and processing bias in depression vulnerable individuals. *Genes Brain and Behavior*, 13(5), 508-516. 10.1111/gbb.12129.

Water, E. de, Cillessen, A.H.N. & Scheres, A.P.J. (2014). Distinct Age-Related Differences in Temporal Discounting and Risk Taking in Adolescents and Young Adults. *Child Development*, 85(5), 1881-1897. 10.1111/cdev.12245.

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| Dissertations: | 32 |
| Scientific publications: | 412 |
| Professional publications: | 36 |

Societal impact

Within BSI fundamental research, for example on addiction, food choice, stress, reading acquisition, anxiety and depression, is translated into practical prevention guidelines and interventions. These interventions, in turn, are subjected to scientific investigation, if possible in randomized controlled trials. On the other hand, societal issues, such as adolescent alcohol consumption and children's reading problems, lead to a more fundamental

understanding of such topics. Increasingly, knowledge or actual interventions are spread to a broad audience via ICT products, such as apps or websites. Researchers also regularly appear in the media and publish the results of their scientific work in professional magazines. Most research conducted at BSI stems from societal questions and/or is aimed at solving societal issues. Three examples of this are:

Director: Prof. Toon Cillessen

Toon Cillessen has been Professor of Developmental Psychology at Radboud University since 2006. He previously held appointments at Duke University and the University of Connecticut. His research interests include the development of social competence, aggression and antisocial behaviour, social dominance and peer influence, and quantitative methods for developmental research (sociometric methods, social network analysis and longitudinal data analysis). He is a Consulting Editor for the journals *Developmental Psychology*, *Social Development*, *Merrill-Palmer Quarterly* and the *International Journal for Behavioural Development*.



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1. In a study conducted in a residential youth care setting, a therapeutic video game using players' biofeedback as the controller was significantly more effective at reducing anxiety levels in highly impaired youth than treatment as usual. One of the largest residential treatment centres in the country (Pluryn) has decided to implement the video game as regular treatment practice with their most impaired youth. MindLight is a 3D video game developed by BSI researchers and game experts that uses the mind as the game controller. Through neuro-feedback mechanics, the game incorporates evidence-based relaxation techniques and attention bias modification methods to produce an immersive game world in which children can learn to face – and overcome – their anxiety and fears.
2. Two BSI PhD students organized symposia on 'Scientific Research in the Class' for primary and secondary school teachers, school psychologists and policy makers, and 'From Developmental Science to Practice', to help researchers understand how their research may benefit schools, families, etc.
3. BSI coordinated the NWO/NIHC programme 'The learning child', which is designed to develop and evaluate new educational forms that do justice to the individual capacities of children in primary education and makes use of the latest insights in the field of brain and cognition research. In each of the projects within the programme, apps and other ICT tools have been developed to facilitate children's learning. These innovative instruments will be disseminated in collaboration with the Expertisecentrum Nederlands.

Future research

Over the next few years BSI will continue to deliver top-level behavioural research with societal relevance. Most of the grants acquired provide researchers with funding for research that is closely linked to societal problems, leading to innovative new projects. BSI will continue to invest in fundamental research and in new ideas through the annual BSI Graduate School round, in which promising candidates are selected to start their own PhD project. In 2015 staff meetings will be organized on the acquisition of European grants, technology grants and the cooperation with companies (*e.g.*, the gaming industry, supermarkets) and other relevant partners.

An increasing amount of research will use an integrative approach to behaviour, physiology and neuroscience. Research on the therapeutic applications of BSI findings will intensify, and more and stronger ties with international partners will help with both successful fundamental research and broader dissemination of the results. The BSI will continue with its successful studies with longitudinal designs in children. More projects will be aimed at improving people's lives. The Institute is increasingly integrative and multi-disciplinary, enabling researchers to capitalize on collective strengths when conducting research, writing grant applications or publishing. The three overarching BSI themes 1) Development and Learning, 2) Psychopathology, Health and Well-Being, 3) Social Processes and Communication are a reflection of this.