Gravitation

Consortium on Individual Development (CID)

Annual Report 2017-2018

Nederlandse Organisatie voor Wetenschappelijk Onderzoek

Consortium on Individual Development

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Call 2012

Consortium on Individual Development (CID)

Why some children thrive and others do not

Application number: 024.001.003

The annual report was written by Chantal Kemner (programme chair), Hilleke Hulshoff Pol (Work Package 1), Eveline Crone (Work Package 2), Susan Branje (Work Package 3), Marian Joëls (Work Package 4), and Lotte Houtepen (project manager), with input from the co-applicants and principal investigators.

This annual report covers the period from the start of the project (May 2013) until August 2018.

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Introduction

Most children develop well and find their way in society without major problems, but some do not. A combination of the child's disposition and the environment in which he or she is raised is thought to underlie this developmental difference. In order to gain a better understanding of the factors involved, the Consortium on Individual Development (CID) was set up in May 2013 and brings together twenty top Dutch researchers (principal investigators, PIs) from different disciplines, working in seven institutes. Together, we have the necessary expertise in developmental research, including the role of parents, peers and media, epigenetics, interventions, brain development, and animal and statistical models, to advance our knowledge and understanding of why some children thrive and others do not. To this end, we plan to develop a comprehensive model of how developmental differences between children arise as a result of the interplay between child characteristics and environmental factors, by filling in crucial gaps in our knowledge of the role of brain development, effects of interventions in the environment, and intergenerational transmission.

Over the past years, we have grouped research into four work packages (WPs), each focusing on specific aspects of development: the role of brain development in WP1, effects of interventions in WP2, the role of generational transmission in families in WP3, and animal and mathematical models of development in WP4. Two new study cohorts have been set up, to provide longitudinal data: a longitudinal cohort based in Utrecht (YOUth, WP1) and an intervention cohort based in Leiden (L-CID, WP2). In WP3 information from four existing cohorts is analyzed: TRAILS (Groningen), Generation-R (Rotterdam), RADAR (Utrecht), and NTR (Amsterdam). In each cohort both shared and specific subsets of measures guide monitoring of the development of two aspects of behaviour and their correlates, namely, social competence and behavioural control, skills that are needed for functioning in society and for reducing the risk of behavioural and emotional problems. Social competence is the ability to engage in meaningful interactions with others. Behavioural control is the ability to control one's emotions, behaviour, and impulses and to adapt to rules. In addition to the measures for social competence and behavioural control, several developmental traits are collected in all cohorts. This allows both integration of datasets and more focused analysis in two or more cohorts. The broad approach including social sciences, humanities, biomedical/medical sciences is unique to CID.

A series of interrelated PhD and postdoc projects on the identification and interplay of factors critical to the development of behavioural control and social competence are now in progress, under the supervision of at least two PIs from different disciplines, in order to stimulate the integration of expertise.

Please see the website (www.individualdevelopment.nl) for additional information on our consortium.

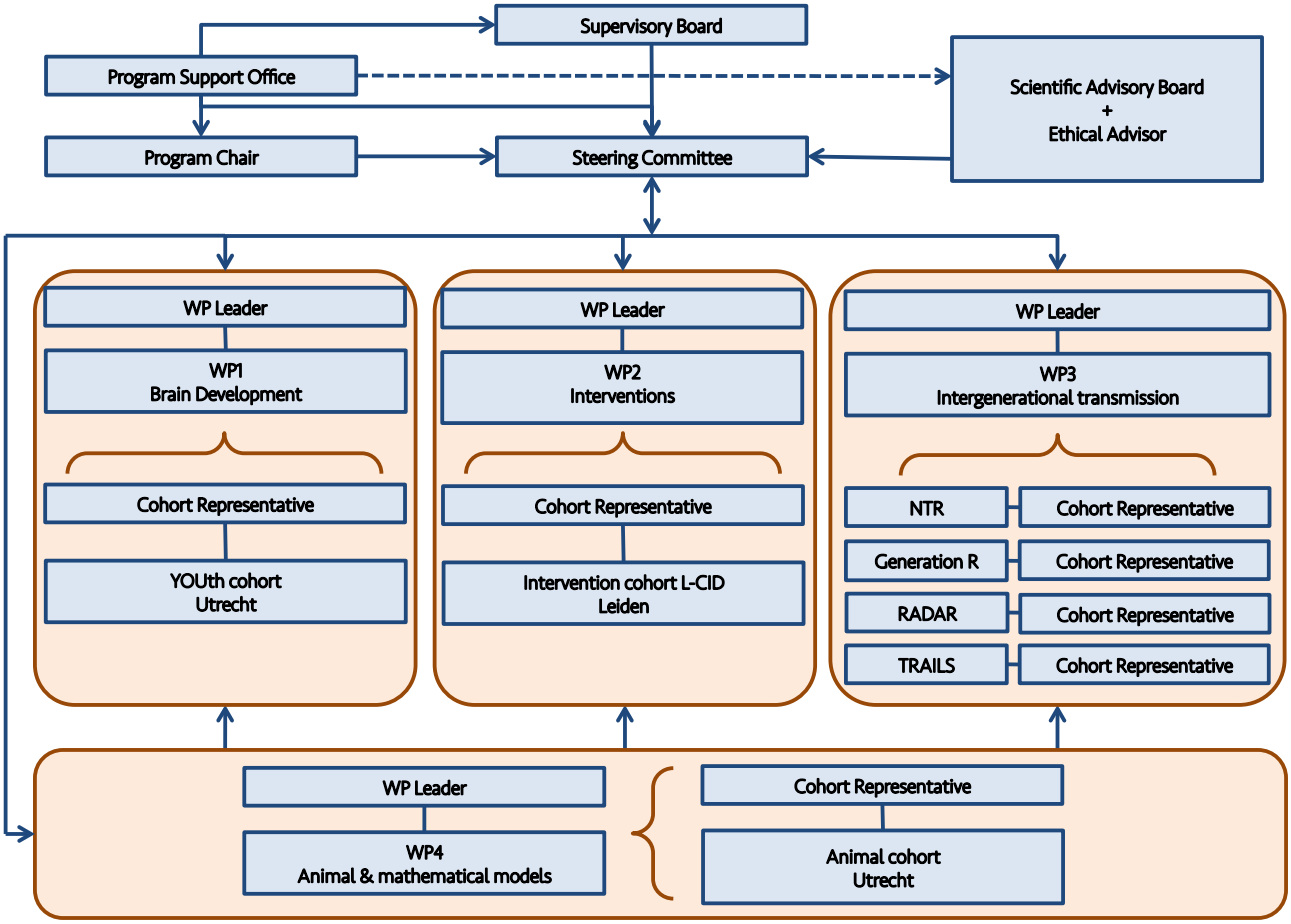
1 – Participating researchers and organization

WP0, general management	Programme Chair: Prof. dr. C. Kemner

The Consortium on Individual Development (CID) started in May 2013. A Consortium Agreement was formulated, specifying the governance structure in more detail than was given in the proposal (amongst others including cohort representatives), the aim of collaboration, the relationship between parties, consortium management, and the rights and obligations of the parties concerning the implementation of research projects and use of project budgets. Conform the Consortium Agreement, structures for meetings, documentation, administration, and finance have been set up. The Finance Office (manager and controller) set up a financial structure (control sheet, forms) and visited the finance staff of all parties to explain procedures and structures.

The organizational structure of CID can be found in the organogram below. The research programme is subdivided into four WPs, each led by a WP leader. The WP leader implements the policy of the Steering Committee for their own WP. The WP leader monitors scientific progress and is responsible for the management of the scientific staff (PhD students/postdocs) associated/assigned to their WP. For each cohort, a CID Cohort representative is responsible for organizing measurements that are needed to achieve the scientific goal of the WP and for organizing the financial management of their cohort. The Scientific Advisory Board is an advisory board to the research programme in general and advises the Steering Committee, as specified in the Consortium Agreement.

Organogram



All PIs received a budget to fund PhD students and postdocs according to the scientific plan outlined in the proposal. It has also been possible to appoint temporary (scientific) personnel on the cohort budgets. Co-funding budgets have been used to appoint additional PhD students, postdocs, and research staff. To ensure integration of expertise, it is mandatory that at least two PIs be involved in the supervision of PhD students and postdocs that are appointed on the CID budget.

As of August 2018, CID consists of 18 PIs, 35 PhD students, 15 postdocs, and 16 other CID researchers.

For the coming 4.5 years, we will adhere to the plans for PI budgets, cohort budgets, and co-funding as described in in the original application.

Names of the members of the different bodies on 31st August 2018

Main applicant: Prof. dr. C. Kemner
Co-applicants: Prof. dr. D.I. Boomsma, Prof. dr. S. Durston, Prof. dr. M. Joëls, Prof. dr. P.M. Valkenburg, Prof. dr. M.H. van IJzendoorn

PIs: Prof. dr. M.J. Bakermans-Kranenburg, Prof. dr. J.J. Bolhuis, Prof. dr. D.I. Boomsma, Prof. dr. E.A.M. Crone, Prof. dr. M. Dekovic, Prof. dr. S. Durston, Prof. dr. H.J.A. Hoijtink, Prof. dr. H.E. Hulshoff Pol, Prof. dr. M. Joëls, Prof. dr. R.W.J. Kager, Prof. dr. C. Kemner, Prof. dr. R.S. Kahn, Prof. dr. S. Branje, Prof. dr. A.J. Oldehinkel, Prof. dr. J. Ormel, Prof. dr. M.H.J. Hillegers, Prof. dr. P.M. Valkenburg, Prof. dr. W.A.M. Vollebergh

Steering Committee: Prof. dr. C. Kemner (Programme Chair), Prof. dr. D.I. Boomsma, Prof. dr. M. Joëls, Prof. dr. H.E. Hulshoff Pol, Prof. dr. S. Branje, Prof. dr. P.M. Valkenburg, Prof. dr. E.A.M. Crone (ad-interim)

Work Package Leaders: Prof. dr. H.E. Hulshoff Pol (WP1), Prof. dr. E.A.M. Crone (ad-interim WP2), Prof. dr. S. Branje (WP3), Prof. dr. M. Joëls (WP4)

Cohort Representatives: Prof. dr. C. Kemner (YOUth cohort, Utrecht), Prof. dr. E.A.M. Crone ((ad-interim L-CID Intervention cohort, Leiden), Prof. dr. D.I. Boomsma (NTR, Amsterdam), Prof. dr. M.H.J. Hillegers (Generation-R, Rotterdam), Prof. dr. A.J. Oldehinkel (TRAILS, Groningen), Prof. dr. S. Branje (RADAR, Utrecht), Prof. dr. M. Joëls (Animal cohort, Utrecht)

Scientific Advisory Board: Prof. dr. J. Belsky (University of California, Davis, USA), A.L. Bredenoord, PhD (University Medical Center Utrecht, the Netherlands), Prof. dr. B.J. Casey (Cornell University, New York, USA), Prof. dr. M.H. Johnson (Birkbeck University of London, UK), Prof. dr. N. Martin (University of Queensland, Australia), Prof. dr. M.J. Meaney (Douglas Mental Health University Institute, Québec, Montreal, Canada), Prof. dr. L. Steinberg (Temple University, Philadelphia, USA)

Supervisory Board:
Prof. dr. M.A.G. van Aken (Chair, UU), Prof. dr. F.J. Oort (UvA), Prof. dr. P.J. Beek (Vrije Universiteit Amsterdam), Prof. dr. V.W.V. Jaddoe (Erasmus UMC Rotterdam), Prof. dr. E. Sterken (University of Groningen), Prof. dr. F. Miedema (UMC Utrecht), Prof. dr. J.T. Swaab (Leiden University)

Programme Support Office: Dr. L.C. Houtepen (Project Manager), Drs. W. Zinger (Finance Office), Drs. H. Aalders (Finance Office)

Changes in organization:

- Because of health reasons, Prof. dr. Sarah Durston has passed on her role as WP leader and member of the Steering Committee from the start of the project to Prof. dr. René Kahn. However, due to his appointment at Mount Sinai (New York), Prof. dr. René Kahn had to hand over his tasks as Steering Committee member and Work Package Leader to Prof. dr. Hilleke Hulshoff Pol per September 2016. He is still a PI of our consortium, since he is part-time employed at the University Medical Center Utrecht.
- Prof. dr. Robert Plomin (King's College, University of London) had to withdraw from the Scientific Advisory Board for personal reasons and has been replaced by Prof. dr. Mark Johnson. Prof. dr. Laurence Steinberg joined the Scientific Advisory Board in early 2013.
- As of March 2016, prof. dr. Rutger Engels – participating PI from our consortium – was appointed at Utrecht University. From that moment, he finished his appointment at the Radboud University Nijmegen (RU). In accordance with the research director and the dean involved from the RU, it was agreed that prof. Engels was allowed to take his PI budget to Utrecht University. As prof. Engels was the only PI from the RU within our consortium, the RU could no longer be a participating institute within CID due to his leave. Prof. dr. Daniël Wigboldus, the participating dean from the RU, thereby withdrew from our Supervisory Board. Our consortium therefore now consists of seven participating institutes. As of April 2017 prof. dr. Rutger Engels is no longer connected to the consortium as PI. Due to lack of time, he was forced to stop his involvement with CID. In June 2017 the decision was taken not to replace him.
- As of 19 May 2017, prof. dr. Frank Verhulst of Rotterdam has retired and will no longer perform his tasks as PI of CID. Prof. dr. Henning Tiemeier has been put forward and approved as his successor.
- Prof. dr. Elmer Sterken, rector of the University of Groningen, has taken prof. dr. Folkert Kuipers' place as member of our Supervisory Board as of June 2017.
- Prof. dr. Eco de Geus of Vrije Universiteit Amsterdam has also left our Supervisory Board, and prof. dr. Peter Beek has taken his place as of April 2017.
- Prof. dr. Jos van Berkum decided to leave our consortium as PI in June 2017. On 4th October 2017 Prof. dr. René Kager was approved as his successor at the faculty of Humanities from Utrecht University.
- As of September 2017, prof. dr. Marcel van Aken replaced Prof. dr. Werner Raub as dean of the Faculty of Social and Behavioural Sciences at Utrecht University and thereby as member within our Supervisory Board.
- Prof. dr. Wim Meeus of Utrecht University retired and handed over his tasks within CID to prof. dr. Susan Branje on 1 January 2018. She is now a CID PI, the RADAR cohort representative and WP3 leader (and because of this will also become a member of the Steering Committee).
- As of 1 January 2018, prof. dr. Henning Tiemeier of Rotterdam has moved to a new position at the Harvard T.H. Chan School of Public Health and will no longer perform his tasks as PI of CID and generation R cohort representative. Prof. dr. Manon Hillegers has been put forward and approved as his successor.
- Prof. dr. Marinus van IJzendoorn retired on 14 May 2018. Prof. dr. Eveline Crone succeeded him ad-interim as the L-CID cohort representative and WP2 leader (and because of this has become an ad-interim member of the Steering Committee).
- As of 1st June 2018, dr. Jacobine Buizer Voskamp has moved to a new position at the YOUth cohort and is replaced as CID project manager by dr. Lotte Houtepen.
- As of 25st June 2018, prof. dr. M.J. Bakermans-Kranenburg has moved to a new position at the Vrije Universiteit Amsterdam. She will still be a PI of our consortium.

Participating institutes:
Vrije Universiteit Amsterdam, University of Amsterdam, Leiden University, Erasmus Medical Center Rotterdam, University Medical Center Groningen, Utrecht University (coordinator), and University Medical Center Utrecht.

2 – Progress report of the research programme

The four work packages, their scientific methods and objectives, their progress, and any substantial changes to the original research plan are described below. In WPs 1, 2 and 3, research is centered on the new and existing cohorts and thus the research lines mainly focus on the design and development of the cohorts. PhD students and postdocs have started projects along the lines envisaged in the original proposal, which are described in **Appendix 8**.

WP1	WP leader:	Prof. dr. H.E. Hulshoff Pol
	YOUth cohort representative:	Prof. dr. C. Kemner
	Other PIs:	Prof. dr. M. Dekovic, Prof. dr. S. Durston, Prof. dr. R.W.J. Kager, Prof. dr. R.S. Kahn, Prof. dr. P.M. Valkenburg, and Prof. dr. W.A.M. Vollebergh

Aim/objectives: The neurobiological developmental trajectory of newborns, children, and adolescents is not fully understood. In particular, we are only just beginning to learn to what extent genetic and environmental factors influence brain development and how these effects in turn influence behaviour. WP1 focuses on brain development in relation to behaviour, specifically on social competence and behavioural control and addresses questions regarding their interrelationships, how associations might develop as a function of age, gender, genetic influences, and environmental exposures.

Method/Cohorts: The YOUth cohort includes children from before birth until 16 years of age in two independent but related samples from the general population. The first entry point consists of 3000 babies recruited via their pregnant mothers. The mothers will be tested (including 3-dimensional ultrasound) at 20 and 30 weeks of pregnancy, and their infants will be evaluated at about 5 and 10 months, and at about 3 and 6 years of age. The second entry point consists of a similar number of 8 –to 10-year-old children recruited via schools. They will be tested at about 12 and 15 years of age. In both groups, at each visit behavioural development and brain development will be assessed by using EEG/ERP (in the infants and young children), structural and functional MRI (in the school-age children), and eye-tracking, behavioural, and computer tasks. The tasks will focus on behavioural control and social competence, and longitudinal changes therein. Parent-child interactions and IQ (both child and parents) will also be evaluated. In addition, questionnaires will be administered to parents and children, and biological samples will be collected at the various assessment times.

Projects: In WP1, seven PhD students and five postdocs are employed via the CID budget.

Start and progress: Preparations for setting up the cohort started in 2013. Decisions were made about the cohort design, participant age at testing, and choice of measures and instruments to be used. Tests were developed and tested. A dedicated soft- and hardware structure was designed to incorporate MRI and Biobank data stored at the UMC Utrecht, and questionnaire and experimental data stored at the UU. Personnel for running the cohort have been hired and trained, and protocols covering logistics, and safety and ethical issues have been prepared. We have also developed a strategy for the recruitment and retention of cohort participants and have a dedicated location and facilities for testing children (the Child Research Center (CRC), http://www.kinderkenniscentrum.nl). Three large pilot studies have been performed: in one data were collected from children at 5 months, and in another data were collected at 10 months, with measurements being performed twice within 2 weeks, to establish test-retest reliability. The third study collected data from children aged 8 to 16 years. Functional Near-Infrared Spectroscopy (fNIRS) was piloted in infants, and preliminary data have been used to adapt the measurements and protocols. It was concluded that this method was not suited for our goals.
The two enrolment moments were described in two protocols submitted to the Institutional Review Board of the UMC Utrecht. These described the general idea of YOUth, including follow-up and inclusion of pregnant women. Subsequently, for each round of assessments an amendment describing the specifics of that assessment round will be submitted for approval. In March and April 2015, the two framework protocols were approved (14-616/NL51465.041.14 and 14-617/NL51521.041.14). The first round for the pregnant women were incorporated in the framework protocol, whereas amendments for measurements

at the age of 5 months, 10 months and 3 years old were approved. Moreover, also the amendment for the first round for YOUth child&teenager (second enrolment moment) has been approved. At the end of May 2015, we started the recruitment of pregnant women, and in March 2016 the first children in the second enrolment period (8–10 years) were recruited. A first prenatal MRI scan of a normal pregnancy and subsequently postnatal MRI scan of this healthy baby was successfully completed. This generated considerable media coverage.

In total we have included 1481 pregnant women (up to 27-07-2018). We measured 772 babies (5 and 10 months old) and we tested 6 infants for the age 2-4 years old. Up to 27-07-2018 we have included 854 children of 8, 9 or 10 years old. Furthermore, our first results have been published in *Human Brain Mapping*: Intra- and interobserver agreement for fetal cerebral measurements in 3D-ultrasonography (Albers et al. DOI: 10.1002/hbm.24076).

Changes compared to original proposal: An important change is that the initial number of 4500 subjects in each cohort has been revised to 3000 for the baby cohort and 3000 for the adolescent cohort the number of visits in young children has been reduced to 4 visits, mainly for logistic and financial reasons. Even with this reduced number of participants, the study will be amply powered to estimate differences in the primary outcome measures (i.e. typical brain development, social competence, and behavioural control), as these are continuous outcomes. We decided to test children over a wider age range (e.g., the assessment time “9 years” will include children aged 8-10 years), and we have included 3D ultrasound studies of pregnant women, to allow the tracking of brain development prenatally. Also, we decided to collect hair and saliva samples, to allow for more detailed determination of environmental influences. In general, we started recruitment to the YOUth cohort later than envisaged, because of the need to build a dedicated research center and extensive discussion of instruments to be used, etc. Furthermore, recruitment of the cohort of 8- to 10-year-old children was delayed because the dedicated 3T Philips MRI scanner was delivered later than planned: it came in use in February 2016. Finally, we added, structural and functional MRI both preterm and in newborns in a subsample of 100 pregnant women participating in YOUth, to study early brain development in greater detail.

Future: In WP1, we are discussing the possibility of greater cooperation with other partners at the Utrecht campus, to enable a more in-depth assessment of environmental effects (Exposome Hub) and somatic factors (with the Wilhelmina Children’s Hospital). For the latter purpose we are collaborating with other Utrecht Children’s studies, such as the HBSC study and the Whistler cohort, in order to line up these studies. In addition, we are working on an Internet platform that will allow us to make more measurements and which will be a tool for cohort recruitment and retention.
We are preparing for the data analysis of the baby cohort and the adolescent cohort. For this purpose we are currently holding brainstorm sessions for optimal scientific integration.

WP2	WP leader:	Prof. dr. M.H. van IJzendoorn (until May 2018) Prof. dr. E.A.M. Crone (from May 2018)
	L-CID cohort representative:	Prof. dr. M.H. van IJzendoorn (until May 2018) Prof. dr. E.A.M. Crone (from May 2018)
	Other PIs:	Prof. dr. M.J. Bakermans-Kranenburg

Aim/objectives: Children are not equally vulnerable to adverse rearing environments nor do they equally profit from supportive environments. Differential susceptibility theory proposes that vulnerable children, who suffer most from bad environments, are also more receptive to positive changes in the child rearing and wider social environment. Central questions are: Which children are most susceptible to environmental influences, and what are the neurobiological mechanisms by which the environment influences children’s social competence and behavioural control? These questions are addressed experimentally in longitudinal randomized controlled trials (Leiden-Consortium Individual Development, L-CID), using cognitive and behavioural interventions.

Method/Cohorts: The intervention studies within L-CID constitute an experimental cohort-sequential design. This implies a number of pre- and post-tests to examine intervention effects, with the added advantage that the control groups of the studies partly overlap in such a way that they can be combined in one series of quasi-longitudinal analyses from the first pre-test evaluation in the youngest L-CID cohort to the last post-test evaluation in the oldest L-CID cohort. The longitudinal studies cover (1) early childhood, and (2) pre-adolescence, with (3) extension of assessments until late adolescence. The first 5 years of the 10-year CID programme focused on L-CID early childhood cohort (starting at 3 years of age) and L-CID middle childhood cohort (starting at 7 years of age); in the second half of the 10-year CID programme the focus will mainly be on the last two waves of the early childhood cohort, the fourth-sixth wave of the middle childhood cohort the extension of the middle childhood cohort into adolescence.

Projects: In WP2 four PhD students and two postdocs are employed with the CID budget, and several PhD students, research assistants and postdocs were matched by Leiden University.

Start and progress: On the basis of discussions with the Scientific Advisory Board and the research team, we decided to recruit families with same-gender monozygotic (MZ) and dizygotic (DZ) twins and their parents. This approach has the advantage of: (i) more efficient recruitment/data collection/implementation of the intervention, (ii) potential for genetic modelling of intervention effects, and (iii) observation of differential intervention effects in siblings within the same family at a behavioural, (epi-)genetic, hormonal, and neural level. The overall design of the intervention studies and the main behavioural and biological measures to be included have been piloted and implemented in several waves of data collection (see below). Experts in various domains were consulted (ambulatory assessments, imaging, hormonal measures, VIPP intervention) to finalize the design.

The first five years of L-CID consisted of pilot studies to validate construct measurements and the first years of measurement waves. The first pilot study investigated the association between behavioural problems and tympanic membrane temperature asymmetry (N=92). In the second study, the Video-feedback Intervention to promote Positive Parenting (VIPP) was revised to include 1 booster session. Internet provision was piloted to see whether it could be used for assessments instead of home visits (with the intention to improve efficiency). Unfortunately, pilot parents and research staff considered it not to be feasible because of technical problems with two-way transfer of videotaped interactions and strict confidentiality requirements. We adapted the VIPP intervention for use with twins and successfully piloted the adapted protocol with three families. In the third study, two paradigms to assess central outcomes, namely, prosocial behaviour (Prosocial Cyberball, PCB) and aggressive behaviour (Social Network Aggression Task, SNAT) were developed and tested (N=136). PCB and SNAT were adapted to be used in the MRI scanner and with younger children. In the fourth pilot study, the Motionlogger (an actigraph worn on the wrist) was used to measure physical activity and sleep characteristics. In addition, the LENA (Language Environment Analysis), a small apparatus, was tested to record and analyze speech/language and other auditory stimuli in the home environment. In the fifth pilot study, a digital ambulatory assessment app was developed to collect data in real-life contexts and to remind parents to collect saliva samples.

Protocols for the early childhood and middle childhood studies have been submitted to the Institutional Review Board of the Institute of Education and Child Studies and the Institute of Psychology, revised and submitted to the Medical Ethics Committee of Leiden University Medical Centre (LUMC; obligatory for studies with a neurobiological component), and to the Central Committee on Research Involving Human Subjects. Both cohorts have been registered in the Netherlands Trial Register (NTR5312).

Recruitment of the early childhood cohort has been successfully completed: 238 families with twins (472 children) have been visited at home for the first wave of data-collection. Between September 2015 and October 2017, families came twice to the EEG laboratory for the second wave of data-collection (second pre-test; N= 215 families; N= 430 children) and the third wave of data-collection (first post-assessment; N= 202 families; N = 404 children). In addition, between the second and third wave of assessments, a random 40% of the families (N = 84) were visited at home for the VIPP-Twins intervention. Families in the control condition (N = 119) received a dummy intervention, comprised of telephone calls instead of home visits. Currently, the fourth wave (second post-test assessment; home visit) is finished off in which 200 families

are still participating with great enthusiasm. Data of most of these families is already collected (N = 182) and the last families (N = 12) are scheduled for a visit.
Recruitment of the middle childhood cohort has also been successfully completed: 256 families with twins (512 children) have visited the MRI laboratory for the first wave of data-collection, with great enthusiasm. Imaging and other tests were conducted in a newly built MRI facility at Leiden University Medical Centre, with two dedicated laboratory rooms, and a mock scanner nearby. Between September 2016 and September 2017 96% of the families (N = 246 families; 492 children) were visited at home for the second wave, where we administered similar behavioural tests as in the first assessment, but adapted to the home situation. For the third wave of data collection, all families were re-invited to the MRI laboratory. At the moment, already 224 families visited the lab and another 12 families are scheduled for a lab visit. Overall, 236 families (N = 472 children) are still participating. In addition, between the second and third assessment, a random 40% of the participating families were assigned to the VIPP-SD (N = 91 families). The remaining 60% of families were assigned to the dummy intervention (N = 152 families).

Even though it was a period with many changes within the team, including leadership of the program, the L-CID research team, consisting of several research assistants, VIPP interveners, PhD.-students, postdocs and many students, were committed to complete the data collection of the fourth wave of the early childhood cohort and the third wave of the middle childhood cohort. Both waves of data collection will be successfully completed end of September 2018. Also, the VIPP-SD and the dummy intervention in the middle childhood cohort were successfully completed in many participating families, by which we maintain the randomized controlled trial design as proposed. In addition, attrition rates in both cohorts are low, with no more than 10% loss to follow-up per year, indicating participating families are committed to the study.

Changes compared to original proposal: As explained above, we decided to recruit families with same gender MZ and DZ twins as subjects, to enable comparison of the effectiveness of the intervention in siblings raised in the same family/environment. The VIPP intervention has been adapted to meet the specific needs of families with twins; the aim and general approach of the intervention programme remained unchanged. Moreover, since parenting twins can be complicated, the parents of twins are eager to participate in the intervention to get support and advice on sensitive parenting and discipline strategies. We decided to stop recruitment after the inclusion of about 500 children in each of the two cohorts, instead of the projected 600 children. Implementation of the original design with several rounds of assessments at specific ages would have been impossible because of the overlapping rounds of data collection within and between the cohorts. The advantage of recruiting twin families is the greater variation in socioeconomic status (and consequently greater statistical power) in the sample relative to that of non-twin families because we have consistently found that families from lower socioeconomic backgrounds are more motivated to participate in research when they have twins.

Because our VIPP intervention focuses on optimizing parental sensitivity and sensitive discipline, we added specific neurophysiological measures to evaluate the effects of VIPP on the parents across pre- to posttest. In 121 families randomly selected from the early childhood cohort primary caregivers were asked to participate in extra lab assessments using EEG/ERP to measure markers of enhanced sensitivity to child signals. We also assessed parental behavioural control, parallel to the measurements in the children. This way we hope to shed more light on the mechanisms that carry the changes in parental behaviour from pre- to posttest due to the intervention. The protocol for this parent-focused part of L-CID has been approved by the CCMO and this part of the trial has been pre-registered (NTR5312). Data collection on 68 families has been finished, and data processing and analysing is in full speed.

Future: In WP2, the studies involving the early childhood cohort and middle childhood cohort, and its extension into adolescence, will continue with assessment rounds. Protocols for the post-intervention assessments in both cohorts and the extension of the middle childhood cohort into adolescence will be prepared, and these studies will be started after prior assessment of the measures that are unique for these cohorts. If necessary, ethical approval will be sought with the Central Committee on Research Involving Human Subjects. The infancy cohort was taken out of the programme for logistical reasons after consultation with the Steering Committee.

WP3	WP leader:		Prof. dr. W.H.J. Meeus (until January 2018) Prof. dr. S. Branje (from January 2018)
	Cohort representatives:	*Generation-R*	Prof. dr. H. Tiemeier (until February 2018) Prof. dr. M.H.J. Hillegers (from February 2018)
		TRAILS	Prof. dr. A.J. Oldehinkel
		RADAR	Prof. dr. W.H.J. Meeus (until January 2018) Prof. dr. S. Branje (from January 2018)
		NTR	Prof. dr. D.I. Boomsma
	Other PIs:		Prof. dr. J. Ormel

Aim/objectives: The WP3 studies investigate how the characteristics of grandparents (Generation 1, G1) impact the development of parents (Generation 2, G2) and – through them – the development of their children (Generation 3, G3). These studies have a multigenerational design and investigate the extent to which genetic and non-genetic transmission between generations causes differences in developmental outcomes in children and adolescents. The three-generation design is used to study behavioural transmission. Two- and three-generation designs are used to study the epigenetics of transmission and to untangle genetic and environmental processes of transmission of processes related to behavioural control and social competence.

Method/Cohorts: The WP3 studies use data collected from existing G1 and G2 cohorts and collect data from the G3 cohort. These cohorts are part of four strong cohort studies of child and adolescent development currently in progress in the Netherlands: Generation-R, the Netherlands Twin Register (NTR), Research on Adolescent Development and Relationships (RADAR), and the Tracking Adolescents' Individual Lives Survey (TRAILS).

Projects: In WP3 six PhD students and seven postdocs are or have been employed via CID budget.

Start and progress:

Generation-R

We collected and processed additional epigenetic data at birth, age 6 and age 10. Genome-wide information on DNA methylation is now available for 1339 children at birth, 493 at age 6 and 465 at age 10. This dataset alone constitutes one of the largest population-based repeated epigenome-wide studies for children worldwide. We further increased the sample size by collaborating with the University of Bristol and the Avon Longitudinal Study of Parents and Children (ALSPAC). We harmonized and pooled together the repeated epigenetic datasets of both ALSPAC and Generation R. The resulting dataset contains repeated measurement from birth to the age of 15 years and depending on the assessment age and probe exceeds 2000 participants. We are preparing a manuscript describing genome-wide DNA methylation changes across childhood and adolescence in the general population. We are observing substantial variability in these developmental changes and thus our next step is to relate DNA methylation change to the experience of stressful life events. In total 5462 primary caregivers completed a structured interview about their child's life events and traumatic experiences. We are currently analyzing whether the number of life events a child experiences is related to changes in DNA methylation from birth to age 10.

NTR

All participants in the Netherlands Twin Register (NTR) belonging to the group of twins with young twins (~700 families), sisters with young twins (~450 families) and adult twins with adult offspring (~300 families) have been identified (last round of identification summer 2018).

Data available for these children and their parents are, amongst others, psychopathology, wellbeing, educational achievement and self- control. The data collection in the group young twins who have become parents themselves is ongoing. At this time twins from the cohorts 1986-1991 (~850 families) have been invited to register their children with the NTR and ~140 families agreed (and ~130 did not agree) to participate. A new cohort will be approached in the near future, data collected in these children include measures on psychopathology, well-being, behavioural control (Childhood Behavior Questionnaire, (CBQ)), temperament, the home environment and parenting styles. Parents of 5-year-old twins filled out a survey

that since 2015 includes the CBQ and data on behavioral control are available for in total ~2500 children (2015: N ~900, 2016: N ~850 and 2017: N ~750).
Teachers of 7, 9 and 12-year-old twins and their siblings filled out, after having ascertained parental consent, a survey on the development of the children. Up until now three waves of data collection (2016: N ~1900, 2017: N ~1600 and 2018: N ~1200) have been done and pupil monitoring test scores are available for one third of these children. Since 2017 the Social Skills Rating System (SSRS) questionnaire has been included and data on social competence are available for in total ~2200 children. A new scale using items from the ASEBA has been developed to measure self-control (Willems et al., 2017). The age appropriate questionnaire of the ASEBA was included in the data collection in all 3, 7, 9 and 12-year-olds (2015-2017: N > 6000 (mother report) and N > 4000 (father report).

RADAR

In 2012-2013, we collected data for the Wave 7 assessment of G2 and linked them with earlier collected data for G1. The Wave 8 assessment of G2 took place in fall 2014 and spring 2015, and the Wave 9 assessment took place in fall 2016 and spring 2017. In total, data were collected for 1298 target parents and 646 partners. Attrition between the Wave 1 and Wave 9 assessments was about 15%. We are now preparing the Wave 10 assessment. Key aspects include measures of personality, behavioural control, parent-child relationships, social competence, peer relationships, and psychopathology. Additional DNA collection in G2 is possible due to a recently acquired ERC CoG (Branje). The preparation of questionnaires and observational measures (special attention given to social competence and behavioural control) for G3 was completed in 2014. Data collection for G3 participants is in progress, in close collaboration with TRAILS. Offspring measures include milestones, temperament, behavioral control, social competence, psychopathology, parenting and peer relationships. Assessments take place at age .5, 2.5 and 4.5 years. Currently approximately 200 children have been included.

TRAILS

In close collaboration with the RADAR study group, we have investigated measures of a third generation (G3), using questionnaires and/or observational measures during pregnancy and at 3, 30, 54, and 72 months of age. Parental measures include personality, psychopathology, life events, and difficulties; offspring measures include early movements, milestones, temperament, behavioural control, social competence, and psychopathology. Data collection started in April 2015, with screening of the cohort regarding pregnancies, and the first home visits started in September 2016. The coming period will see the inclusion of children born before the start of the screening (> 80).

Changes compared to original proposal: The Generation-R, NTR, and RADAR studies are being carried out according to the original plans. This is also true for the TRAILS study, with the exception that offspring follow-up assessments are planned at 3, 30, 54, and 72 months of age instead of the originally planned twice within 12 months, at 18 months, and once every year thereafter. We made this change to optimize the time window for specific assessments (e.g. early motor activity should be assessed between the 11th and 16th week in order to be informative) and to enable comparisons with the other cohorts of the CID, as far as possible given the budget. The assessment at 72 months was added recently, thanks to a recently acquired ERC grant (to Dr. Kretschmer).

Future: In WP3, the data collection of the four studies (Generation-R, NTR, TRAILS, and RADAR) is on track. A cooperative submission for additional funding was made to NWO large investment grant 2015, to support the projected large-scale investigations, specifically for the large-scale collection of data from G3 children in the coming years. Also, WP3 continues to collaborate with Geosciences UU to study the effects of neighbourhoods on child and adolescent development.

WP4	WP leader:	Prof. dr. M. Joëls
	Animal cohort representative:	Prof. dr. M. Joëls
	Other PIs:	Prof. dr. J.J. Bolhuis
		Prof. dr. H.J.A. Hoijtink

Aim/objectives: We aim to gain an understanding of *how* gene x environment (G x E) interactions influence the development of behavioural control and social competence (relevant to work packages 1-3). To this end, we will use models to study G x E interactions under highly controlled conditions; use experimental methods to examine specific brain connections (down to the level of synapses); investigate trans-generational effects within a time-frame of a few years; and test the validity of specific theoretical frameworks, which in turn can be used to guide future experiments. Like the other WPs, WP4 makes use of shared technology (e.g. neuroimaging) and has a focus on behavioural control and social competence.

Methods/cohorts: In the animal (rodent and bird) cohort, we now focus on genes known to be important in environmental/intervention susceptibility (WP2), i.e. *DRD4*. We will also investigate the influence (i) of parent-infant interactions in rodents and birds or (ii) of growing up in a complex environment, on the development of various cognitive skills including social communication and behavioural control (WPs 1-3). We will also examine trans-generation parallels in parenting styles and the commonalities/differences in epigenetic programming between humans and rodents (aligned with WP3). We apply meta-analytical tools and (Bayesian) statistics to existing human/animal datasets to test the effects of early life environment on cognitive domains as well as the interaction between early life stress and stress in adulthood.

Projects: In WP4 five PhD students and four postdocs have been employed via the CID PI budget; and 2 postdocs, 1 senior consultant and 1 technician from the cohort budget.

Start and progress:

Use of rodent models/rodent cohorts

This part started in October 2013, with the optimization of the animal models and behavioural tasks. Two animal models for early life adversity (limited bedding/nesting material in mice from postnatal day 2-9; maternal deprivation on postnatal day 3) have been developed, as well as the complex housing environment. We have set up various cohorts: genetically modified mouse lines with Mineralocorticoid Receptor (MR) overexpression or knockout; Glucocorticoid Receptor (GR) knockout; combinations thereof; and DRD4 knockouts. Most behavioural set-ups were optimized in 2013/2014. More recently we developed 2 different tests for prosocial behaviour. We now also start to implement tests for behavioural flexibility.

We have investigated whether the consequences of early life stress on the developing rodent brain can be normalized during the sensitive peripubertal period, by means pharmacological interventions, and now focus on the role of genome-wide epigenetic programming, in males and females. Experimental endpoints include: social competence (play behaviour, social interaction behaviour, behavioural flexibility, 2 tests for prosocial (empathic) behaviour), emotion regulation and flexibility as index for adaptive capacity. More recently we have expanded our studies to the investigation of growing up in a complex environment, given the strong phenotype. A challenge for the coming 2-3 years will be to incorporate the wealth of information on rodent data (also from other labs) into a general model describing the effect of early life adversity (or enrichment) on behavioural development –including the social domain-, taking the underlying neuronal substrate into account.

Use of avian models/avian cohort

There are two research lines: (1) Gene-environment interactions in the development of social behaviour in a cohort of birds, and (2) How do developmental factors affect each other in the development of song and social preferences in birds? In research line 1, we are examining the neurogenetics of birdsong learning. In research line 2, further technical advances in the high-density multielectrode recording set-up have enabled us to measure auditory-evoked and event-related action and local field potential activity in a sleep-like state with sub millisecond precision over long recording episodes (hours). Sleep is strongly involved in learning, including vocal learning in songbirds and grammar learning in human infants. However, the underlying neurophysiological mechanisms remain poorly understood. We aim to examine the role of large-scale cortical oscillations that occur during deep sleep in perception and learning of vocalizations in zebra finches, *Taeniopygia guttata*. We previously studied sensitivity to vocal sequence structure, particularly in secondary auditory cortices, from action and local field potential activity recorded with high-density multi-electrodes of isoflurane anesthetized birds. Sleep and anesthesia have not been systematically compared in birds. We recorded with the same methodology as earlier intracerebral oscillation dynamics during

anesthesia and sleep. We used a different bird species, *Columba livia,* because our methodology cannot be applied in naturally sleeping zebra finches yet, because of their small size. We obtained good recordings in isoflurane anesthesia and natural sleep states (deep sleep and REM sleep) from the same subjects. Oscillatory dynamics of electrical activity during anesthesia are in many aspects similar to those during deep sleep (NREM), and dissimilar to those during REM sleep and wakefulness.

Use of statistical models

We have developed inferential procedures that are relevant for CID research in cooperation with CID researchers. In the past period, we have completed the following projects:

- Use of data and expert knowledge to estimate and evaluate statistical models
- Development of statistical tools for replication studies in the context of cumulative stress and match/mismatch theories
- Development of statistical tools for theory-based evaluation of contingency tables in the context of eye-tracking studies
- Use of the data from multiple cohorts (Trails, NTR, Radar, GenR) to evaluate the relation between parental age and offspring problem behaviour.
- Development of a prior predictive p-value that can be used to evaluate replication studies.
- The dissertation of Yasin Altinisik is finished and has been successfully defended.
- The dissertation of Mariëlle Zondervan-Zwijnenburg will be finished in 2018.

An essential component of these projects is consultation and cooperation with PIs from other WPs, to ensure that the newly developed statistical techniques can be applied to and are relevant for CID projects.

Changes compared to original proposal: At this stage, there have been no changes to the plans described in the original proposal.

Future: In WP4, several series of experiments using rodent models have been started in collaboration with WP1 – WP3. The development of avian models and their use in studies will continue as planned. With respect to statistical models two goals will be pursued:

(1) Bayesian approaches using the data from multiple cohort studies will be developed that can be used to address research questions with respect to development of children over time, that is that can be used for the analysis of longitudinal data.
(2) A Bayesian approach will be developed to address the fact that many rodent studies are underpowered. The key idea is to use very small control groups because historical studies already contain a lot of useable information with respect to the control groups, which implies that larger experimental groups can be used. Strong collaborative ties have been developed for this purpose between the investigators of the rodent models and the statistical experts.

Interaction and coherence between the lines of research

CID brings together top researchers from different disciplines. We have established several ways to stimulate interaction, coherence, and complementarity that are in line with our original plans.

WP1 is collaborating closely with WP2 in its research on the development of connectivity. Cooperation and complementarity with WP3 exist with NTR in its research on (epi)genetics and brain development in a twin model, with RADAR in its research on parenting during adolescence and young adulthood, and with TRAILS in its research on the development of parenting and its role in adolescent adaption. Furthermore, WP1 is collaborating with WP4 in the predictive Bayesian analysis of relevant cohort results and in a project to study social interaction in a hybrid setting, where a live setting of two people interacting is mimicked, under controlled laboratory conditions. As this is a novel method of studying social interaction, there are few tools available to analyse such data, so WP1 and WP4 are developing a tailored statistical tool.

WP2 has collaboration with WP1, WP3, and WP4. Generation-R and L-CID are collaborating in epigenetic

and genetic-environment interaction studies, for example, in the analysis of the psychometrics of cortisol levels in hair samples collected in the Generation-R study, and in the analysis of structural MRI findings in Generation-R children in relation to parental sensitivity, sharing the supervision of 4 PhD students. With WP4 the collaboration is also rather intensive, with 2 PhDs, both co-supervised by researchers from WP2 and WP4, involved in projects testing behavioural control and prosocial competence, as well as models of differential susceptibility and parenting support in mice and rat models. With WP1 a common interest is shared in the replicability of neurobiological measures across time and age, resulting in workshops for discussions of replicability and in exchanges of paradigms.

WP3: NTR is collaborating with statistical experts in WP4 on a study on the effect of parental age on psychopathology and cognition in children. The first paper with multiple cohorts (Generation-R, NTR, RADAR and TRAILS) from CID focused on internalizing and externalizing problems; a second paper is in progress with a focus on ADHD and cognition. WP3 is collaborating closely with WP1 in its research on brain development adolescent identity, adolescent drug use, and victimization. RADAR is also collaborating with WP1 in studies on parenting and intergenerational transmission of abuse. TRAILS (WP3) is collaborating with WP4 in its research into the cumulative stress and mismatch hypotheses.

WP4 is participating in several projects with WP1; for example, the role of epigenetics in early adversity, the relation between exposure to fiction and social competence, the use of theory-based evaluation in the context of eye-tracking data, and the development of language. WP4 is also strongly collaborating with L-CID in its studies of the influence of parenting on cognitive development and the role of genes in susceptibility (see WP2). Furthermore, there is across work packages collaboration because multiple cohort studies (Trails, GenR, NTR, Radar) cooperate with WP4 to evaluate research questions that are relevant across CID that are supported by data originating from different sources.

3 – Joint activities

Joint activities since the start in 2013
22 March 2013, Utrecht: Brainstorming with all 20 CID PIs about the implementation of the research programme.
10 October 2013, Utrecht: First Scientific Advisory Board meeting with the Steering Committee and Scientific Advisory Board members; presentations and discussion about all WPs.
11 October 2013, Utrecht: Kick-off CID symposium with presentations by international experts (Scientific Advisory Board members and PIs) and poster presentations by PhD students and postdocs.
30 October 2013, Utrecht: PI meeting to decide on the core measures for social competence and behavioural control.
26 November 2013, Utrecht: Cohort expert meeting. Advice meeting for the YOUth cohort. Experts from other cohorts within the consortium were attending.
15 January 2014, Utrecht: PI meeting on core measures for social competence and behavioural control. Core measures were selected for use in each cohort in the consortium: http://www.individualdevelopment.nl/research/measurements.
25 June 2014, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties. Giving the opportunity to meet each other, to present work and learn about each other activities. Along with a community coffee session, the PI meeting, the Steering Committee meeting, and an informal reception. This meeting is held regularly every 6 months (*see below **).
29 October 2014, Utrecht: Seminar for directors of primary schools, teachers, internal counselors, and care teams on behavioural problems in children. Organized by the Brain Center Utrecht (CID PI Joëls) and the Child Research Center (CID PI Kemner).
17 December 2014, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*
18 March 2015, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*
9 April 2015, Utrecht: Second Scientific Advisory Board meeting with the Steering Committee and Scientific Advisory Board members; presentations and discussion about all WPs.
10 April 2015, Utrecht: Second CID symposium with presentations by international experts (Scientific Advisory Board members and PIs) and poster presentations by PhD students and postdocs.
31 August 2015, Utrecht: Jet Bussemaker, Minister of Education, Culture and Science, and Jos Engelen, Chairman of the Governing Board of NWO visited the Child Research Center Utrecht (KinderKennisCentrum Utrecht), base of the WP1 YOUth cohort.
30 September 2015, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*
22 March 2016, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*
7 June 2016, Utrecht: Tour de Consortium for all CID PhD students and postdocs to visit a participating institute, to look at its laboratories, facilities, and methods/tools.
27 October 2016, Utrecht: Third Scientific Advisory Board meeting with the Steering Committee and Scientific Advisory Board members; presentations and discussion about all WPs.
28 October 2016, Utrecht: Third CID symposium with presentations by international experts (Scientific Advisory Board members and PIs) and poster presentations by PhD students and postdocs.
24 February 2017, Utrecht: PI brainstorming session on the next five years of CID
18 April 2017, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*
4 October 2017, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*
10 November 2017, Utrecht: PI brainstorming session on the next five years of CID
20 April 2018, Utrecht: Fourth CID symposium with presentations by international experts (Scientific Advisory Board members and PIs) and poster presentations by PhD students and postdocs.
20 and 21 April 2018, Woudschoten: CID retreat with meet-the-expert sessions, workshops and ethics debate with PIs, PhD students and postdocs.
29 May 2018, Utrecht: CID meeting with all PIs, PhD students, postdocs, and other interested parties.*

* CID meeting with all PIs, PhD students, postdocs, and other interested parties. Giving the opportunity to meet each other, to present work and learn about each other activities. Along with a community coffee session, the PI meeting, the Steering Committee meeting, and an informal reception. This meeting is held regularly every 6 months

4 – Institutional and organizational embedding

The consortium is associated with one of the four strategic themes of Utrecht University, namely, *Dynamics of Youth* (*DoY*, www.uu.nl/doy), which focuses on child development, but with an even broader scope and participation (including involvement of all Utrecht Faculties: Social and Behavioural Sciences, Geosciences, Humanities, Law, Economics and Governance, Science, Medicine, and Veterinary Medicine). This clear nucleus of organization at Utrecht University increases the coherence of the programme and provides structural embedding. The co-funding reflects local embedding provided by different institutes, both in material and personnel. Furthermore, all participating research groups have excellent, state-of-the-art facilities and equipment at their disposal. The institutional embedding of the different sites and examples of national and international embedding are described below.

WP1:

Institutional embedding: WP1 (the YOUth cohort) is embedded within the UU strategic research theme, "Dynamics of Youth". Within Dynamics of Youth cooperation exists with the strategic research programme *'Child Health'* of the UMC Utrecht, the Julius Center (UMC Utrecht), the Wilhelmina Children's Hospital, the University of Applied Sciences Utrecht and the Princess Maxima Center in Utrecht. YOUth is also embedded in the *'Brain'* strategic research programme of the UMC Utrecht. YOUth is collaborating with the Departments of Media and Culture, Education & Pedagogy, Utrecht University, and the Utrecht Institute of Linguistics in its research on, for example, communication skills as a predictor of behavioural problems in children and adolescents.

National embedding: WP1 is collaborating with the Trimbos Institute Utrecht, the Departments of Media and Culture, Education & Pedagogy, Utrecht University, and the Utrecht Institute of Linguistics in its research on, for example, communication skills as a predictor of behavioural problems in children and adolescents. It is also collaborating with the Erasmus University Medical Center, Rotterdam, in the ongoing large-scale longitudinal study *'Flemish Study on Parenting, Personality, and Development'* (FSPPD) , in the *Hersenstichting Nederland* project on influence of alcohol intake on adolescent brain development, in the Open Data Infrastructure for Social Sciences and Economics Innovation (Oddissei), in the *'BBMRI-NL2.0 Roadmap for Large-Scale Research Facilities'* and is in contact with the *Health-RI* initiative. It is also collaborating with the Radboud University Medical Center, Nijmegen, with a focus on infant research. It collaborates with Leiden University, Radboud UMC, Free University Amsterdam and others in NeurolabNL on youth within the *National Science Agenda*.

International embedding: At an international level, WP1 is collaborating with the Marie-Curie training school on neurocognitive methods in infants (Brainview). Furthermore, WP1 is collaborating within the *Enhancing Neuroimaging Genetics through Meta Analysis' (ENIGMA) Consortium for imaging-genetics studies* (Paul Thompson, Keck University, Los Angeles, USA). Kirby Deater-Deckard (Virginia Tech, USA) and Bruce Ellis (University of Arizona, USA) – experts on the development of self-regulation and differential susceptibility, respectively – both visited the Department of Clinical Child and Family Studies (UU, Faculty of Social and Behavioural Sciences) for a few months, financed by NWO visitor travel grants. Furthermore, WP1 is collaborating with Ohio State University, Nanyang Technological University Singapore, and with the *European FP7 TACTICS consortium* with, among others, the Institute of Psychiatry, London (UK), the Institute of Psychiatry, Mannheim (Germany), the Institute of Psychiatry, Nijmegen, and the Karolinska, Institute Stockholm (Sweden).

WP2:

Institutional embedding: L-CID is part of the Leiden University profile area *'Health, Prevention and the Human Life Cycle'*, and the neurobiological projects of L-CID are also part of the *Leiden Institute for Brain and Cognition* (LIBC).

National embedding: At a national level, L-CID has cooperative links resulting in co-publications with the Vrije Universiteit Amsterdam on challenges to child-caregiver relationships, with Generation-R (Erasmus University Medical Center Rotterdam), Brain Center Rudolf Magnus (Utrecht University), NTR (Vrije Universiteit Amsterdam).

International embedding: L-CID is collaborating with Gusto, a large cohort study in Singapore, on epigenetics of parenting, and with Imperial College, department of Medicine, London (UK), University

College London, Research Department of Clinical, Educational and Health Psychology (UK), and the University of Cambridge School of Clinical Medicine on video feedback interventions. Furthermore, there are cooperative links with the *Avon Longitudinal Study of Parents and Children* (ALSPAC) in the UK in research into the genetics of parenting and child development, and with *Mercy Pregnancy and Emotional Well-being Study* (MPEWS) in Melbourne (Australia) in research on stress-related aspects of parenting. The imaging studies are embedded in a large network, e.g. organized in the Jacobs Foundation Network Initiative on prosocial development. There are collaborative links with Columbia University, New York , the University of Illinois, the University of Oregon, and Harvard University for research into methods for longitudinal imaging analysis in adolescents. Finally, there is ongoing collaboration with the Youth Development Lab at UC Berkeley (USA).

WP3:

Institutional embedding: Generation-R is embedded in five different research groups of the Erasmus Medical Center Rotterdam: *'Mother & Child'*, *'Behaviour & Cognition'*, *'Asthma & Atopy'*, *'Diseases in childhood'*, and *'Health & Healthcare'*. NTR was founded on February 1 1987 at the Vrije Universiteit Amsterdam and is part of Amsterdam Public Health (APH). TRAILS is a joint project of the University of Groningen and the Erasmus Medical Center, Rotterdam. Other participating universities include Radboud University Nijmegen Medical Center, and Utrecht University. TRAILS is embedded in the departments/faculties of Psychiatry, Sociology, Health Science, Child & Adolescent Psychiatry, and Social Sciences. RADAR is embedded at long-term research lines of Utrecht University and the Free University Amsterdam.

National embedding: NTR collaborates with the Max Planck Institute, Nijmegen, regarding its research on literacy development(GenLang consortium) and with the VUmc Amsterdam in its research on gene-environment interactions (GECCO consortium). NTR is a major partner in BBMRI-NL (Biobanking and BioMolecular resources Research Infrastructure The Netherlands) and ODISSEI (Open Data Infrastructure for Social Science and Economic Innovations). TRAILS maintains close collaborative links with its consortium members, who represent institutes across the Netherlands. RADAR continues close collaboration with consortium partners, but also with Tilburg University and with Erasmus University Rotterdam on intergenerational transmission of fathering and SES (Prof. Keizer, ERC StG).

International embedding: At an international level, NTR, Generation-R, and TRAILS collaborate as part of the EAGLE consortium (EArly Genetics and Lifecourse Epidemiology) the and Early Growth Genetics (EGG) Consortium with other international groups in studies to identify genes underlying childhood psychopathology and growth related traits. NTR leads the EU-ACTION (Aggression in Children: Unraveling gene-environment interplay to inform Treatment and InterventiON strategies consortium with a focus on childhood aggression) and the Twinning Genetics Consortium. Generation-R also contributes to the EU-ACTION ans is participating in the Pregnancy And Childhood Epigenetics (PACE) consortium, leading or contributing to projects with the aim to identify DNA methylation sites associated with child development. RADAR has collaborated with Pittsburgh University (USA) in its research on adolescent delinquency, and is collaborating with Leuven University (Belgium) in its research on gene-environment interactions. RADAR is also part of the cannabis consortium. TRAILS has collaborative links with, among others, the University of Arizona (USA) for its research on mechanisms involved in adaptive calibration and with the University of Illinois (USA) for its research on positive affect.

WP4:

Institutional embedding: WP4 is embedded in the research programme *'Translational Research' of the* Brain Center Rudolf Magnus of the UMC Utrecht. Furthermore, the research of WP4 is part of *Neuroscience & Cognition Utrecht* (NCU); its replication studies for TRAILS are carried out within existing research programmes of the University of Groningen.

National embedding: At a national level, WP4 collaborates with Radboud University Nijmegen and has collaborative links with Utrecht University, the University of Amsterdam, Tilburg University, Endocrinology in Leiden (LUMC), and the Department of Psychology of the University of Amsterdam.

International embedding: WP4 has a close collaboration with the Max Planck Institute for Psychiatry, Munich (Germany), and with the Massachusetts Institute of Technology, Cambridge (USA). Furthermore, WP4 is collaborating closely with the Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig

(Germany), the British Heart Foundation, and the Department of Data Analysis of Ghent University (Belgium).

Talent management

We designed a curricular environment in which our Master's and PhD students can obtain the right mix of deep disciplinary expertise *and* a wider interdisciplinary outlook. To this end, we determined what is already in place in the participating graduate programmes and added specific facilities relevant to our CID junior scientists. On the CID website (www.individualdevelopment.nl) we refer to the information on Master and PhD level courses organised by the participating graduate programmes. The Programme Support Office facilitates participation in courses outside its own graduate programme for the CID PhD students and postdocs. PhD level courses, Master's-level courses, and Master classes are regularly organized by CID PIs. In addition:

- All cohorts offer on-the-job training and coaching. They provide students with the possibility to participate for several months (Master's level) or several years (PhD level). To foster interdisciplinary development, all CID PhD students have a second supervisor with a different disciplinary background from the consortium.
- Graduate programme students are regularly invited to attend lectures given by one of the researchers, which address a specific topic from the research programme in depth.
- We organized a Tour de Consortium on 7 June 2016 in Utrecht. All CID PhD students and postdocs were invited to visit the participating institute, to look at its laboratories, facilities, and methods/tools. We are exploring the possibilities to integrate Tour de Consortium visits with the CID meetings we organize twice a year.
- After reviewing the available courses on ethical aspects of research, we have provided an ethics workshop and debate in collaboration with our Ethical Advisor to close ethical educational gaps.
- The first CID 2-days retraite was on 20 and 21 April 2018, combined with our Scientific Advisory Board meeting included an evening lecture and workshops for junior scientists. There was also room for 'meet-the-expert' sessions for CID PhD students and postdocs with PIs and Scientific Advisory Board members in order to explore their research career possibilities.

5 – Knowledge utilization

CID acknowledges the importance of knowledge dissemination and utilization and is fully committed to actively communicate information about the objectives, approach, and results of this research to the community. Given the relatively short time since the start of CID, dissemination of knowledge specifically related to consortium efforts is necessarily limited, although pilot results have been presented at conferences, at meetings open to the general public, in newspapers, and in other popular media. Specific examples of knowledge utilization and societal relevant activities by our PIs are described below and in **Appendix 6**.

WP1: WP1 has a longstanding cooperation with The Netherlands Youth Institute (*Nederlands Jeugdinstituut*), the national institute for disseminating knowledge on children and youth matters. In addition to publishing the results in journals, magazines, and websites aimed at clinicians and parents of children, at the end of the project we will also organize a workshop during the annual congress for professionals in youth care, *Youth in Research*. In the current phase of the YOUth cohort acquisition we organize evenings with parents and afternoon lectures for children to exchange knowledge to ensure that knowledge utilization can be optimized in the future when the cohort will generate new findings. Already in this phase of the studies, PhDs, post-docs and junior and senior researchers provide lectures and other events to transfer knowledge.

WP2: WP2 contributes to the Child and Family Blog of the University of Cambridge. Furthermore, video blogs have been prepared (www.brainanddevelopmentlab.nl/index.php/video), and the Braintime Festival in Corpus was co-organized (http://www.universiteitleiden.nl/nieuws/2016/02/feest-voor-het-puberbrein). PhD students (Achterberg and van de Meulen) regularly write blogs for the Leiden Psychology blog on topics related to the study.
Marinus van IJzendoorn made two contributions to the youtube videoclip series Implications of attachment research, initiated by Robbie Duschinsky at the University of Cambridge (https://www.youtube.com/channel/UCZrrh_xgB15qWYzu6Vwk6ew).
Several invited talks to professionals and policy makers, in the Netherlands and abroad have been given (e.g., a public lecture by Van IJzendoorn about the development of prosocial behaviour in children, in Honour of Robert Hinde at St John's College Cambridge), and workshops on the VIPP parenting intervention as well as on parental sensitivity and sensitive discipline are provided on a regular basis, for researchers as well as professionals and clinicians in the Netherlands and abroad (e.g. China, South-America, the UK, USA and various European countries). Marinus van IJzendoorn also contributed to the following international interviews:
- A Troubling Prognosis for Migrant Children in Detention
- The New York Times June 18 2018
- The long-lasting health effects of separating children from their parents at the U.S. border Los Angeles Times June 20, 2018

WP3: WP3 communicates study findings through Twitter (NTR, TRAILS and Generation R; NTR maintains separate Twitter accounts for science and for participants), study websites, and newsletters for respondents (NTR, RADAR, TRAILS, Generation R; NTR newsletters may be downloaded from the website). NTR, TRAILS and generation R also have Facebook pages and NTR has a personal online portal with results and information for its participants. GWAS summary statistics of EAGLE projects (NTR, TRAILS and Generation R) can be downloaded via the psychiatric genomics consortium website and be analyzed at LD hub.

WP4: WP4 provides educational modules for professionals in the teaching world. Furthermore, they published several interviews in national magazines, newspapers, online, on television, and in radio programmes. They maintain the website informative-hypotheses.sites.uu.nl, containing free software that can be used by researchers interested in theory based data evaluation and/or the evaluation of replication studies and multiple cohort studies. Besides books, theoretical papers and tutorials, the website contains an overview of applied papers of researchers that used and published with the approaches from the website.

Appendices

Appendix 1 – Realization and budget

CID started in May 2013. The accounts and budgets presented below show that CID has made a successful start and that personnel and infrastructure are in place to support the further development of CID and its research.

Tables A-C reflect the tables conform the original application, but with actual costs up to June 2018.

Table A: According to the original proposal, every work package was divided into objectives to which specific PIs were assigned. Originally, the scientific staff budget per work package was subdivided into PhD students and postdocs. In order to come to the realization of this budget, we further subdivided the total budget per work package into the different PIs participating (and thereby into the different objectives per WP). There would appear to be a discrepancy between projected and actual costs (see Table A), which can be explained by the fact that PhD students and postdocs are appointed for a number of years.

Tables B and C: Table B provides an overview of projected and actual investment costs and Table C an overview of co-funding acquired.

Table of content:

Table A – Allocation PI budgets and actuals (PhD students and postdoc costs)
Up to June 2018

(€)	2013		2014		2015		2016		2017		2018		2019	2020	2021	2022	2023	Total budget	Total actual	Total allocated
	Actual	Allocated	Actual	Allocated	Actual	Allocated	Actual	Allocated	Actual	Allocated	Actual	Allocated	Allocated	Allocated	Allocated	Allocated	Allocated	2013-2023	2013-2018	2013-2023
WP1- Brain development																				
Dekovic	0	0	3.219	4.306	28.449	37.197	49.725	54.543	45.694	55.216	22.570	68.347	63.820	56.034	59.514	47.224	-	540.000	149.657	446.201
Durston	0	0	0	0	27.286	75.254	66.275	70.950	4.200	14.700	37.659	27.568	52.554	58.241	56.605	-	-	675.000	135.420	355.873
Hulshoff Pol	0	0	0	0	20.243	62.917	87.722	50.188	45.489	66.127	30.083	102.714	83.699	58.241	61.900	20.764	-	675.000	183.537	506.549
van Berkum & Kager	0	0	39.983	61.106	51.661	62.182	56.101	68.961	27.655	62.821	0	14.930	-	-	-	-	-	540.000	175.400	270.000
Kahn	0	0	20.513	25.903	48.603	68.386	89.200	71.729	58.203	75.808	24.542	27.158	-	-	-	-	-	540.000	241.061	268.983
Kemner	0	3.750	68.926	68.147	51.496	53.168	100.513	64.955	87.353	52.500	46.225	77.333	121.256	116.286	83.013	47.911	-	810.000	354.513	688.318
Valkenburg	0	0	0	0	23.360	25.696	113.062	108.599	110.583	109.992	58.605	113.050	89.420	-	-	-	-	810.000	305.611	446.757
Vollebergh	0	0	0	0	31.654	31.654	29.932	29.932	12.235	12.235	0	30.033	104.541	118.617	125.702	82.732	-	540.000	73.821	535.447
Total WP1		**3.750**	**132.640**	**159.462**	**282.753**	**416.455**	**592.530**	**519.856**	**391.412**	**449.399**	**219.685**	**461.133**	**515.290**	**407.420**	**386.734**	**198.631**		**5.130.000**	**1.619.020**	**3.518.129**
WP2- Interventions																				
Bakermans-Kranenburg	19.443	21.332	33.755	40.550	33.124	42.639	24.586	45.389	0	46.534	0	7.853	-	-	-	-	-	540.000	110.908	204.297
Crone	0	0	9.451	11.658	33.390	35.046	37.376	40.123	39.751	43.010	20.601	45.405	30.093	-	-	-	-	540.000	140.569	205.335
Engels	0	0	0	0	30.828	32.975	37.147	39.187	41.274	41.996	22.220	45.038	46.139	-	-	-	-	540.000	131.469	205.335
van IJzendoorn	6.797	6.682	38.260	44.964	44.879	51.791	67.674	86.521	81.895	90.396	21.578	42.145	42.145	10.536	-	-	-	810.000	261.083	375.179
Total WP2	**26.240**	**28.014**	**81.466**	**97.173**	**142.221**	**162.451**	**166.783**	**211.220**	**162.920**	**221.935**	**64.399**	**140.441**	**118.376**	**10.536**				**2.430.000**	**644.030**	**990.146**
WP3 - Intergenerational																				
Boomsma	0	0	4.579	1.387	94.656	96.035	92.795	115.864	87.287	116.256	20.861	74.464	73.823	58.646	40.856	-	-	810.000	300.178	577.331
Meeus & Branje	0	0	27.605	40.440	97.539	105.084	50.418	52.797	138.996	122.132	77.832	115.588	53.719	56.882	39.914	-	-	810.000	392.390	586.556
Oldehinkel	15.327	16.570	58.384	68.624	60.134	66.864	42.277	44.713	41.902	45.230	21.119	3.811	-	-	-	-	-	540.000	239.143	245.812
Ormel	8.516	11.811	43.316	45.662	52.313	52.224	75.394	75.710	78.779	77.609	39.758	6.984	-	-	-	-	-	540.000	298.077	270.000
Tiemeier & Hillegers	0	0	17.814	75.349	45.650	61.887	51.844	54.655	57.137	58.263	37.672	19.846	-	-	-	-	-	540.000	210.116	270.000
Total WP3	**23.843**	**28.380**	**151.698**	**231.462**	**350.292**	**382.094**	**312.728**	**343.739**	**404.101**	**419.490**	**197.242**	**220.694**	**127.542**	**115.528**	**80.770**			**3.240.000**	**1.439.904**	**1.949.699**
WP4 - Animal																				
Bolhuis	0	0	5.928	27.427	78.822	72.337	74.642	73.981	70.738	72.321	2.494	34.688	30.443	24.540	24.920	25.307	7.653	540.000	232.624	393.617
Hoijtink	0	0	23.741	25.153	71.765	83.905	48.605	75.931	53.061	56.260	25.157	28.351	-	-	-	-	-	540.000	222.329	269.600
Joëls	13.069	11.802	6.811	71.775	75.774	89.405	55.267	55.627	63.226	94.517	44.388	133.750	114.223	122.326	71.699	-	-	810.000	258.534	765.123
Total WP4	**13.069**	**11.802**	**36.480**	**124.355**	**226.361**	**245.647**	**178.514**	**205.539**	**187.025**	**223.098**	**72.039**	**196.789**	**144.666**	**146.866**	**96.619**	**25.307**	**7.653**	**1.890.000**	**713.488**	**1.428.340**
TOTAL	**63.151**	**71.945**	**402.285**	**612.451**	**1.001.628**	**1.206.647**	**1.250.555**	**1.280.354**	**1.145.458**	**1.313.922**	**553.365**	**1.019.058**	**905.874**	**680.349**	**564.123**	**223.938**	**7.653**	**12.690.000**	**4.416.442**	**7.886.314**

The difference between actual and allocated for the years 2013 and 2014 can be explained by the starting period for projects. PhD students and postdocs sometimes started later than originally allocated.

The total allocated budget reflects to which extend the PIs allocated their total 10-years budget.

Table B – Investment costs (per cohort for the different work packages)

Up to June 2018

Including	2013		2014		2015		2016		2017		2018		2019	2020	2021	2022	2023	Total Budget	Total Actual
June 2018 (€)	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Budget	Budget	Budget	Budget	Budget	2013-2023	2013-2018
WP0																			
Project Management	44.735	104.400	107.403	156.600	110.615	156.600	92.149	155.700	103.254	155.700	110.137	155.700	155.700	155.700	155.700	155.700	52.200	1.559.700	568.293
General Project Costs	51.224	38.020	13.865	57.030	37.022	57.030	30.456	57.030	12.647	57.030	29.608	57.030	57.030	57.030	57.030	57.030	19.010	570.300	174.821
Total WP 0	**95.959**	**142.420**	**121.269**	**213.630**	**147.637**	**213.630**	**122.605**	**212.730**	**115.900**	**212.730**	**139.745**	**212.730**	**212.730**	**212.730**	**212.730**	**212.730**	**71.210**	**2.130.000**	**743.114**
WP1 (a)																			
Direct Costs	88.400	119.520	204.645	352.062	357.122	352.062	397.002	352.062	953.555	352.062	477.859	352.062	352.062	352.062	352.062	352.062	59.760	3.347.838	2.478.581
Marketing & Communication	0	27.240	2.871	66.150	29.445	66.150	96.524	66.150	138.808	66.150	65.069	66.150	66.150	66.150	66.150	66.150	13.620	636.210	332.717
Recruitment	0	67.488	19.710	163.350	38.932	163.350	67.520	163.350	115.180	163.350	80.581	163.350	163.350	163.350	163.350	163.350	33.744	1.571.382	321.923
Accommodation	0	6.780	92	22.500	10.834	22.500	12.946	22.500	21.804	22.500	19.128	22.500	22.500	22.500	22.500	22.500	3.390	212.670	64.804
ICT cost	0	43.080	0	127.800	21.969	127.800	135.910	127.800	111.658	127.800	61.597	127.800	127.800	127.800	127.800	127.800	21.540	1.214.820	331.134
Equipment	0	217.080	186.918	0	63.157	0	68.291	0	65.638	0	39.865	0	0	0	0	0	0	217.080	423.871
Total WP1	**88.400**	**481.188**	**414.237**	**731.862**	**521.459**	**731.862**	**778.193**	**731.862**	**1.406.643**	**731.862**	**744.098**	**731.862**	**731.862**	**731.862**	**731.862**	**731.862**	**132.054**	**7.200.000**	**3.953.030**
WP2																			
Intervention (b)	21.587	234.000	163.603	351.000	391.329	351.000	330.211	351.000	669.286	351.000	313.941	351.000	351.000	351.000	351.000	351.000	117.000	3.510.000	1.889.957
Total WP 2	**21.587**	**234.000**	**163.603**	**351.000**	**391.329**	**351.000**	**330.211**	**351.000**	**669.286**	**351.000**	**313.941**	**351.000**	**351.000**	**351.000**	**351.000**	**351.000**	**117.000**	**3.510.000**	**1.889.957**
WP3																			
NTR (c)	98	24.000	31.806	36.000	27.166	36.000	35.812	36.000	25.681	36.000	25.170	36.000	36.000	36.000	36.000	36.000	12.000	360.000	145.732
Radar (d)	0	24.000	0	36.000	4.758	36.000	111.883	36.000	57.379	36.000	9.035	36.000	36.000	36.000	36.000	36.000	12.000	360.000	183.055
Trails (e)	0	24.000	21.412	36.000	24.506	36.000	14.558	36.000	24.456	36.000	28.280	36.000	36.000	36.000	36.000	36.000	12.000	360.000	113.212
Generation-R (f)	0	6.000	25.000	9.000	0	9.000	0	9.000	0	9.000	0	9.000	9.000	9.000	9.000	9.000	3.000	90.000	25.000
Total WP 3	**98**	**78.000**	**78.218**	**117.000**	**56.430**	**117.000**	**162.253**	**117.000**	**107.515**	**117.000**	**62.485**	**117.000**	**117.000**	**117.000**	**117.000**	**117.000**	**39.000**	**1.170.000**	**466.999**
WP4																			
Animal costs (g)	21.402	60.000	91.459	90.000	51.411	90.000	51.063	90.000	139.867	90.000	84.240	90.000	90.000	90.000	90.000	90.000	30.000	900.000	439.443
Total WP 4	**21.402**	**60.000**	**91.459**	**90.000**	**51.411**	**90.000**	**51.063**	**90.000**	**139.867**	**90.000**	**84.240**	**90.000**	**90.000**	**90.000**	**90.000**	**90.000**	**30.000**	**900.000**	**439.443**
TOTAL	227.446	995.608	868.786	1.503.492	1.168.265	1.503.492	1.444.326	1.502.592	2.439.211	1.502.592	1.344.510	1.502.592	1.502.592	1.502.592	1.502.592	1.502.592	389.264	14.910.000	7.492.543

(a) YOUth Utrecht (WP1): The actuals of the first few years were lower than budgeted, because it took longer than anticipated to set up the cohort due to careful tuning with the Institutional Review Board and their request for additional information (in the form of, among others, performing several pilot studies). Moreover, the dedicated MRI scanner and relevant software were not delivered on time. The current actuals are conform planned realisation.

(b) L-CID Leiden: The investment budget for 2013-2015 has been carried over because collection and analysis of saliva samples and cheek swabs will be done at the same time for all first-wave samples. Measurements are in progress. Delayed ethical approval of the cohort 2 study meant that it started in September 2014 instead of June 2014. This also delayed the appointment of personnel.

(c) NTR: The costs of the cohort studies are lower than projected, mainly because the PhD student and postdoc started later than planned. The remaining sum has been carried over to 2016 onward.

(d) RADAR: Other funding sources were first used for data collection in Wave 8 (2014–2015). From 2016 onward, the CID cohort budget is spent.

(e) TRAILS: The initial cost of data collection in TRAILS was lower than budgeted, mainly because there were fewer assessments of infants born before the start of CID. The primary focus was to include all new pregnancies, and recruitment of pregnant women was complicated and logistically difficult (problems now solved). An additional problem was that the interviewer training to perform the home visits at 24 months was appointed later than anticipated. The expenditures will be compensated in the upcoming years.

(f) For Generation-R there was a prepayment, resulting in higher actual costs than budgeted for 2014. This was compensated for in the years 2013 and 2015.

(g) Animal costs: Animal costs were lower than projected, because of the long time needed to start-up the different mouse lines (e.g., quarantine and some problems with the bringing on and breeding of mice). At the moment, everything is running on schedule.

Table C – Co-funding description (for the institutes specified in the original proposal)

Up to June 2018

Including June 2018 (€)	2013		2014		2015		2016		2017		2018		2019	2020	2021	2022	2023	Total Actual 2013-2018	Total Budget 2013-2023
	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Budget	Budget	Budget	Budget	Budget		
UMCU Contribution of strategic budget year 1 to 5 (a)	51.311	360.000	80.871	360.000	180.011	360.000	310.143	360.000	329.190	360.000	462.706	0	0	0	0	0	0	1.414.232	1.800.000
UMCU Contribution strategic budget year 6 to 10 (a)	0	0	0	0	0	0	0	0	0	0	0	360.000	360.000	360.000	360.000	360.000	0	0	1.800.000
UMCU Free MRI Scans (b)	0	0	0	777.778	0	777.778	113.314	777.778	214.400	777.778	83.200	777.778	777.778	777.778	777.777	777.777	0	410.914	7.000.000
UU Toparea Youth (c)	0	1.000.000	434.339	1.000.000	424.871	1.000.000	569.662	1.000.000	197.459	0	132.867	0	0	0	0	0	0	1.759.197	4.000.000
UU Contribution FSW for additional postdocs (c)	16.769	0	203.275	0	186.198	340.000	169.449	340.000	171.234	340.000	64.925	340.000	0	0	0	0	0	811.850	1.360.000
UMCG Add PhDs infrastr. TRAILS and int. PhDs (d)	22.600	200.000	132.238	200.000	150.158	200.000	223.125	200.000	150.860	0	97.429	0	0	0	0	0	0	776.410	800.000
UL Free MRI-scans (e)	4.884	0	52.938	20.000	104.633	20.000	254.175	20.000	173.353	20.000	153.678	24.000	24.000	24.000	24.000	24.000	0	743.660	200.000
UL Additional PhDs (f)	0	0	0	50.000	0	50.000	0	50.000	0	50.000	0	0	0	0	0	0	0	0	200.000
UvA Four additional PhDs (g)	0	0	0	0	0	0	0	50.000	0	50.000	0	50.000	50.000	0	0	0	0	0	200.000
TOTAL	**95.564**	**1.560.000**	**903.661**	**2.407.778**	**1.045.871**	**2.747.778**	**1.639.867**	**2.797.778**	**1.236.496**	**1.597.778**	**994.804**	**1.551.778**	**1.211.778**	**1.161.778**	**1.161.777**	**1.161.777**	**0**	**5.916.263**	**17.360.000**

(a) University Medical Center Utrecht (UMCU): The 2018 actuals are up to June 2018 and therefore represent expenditure on the UMCU contribution for the first five-years. The 2018 budget is part of the second five-year tranche and is therefore represented in the UMCU contribution year 6 to 10.

(b) University Medical Center Utrecht (UMCU): Initially less than dedicated to MRI scans was used as the dedicated 3T Philips MRI scanner arrived later than planned. During this initial period, some of these funds have been used by Division of Neuroscience to pay the baby recruitment team.

(c) Utrecht University (UU): The budget for Toparea Youth (i.e., the strategic theme *Dynamics of Youth*) and the contribution for additional postdocs are received in the first 4 years of the project, whereas actual costs will be spread out over the total 10-year period of the project. Therefore, the numbers in 'actual' columns for 2013 to 2015 are given according to the proposed budget.

(d) University Medical Center Groningen (UMCG): Up to June 2018, one PhD student has been matched by co-funding from the UMCG.

(e) University of Leiden (UL): In September 2015, MRI scans were started. In total, the aim is to carry out approximately 1500 scans, which, as anticipated in the midterm evaluation, exceeds the proposed total matching budget.

(f) University of Leiden (UL): Up to June 2018, two PhD students and three postdocs have been matched by co-funding university budgets. Due to unclear financial positions, there are no actuals represented in this table, but we are working on the correct representation of costs made.

(g) University of Amsterdam (UvA): The co-funding of one PhD student in the first period did not materialize for two reasons. First, it was the intention that the PhD student would work on the WP1 cohort data, but data became available much later than anticipated. Second, the Amsterdam School of Communication Research has received significantly less Government funding in the last 2 years, so that it is no longer possible to fund additional PhD projects.

Table D – Specification of table A (scientific staff) per principal investigator

Up to June 2018

Up to June 2018 (€)	Total budget 2013-2023	Total allocated 2013-2023
WP1- Brain development		
Deković	540.000	446.201
Durston	675.000	355.873
Hulshoff Pol	675.000	506.549
van Berkum & Kager	540.000	270.000
Kahn	540.000	268.983
Kemner	810.000	688.318
Valkenburg	810.000	446.757
Vollebergh	540.000	535.447
Total WP1	**5.130.000**	**3.518.129**
WP2- Interventions		
Bakermans-Kranenburg	540.000	204.297
Crone	540.000	205.335
Engels	540.000	205.335
van IJzendoorn	810.000	375.179
Total WP2	**2.430.000**	**990.146**
WP3 - Intergenerational		
Boomsma	810.000	577.331
Meeus & Branje	810.000	586.556
Oldehinkel	540.000	245.812
Ormel	540.000	270.000
Tiemeier & Hillegers	540.000	270.000
Total WP3	**3.240.000**	**1.949.699**
WP4 - Animal		
Bolhuis	540.000	393.617
Hoijtink	540.000	269.600
Joëls	810.000	765.123
Total WP4	**1.890.000**	**1.428.340**
TOTAL	**12.690.000**	**7.886.314**

The column *'Total allocated'* reflects the total budget allocated from the 10-year budget per principal investigator (PI).

Appendix 2 – CID appointed PhD students and postdocs from principal investigator budget

PhD students or postdocs financed by CID through PI-budget, as seen in **Appendix 1, Table A.**

CID appointed PhD students and postdocs from PI-budget	
WP1	
Dienke J. Bos *Connected and in control* Durston, Crone; UMC Utrecht	**Postdoc** Mar/15 – Sep/18
Ine Beyens *The effect of media on ADHD-symptoms* Valkenburg, Dekovic; University of Amsterdam	**Postdoc** Nov/15 – Nov/19
Fraukje Coopmans *Developmental trajectory of the human connectome in health and disease* Kahn, Hulshoff Pol; UMC Utrecht Project has been continued by: **Guusje Collin**	**PhD student** Jun/14 – Aug/15 **Postdoc** Oct/15 – Apr/17
Elizabeth Buimer *Resilience, adversity, and the effect on brain development in children* Hulshoff Pol; UMC Utrecht	**PhD student** Jun/18 – May/22
Karin Fikkers *The effects of media violence exposure on aggression: A differential susceptibility perspective* Valkenburg, Dekovic, University of Amsterdam	**Postdoc** Sept/15 – Sept/19
Sanne B. Geeraerts *Development of infant self-regulation within the early caregiver relationship: A cascade model* Dekovic, Kemner; UU Faculty of Social and Behavioural Sciences	**PhD student** Oct/14 – Apr/19
Bram Gooskens *Connected and in control: profiling the development of neural networks underlying behavioral control and creativity* Durston, Crone; UMC Utrecht	**PhD student** June/18 – Dec/21
Gijs Holleman *Paradigm development for the study of gaze behaviour in social interaction* Kemner, Dekovic; UU Faculty of Social and Behavioural Sciences	**PhD student** May/17 – Apr/21
Roy S. Hessels *The effects of social stimulation/interaction on perceptual and social development* Kemner, Hoijtink; UU Faculty of Social and Behavioural Sciences	**PhD student** Jan/14 – Dec/16
Jalmar Teeuw *Genetic and environmental influences on development of structural and functional brain connectivity* Hulshoff Pol, Boomsma; UMC Utrecht	**PhD student** Jul/15 – Jun/19
Hannah de Mulder *The power of stories: exploring the effects of (self) narrative on the development of social competence and behavioural control* Van Berkum, Valkenburg; UU Faculty of Humanities	**Postdoc** Jan/14 – May/17
Margot Peeters *Behavioural control and reward sensitivity as predictors of adolescents' risk behaviours* Vollebergh, Oldehinkel; UU Faculty of Social and Behavioural Sciences	**Postdoc** Jan/15 – Dec/18

Bauke van der Velde *Connectivity of the social brain* Kemner, Kahn; UU Faculty of Social and Behavioural Sciences *The PhD is financed for 25% from PI-budget Kemner (Appendix 1 Table A), for 25% from co-funding budget from the UMCU (Kahn, Appendix 1 Table C, Appendix 5) and for 50% from cohort budget (Appendix 1 Table B, Appendix 4).*	**PhD student** Dec/15 – Nov/19
WP2(a)	
Michelle Achterberg *Social aggression regulation in childhood and emerging adolescence* Crone, Bakermans-Kranenburg; UL Faculty of Social and Behavioural Sciences	**PhD student** Sep/14 – Dec/19
Elisabeth Bilo *Hormonal correlates of social and behavioural development in childhood* van IJzendoorn, Bakermans-Kranenburg; UL Faculty of Social and Behavioural Sciences *The PhD was first financed from co-funding budget*	**PhD student** April/16 – Feb/20
Mara van der Meulen *Prosocial development in childhood and emerging adolescence* Crone, Van IJzendoorn; UL Faculty of Social and Behavioural Sciences	**PhD student** Jan/15 – Jan/20
Claudia I. Vrijhof *Intervention effects of video-feedback on social competence and behaviour control in preschoolers: the mediating role of parenting and physiological regulation* Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioural Sciences	**PhD student** Nov/13 – Nov/17
WP3	
Andrik Becht *Why some adolescents thrive and others don't: The role of uncertainty dynamics* Meeus, Vollebergh; UU Faculty of Social and Behavioural Sciences	**PhD student** Sep/14 – Sep/18
Sofieke Kevenaar *The impact of the home environment on academic skills and educational achievement* Boomsma, Oldehinkel; VU University Amsterdam	**PhD student** Sep/18-Sep/2021
Tina Kretschmer *Examining the complex interplay between relationship experiences and individual factors to understand adolescent development* Oldehinkel, Meeus, Dekovic; UMC Groningen Project has been continued by: **Jennifer Klop-Richards**	**Postdoc** Oct/13 – Nov/15 **Postdoc** Dec/15 – Oct/18
Odilia M. Laceulle *Investigating developmental models of psychological distress: transactional processes and explanatory models of individual differences* Ormel, Meeus, Van IJzendoorn; UMC Groningen Project has been continued by: **Anoek Sluiter-Oerlemans**	**Postdoc** Oct/13 – Aug/18 **Postdoc** Sep/15 – Nov/18
Barzeva, Stefania *Social withdrawal and romantic relationships* Oldehinkel, Meeus; UMC Groningen *Partly financed by CID*	**PhD student** Sep/17- Sep/18
Stefanie A. Nelemans *Development of anxiety symptoms in adolescence and early adulthood: over/time links with biological, psychological, and social factors* Meeus, Oldehinkel; UU Faculty of Social and Behavioural Sciences	**Postdoc** Sep/14 – Dec/18

Susanne Schulz *Longitudinal transmission of relationships and psychopathology in adolescence and emerging adulthood* Meeus/Branje, Oldehinkel; UU Faculty of Social and Behavioural Sciences	**PhD student** nov/17 – nov/21
Alexander Neumann *The epigenetics of intergenerational transmission* Verhulst, Oldehinkel, van IJzendoorn; Rotterdam Erasmus MC	**PhD student** Aug/14 – Aug/18
Sabine Veldkamp *Intergenerational transmission of reading and cognitive skills* Boomsma, Van Berkum; Vrije Universiteit Amsterdam	**PhD student** May/15 – May/19 (not fulltime)
Eveline de Zeeuw *Longitudinal development and intergeneration transmission of psychopathology versus wellbeing* Boomsma, Oldehinkel; Vrije Universiteit Amsterdam *The postdoc was financed for 5 months from cohort budget (Appendix 1 Table B, Appendix 4).*	**Postdoc** Dec/14 – Dec/17 & May/18 – Dec/18
WP4	
Gabriël J.L. Beckers *A neurogenetic analysis of birdsong learning as a model for infant development* Bolhuis, Joëls; UU Faculty of Social and Behavioural Sciences	**Assistant professor** Oct/14 – Jan/18 & Aug/18 - May/23
Sita M. ter Haar *A neurogenetic analysis of birdsong learning as a model for infant development* Bolhuis, Joëls; UU Faculty of Social and Behavioural Sciences	**Postdoc** Mar/15 – Jan/16
Sofia Kanatsou *Environmental influences on brain development: rodent models* Hoijtink, Joëls; UU Faculty of Social and Behavioural Sciences	**Postdoc** Aug/15 – Apr/16
Jiska Kentrop *Maternal care as predictor of later life success: possibilities for intervention* Joëls, Bakermans-Kranenburg; UMC Utrecht, UL	**PhD student** Jul/14 – Jul/18
Manila Loi *Intervention at puberty after early life adversity* Joëls, van IJzendoorn; UMC Utrecht	**PhD student** Sep/13 – Sep/15
Carien Mol *Twitter evolution: Comparative linguistics of birdsong and child language acquisition* Bolhuis, Kemner; UU Faculty of Social and Behavioural Sciences *The PhD is financed for 67% from PI-budget Bolhuis (Appendix 1 Table A), and for 33% from co-funding budget from the UU (Dynamics of Youth, Appendix 4)*	**PhD student** Oct/15 – Feb/20
Mariëlle A.J. Zondervan-Zwijnenburg *Formalization and evaluation of prior knowledge based on prior/posterior predictive inference* Hoijtink, van Berkum; UU Faculty of Social and Behavioural Sciences	**PhD student** Jul/14 – Jun/18
Valeria Bonapersona *Impact of early life adversity on networks: pathways, transmitters, cognitive domains* Joëls, Hoijtink; UMC Utrecht / UU Faculty of Social and Behavioural Sciences	**PhD student** Sep/17 – Aug/21

(a) The WP2 appointments are shown as known in the CID administration on 1st June 2018. Currently the last organisational changes after the retirement of prof. dr. van IJzendoorn are being implemented, but we are working on the correct representation of CID appointments in WP2.

Appendix 3 – CID PhD students, postdocs or researchers from cohort budget

PhD students, postdocs or researchers financed from CID cohort budget, as seen in **Realization and budget, Appendix 1, Table B**.

CID PhD students, postdocs or senior researchers from cohort budget	
WP1	
Stefanos Mastrotheodorus Branje, Dekovic; UU Faculty of Social and Behavioural Sciences	**PhD student** Dec/15 – Dec/19
Dr. N. Charlotte Onland-Moret UMC Utrecht	**Associate professor**
Soundry Staats *The role of parenting and self-regulation in (pre)adolescent psychosocial functioning: Macro- and micro-level relations.* Dekovic, Huijding; UU Faculty of Social and Behavioural Sciences	**PhD student** Mar/16 –Jan/18
Bauke van der Velde *Connectivity of the social brain* Kemner, Kahn; UU Faculty of Social and Behavioural Sciences *The PhD is financed for 25% from PI-budget Kemner (Appendix 1 Table A, Appendix 3), for 25% from co-funding budget from the UMCU (Kahn, Appendix 1 Table C, Appendix 5) and for 50% from cohort budget (Appendix 1 Table B)*	**PhD student** Dec/15 – Nov/19
WP2a	
Bianca G. van den Bulk *Integrating neural intervention effects in a longitudinal twin study with a sequential cohort design.* Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioural Sciences	**Postdoc** Aug/14 – Jan/23
Jizzo Bosdriesz *Integrating behavioural genetics across cohorts in longitudinal perspective* Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioural Sciences	**Postdoc** Mar/17 – Feb/18
WP3	
Eveline de Zeeuw *Next round of teacher and multi-generation data collection* Boomsma; Vrije Universiteit Amsterdam	**Postdoc** Dec/17-Apr/18
WP4	
Angela Sarabdjitsingh UMC Utrecht *The postdoc is financed for 14% from cohort budget (Appendix 1 Table B), and for 86% from co-funding budget (VENI grant, Appendix 5)*	**Postdoc** Nov/13 – Nov/18
Rixt van der Veen UMC Utrecht, UL Faculty of Social and Behavioural Sciences *After this period the postdoc is financed from co-funding budget from Leiden University (Appendix 5)*	**Postdoc** Oct/13 – Aug/14
Rinke Klein-Entink UU Faculty of Social and Behavioural Sciences	**Senior Research Consultant** Sept/14 – Aug/18
Ruth Damsteegt UMC Utrecht	**Technician** Oct /16 – Oct /20
Marcia Santos da Silva UMC Utrecht *Financed for 20% from the cohort budget*	**Research assistant** Nov / 17 – Aug / 18

(a) The WP2 appointments are shown as known in the CID administration on 1st June 2018. Currently the last organisational changes after the retirement of prof. dr. van IJzendoorn are being implemented, but we are working on the correct representation of CID appointments in WP2.

Appendix 4 – CID researchers from co-funding budgets conform NWO application

PhD students, postdocs or researchers not financed by CID, but directly from the government, from the government through a funding allocation agency or by contracts with third parties and specified within the original NWO application as matching, as can be recognized from **Realization and budget, Appendix 1 Table C.**

CID researchers from co-funding budgets conform NWO application	
WP1	
Marieke E.W. Albers UMC Utrecht, Contribution of strategic budget year 1 to 5	**PhD student** Feb/15 – Feb/19
Bauke van der Velde *Connectivity of the social brain* UMC Utrecht, Contribution of strategic budget year 1 to 5 *The PhD is financed for 25% from PI-budget Kemner (Appendix 1 Table A, Appendix 3), for 25% from co-funding budget from the UMCU (Kahn, Appendix 1 Table C) and for 50% from cohort budget (Appendix 1 Table B, Appendix 4)*	**PhD student** Dec/15 – Nov/19
Janna Cousijn UU Faculty of Social and Behavioural Sciences, Contribution FSW for additional postdocs	**Postdoc** Jan/14 – Nov/15
Caroline Junge UU Faculty of Social and Behavioural Sciences, Contribution FSW for additional postdocs	**Assistant professor** Jun/14 – present
WP3	
Dr. C.A. Hartman UMC Groningen, infrastructure TRAILS	**Associate professor** Oct/13 – Feb/23
Annelene Bloemen *Determinants and consequences of (low) cognitive control* UMC Groningen, Additional PhD	**PhD student** Dec/14 – Dec/17

Appendix 5 – Other CID researchers from co-funding budgets

PhD students, postdocs or researchers not financed by CID, but directly from the government, from the government through a funding allocation agency or by contracts with third parties and not specified within the original NWO application as matching, but contributing to the consortium.

Other CID researchers from co-funding budgets	
WP1	
Carlijn van den Boomen UU Faculty of Social and Behavioural Sciences	**Postdoc** Sep/09 – present
Roy S. Hessels *The effects of social stimulation/interaction on perceptual and social development* Kemner, Hoijtink; UU Faculty of Social and Behavioural Sciences	**Postdoc** Jan/17 – Jan/20
Wouter Boendermaker UU Faculty of Social and Behavioural Sciences	**Postdoc** Apr/17-Dec/19
Elisabeth Buimer UMC Utrecht	**Research assistant** Sep/17 – Feb/18
Jolien van der Graaf UU Faculty of Social and Behavioural Sciences	**Postdoc** Oct/13 – Dec/13
Marinka M.G. Koenis UMC Utrecht	**Postdoc** Feb/15 – Aug/17
Renske Koordeman UU Faculty of Social and Behavioural Sciences	**Postdoc** Sep/13 – Dec/13
Nicolette Munsters UU Faculty of Social and Behavioural Sciences	**PhD student** Mar/13 – Mar/18
Pascal Pas UMC Utrecht	**PhD student** Jan/17 – Dec/20
Matthijs Vink UU Faculty of Social and Behavioural Sciences	**Assistant professor** Jan/16 – present
WP2	
Dr. Szilvia Biro UL Faculty of Social and Behavioural Sciences **Dr. Anna C.K. van Duijvenvoorde** UL Faculty of Social and Behavioural Sciences	**Assistant Professor** May/13 – April/23 **Assistant Professor** May/15 – April/23
Dr. Saskia Euser *Intervention effects of video feedback on social competence and behavioural control in early childhood and early adolescence: The role of children's daily experiences.* Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioural Sciences; UL Faculty of Social and Behavioural Sciences	**Postdoc** Dec/13 – Jan/23
Dr. Renske Huffmeijer UL Faculty of Social and Behavioural Sciences **Laura Kolijn** *Neural mechanisms involved in a parenting intervention that aims to enhance parental sensitivity and sensitive discipline.*	**Assistant Professor** May/13 – April/23 **PhD student** Apr/16 – Apr/20

Bakermans-Kranenburg; Van IJzendoorn, UL Faculty of Social and Behavioural Sciences; UL Faculty of Social and Behavioural Sciences	
Dr. Nikolaus Steinbeis UL Faculty of Social and Behavioural Sciences	**Assistant Professor** Sep/15 – Sep/17
Rixt van der Veen UMC Utrecht, UL Faculty of Social and Behavioural Sciences *The postdoc was first financed from cohort budget from WP4 (Appendix 3)*	**Postdoc** Aug/14 – May/23
Dr. Lara Wierenga UL Faculty of Social and Behavioural Sciences	**Postdoc** Jan/17 – Nov/20
Ilse C. van Wijk *Neural correlates of social rejection and aggression in young children* Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioural Sciences; UL Faculty of Social and Behavioural Sciences	**PhD student** Feb/14 – June/18
WP3	
Dr. E. van den Bergen Vrije Universiteit Amsterdam	**Assistant professor** Apr/15 – Apr/20
WP4	
Yasin Altinişik UU Faculty of Social and Behavioural Sciences	**PhD student** Mar/14 – Mar/18
Ruth Damsteegt UMC Utrecht	**Research analyst** Oct/15 – Oct/16
Nienke Derks UMC Utrecht	**PhD student** Jun/14 – Jun/18
Carien Mol *Twitter evolution: Comparative linguistics of birdsong and child language acquisition* Bolhuis, Kemner; UU Faculty of Social and Behavioural Sciences *The PhD is financed for 67% from PI-budget Bolhuis (Appendix 1 Table A, Appendix 2), and for 33% from co-funding budget from the UU (Dynamics of Youth)*	**PhD student** Oct/15 – Jun/18
Angela Sarabdjitsingh UMC Utrecht *The postdoc is financed for 14% from cohort budget (Appendix 1 Table B, Appendix 3), and for 86% from co-funding budget (VENI grant)*	**Postdoc** Nov/13 – Feb/18
Jelle Knop Leiden University *PhD student matched by Leiden University and working at UMC Utrecht*	**PhD student** Apr / 16 – March /20
Rob Buurstede UMC Utrecht / LUMC *PhD student is financed during the first 3 years via LUMC and then for 1 year from PI budget Joëls*	**PhD student** Sept/17 – Aug/21
Eduardo Umeoka UMC Utrecht / UvA *Postdoctoral Fellow from Brazil who received a FAPESP grant from Sao Paolo; additional funding was received from Corcept Therapeutics Inc*	**Postdoc** Apr/17 – Aug/18

Appendix 6 – Examples societal relevant activities

Examples societal relevant activities (*see 5 – Knowledge utilization*)

For every PI a maximum of 5 examples of societal relevant activities are given.

Examples of societal relevant activities by CID PIs
Papa speelt mee – Volkskrant Magazine 18-3-2017 (Bakermans-Kranenburg, VIPP-interventie) *Bakermans-Kranenburg, M.J.* (May 2018). *The power of parenting support.* Bradford Hill seminar, Cambridge, UK. *Bakermans-Kranenburg, M.J.* (20-08-2018) *New fathers may undergo hormonal, neural and behavioural changes.* Horizon, the EU Research and Innovation Magazine: https://horizon-magazine.eu/article/new-fathers-may-undergo-hormonal-neural-and-behavioural-changes_en.html *Bakermans-Kranenburg, M.J.* (2018). *Vasopressin and fatherhood | Interview with Marian Bakermans-Kranenburg*. Podcast by Quintana D available at: https://www.youtube.com/watch?v=H7x4CHdc1r8&feature=youtu.be *Bakermans-Kranenburg, M.J. (*12-10-2017) *Lastig man, die hormonen!* Quest Psychologie *Bakermans-Kranenburg, M.J. (2018). The burden of bad beginnings. Key note at the 19th Bridging the Gap conference, Salt Lake City (February 8).* *Bartels, M.:* University of the Netherlands. *Hoe meet je hoe gelukkig je bent?* https://www.youtube.com/watch?v=W_t5oFz5plk&feature=youtu.be. *Bolhuis, J.:* Interview online programme 'Radio Rene' (http://www.radiorene.nl), "*Taal definieert ons mens zijn*", November 2015. *Bolhuis, J.* With Everaert, M. And Huijbregts, R.: Royal Dutch Academy of Sciences (KNAW) Academy Colloquium '*The Biology of Language*', plus Master class, Amsterdam, December 10-13, 2014. *Bolhuis, J.:* TV interview in talkshow 'Pauw & Witteman', May 2013. *Bolhuis, J.:* Radio interview 'Radio 1', May 2013 *Bolhuis, J.:* Interview in national newspaper 'De Volkskrant', April 2013. *Boomsma (2017) Genetica van het gedrag. Het brein in de boardroom.* Dordrecht *Boomsma (2018) De laatste resultaten uit tweeling onderzoek.* Nl Vereniging Ouders van Meerlingen, Amersfoort. *Boomsma (2018) Waarom tweelingenonderzoek?* Deelnemersdag VUMC, Amsterdam. *Boomsma (2017) Ontwikkeling van jonge tweelingen.* Gynaecologierefereeravond, VUmc, Amsterdam. *Boomsma (2016) Het eerste toeval.* (KNAW symposium Uitgedaagd door het toeval, Amsterdam) *Crone, E.:* Videoblog: http://www.brainanddevelopmentlab.nl/index.php/video-blog *Crone, E.:* Braintime Festival in Corpus: http://www.universiteitleiden.nl/nieuws/2016/02/feest-voor-het-puberbrein. *Crone, E.: 3rd Annual Flux Congress*, Leiden, September 2015. *Crone, E.* (September 22, 2017). NTR uitzending. *Dankzij Spinoza: Eveline Crone en Piek Vossen*: https://dekennisvannu.nl/site/media/Dankzij-Spinoza-Eveline-Crone-en-Piek-Vossen/6563 *Dekovic, M.:* co-author several chapters in books (*'Intieme relaties en seksualiteit', 'Jeugdcriminologie. Achtergronden van jeugdcriminaliteit', 'Handboek klinische ontwikkelingspsychologie', 'Leerboek psychiatrie kinderen en adolescenten', 'Psychologie van de adolescentie'*) that aim at higher education of students and professionals. *Dekovic, M.:* member of the Accreditation Committee for Behavioural Interventions that helps the Ministry of Security and Justice to develop and implement a high quality programme to prevent/reduce recidivism. *Deković, M.,* Van de Bongardt, D., Baams, L., Doornwaard, S., Dalenberg, W., Reitz, E., … Van Geert, P. (2016). Ontwikkeling van romantische relaties en seksualiteit van Nederlandse adolescenten in context: Project STARS. *Tijdschrift voor Seksuologie, 40*, 195-199. *Deković, M.* (2016). Foreword *Inleiding in de gezinspedagogiek*. In F. van der Horst, N. Lucassen, R. Kok, M. Sentse, L. Jooren, & M. Luijk (Red.), *Opgroeien in het hedendaagse gezin. Inleiding in de gezinspedagogiek* (pp. 9-10). Houten: LannooCampus.

Deković, M., & Asscher, J. J. (2016). *Interventies voor jongeren met antisociaal gedrag*. In I. Weijers (Red.), *Justitiële interventies voor jeugdige daders en risicojongeren* (pp.147-163). Den Haag: Boom criminologie.

Deković, M., Asscher, J. J., & Stoltz, S. (2016). *Interveniëren in opvoeding bij (ernstige) gedragsproblemen van kinderen en adolescenten.* In M. H. van Ijzendoorn & L. van Rosmalen (Red.), *Pedagogiek in beeld*. *Een inleiding in de pedagogische studie van opvoeding, onderwijs en hulpverlening* (pp. 205-216). Houten, Nederland: Bohn Stafleu van Loghum.

Hoijtink, H.: Preconference Workshop on Bayesian Structural Equation Modelling. International Meeting of the Psychometric Society, 2013, Arnhem.

Hoijtink, H. (continuously) Workshops on Bayesian evaluation of informative hypotheses at, for example, the meetings of the Psychometric Society, the American Psychological Association, the Association for Psychological Science, the European Association of Methodology, the universities of Groningen, Mainz, and Erfurt, and the PhD networks Christoph Dornier Stiftung, Experimental Psychopathology, and Statistical Modeling in Psychology

Hoijtink, H. (and his research group) (2013-onwards). Website on informative hypotheses containing books, papers, software, manuals and examples. https://informative-hypotheses.sites.uu.nl/

Hoijtink, H. (2013-2017). Seconded for one day a week to the CITO institute for education testing in Arnhem, to develop a psychometric model for the diagnostic educational test.

Hoijtink, H. (and his research group) (2013-onwards). Applied Bayesian Statistics, a postgraduate course in the winter school of Utrecht University. https://www.utrechtsummerschool.nl/courses/winter

Hulshoff Pol, H.E., Ophoff, R., Bartels, M., Boomsma, D.I. (2015). *Chapter book – Influence of genes and environment on the brain (Invloed van genen en omgeving op de hersenen)*. In Hulshoff Pol & Aleman – Handboek Beeldvorming van het Brein, Imaging voor Psychiaters en Psychologen. Uitgeverij de Tijdstroom.

Hulshoff Pol, H.E. and Aleman, A. (Eds). Beeldvorming van het Brein, Imaging voor Psychiaters en Psychologen (Imaging of the Brain). Uitgeverij de Tijdstroom. 2015, 412 pag. ISBN 978 90 5898 262 9

Hulshoff Pol, H.E. Ontwikkeling van het Puberbrein I. Universiteitsdag, 1 april 2017. Presentation at the Utrecht University.

Joëls, M. (2015). *Stress en voordelen.* Interview Quest, October 2015.

Joëls, M. (2015). *Stress is goed, met mate*. Interview Flow Magazine, August 2015.

Joëls, M. (2015). *Werkstress bij jongeren*. Presentation at Workshop of Ministry of Social Affairs, The Hague, November 2015.

Joëls, M. and de Krom, M.: *Translational approaches in developmental disorders and schizophrenia*. Course for PhD students (including 5 plenary lectures accessible to a broad audience), Utrecht, May – June 2015.

Joëls, M., *S.M. Schaafsma, R.A. Sarabdjitsingh, C.H. Vinkers* (2016): *Stress in the Clinic*. Course for PhD students (including 5 plenary lectures accessible to a broad audience), Utrecht, May 2016.

Joëls, M. (2016): Science Festival Studium Generale (Vredenburg, Utrecht)

Kager, René. How do infants disaggregate referential and affective pitch? 2018. To appear in Frontiers in Psychology.

Kemner, C. and Hullshoff Pol, H. (2015). *Chapter book – Brain development of the young child (Hersenontwikkeling van het jonge kind)*. In: Hulshoff Pol & Aleman – Handboek Beeldvorming van het Brein, Imaging voor Psychiaters en Psychologen. Uitgeverij de Tijdstroom.

Kemner, C. (2013-2015). Public talks (*Festival De Beschaving 2013, Studium Generale 2013, Culturele Zondag Utrecht 2015, Nationale Wetenschapsagenda lezing KHMW 2015*).

Kemner, C. (2013-2014). TV and radio appearances (*e.g. NPO Hoe?zo! radio 2013, omroep Max Breingeheim 2013, VPRO Labyrinth 2013, RTV Utrecht 2014*).

Meeus, W. (November 24, 2015). Terrorisme is jeugdprobleem. *De Volkskrant,* p.20.

Meeus, W. (Mei 2015). Contribution to *SASS film RADAR, Slachtoffers en daders van jeugdcriminaliteit*. Amsterdam: Fast facts

Oldehinkel, A.J. (March 2018). *Waarom worden jonge mensen depressief?* Medical Public Academy, UMCG (www.youtube.com/watch?v=oBRLVs27-rM&list=PL57rlzPmUY0cqkNf-eQre4KJDRTvZk3Q&index=2&t=0s)

Oldehinkel, A.J. (2017). Development of a massive online open course (MOOC) on adolescent mental health problems, tailor-made to adolescents' needs and communication styles. Launched January 2018. (www.futurelearn.com/courses/psychische-gezondheid-jongeren; www.futurelearn.com/courses/young-people-mental-health).

Oldehinkel, A.J. (June 2015). Interview about TRAILS in *Kind en Adolescent Praktijk.*

Oldehinkel, A.J. (October 2014). *Stress-reactiviteit? Een uitnodiging om bestaande ideeën over stress en depressie te herzien.* Contribution to the *Studiedag Vlaamse Klinisch Psychologen,* Leuven.

Sarabdjitsingh, R.A. (2017): Science Cafe Studium Generale (Tivoli, Utrecht)

Valkenburg, P. (2014). *Schermgaande jeugd*. Publication of a Dutch book aiming at an academic and non-academic public. Prometheus, Amsterdam.

Van Bergen, E. (2015). *"Waarom is dyslexie familiair?"* Guest lecture for educational professionals, *Nationale Dyslexie Conferentie* (National Dyslexia Conference), Ede, The Netherlands, 8th April 2015.

van Bergen, E, & *de Zeeuw, E.L.* (2017). *Mathematics anxiety is in the genes. Is this true?* Interview for article in de Volkskrant.

Van Berkum, J.J.A. (2013). TV interview *VPRO Labyrint*: http://tvblik.nl/labyrint/groot-nationaal-onderzoek-taal.

Van Berkum, J.J.A. (2015). Radio interview *Radio 1*: http://www.eo.nl/ditisdedag/radio/item/krijg-de-rambam-beschaafd-schelden/.

Van Berkum, J.J.A. (2016). Interview *Quest* "God…#@$&" http://www.quest.nl/magazine/april-2016.

Van IJzendoorn, M.H. (August 31, 2017). *Necessary relational conditions for healthy development across developmental stages and in various child rearing arrangements.* Consensus Conference and Expert Symposium on Promoting child wellbeing when parents live apart. Oslo, Norway 31 August, 2017. Presentation also to the Norwegian Directorate of Children, Youth and Family Affairs, 1 September, 2017.

Van IJzendoorn, M.H. (30 September 2016). *Gehechtheid bij mensen met autisme.* Autismecongres: Hechting, emoties en autisme. Congrescentrum The Strip, Eindhoven.

Van IJzendoorn, M.H. (2014). *Attachment, oxytocin and infant crying. Key note at the joint conference of the RSM Psychiatry Section and RSM Obstetrics and Gynaecology Section on Women's Mental Health: Integrating body and mind.* A dialogue between Psychiatry, Obstetrics and Gynaecology. In association with the Royal College of Psychiatrists Mental Health Special Interest Group. Tuesday, 11th March 2014, at the Royal Society of Medicine, London, UK.

Van IJzendoorn, M.H. (2017). Herijking ouderschap pedagogisch belicht. *Tijdschrift voor Familie- en Jeugdrecht*, 39, 153-155.

Vink, M. (2017, 2018) Summerschool Junior, University Utrecht https://youthonderzoek.nl/2018/06/26/summerschool-junior-2018/

Junge, C., (26 February 2017) *Hoe leren baby's hun moedertaal.* Lecture for parents of YOUth participants.

Every year the Leiden Institute for Brain and Cognition (LIBC) organizes a 'publieksdag' (a day-long symposium open to the general public) to which several L-CID members have been contributing. The most recent Publieksdag attracted 800 enthusiastic participants from the general public (http://www.nieuws.leidenuniv.nl/nieuws-2015/800-mensen-kijken-in-de-wereld-van-het-sociale-brein.html).

Study websites

Study	Website
YOUth cohort	www.youthonderzoek.nl
Child Research Center	www.kinderkenniscentrum.nl
Dynamics of Youth	www.uu.nl/doy
L-CID cohort	www.samen-uniek.com
Generation-R	www.generationr.nl
NTR	www.tweelingenregister.org
RADAR	www.uu.nl/onderzoek/radar
TRAILS	www.trails.nl

Appendix 7 – CID publications and PhD student and postdoc activities

Publications count as CID publications if:

- The first or second author is appointed by CID (from PI-budget or cohort budget), or
- CID is mentioned in the acknowledgements

Authors indicated in **bold** are CID researchers. Authors indicated in **bold orange** are CID PhD students or postdocs.

Publications within consortium (232)	
1	**Achterberg, M., Bakermans-Kranenburg, M. J., Van IJzendoorn, M.H., Van der Meulen, M.,** Tottenham, N., & **Crone, E.A.** (2018). Distinctive heritability patterns in childhood subcortical-prefrontal cortex resting state connectivity in childhood: A twin study. *NeuroImage, 175*, 138-149.
2	**Achterberg, M., Van Duijvenvoorde, A.C.K., Van der Meulen, M., Bakermans-Kranenburg, M.J.,** & **Crone, E.A.** (2018). Heritability of aggression following social evaluation in middle childhood: An fMRI study. *Human Brain Mapping*, 39(7): 2828-2841.
3	**Achterberg, M., Van Duijvenvoorde, A.C.K., Van der Meulen, M., Euser, S., Bakermans-Kranenburg, M.J.,** & **Crone, E.A.** (2017). Understanding the neural correlates of social evaluation in children using a design with built-in replication and meta-analysis. *Developmental Cognitive Neuroscience, 24,* 107-117.
4	**Achterberg, M., Van Duijvenvoorde, A.C., Bakermans-Kranenburg, M.J.** & **Crone, E.A.** (2016). Control your anger! The neural basis of aggression regulation in response to social rejection. *Social Cognitive and Affective Neuroscience, 11*(5):712-720.
5	**Achterberg, M.,** Peper, J.S., **Van Duijvenvoorde, A.C.K.,** Mandl, R.C.W., & **Crone, E.A.** (2016). Fronto-striatal white matter integrity predicts development of delay of gratification: a longitudinal study. *Journal of Neuroscience*, 36(6), 1954-1961.
6	**Achterberg, M. & van der Meulen, M.** (submitted) Genetic and environmental influences on MRI scan quantity and quality.
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186	Thijssen, S., Wildeboer, A., Muetzel, R.L., **Bakermans-Kranenburg, M.J.**, El Marroun, H., Hofman, A., et al. (2015). Cortical thickness and prosocial behavior in school-age children: A population-based MRI study. *Soc Neurosci*, 10(6), 571-582. doi: 10.1080/17470919.2015.1014063.
187	Thijssen, S., Ringoot, A.P., Wildeboer, A., **Bakermans-Kranenburg, M.J.**, El Marroun, H., Hofman, A., **Jaddoe, V.W.V.**, **Verhulst, F.C.**, **Tiemeier, H.**, **Van IJzendoorn, M.H.**, White, T. (2015) Brain morphology of childhood aggressive behavior: A multi-informant study in school-age children. *Cognitive, Affective, & Behavioral Neuroscience*, 15, 564-577. doi 10.3758/s13415-015-0344-9.
188	Thijssen, S., Muetzel, R. L., **Bakermans-Kranenburg, M. J.**, Jaddoe, V. W. V., **Tiemeier, H.**, Verhulst, F. C., white, T. & **Van IJzendoorn, M. H.** (2017). Insensitive parenting may accelerate the development of the amygdala-medial prefrontal cortex circuit. Development and Psychopathology 29(2), 505-18.
189	Thijssen, S., Wildeboer, A., **van IJzendoorn, M. H.**, Muetzel, R. L., Langeslag, S. J. E., Jaddoe, V. W. V., Verhulst, F. C., **Tiemeier, H., Bakermans-Kranenburg, M. J.** & White, T. (2017). The honest truth about deception: Demographic, cognitive, and neural correlates of child repeated deceptive behavior. Journal of Experimental Child Psychology 162, 225-41.
190	Treur, J.L., Verweij, K.J.H., Abdellaoui, A., Fedko, I.O., **De Zeeuw, E.L.**, Ehli, E.A., Davies, G.E., Hottenga, J.J., Willemsen, G., **Boomsma, D.I.**, **Vink, J.M**. Testing familial transmission of smoking with two different research designs. Nicotine Tob Res. 2017, epub
191	**Van Bergen, E**, Snowling, MJ, **de Zeeuw, EL**, van Beijsterveldt, CEM, Dolan, CV & **Boomsma, DI** (2018). Why do children read more? The influence of reading ability on voluntary reading practices. *Journal of Child Psychology and Psychiatry* (online version ahead of print).
192	Van Bommel, D., Van der Giessen, D., Van der Graaff, J., **Meeus, W., & Branje, S.** (2018). Mother-adolescent conflict interaction sequences: The role of maternal internalizing problems. *Journal of Research on Adolescence.* doi: 10.1111/jora.12441
193	**Van den Boomen, C.**, Jonkman, L.M., Jaspers-Vlamings, P.H.J.M., **Cousijn, J.**, **Kemner, C.** (2015): Developmental changes in ERP responses to spatial frequencies. *Plos One*, 10(3): e0122507.
194	**Van der Graaff, J.**, **Meeus, W.**, De Wied, M., Van Boxtel, A., Van Lier, P. & Branje, S. (2016). Respiratory sinus arrhythmia moderates the relation between parent-adolescent relationship quality and adolescent's social adjustment. *Journal of Abnormal Child Psychology*, 44: 269-281.
195	**Van der Meulen, M.**, Steinbeis, N., **Achterberg, M.**, **Van IJzendoorn, M.H.**, & **Crone, E.A.** (2018). Heritability of neural reactions to social exclusion and prosocial compensation in middle childhood. *Developmental Cognitive Neuroscience, 34*, 42-52.
196	**Van der Meulen, M.**, Steinbeis, N., **Achterberg, M.**, **Bilo, E.**, **Van den Bulk, B.G.**, **Van IJzendoorn, M.H.**, & **Crone, E.A.** (2017). The neural correlates of dealing with social exclusion in childhood. *Neuropsychologia, 103,* 27-39.
197	**Van der Meulen M.**, **Van IJzendoorn M.H.**, & **Crone E.A.** (2016). Neural correlates of prosocial behavior: Compensating social exclusion in a four-player cyberball game. *PLoS ONE 11*(7): e0159045. doi:10.1371/journal.pone.0159045
198	**Van der Meulen M.**, Veldhuis J., Braams, B.R., Peters, S., Konijn, E.A. & **Crone, E.A.** (in press). Brain activation upon ideal-body media exposure and peer feedback in late adolescent girls. *Cognitive, Affective, and Behavioral Neuroscience*. Doi: 10.3758/s13415-017-0507-y.
199	Van der Stigchel S., **Hessels R.S.**, van Elst J.C., **Kemner C.** (2017). The disengagement of visual attention in the gap paradigm across adolescence. *Exp Brain Res*, 3585-3592.
200	**Van der Veen R.**, **Kentrop J.**, Van der Tas L., **Loi M.**, **Van IJzendoorn M.H.**, **Bakermans-Kranenburg M.J.**, **Joëls M.** (2015) Complex living conditions impair behavioral inhibition but improve attention in rats. *Front. Behav. Neurosci.* 9: 357. doi: 10.3389/fnbeh.2015.00357.
201	van Doeselaar, C., **Meeus, W.**, Koot, H. M., & **Branje, S.** (2016). The role of best friends in educational identity formation in adolescence. *Journal of Adolescence, 47,* 28-37. doi: 10.1016/j.adolescence.2015.12.002.
202	**Van IJzendoorn, M.H.**, & **Bakermans-Kranenburg, M.J.** (2014). Confined quest for continuity: the categorical versus continuous nature of attachment. *Monographs of the Society for Research in Child Development*, 79(3), 157-167. doi: 10.1111/mono.12120.
203	**Van IJzendoorn, M.H.**, & **Bakermans-Kranenburg, M.J.** (2014). Prosocial Development and Situational Morality Neurobiological, Parental, and Contextual Factors. In J. F. Leckman, C. Panter-Brick & R. Salah (Eds.), *Pathways to Peace: The Transformative Power of Children and Families* (Vol. 15). Cambridge: MIT Press.

204	**Van IJzendoorn, M.H.**, & **Bakermans-Kranenburg, M.J.** (2015). Genetic differential susceptibility on trial: Meta-analytic support from randomized controlled experiments. *Development and Psychopathology*, 27(1), 151-162. doi: 10.1017/S0954579414001369.
205	**Van Wijk, I.C., van den Bulk, B. G., Euser, S., Bakermans-Kranenburg, M. J., van IJzendoorn, M. H.**, & Huffmeijer, R. (2017). Social judgments, frontal asymmetry, and aggressive behavior in young children: A replication study using EEG. *Neuropsychologia*. http://dx.doi.org/10.1016/j.neuropsychologia.2017.06.022
206	**Van Wijk, I.C., Huffmeijer, R., Bosdriesz, J.R., Bakermans-Kranenburg, M.J., Kolijn, L., Van IJzendoorn, M.H., Vrijhof, C.I., Van den Bulk, B.G.** (Submitted) Behavioral genetics of temperament and frontal asymmetry in early childhood.
207	**Van Wijk, I.C., Euser, S., Huffmeijer, R., Van den Bulk, B.G., Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H.** (Submitted) Prosocial owl game: Assessing compensation for social exclusion in early childhood.
208	Voorthuis A., **Bakermans-Kranenburg M.J.** & **Van IJzendoorn M.H.** (2017), Testosterone reactivity to infant crying and caregiving in women: The role of oral contraceptives and basal cortisol. *Infant Behavior & Development*.
209	**Veldkamp, S.A.M.**, **Van Bergen, E.**, **de Zeeuw, E.L.**, van Beijsterveldt, C.E.M., **Boomsma, D.I.** & **Bartels, M.** (2017). Bullying and victimization: The effect of close companionship. *Twin Research and Human Genetics, 20 (10),* 19-27.
210	Viuff, A., Sharp, G., Rai, D., Henriksen, T., Pedersen, L., Kyng, K., …, **Neumann A.,** … , **Tiemeier H**.,… & Relton, C. (2018). Maternal depression during pregnancy and cord blood DNA methylation: Findings from the Avon Longitudinal Study of Parents and Children. *Translational Psychiatry*. (in press).
211	Vogel S, Fernández G, **Joëls M**, Schwabe L. Cognitive Adaptation under Stress: A Case for the Mineralocorticoid Receptor. *Trends Cogn Sci.* 2016 Mar;20(3):192-203.
212	Vojinovic, D., Adams, H, Jian, X., Yang, Q., Smith, A., Bis, J., …, **Neumann A.**, …, **Tiemeier H**., … & Fornage. (2018). Genome-wide association study of 23,500 individuals identifies 7 loci associated with brain ventricular volume. *Nature Communications.* 2018 Sep 26;9(1):3945. doi: 10.1038/s41467-018-06234-w.
213	**Vrijhof, C.I.**, **Van den Bulk, B.G.**, Overgaauw, S., Lelieveld, G-J., **Engels, R.C.M.E.**, **Van IJzendoorn, M.H.** (2016). The Prosocial Cyberball Game: compensating for social exclusion and its associations with empathic concern and bullying in adolescents. *Journal of Adolescence. 52,* 27–36.
214	**Vrijhof, C.I.**, Van der Voort, A., **Van IJzendoorn, M.H.**, & **Euser, S.** (2018). Stressful Family Environments and Children's Behavioral Control: A Multimethod Test and Replication Study With Twins. *Journal of Family Psychology 32*(1), 49-59.
215	**Vrijhof, C.I., Euser, S., Bakermans-Kranenburg, M.J., Van den Bulk, B.G., Bosdriesz, J.R.,** Linting, M., **Van Wijk, I.C., De Visser, I., Van IJzendoorn, M.H.** Hot and cool effortful control in twins: the role of parental sensitivity in different contexts. *Submitted for publication.*
216	Walker CD, Bath KG, **Joels M**, Korosi A, Larauche M, Lucassen PJ, Morris MJ, Raineki C, Roth TL, Sullivan RM, Taché Y, Baram TZ. Chronic early life stress induced by limited bedding and nesting (LBN) material in rodents: critical considerations of methodology, outcomes and translational potential. *Stress*. 2017 Jul 12:1-28.
217	**Werner, L.**, Graaff, J. van der, **Meeus, W., & Branje, S**. (2016). Depressive symptoms in adolescence: Longitudinal links with maternal empathy and psychological control. *Journal of Abnormal Child Psychology, 44,* 1121-1132. doi 10.1007/s10802-015-0106-8
218	Wildeboer, A., Thijssen, S., **Van IJzendoorn, M.H.**, van der Ende, J., **Jaddoe, V.W.**, **Verhulst, F.C.**, et al. (2015). Early childhood aggression trajectories: Associations with teacher-reported problem behavior. *International Journal of Behavioral Development*, 39(3), 221-234. doi:10.1177/0165025414562239.
219	Wildeboer, A., Thijssen, S., Muetzel, R.L., **Bakermans-Kranenburg, M.J., Tiemeier, H.**, White, T. & **van IJzendoorn, M.H.** (2018) Neuroanatomical correlates of donating behavior in middle childhood, Social Neuroscience, 13:5, 541-552, doi: 10.1080/17470919.2017.1361864
220	Wildeboer, A., Thijssen, S., **Bakermans-Kranenburg, M.J.**, Jaddoe, V.W.V., White, T., **Tiemeier, H.**, & **Van IJzendoorn, M.H.** (2017) Anxiety and Social Responsiveness Moderate the Effect of Situational Demands on Children's Donating Behavior, *Merrill-Palmer Quarterly*: 63:3, Article 2.
221	Willems, YE, van Beijsterveldt, CEM, **de Zeeuw, EL, Boomsma, DI, Bartels, M**, Finkenauer C. (2018). Genetic and environmental influences on self-control: Assessing self-control with the ASEBA self-Control scale. *Behavior Genetics, 48* , 135-146.
222	Windhorst, D.A., Mileva-Seitz, V.R., Linting, M., Hofman, A., **Jaddoe, V.W.V.**, **Verhulst F.C.**, **Tiemeier, H.**, **Van IJzendoorn, M.H.** & **Bakermans-Kranenburg, M.J.** (2014). Differential susceptibility in a developmental perspective: DRD4 and maternal sensitivity predicting externalizing behavior. *Developmental Psychobiology*, 57(1), 35-49. doi 10.1002/dev.21257.
223	Windhorst, D. A., Rippe, R. C. A., Mileva-Seitz, V. R., Verhulst, F. C., Jaddoe, V. W. V., Noppe, G., van Rossum, E.F.C., van den Akker, E. L. T., **Tiemeier, H., van IJzendoorn, M. H. & Bakermans-Kranenburg, M. J.** (2017). Mild

	perinatal adversities moderate the association between maternal harsh parenting and hair cortisol: Evidence for differential susceptibility. Developmental Psychobiology 59(3), 324-37.
224	Yang, C., Crain, S., Berwick, R.C., Chomsky, N. & **Bolhuis, J.J.** (2017) The growth of language: Universal Grammar, experience, and principles of computation. *Neuroscience & Biobehavioral Reviews*, 81,103-119.
225	Yu, R., Aaltonen, M., Branje, S., Ristikari, T., **Meeus, W.**, Salmela-Aro, K., Goodwin, G., & Fazel, S. (2017). Depression and violence in adolescence and young adults: Findings from three longitudinal cohorts. *Journal of the American Academy of Child and Adolescent Psychiatry, 56,* 652-658. doi: 10.1016/j.jaac.2017.05.016.
226	Yu, R., **Branje, S., Meeus, W.**, Koot, H. M., Lier, P. van, & Fazel, S. (2018). Victimization mediates the longitudinal association between depressive symptoms and violent behaviors in adolescence. *Journal of Abnormal Child Psychology, 46,* 839-848. doi: 10.1007/s10802-017-0325-2
227	Yu, R., Nieuwenhuis, J., **Meeus, W.**, Hooimeijer, P., Koot, H. M., & **Branje, S**. (2016). Biological sensitivity to context: Cortisol awakening response moderates the effects of neighbourhood density on the development of adolescent externalizing problem behaviours. *Biological Psychology, 120,* 96-107.
228	**Zondervan-Zwijnenburg, M.A.J.**, Van de Schoot, R., & **Hoijtink, H** (unpublished). Testing ANOVA replications by means of the prior predictive *p*-value.
229	**Zondervan-Zwijnenburg, M.A.J.**, Depaoli, S., Peeters, M., & Van de Schoot, R. (unpublished). Pushing the Limits: The performance of ML and Bayesian estimation with small and unbalanced samples in a latent growth model.
230	**Zondervan-Zwijnenburg M.A.J., Veldkamp S.A.M., Nelemans S.A., Neumann A., Barzeva S.A., Branje S.J.T.,** Van Beijsterveldt C.E.M. **Meeus W.H.J., Tiemeijer H.W., Vollebergh W.A.M., Hoijtink H.J.A., Oldehinkel A.J., Boomsma D.I**. (under review) Parental age and offspring childhood mental health: A multi-cohort, population-based investigation.
231	**Zondervan-Zwijnenburg, M.A.J.**, Peeters, M., Depaoli, S., & Van de Schoot, R. (2017). Where do priors come from? Applying guidelines to construct informative priors in small sample research. *Research in Human Development, 14:4*, 305:320, doi: 10.1080/15427609.2017.1370966
232	**Zondervan-Zwijnenburg, M.A.J.**, Van de Schoot-Hubeek, W., Lek, K., **Hoijtink. H.,** & Van de Schoot, R. (2017). An expert judgment elicitation procedure for correlations. *Frontiers in Psychology, 8*:90. doi: 10.3389/fpsyg.2017.00090.

PhD student and postdoc activities

See below a list of the most important PhD student and postdoc activities (max. 3 examples per person)

CID PhD student and postdoc activities
Achterberg, M., van Duijvenvoorde, A.C.K., Bakermans-Kranenburg, M.J. & Crone, E.A. (2015). *Heritability of aggression following evaluation in middle childhood: an fMRI study.* Poster presentation at: the conference of the Society for Research in Child Development (SRCD), Austin, Texas (16-03-'17); Social Affective Neuroscience Symposium (SANS), Brooklyn, New York (04-05-'18); Flux Big Data Satellite meeting and FLUX congress, Chapel-Hill, North Carolina, (08-05-'18).
Achterberg, M., Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., van der Meulen, M., Tottenham, N., & Crone, E. A. *Distinctive heritability patterns in childhood subcortical-prefrontal cortex resting state connectivity: A twin study.*Poster presented at: European Conference on Developmental Psychology (ECDP), Utrecht, the Netherlands (17-08-'17); Flux Big Data Satellite meeting (08-05-'18).
Achterberg, M., van Duijvenvoorde, A.C., Bakermans-Kranenburg, M.J. & Crone, E.A. (2015). *Control your anger! The neural basis of aggression regulation following social rejection.* Oral presentation at Donders Discussions, Nijmegen, the Netherlands (06-11-'15); VNOP-ISED-CAS day, Leiden, the Netherlands (13-11-'15) and NVP Winter conference, Egmond aand zee, the Netherlands (18-11-'15).
Altinişik, Y., (2015, April 10). *Generalized Order Restricted Information Criterion Approximation.* Consortium on Individual Development (CID), Utrecht, The Netherlands.
Altinişik, Y., (2015, December 10). *A Generalization of the AIC that evaluates (in)equality constrained hypotheses.* The 25th IOPS Winter Conference, Leiden, The Netherlands.
Altınışık, Y., (2016, June 13). *A Generalization of the AIC that Uses Prior Knowledge.* International Society for Bayesian Analysis (ISBA) World Meeting, Cagliari, Italy
Becht, A. I., Bos, M. G. N., Nelemans, S. A., Peters, S., Vollebergh, A. M., Branje, S. J. T., Meeus, W. H. J., & Crone, E. A. (31-08-2017). Neurobiological Underpinnings of Identity Formation in Adolescence. In W. H. J. Meeus (chair, invited symposium), *Advances in the study of adolescent identity formation.* Symposium conducted at the 18th European Conference on Developmental Psychology (ECDP), Utrecht, The Netherlands.
Becht, A. I., Nelemans, S. A., Branje, S. J. T., Koot, H. M., Vollebergh, W. A. M., Meeus, W. H. J. (06-04-2017). The role of identity uncertainty in identity commitment making across adolescence: Five-year within-person associations. In A.I. Becht (chair), *Adolescents' ethnic and personal identity across the globe: Development, context, and social exclusion.* Symposium conducted at the Biennial meeting Society for Research in Child Development (SRCD), Austin, Texas, USA.
Becht, A. I., Nelemans, S. A., Branje, S. J. T., Vollebergh, W. A. M., Koot, H. M., Denissen, J. J. A., Meeus, W. H. J. (20-05-2017). The Quest for Identity in Adolescence: Heterogeneity in Daily Identity formation and Psychosocial Adjustment Across 5 Years. In A.I. Becht (**chair**), Adolescents' Identity Formation in Context: Longitudinal Studies from Japan, Italy, and The Netherlands. Symposium conducted at the 24th International Society For Research on Identity (ISRI), Groningen, The Netherlands.
Beckers, G. (2015). *Vocal sequence predictability modulates traveling wave activity in songbird auditory forebrain.* Poster presentation at SfN Neuroscience conference, Chicago.
Beckers, G. (2015). Lecture *Plasticity in the avian brain: A bird's eye view* for UU Neuroscience and Cognition programme, Utrecht, The Netherlands.
Beckers, G. (2015). Invited visit to Max Planck Institute for Brain Research (Frankfurt, DE), Laurent department, for establishing cooperation in sleep research.
Beyens, I. (2018). *Developmental trajectories of parental media mediation across childhood.* Paper presented at the 68th Conference of the International Communication Association, Prague, Czech Republic.
Beyens, I., Piotrowski, J. T., & Valkenburg, P. M. (2017). Which came first? Assessing transactional relationships between children's violent media use and ADHD-related behaviors. Paper presented at the 67th International Communication Association Conference, San Diego, United States, 25-29 May 2017.
Bonapersona, V. (2017). *A PhD in stress research.* Lecture and workshop at University College Utrecht (Utrecht University).

Bonapersona, V. (2018). *Which behaviors are altered by early life stress? A meta-analysis of preclinical studies*. Poster presentation, Dutch Neuroscience Meeting (Lunteren, NL)
Bonapersona, V. (2018). *The dopaminergic system is surprisingly resilient to early life stress: a 3-level meta-analysis of rodent studies.* Poster presentation, FENS Forum meeting (Berlin, NL).
Beyens, I., Piotrowski, J. T., & Valkenburg, P. M. (2017). Screen media use and ADHD-related behaviors in children and adolescents: Four decades of research. Paper presented at the 67th International Communication Association Conference, San Diego, United States, 25-29 May 2017.
Beyens, I., Piotrowski, J. T., & Valkenburg, P. M. (2017). Assessing intraindividual relationships between children's violent media use and ADHD-related behaviors. Presentation presented at the Consortium on Individual Development Meeting, Utrecht, The Netherlands, 18 April 2017.
Bos D (2016) Cognitive control and brain connectivity in Autism Spectrum Disorders and ADHD, Child Mind Institute, New York University, New York, USA
Bos D (2016) Cognitive control in Autism Spectrum Disorders (and ADHD), Hartley Lab, New York University, New York, USA
Bos D (2016) Brain connectivity and cognitive control in Autism Spectrum Disorders, Center for Autism and the Developing Brain, New York Presbyterian Hospital, White Plains, USA
Cousijn, J. (2015). Chair and organizer of symposium *From impulsivity to habit? Neuropsychopharmacological mechanisms underlying addiction.* Congress of the European College of Neuropsychopharmacology, Amsterdam, The Netherlands.
Cousijn, J. (2015). Chair and speaker within the symposium *Behavior in context: a neuro-cognitive, behavioral and educational perspective on cognition and adolescent substance use.* International Convention of Psychological Science, Amsterdam, The Netherlands.
Cousijn, J. (2015). *Tracking the development of behavioral control across 6,000 infants and children: Introduction to the Dutch Consortium on Individual Development.* Oral presentation at the International Society for Research on Impulsivity Meeting, Amsterdam, The Netherlands.
Damsteegt, R. C. (2015, March). *Owl task: Measuring prosocial behavior in early childhood.* Presentation at the CID meeting, Utrecht, The Netherlands.
De Mulder, H., Van der Graaf, J., Van den Bos, N., Branje, S. (2016, April). *Talking about the mind: effects of emotional language in mother-adolescent conflict on adolescents' empathic concern and prosocial behavior.* Society for Research on Adolescence Biennial Meeting, Baltimore, USA.
De Mulder, H., Bergstra, M., Coopmans, P. (2014, July). *'I know this is a mit!': Children's ability to use speaker certainty in learning novel words.* Poster presentation XIII International Congress for the Study of Child Language (IASCL), Amsterdam, The Netherlands.
De Zeeuw, E.L. (2017). *How knowledge on genetics can be used to help children thrive* Presentation at a meeting from the research programme Personalized Medicine from the Amsterdam Public Health, Amsterdam, the Netherlands
De Zeeuw, E.L. (2017). *Research shows possible link ADHD and low educational achievement.* Blog on Open Forest
De Zeeuw, E.L (2017). *Tweelingen op school: Samen of apart.* Factsheet distributed to all primary schools in the Netherlands.
Euser, S., Damsteegt, R.C., Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H. (2015, June, September). *The use of ambulatory real time assessments to measures children's daily life experiences.* Poster presented at 4th Biennial Society for Ambulatory Assessment Conference, State College, Pennsylvania and at 17th European Conference on Developmental Psychology, Braga, Portugal.
Euser, S., Van der Ploeg, N., Vrijhof, C.I., Van IJzendoorn, M.H. (2017, June). *Unraveling the association between household chaos and children's sleep quality: A test and replication study using moderated mediation analyses.* Poster presented at 5th Biennial Society for Ambulatory Assessment Conference, Luxembourg, Luxembourg.
Euser, S., Bosdriesz, J., Meijer, W.M., Van den Bulk, B.G., Kolijn, L., Van IJzendoorn, M.H., Bakermans-Kranenburg, M.J. (2018) *Sleep Quality and Sleep Regularity in Twins: Influence of genetic and environmental factors.* Poster presented at the 16th World Congress of the World Association of Infant Mental Health, Rome (28-05-'18); Presentation at the Symposium of the Consortium on Individual Development, Utrecht, The Netherlands (20-04-'18).

Fikkers, K.M. (2017, January). Organizer of and speaker at preconference “Moving beyond self-report: Measuring arousal, emotional, and cognitive responses to media through physiological measures”. *Etmaal van de Communicatiewetenschap, Tilburg, The Netherlands*.
Geeraerts, S.B., Deutz, M. H. F., Deković, M., van Baar, A.L., & Prinzie, P., (2017, April). *Factor structure of the dysregulation profile: Evidence for a broad dysregulation syndrome.* Paper presented at the Biennial Meeting of the Society of Research in Child Development, Austin, USA.
Geeraerts, S.B., Backer, P., & Stifter, C. (2018, July). The Prospective Relation between Naturally Occurring Variations in Negative Emotionality and Self-Regulation: The Importance of Parental Sensitivity. In: *It Takes Two to Regulate: The Interplay between Parents and Infants in the Development of Regulatory Capacities* (**Chair**). International Conference on Infant Studies (ICIS), Philadelphia, USA.
Geeraerts, S.B. (2016). Chair and co-organizer of the symposium "*New insights on the structure of psychopathology*." Utrecht, The Netherlands.
Hessels, R.S. (2017). *Eye tracking live social interaction to capture gaze behavior of subclinical autism and social anxiety*. Oral presentation at the European Conference on Eye Movements 2017, Wuppertal.
Hessels, R.S. (2016). *Methodological issues in infant eye-tracking*. Invited lecture at Tobii Pro Boot Camp 2016. Bro, Sweden.
Hessels, R.S. (2016). *Eye tracking in difficult subjects*. Invited workshop on eye tracking. University of Geneva.
Huijding, J.: Development of a massive online open course for Dynamics of Youth titled “Understanding development: from synapse to society”. The course is available via Coursera.
Junge, C. (2015). Presenter at the course *Longitudinal data analysis: current best methods* (5-day advanced stats course), Faculty of Social and Behavioral Sciences, Utrecht University, The Netherlands.
Junge, C. (2015). *The learning brain.* Presentation for the general public on the opening of the childlab Terpstraschool, The Netherlands.
Junge, C. (2015). *Testing the scope of cross-situational learning: auditory context and retention.* Oral presentation at the 2nd workshop on Infant Language Development, Stockholm, Sweden and Psychology (EADP), Braga, Portugal.
Kentrop, J. (2016, 2018). Organisation of the 2016 CID Tour the Consortium day in Utrecht and 2018 CID symposium and retreat for CID researchers.
Kentrop, J. (2014, -2018). *Early life stress, impulsivity and (pro-)social competence.* Yearly lecture for the Affective Neurosciences course for Neuroscience and Cognition, Master students at Utrecht University, The Netherlands and several oral presentations at CID symposia, Utrecht, The Netherlands.
Kentrop, J. (2017, September). *The effects of early life stress and complex housing on social competence in adolescent rats*. Poster presentation at European Brain and Behaviour Society conference, Bilbao, Spain.
Knop, J (2018, June). *The effects of different early-life rearing conditions on sexual maturation and maternal care in mineralocorticoid receptor knockout mice*. Poster presentation at stress neurobiology workshop, Banff, Canada.
Knop, J. (2018, July). *The effects of different early-life rearing conditions on sexual maturation and maternal care in mineralocorticoid receptor knockout mice*. Poster presentation at FENS forum meeting, Berlin, Germany.
Knop, J. (2017, April). *Testing the differential susceptibility theory in MRKO mice*. Oral presentation at CID symposium, Utrecht, The Netherlands.
Koenis M.M. *Ontwikkeling van het Puberbrein II.* Universiteitsdag, 1 april 2017. Presentation for allumni of the Utrecht University.
Kolijn, L., Euser, S., van den Bulk, B.G., Huffmeijer, R., van IJzendoorn, M.H. & Bakermans-Kranenburg, M.J. (2016). *Which neural mechanisms mediate the effects of a parenting intervention program on parenting behavior: design of a randomized controlled trial.* Poster presented at and at Consortium on Individual Development symposium on October 2016, Utrecht, The Netherlands; the Donders Discussions in November 2016, Nijmegen, The Netherlands; at the VNOP-ISED-CAS day in November 2016, Leiden, The Netherlands

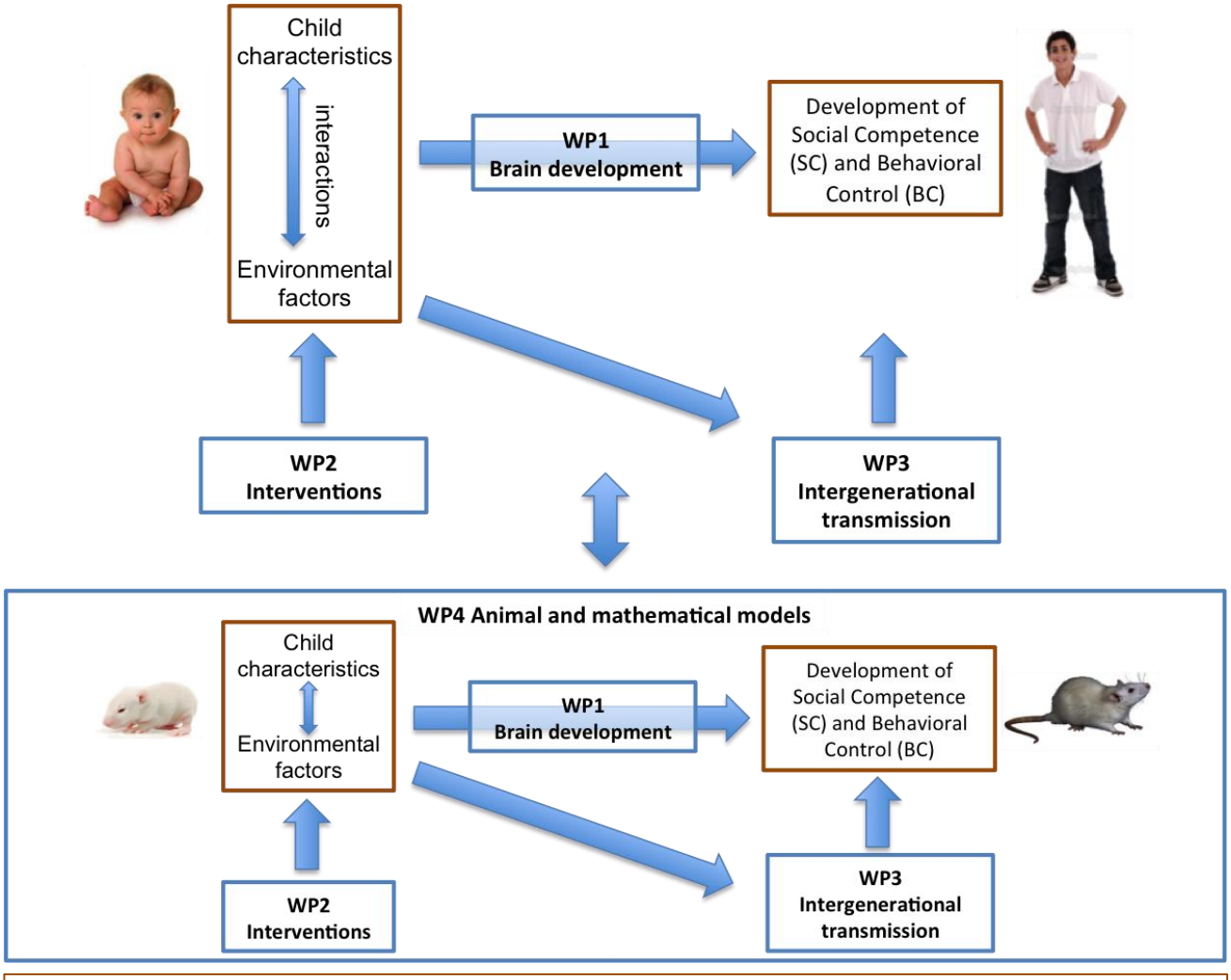
Kolijn, L., Huffmeijer, R., van den Bulk, B.G., van IJzendoorn, M.H. & Bakermans-Kranenburg, M.J. (2018). *Effects of the Video-feedback Intervention to promote Positive Parenting on N170 amplitudes in response to children's facial emotions.* Oral presentation presented at the 16th World Congress of the World Association of Infant Mental Health, Rome, Italy (27-05-18).
Kolijn, L., Huffmeijer, R., van den Bulk, B.G., van IJzendoorn, M.H. & Bakermans-Kranenburg, M.J. (2018). *Processing children's facial emotions: combining neural and behavioral data.* Poster presented at the 16th World Congress of the World Association of Infant Mental Health, Rome, Italy (27-05-18).
Kretschmer, T. (2015). *Multifinality of peer victimization: Are genetic polymorphisms influential in determining individual pathways?* Biennial Meeting of the Society for Research in Child Development, Philadelphia, USA
Kretschmer, T. (2015). *Sticks and stones will break my bones but words can never harm me? Current knowledge and new avenues in research on outcomes of peer victimization.* Lecture at Tilburg University.
Kretschmer, T. (2014). *Peer victimization and individual variation in maladjustment.* Biennial meeting of the European Association for Research on Adolescence, Çesme, Turkey (invited presentation).
Loi, M. (2013, October 5-9). *Effects of early life experiences on brain structure and function: neurogenesis and decision-making*. ECNP Conference, Barcelona, Spain.
Loi, M. (2014, June 18-20). *Effects of early life experiences on brain structure and function: neurogenesis and decision-making.* Stress Neurobiology Workshop, Cincinnati, USA.
Loi, M. (2014, July 5-9). *Effects of early life experiences on brain structure and function: neurogenesis and decision-making.* FENS Forum, Milan, Italy.
Mol, C. (2015, July). *Tutor song recognition is not dependent on syllable order in zebra finches.* Oral presentation at Helmholtz PhD day, Utrecht, The Netherlands.
Mol, C. (2015, March). *Comparative linguistics of birdsong and child language acquisition.* Oral presentation at CID meeting, Utrecht, The Netherlands.
Mol, C. (2014). *Tutor song recognition is not dependent on syllable order in zebra finches.* Poster presentation at Society for Neuroscience Conference (SfN), Washington, USA.
Nelemans, S. A., Van Assche, A., Bijttebier, P., Colpin, H., Van Leeuwen, K., Verschueren, K., … Goossens, L. (2017). Parenting interacts with polygenic oxytocin scores to predict adolescent social anxiety symptom development. In S. A. Nelemans (Chair), *Biological underpinnings of internalizing symptoms in childhood and adolescence*. Symposium conducted at the Biennial Conference of the European Association of Developmental Psychology (ECDP), Utrecht, the Netherlands.
Nelemans, S. A., Meeus, W. H. J., Branje, S. J. T., Van Leeuwen, K., Colpin, H., Verschueren, K., & Goossens, L. (2017). *Adolescent social anxiety symptoms: Longitudinal measurement invariance of SAS-A and developmental trends in two community samples.* Poster presentation at the Biennial conference of the Society for Research in Child Development (SRCD), Austin, TX, USA.
Nelemans, S. A., Meeus, W. H. J., Branje, S. J. T., & Goossens, L. (2017). Adolescent social anxiety symptom development: A gene-environment interaction study using a novel polygenic approach. In L. Leve (Chair), *Gene-environment interactions and adolescent antisocial behavior, social anxiety, and depressive symptoms*. Symposium conducted at the Biennial conference of the Society for Research in Child Development (SRCD), Austin, TX, USA.
Neumann, A. (2017). "*The (epi)genetic structure of co-occurring forms of child and adolescent psychopathology*", symposium member, SRCD conference, Austin, USA
Neumann, A. (2017). "*Genetics and epigenetics of early life psychopathology*", symposium member, ISRCAP conference, Amsterdam, Netherlands
Sarabdjitsingh, R.A. (2017, September). Invited lecture, European Brain and Behavior Society, Bilbao, Spain.
Sarabdjitsingh, R.A. (2017, June). Moderator parallel symposium at the Dutch Neuroscience Meeting, The Netherlands.
Sarabdjitsingh, A. (2015, November). Poster presented at the Colston Research Society Symposium, Bristol.
Sluiter, A. (2017). *De vroegste signalen van autism en ADHD.* Gratama subsidie

Staats, S., Van der Valk, I. E., Meeus, W. H. J., & Branje, S. J. T. (2017, August). *Longitudinal transmission of conflict management styles across inter-parental and adolescent Relationships.* Poster presentation at the European Conference on Developmental Psychology (ECDP), Utrecht, The Netherlands.
Staats, S., Huijding, J. & Dekovic, M. (2016, November). *The role of parenting and self-regulation in (pre)adolescent psychosocial functioning: Macro- and micro-level relations.* Poster presentation at the VNOP-ISED-CAS Research Days, Leiden, The Netherlands.
Staats, S., Van der Valk, I. E., Meeus, W. H. J., & Branje, S. J. T. (2016, September). *Longitudinal transmission of conflict management styles across inter-parental and adolescent Relationships.* Oral presentation at the Conference of the European Association for Research on Adolescence (EARA), Cádiz, Spain.
Teeuw J., Brouwer, R., Koenis, M., Swagerman, S., Boomsma, D., Hulshoff Pol, H. (2017) Genetic influences on development of cortical thickness from a longitudinal adolescent twin sample, Conference OHBM
Teeuw J., Brouwer, R., Koenis, M., Swagerman, S., Boomsma, D., Hulshoff Pol, H. (2016) Genetic factors of cortical development and intelligence in a longitudinal Dutch twin study, Conference OHBM
Teeuw J., Brouwer, R., Koenis, M., Swagerman, S., Boomsma, D., Hulshoff Pol, H. (2015) Trajectories of cortical thickness and their relation to cognitive abilities in the BrainSCALE project: preliminary results, ONWAR/BCRM & CID symposium
Van den Boomen, C. (2015). Organization and presentation Symposium *From infancy to adulthood: how to set up and succeed in longitudinal interdisciplinary studies* at European Conference on Developmental Psychology, Braga, Portugal.
Van den Boomen, C. (2015). Organization and presentation Summerschool *Neurocognitive methods for infant and toddler research*, Utrecht University, Utrecht, The Netherlands.
Van den Boomen, C. (2014). Invited expert in panel discussion on infant imaging methods at COST ESSEA conference, Toulouse, France.
Van den Bulk, B.G., Van Wijk, I.C., Huffmeijer, R., Euser, S., Bosdriesz, J.R., Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H. (2017, April). *Genetic and environmental components of temperament and frontal asymmetry in young children.* Poster presented at the conference of the Society for Research in Child Development (SRCD), Austin, Texas.
Van der Meulen, M., Steinbeis, N., Achterberg, M., Bilo, E., van den Bulk, B. G., van IJzendoorn, M. H., & Crone, E. A. (2017-2018). *Heritability of neural reactions to social exclusion in middle childhood.* Poster presentation at Flux conference (September 2017), conference for Social and Affective Neuroscience Society (SANS; May 2018), and conference for Vereniging voor Nederlandse Ontwikkelings Psychologen (VNOP; May 2018).
van der Meulen, M., Steinbeis, N., Achterberg, M., van IJzendoorn, M. H., & Crone, E. A. (2017). *Heritability of neural reactions to social exclusion in middle childhood.* Oral presentation at Donders Discussions (October 2017), VNOP-CAS-ISED Research Days (November 2017), and conference for Nederlandse Vereniging voor Psychonomie (NVP; December 2017).
van der Meulen, M., Wierenga, L.M.., Achterberg, M., van IJzendoorn, M. H., & Crone, E. A. (2018). *Heritability of prosocial behavior and social brain morphometry in middle childhood*. Poster presentation at Flux Satellite meeting (May 2018) and Flux conference (September 2018**).**
Van Wijk, I.C., Van den Bulk, B.G., Euser, S., Bakermans-Kranenburg, M.J., van IJzendoorn, M.H., & Huffmeijer, R. (2016, November) *Social judgments, frontal asymmetry and aggressive responses in young children: A replication study using EEG.* Oral presentation at VNOP/ISED, Leiden, Netherlands
Van Wijk, I.C., Van den Bulk, B.G., Euser, S., Bakermans-Kranenburg, M.J., van IJzendoorn, M.H., & Huffmeijer, R. (2016, November; 2017, April, August) *Social judgments, frontal asymmetry and aggressive responses in young children: A replication study using EEG. P*oster presentation at Donders Discussions, Nijmegen, Netherlands; SRCD congress, Austin, Texas, USA; ECDP congress, Utrecht, Netherlands
Van Wijk, I.C., Van den Bulk, B.G., Euser, S., Bakermans-Kranenburg, M.J., van IJzendoorn, M.H., & Huffmeijer, R. (2017, April) The social network aggression task – Early Childhood: a new task to measure aggression in response to social judgments in young children. SRCD congress, Austin, Texas, USA

Veldkamp, S.A.M., Van Bergen, E., de Zeeuw, E.L., van Beijsterveldt, C.E.M., Boomsma, D.I. & Bartels, M. (2017). *Bullying and victimization: The effect of close companionship*. Paper presented at the European Conference of Developmental Psychology, Utrecht, the Netherlands
Vrijhof, C.I., van der Voort, A., van IJzendoorn, M. H., & Euser, S. (2016, November). *The relation between a stressful family environment and children's behavioral control: A multimethod test and replication study with twins.* Presentation at the VNOP-ISED-CAS days, Leiden, The Netherlands.
Vrijhof, C.I., Overgaauw, S., van den Bulk, B.G., Lelieveld, G., Bakermans-Kranenburg, M.J. & van IJzendoorn, M.H. (2017, April). *The Prosocial Cyberball Game: Compensating behavior in typically and atypically developing children after observing social exclusion.* Poster presented at the conference of the Society for Research in Child Development (SRCD), Austin, Texas.
Vrijhof, C.I., Euser, S., van IJzendoorn, M.H. & the L-CID team (2017, August). *Parenting effects on children's hot and cool behavioral control: the role of sensitivity and sensitive discipline*. Poster presented at the European Conference on Developmental Psychology (ECDP), Utrecht, The Netherlands.
Zondervan-Zwijnenburg, M. A. J. (2015, March 13). *Including existing knowledge in your data analysis: An illustration from research on cognitive development*. International Conference of Psychological Science (ICPS).
Zondervan-Zwijnenburg, M. A. J. (2016, November 11). *How to test the replication of ANOVA findings.* VNOP ISED CAS Research Days, Leiden, The Netherlands.
Zondervan-Zwijnenburg, M. A. J. (2017, May 26). *Do we have a (mis)match? Checking whether rodent information replicates in other contexts.* 29th Annual Convention, American Psychological Society, Boston, USA.

Appendix 8 – CID PhD student and postdoc projects (progress reports)

Within CID several close-knitted projects focus on identifying critical factors and their interplay during child development. CID PhD and postdoc projects study how environment (family characteristics, parents and siblings, peers, and broader societal influences including media) and child characteristics (genetic makeup, temperament, and pre- and perinatal factors) affect the development of social competence (SC) and behavioural control (BC), skills that are essential for functioning in society and for reducing risk of behavioural and emotional problems. **Figure 2** shows how CID aims to gain new insights in how developmental differences arise between children as a result of the interplay of child characteristics and environmental factors, by filling crucial knowledge gaps on the role of brain development, effects of interventions in the environment, and intergenerational transmission.



The WPs and how they are interrelated on their focus on the interplay of child characteristics and environmental factors, determining developmental differences, specifically on SC and BC.

All WPs focus on the development of SC and BC (upper right-hand box of the **Figure**) and use the same core measures, as decided in the PI meeting of 15 January 2014 (*see 2.3*) and found on our website http://www.individualdevelopment.nl/research/measurements. In all WPs there is a focus on specific child characteristics (including candidate genes, perinatal factors, and temperament) and environmental factors (parent, peers, and media), and their interactions (upper left-hand box of the **Figure**).

CID PhD students and postdocs have started projects along the lines envisaged in the original proposal and these are described in short progress reports below.

Progress reports

WP1

Dr. Ine Beyens, Postdoc, Nov/15 – Nov/19

The relationship between media use and ADHD-symptoms: A differential susceptibility perspective
Valkenburg; UvA Amsterdam School of Communication Research (ASCoR) and Center for research on Children, Adolescents, and the Media (CcaM)

Aim: The aim of this project is to investigate (1) how and why certain types of media entertainment may influence children's ADHD-related behaviors and (2) which children are particularly susceptible to the effects of media entertainment on ADHD-related behaviors. More generally, the project aims to contribute to transactional (e.g., Slater, 2007) and differential susceptibility (e.g., Valkenburg & Peter, 2013) theories of media effects.
Methods: This project will use data collected through the CID pilot and main study. In addition, the project uses survey data collected through a four-wave cohort study among 900 Dutch families (funded by an ERC Advanced grant to Valkenburg). The survey includes parent- and self-report measures of media exposure, ADHD-related behaviors (i.e., attention problems, impulsivity, and hyperactivity), as well as temperament, parenting style, and media-specific parenting (parental media mediation).
Progression up to now: We further developed the media exposure and media-specific parenting measures to be included in the CID questionnaires. Two papers were accepted for publication and new papers were submitted for publication and are being developed. A paper in which we provide a systematic review of the literature on the relationship between children and adolescents' screen media use and ADHD-related behaviors was accepted for publication in the *Proceedings of the National Academy of Sciences (PNAS)*. A second paper, in which we analyze data of the four-wave cohort study (Valkenburg ERC project) to investigate transactional relationships between children's violent media use and ADHD-related behaviors was accepted for publication in *Communication Research*. A third paper was developed, in which we investigate developmental trajectories of restrictive and active parental media mediation across childhood and individual differences in these trajectories using latent growth curve modeling. The findings of this paper were presented at the 2018 conference of the International Communication Association. The paper was revised and resubmitted for journal publication. A fourth paper, in which we investigate the development of media-specific parenting across adolescence and individual differences in this development is in preparation. In addition, data of an observation study (Valkenburg ERC project) are being analyzed to investigate individual differences in children's processing of entertainment media.

Dr. Dienke J. Bos, Postdoc, Mar/15 – Mar/17

Connected and in control: What puts the development of neural networks underlying behavioral control at risk?
Durston, Crone; UMC Utrecht, Dept. of Psychiatry

Aim: The aim of this project is to investigate the neurobiological processes underlying (a)typical development of behavioral control networks in a large cohort of children.
Methods: Participants will be profiled on a broad, multimodal array of characteristics, including several MRI-based measures, neurocognition and psychophysiology. This project will consist of two phases. In the first phase, a pilot study using existing data will be conducted as a proof of concept before phase 2, where we will conduct a multimodal study of the development of behavioral control.
Progression up to now: The first paper as part of the fellowship at the Sackler Institute for Developmental Psychobiology was published in 2017 in *Social Cognitive and Affective Neuroscience*. The pilot projects investigating structural and functional connectivity in typical and atypical development are currently being analyzed and prepared for publication (2 publications), and an additional manuscript from the fellowship with the Sackler Institute is currently being prepared for submission.
Dienke Bos has been collaborating with the Sackler Institute since 2017 and, as such, we are currently extending her appointment with CID as she worked reduced hours for CID (2017: 0.2FTE CID, 2018: 0.5FTE CID). For the upcoming period (present – March 2022) we plan to request data form the Youth 'Rondom 9' cohort for the second phase of the project, starting data analyses in the fall of 2018.

Fraukje Coopmans, PhD student, Jun/14 – Aug/15 and **Dr. Guusje Collin,** Postdoc, Oct/15 – Apr/17

Developmental trajectory of the human connectome in health and disease
Kahn, Hulshoff Pol; UMC Utrecht, Dept. of Psychiatry

Aim: The aim of this project is twofold:
(1) map the developmental changes to the brain's wiring architecture during adolescence
(2) examine whether, and if so how, deviating connectome development forms a vulnerability for the development of psychiatric symptoms later in life.
Methods: Compare the brain connectome in offspring of bipolar disorder (BDo) and schizophrenia SZo) patients to offspring of community (Co) control subjects.
Sample: 28 SZo, 60 BDo and 39 Co, average age 13 yo.
Results:

1. Lower structural connectivity among brain hubs in SZ-offspring
   ➢ Connectome signature of familial risk for schizophrenia
2. Rich club deficits impact functional connectome organization
3. No rich club deficits in BD-offspring
   ➢ Differential effect of familial predisposition for SZ vs BD on developmental formation of the connectome

Dr. Carlijn van den Boomen, Postdoc, Sept/13 – Sept/16

Typical and atypical development of visual perception
Kemner, UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is examining the typical and atypical development of visual and social perception in children, thereby focusing on underlying processes involved in social competence.
Methods: This project applies experimental designs. Visual stimuli of basic objects (e.g. stripe-patterns) and faces are shown to children, while we measure behavioral responses or neural processing using electroencephalography (EEG) and functional near infrared spectroscopy (fNIRS). We use existing databases and collect new data. The populations of interest are typically developing adults and children, and persons with Autism Spectrum Disorder.
Progression up to now: Regarding typical development of emotional face perception in infants, I showed that detailed information is important for infants to discriminate between two emotions, and investigated the reliability of EEG measures of face perception in infants. We also investigated visual and social perception in 5-month-olds, and submitted the results for publication. In addition, I showed that detail perception develops until at least 12 years of age. Finally I investigated visual and social perception in adults with Autism Spectrum Disorder, of which the results are submitted for publication.

Karin Fikkers, Postdoc, Sep/15 – Sep/19

Understanding children's and adolescent's differential use of and susceptibility to media entertainment
Valkenburg; UvA Amsterdam School of Communication Research (ASCoR) and Center for research on Children, Adolescents, and the Media (CcaM)

Aim: The goal of this project is to understand (1) individual differences in children's and adolescents' emotional, cognitive, excitative, and behavioral responses to media entertainment, and (2) the role of parents in this process.
Methods: We use survey data on youths' media (violence) exposure, temperament, and self- and parent-reported behavior. In addition, data collected in an observational within-subjects experiment conducted in the Nemo Science Museum (August 2016) are used to inform the aim of our study.
Progression up to now: Data collection in Nemo (August 2016) was used in a submitted manuscript that describes children's individual differences in their emotional, cognitive, and arousal responses to positive and negative media entertainment, based on both child self-report, parent-report, and physiological data. Based on the current data set of Valkenburg's ERC-funded project on individual differences in media use and effects, analyses for a manuscript on the longitudinal relationship between parental media mediation and teens' entertainment use are currently underway. The results of these manuscripts will inform questions that can be answered using data of the CID main project.

Sanne B. Geeraerts, PhD student, Oct/14 – Sep/19

Development of infant self-regulation within the early caregiver relationship: A cascade model
Dekovic, Kemner; UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to examine the early processes through which self-regulation (behavioral control) develops within the proximal caregiver relationship.

Methods: We perform various longitudinal studies with a range of methods. We use both existing data and newly collected data, including the YOUth baby pilot data, for which we collected a follow-up wave.
Progression up to now: The first article, on regulation problems, was accepted in the *Journal of the American Academy of Child and Adolescent Psychiatry (JAACAP)*. We are currently revising the third article (Individual Differences in Visual Attention and Self-Regulation: A Multi-Method Longitudinal Study from Infancy to Toddlerhood) for the *Journal of Experimental Child Psychology*. The third article (It Takes Two: Infants' Moderate Reactivity and Maternal Sensitivity Predict Self-regulation in Early Childhood) will be submitted in the upcoming months. At the moment, we are also analyzing parent-child interaction data for a fourth manuscript on the role of parental self-regulation in parent-child interactions, and we are in the process of analyzing longitudinal data on the development of inhibitory control for a fifth paper. These studies have been presented during various international and national conferences, including SRCD (poster and symposium participant), ICIS (poster and symposium chair), and VNOP (paper presentation). The PhD candidate also visited prof. Cynthia Stifter from Penn State University, for which she received three grants (Fulbright, Prins Bernhard Cultuurfonds, Jo Kolk), and she received a visitors grant to invite professor Kirby Deater-Deckard.

Roy Hessels, PhD student, Jan/14 – Jan/17

The effects of social stimulation/interaction on perceptual and social development
Kemner; Hoijtink; UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to investigate the effects of social interaction (a critical aspect of social competence) on perceptual and social development.
Methods: Social development will be studied via two routes. First, by investigating face-scanning behavior of individuals diagnosed with autism, we can model face scanning during abnormal development. If abnormal looking behavior evokes reactive abnormal looking behavior in controls, this can shed light on the role of social interaction in abnormal development. Second, the development of infant face scanning will be investigated in an interactive eye-tracking setup.
Progression up to now: The setup for investigating social interaction has been developed. As this is a novel setup for studying social interaction there are few tools for statistical analyses available. In our collaboration we develop a tailored statistical tool for analyzing how people make eye contact and look at each other in a live setting. At the moment, the first prototypes are being tested. The results have been described in two publications.

Roy Hessels, Postdoc, Jan/17 – Aug/18

Measuring gaze behavior during social interaction
Kemner; UU Faculty of Social and Behavioral Sciences

Aim: The way people look at each other's faces is a cornerstone of human interaction, as it served both the acquisition of information (e.g. speech perception) and the regulation of interaction (e.g. turn-taking behavior). Little is known about how this operates in interaction, however. The aim of this project is to understand the dynamics of fine-grained gaze behavior during social interaction (a critical aspect of social competence), and how gaze of the two interacting partners is coupled in time.
Methods: A state-of-the-art dual eye-tracking setup (developed in a previous PhD-project in WP1) is used to simultaneously record gaze behavior of two people interacting with each other. The setup and preliminary analysis tools are detailed in previous publications (Hessels et al., 2017, Can. J. Expt. Psych.; Hessels et al., 2018, J. Expt Psychpath.).
Progression up to now: Since January 2017, a paper highlighting the fact that task structure and social context are more important than stimulus factors in driving gaze behavior in interaction has been submitted. A grant of 10k€ was acquired to build a second version of the setup that is suitable for parent-child interaction, and allows for the recording of two speech channels. This new version is currently being validated with adult participants. A PhD-candidate is scheduled to use this setup to investigate gaze behavior during parent-child interaction in the YOUth cohort study.

Dr. Caroline M.M. Junge, Assistant professor, **Dr. Janna Cousijn,** Postdoc (until 1/12/15) and **Dr. Matthijs Vink**, Assistant professor (since 1/1/16)

Selecting suitable tasks from infancy to adolescence that tap social competence and behavioral control
Kemner, UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to select suitable tasks from infancy to adolescence that tap social competence and behavioral control.
Methods: For both cohorts, we will use a variety of SC- and BC-tasks repeated at each wave. The tasks are chosen such that they a) can be administered from infancy to adolescence; b) measure a key part of either social competence or behavioral control, and c) are expected to yield meaningful differences at this age. Crucially, we do not only sample behavioral measures, but also eye-tracking and brain-related measures (baby-child cohort: EEG/ERP; child-adolescent cohort: (f)MRI). Some of the tasks will also be used in other work packages.
Progression up to now In 2015, the postdocs from WP1 made a final task selection for the longitudinal cohort studies (baby-child cohort and child-adolescent cohort). In addition, we have piloted as much of the tasks as possible for both cohorts. For the baby-child cohort, we tested a full-day procedure with 5-month-olds (n=44) and with 10-month-olds (n=77). For the child-adolescent cohort, we have piloted the behavioral and eye-tracking tasks in a cross-sectional design (n=135; range 8-16 years). Early 2016 we are fully prepared to test the first waves for both cohorts.

Dr. Hannah De Mulder, Postdoc, Jan/14 – May/17

The power of stories: exploring the effects of (self) narrative on the development of social competence and behavioral control
Van Berkum, Hoijtink, Valkenburg, Crone; UU Faculty of Humanities

The project consists of two subprojects: 1: From book smart to street smart: does exposure to fiction enhance social competence? And 2: What to say when you talk to yourself: the role of verbal reappraisal in behavioral control.
Aims: The aim of subproject 1 is to assess the predicted positive impact of exposure to fictional narrative on the child's development of social competence, in his/her actual behavior (tendency to engage in pro-social behavior) and in relevant cognitive component skills (perspective taking, empathy and moral values). The aim of subproject 2 is to assess how the development of verbally mediated reappraisal, at the level of linguistic form and content, affects the development of the child's ability to regulate emotion (a crucial component of behavioral control) and how general linguistic and narrative abilities mediate this relationship.
Methods: In the cohort study, we use dedicated questionnaires and experimental tasks to assess the various relevant constructs (e.g. exposure to various types of fiction, perspective-taking competence, moral profile), and we will relate those dedicated measures to WP1- and/or CID-wide assessments of social competence and behavioral control, as well as to WP1-wide measurements of brain-anatomical development. In experimental work conducted on non-cohort participants, we use additional lab tasks, as well as additional physiological measures (EEG, facial EMG (electromyography), skin conductance) to assess the effects of emotion regulation.
Progression up to now: In subproject 1 we a) created a fiction exposure questionnaire for use in the cohort (pilot data gathered from a large online study), b) created additional measures to assess fiction exposure for use outside of cohort (data gathered for validation of Author Recognition Test for 8-17 year olds), c) created a Bayesian analysis plan for analysis of data from the YOUth adolescent cohort (to be implemented once data collection has terminated), and d) are gathering data in an intervention study considering effects of reading particular types of fiction on adults' social competence (to be modified for use with adolescents at a later stage). In subproject 2 we a) are gathering data in an intervention study considering effects of particular reappraisal strategies on adults' ability to deal with verbal insults and with social exclusion (to be modified for use with adolescents at a later stage).

Dr. Margot Peeters, Postdoc, Jan/15 – Dec/18

Behavioral control and reward sensitivity as predictors of adolescents' substance use
Vollebergh, Oldehinkel; UU Faculty of Social and Behavioral Sciences

Aim: Former studies suggest that risk-taking behavior among adolescents is a result of different underlying motivational and cognitive processes, in particular a heightened sensitivity for reward on the one hand, and impaired behavioral control on the other. Most of this research includes fMRI studies that report on differences in brain activity, however, the translation of these neurocognitive results into actual behavior has less often been studied. In the present proposal, we intent to focus on the way these two processes interact with each other in impacting developmental trajectories of risk behavior in adolescence.
Methods: We use both a variable-centered and a person-centered approach. In addition, we will look at peer status as possible interacting variable. We will use data from a large longitudinal national cohort study, TRAILS (total sample N = 2223; and data from a high risk focus cohort used in this study N = 715), in which a number of behavioral tests have been taken.
Progression up to now: The first results suggest that self-reported behavioral control at age 11 predicts initiation of alcohol use at age 16. Both effortful control and measures of cognitive control at age 11 predict the initiation of

cannabis use at age 16. For smoking no such effects were found. In addition, interaction effects between reward sensitivity at age 16 and effortful control at age 11 are found for alcohol and cannabis use, suggesting that lower levels of control in early adolescence combined with higher sensitivity for reward in mid adolescence predict alcohol and cannabis use.

Jalmar Teeuw, PhD-student, Jul/15 – Jun/19

Imaging genetics of brain development in healthy adolescent twins
Prof. dr. Hilleke Hulshoff Pol, UMC Utrecht; Prof. dr. Dorret Boomsma, VU Amsterdam; Dr. Rachel Brouwer, UMC Utrecht

Aim: The aim of this project is to disentangle the (epi)genetic and environmental influences on brain development in healthy adolescent twins and their siblings.
Methods: Magnetic resonance imaging scans, cognitive test batteries and genetic material have been acquired from monozygotic and dizygotic twins and their older sibling at the ages of 9, 12, and 17 years old, as part of the longitudinal BrainSCALE study. In this project we will integrate information from the different MRI modalities (including structural, diffusion, and resting-state functional imaging) and elucidate causal (epi)genetic and environmental influences on the development of the brain and its association with cognitive performance.
Progress up to now: We have established that *thinning* of the cerebral cortex is influenced by additive genetics, with indications of distinct gene pools influences cortical thickness at different ages throughout childhood and adolescence (Teeuw et al., Cerebral Cortex 2018). We have identified "stable" components of functional connectivity throughout adolescence for connections within and between canonical cortical resting-state networks that are influenced by genetic and common environment (in preparation). We have found no indication that accelerated aging of the brain in schizophrenia patients is associated with accelerated aging predicted by DNA methylation in blood (in preparation).

Stefanos Mastrotheodoros, PhD student, Dec/15-Dec/19

Parenting during adolescence and young adulthood: Individual, relational, and intergenerational processes
Branje, Deković, van der Graaff; UU Faculty of Social and Behavioral Sciences

Aim: The project will focus on the predictors of parenting during adolescence and young adulthood. The project will disentangle how the marital relationship, parental adjustment and emotional wellbeing affect parenting behavior. The project also involves data collection for the YOUth baby cohort.
Method: Data from the RADAR-young longitudinal study will be used. This is an ongoing longitudinal study that has followed almost 500 families (including adolescents, mothers, fathers, and siblings) for 6 waves, and still continues following these adolescents as they progress to young adulthood. Data from YOUth cohort may also be used.
Progress up to now: Two papers have been published up to now. A third paper has been submitted and is under review, and a fourth paper is in preparation. In the first of the published papers (https://doi.org/10.1111/jora.12417) we used 6 waves of data to investigate how parental behavioral control, and parental support develop during adolescence (from age 13, to age 18), according to the perceptions of mothers, fathers, and adolescents. This allowed us to investigate mother-father differences in parenting, but also to examine how the differences in perceptions of parenting develop among those reporters. We found only few differences between mothers and fathers, and we showed that there is increasing convergence in views of parenting among parents and adolescents. In the second published paper (https://doi.org/10.1111/jomf.12528) we investigated how different parental behaviors during interparental conflict are longitudinally associated with parenting behaviors, across adolescence. We used multiple informants (mothers, fathers, adolescents), and applied novel analytic techniques that allow the disaggregation of the between-family variance from the within-family variance. We found most associations among interparental conflict and parenting held on the between-family level, whereas only few effects were found on the within-family level. Therefore, whereas those families that generally express worse behaviors during interparental conflict tend to be also those families that have worse parent-child relationships, increases or decreases in interparental conflict within a family do not necessarily lead to worse or better parent-child relationships. In the third paper, we investigated whether and how interparental conflict spills over to mother-adolescent conflict in the short run and the long run. Using daily diaries, we investigated the day-to-day and year-to-year cross lagged associations among interparental conflict and mother-adolescent conflict, as well as the possible mediation by maternal and adolescent negative mood. We found spillover of interparental conflict on mother-adolescent conflict from year to year, but not from day to day. Additionally, we did not find any mediation by negative mood. In the fourth paper we investigate how parent-adolescent conflict develops across adolescence (from age 13 to age 18), as well as how differences in perceptions of parent-adolescent conflict develop during adolescence. In addition, we will investigate whether parenting during early adolescence (parental behavioral control and parental support at age 13) can predict

the trajectories of parent-adolescent conflict as well as the trajectories of parent-adolescent discrepancies in perceptions of conflict.
Regarding data collection, up to now 14 months full-time have been spent on baby assessments and other activities related to these assessments.

Bauke van der Velde, PhD student, Sept/15 – Sept/19

Typical and atypical development of functional networks in the infant's brain
Kemner, UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to further understand functional networks in the infant's brain and their defining characteristics and relating these characteristics to developing social behavior during the first year of life
Methods: This project applies experimental designs. Infants are watching videos of moving toys and singing women, while we measure their continuous EEG response. Connectivity between electrode sites is calculated using the phase lag index. From which, functional whole brain networks can be created based on the likelihood of structures being connected and communicating. A graph theoretical framework can be used to standardize network characteristics, which enables us to compare networks within and between subjects. First, the focus will be on the development of the optimal analysis strategy of connectivity data in infants. Later, the focus will be on testing the reliability of these characteristics, which is followed by an exploratory study reporting on the defining characteristics which tend to develop during the first year of life. Lastly, these characteristics will be connected to the typical and atypical development of social skills.
Progression up to now: An analysis pipeline has been created, which automatically performs preprocessing, cleaning, and the analysis of the data, which results in connectivity matrices for each individual. All these steps are visually checked. A comparison between highly cleaned data and slightly noisy data yielded no considerable differences. Therefore, a decision was made to use data with only the most egregious noise removed, since this enables us to analyze more participants and overcomes the problems with subjective data cleaning. Regarding the reliability of network characteristics, we showed in a recently submitted paper that global network characteristics like global connectivity, characteristic path length, and clustering coefficient are highly reliable over sessions. Local connectivity shows lower, but still acceptable reliability. Currently, we are working on the exploratory study, comparing 750 infants' 5 and 10-month-old EEG-sessions on network characteristics.

Marieke E.W.A. Albers, PhD student, Jan/15 – Jan /19

3D-ultrasonograpy of fetal brain development
Dr. Onland-Moret, UMC Utrecht, Julius Center; Dr. de Heus, Prof. Franx, UMC Utrecht, Div. of Woman and Baby; Prof. Kahn, Brain Center Rudolf Magnus, UMC Utrecht

Aim: (1) to assess the reliability of the measurement of the volume of several fetal brain structures in 3D ultrasound images and (2) to assess the influence of prenatal environmental factors (such as maternal smoking or maternal nutrition) on fetal brain development.
Methods: For this project we use ultrasound and questionnaire data that are acquired during the first 2 visits (around 20 weeks and around 30 weeks of pregnancy) of the YOUth-study. We measure the volume of several brain structures in the ultrasound images with the VOCAL (Virtual Organ Computer-aided AnaLysis) technique. We perform intra- and interobserver agreement studies to assess the reliability of the ultrasound volume measurements. With the questionnaires we collect data on maternal environmental factors (smoking, alcohol, nutrition). This data will be used to investigate the influence of prenatal environment on fetal brain development.
Progression up to now: The analyses for the intra- and interobserver agreement studies have been completed. We assessed the reliability of previously described methods for the measurement of intracranial, cerebellar and thalamic volume. The results of this study were published in Human Brain Mapping (Albers MEWA, Buisman ETIA, Kahn RS, Franx A, Onland-Moret NC, de Heus R. Intra- and interobserver agreement for fetal cerebral measurements in 3D-ultrasonography. Hum Brain Mapp. 2018;39:3277-3284). We have examined the reliability of a new method for the measurement of fetal frontal lobe volume in 3D-ultrasound images. The results of this study will be published in the near future, in combination with growth curves for the prenatal growth of frontal lobe volume.

Elizabeth E.L. Buimer, PhD student, Jun/18 – May/22

Resilience, adversity and the effect on brain development in children
Hulshoff Pol, Brouwer; UMC Utrecht, Dept. of Psychiatry

Aim: The aim of this project is to investigate the relation between (resilience to) negative life experiences and structural and functional brain development in children.
Methods: In this project we will use YOUth data of children around the age of 9 years old and possibly the 12 year follow-up. We will use questionnaires assessing life events, Magnetic Resonance Imaging (MRI) scans and behavioral outcome measures, with a focus on prosocial behavior rather than inhibition.
Progression up to now: We are currently working on a methodology paper on the test-retest reliability of the structural MRI data. All test-retest data is collected using the YOUth MRI protocol. Furthermore, we compared outcomes of an open-source toolbox that can be used to mask the faces and ears on structural MRI scans. This toolbox is developed to prevent participant identification by 3D rendering of MRI scans.

Gijs A. Holleman, PhD student, May/2017 – May/2021

Paradigm development to study social gaze behavior in face-to-face interaction
Kemner, Dekovic, Hessels, Hooge UU Faculty of Social and Behavioral Sciences

Aim: This project aims to understand the role of gaze behavior during social interaction (a critical component of social competence). We want to understand how processes of social gaze are related to functional behavior of social agents in interaction; *e.g.,* social information uptake and social signaling during conversations.
Methods: By using a state-of-the-art dual-eye tracking setup, we can investigate gaze behavior during social interaction at a fine-grained level of analysis (e.g. temporal and spatial resolution). We will test parents and children in two conversational scenario's (cooperative vs. conflict).
Progression up to now: The experimental setup has been revised and hardware for audio communication has been implemented. A pilot with 100 adolescent-parent pairs has been approved by the board of YOUTh and the METC research proposal for this pilot is currently being written.

Bram Gooskens, PhD student, Jun/18-Jan/21

Out of control: How does the environment put the development of cognitive control at risk?
Durston, Crone; UMC Utrecht, Dept. of Psychiatry

Aim: The aim of this project is to investigate how the environment puts the development of cognitive control at risk. The project will be divided in three stages, ultimately leading to a thorough and multimodal profile of strengths and weaknesses in cognitive control and its neurobiological correlates
Methods: Firstly, using all parent- and environmental questionnaires, we will investigate environmental effects on cognitive control. Secondly, we will use performance on the fMRI-tasks and neurocognitive test battery to create individual profiles of cognitive control. Thirdly, we expand the individual cognitive control profiles by investigating structural and functional connectivity networks.
Progression up to now: Bram has just started (augustus 2018) conducting measurements for the YOUth 'Rondom 9' cohort. For the upcoming period (present – June 2021) we plan to request data from the Youth 'Rondom 9' cohort for the first and second stage of the project, starting data analyses in the fall of 2018.

WP2

Michelle Achterberg, PhD student, Sep/14 – Jan/20

Social aggression regulation in childhood and emerging adolescence
Crone, Bakermans-Kranenburg; UL Faculty of Social and Behavioral Sciences

Aim: The goal of this project is to study how the developing brain is shaped by the interplay of personal and environmental factors using a randomized controlled trial with longitudinal brain imaging. Specifically, my project focuses on the developmental differences in social rejection related aggression and aggression regulation (as a part of social competence and behavioral control).
Method: We developed a new social evaluation paradigm. During the experiment, participants view pictures of peers who responded to the participants' profile (accept, neutral or reject). Participants are requested to react to the peer feedback by pressing a button, producing a loud noise. Noise blast duration is used as an index of aggression.
Progression up to now: The paradigm was first tested in an adult sample (N=30, 15 males; see Achterberg et al., 2016). Next, we tested the paradigm in a pilot sample of 7 to 8 year old children (N=19, 10 males; see Achterberg et al., 2017). In September 2015 we started with the longitudinal data collection. We have included 256 families (N=512

children) in the first year. The first visit was a lab visit in which the children underwent (amongst others) a MRI scan. Results on replicability and heritability regarding resting state functional brain connectivity are currently now published (Achterberg, Bakermans-Kranenburg et al., 2018). Results on heritability regarding social aggression are also published (Achterberg, van Duijvenvoorde et al., 2018). Results on genetic and environmental influences on MRI scan quantity and quality in children have recently been submitted for publication (Achterberg & van der Meulen, Submitted).
After the first visit, 10 families dropped out and one family started in the second year, so we collected data of 247 families (494 children) in year two. In between year two and three 70 families (30%) received the Video-Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD). We are currently finishing up data collection of the third wave, which amongst others included the second MRI session. In total 230 families (460 children) participated in the first 3 waves of the longitudinal twin study in middle childhood. In the upcoming year(s) I will focus on the effects of parenting interventions on (neural mechanisms) of aggression regulation.

Elisabeth Bilo, PhD student, Apr/15 – Jun/18

Hormonal correlates of social and behavioral development in childhood
van IJzendoorn, Bakermans-Kranenburg, Joëls; UL Faculty of Social and Behavioral Sciences

Aim: The overall aim of this project is to explore the hormonal correlates of social competence and behavioral control of twins in childhood, with special emphasis on diurnal cortisol.
Methods: Caucasian families with young twins are invited to participate in our study. Two pretests are conducted, after which families are randomly assigned to an intervention or control group. Various measures are used to measure behavioral and hormonal development. To assess cortisol development, both saliva and hair samples are used. In this project the focus is on cortisol in the first pretest.
Progression up to now: I have started the project in April 2015 and have been fully immersed in data collection and analysis. In addition to the data collection, I am currently processing and analyzing salivary cortisol data from the first pretest home visit of 239 families with a 3- or 4-year-old twin who also participates in the study. From these families, a total of 2335 saliva samples have been analyzed for cortisol concentration. In addition, I am involved in writing a review on hormonal assays such as collected in L-CID.

Dr. Jizzo Bosdriesz, Postdoc, Mar/17 – Feb/18

Integrating behavioral genetics across cohorts in longitudinal perspective
Bakermans-Kranenburg, Van IJzendoorn, Crone; UL Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to investigate the behavioral genetic aspects of child behavioral control and social competence across age and cohorts, and determine the relative influence of genetic and environmental factors.
Methods: Structural equation modeling will be used to assess to what extent individual differences in behavioral control and social competence can be explained by genetic (A), shared environmental (C), or unique environmental (E) factors. Outcomes are derived from MRI, EEG, observational, and questionnaire data taken from two partially overlapping cohorts of same-sex monozygotic and dizygotic twins, starting at age 3-4, and 7-8.
Progression up to now: Several papers are currently in progress, two of them have been submitted (revised and resubmitted), the topics of these papers are: hot and cool behavioral control; and the associations between fear, effortful control, and frontal asymmetry.
Analyses are currently underway for an investigation of the behavioral genetic background of sensitive parenting and parental sensitive discipline; as well as a study on the behavioral genetics of sleep duration and quality. My next paper is planned to focus on chaos in the home environment and its association with executive function in children. My main role in L-CID besides coordinating data-collection and interventions is the statistical support and consultation of the L-CID PhD students, postdocs and senior researchers.

Dr. Bianca van den Bulk, Post-doc, Jun/14 – Jan/23

Integrating neural intervention effects in a longitudinal twin study with a sequential cohort design
Crone, Bakermans-Kranenburg, van IJzendoorn; UL Faculty of Social and Behavioral Sciences

Aim: Within the Leiden Consortium on Individual Development (L-CID) we study the genetic, neurobiological and environmental influences on the development of social competence and behavioral control. We set-up a longitudinal twin study with an accelerated cohort-sequential design, in which a random selection of families is assigned to the VIPP-SD intervention or a control group. With this study design we are able to investigate the underlying mechanisms of differential susceptibility within and between families. Within L-CID, I focus on the effect of the intervention on

neurobiological measurements like EEG/ERP and the relation to the development of social competence and behavioral control in early childhood. In addition, I am involved in the parent project in which we examine (1) whether the VIPP-SD influences parents' neural processing of children's emotional expressions and the neural precursors of response inhibition and (2) whether neural changes in these two neurocognitive factors mediate intervention effects on parenting behavior.

Methods: During all waves we collected child data on social competence and behavioral control, parent-child interaction data to examine sensitivity and sensitive discipline, a broad range of parent reported questionnaire data and ambulatory measurements. Wave two and three were conducted at the university and also included EEG/ERP/ECG measurements with the children. In addition, a random selection of primary parents were invited to the EEG lab at Leiden University right before and after the VIPP-SD/control condition to participate in the parent project which also included the collection of EEG/ERP/ECG data.

Progression: For the first wave, we included 237 families with a 3-4 year old same-sex twin and 256 families with a 7-8 year old same-sex twin. Currently we finish off the fourth wave of data collection with the younger children in which 200 families still participated. Of these families, 84 families received the VIPP-SD between wave two and three and all other families received a dummy intervention within the same time period. For the older children, we almost completed the third wave of data collection in which 236 families will participate. Of these families, 90 families received the VIPP-SD between wave two and three. All other families received a dummy intervention within the same time period. I am one of the project coordinators of the L-CID project and supervise the project on a daily basis. Also, I am the daily supervisor of many of the project employees and students involved in the project. In addition, I am involved in the supervision of two PhD. students (Ilse van Wijk and Laura Kolijn).

Rani Damsteegt, PhD student, May/13 - Aug/16

Parenting and prosocial development in childhood
Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to examine the effects of an intervention focused on positive parenting and sensitive discipline on prosocial behavior (a hallmark of social competence) of preschoolers.
Methods: Families with 3 or 4-year-old twins were invited to participate in our study. Two pretests will be conducted, after which families will be randomly assigned to an intervention or control group. Prosocial behavior will be measured annually with two tasks: the Owl task (an age-appropriate version of prosocial Cyberball) to measure non-costly prosocial behavior, and the Donating task to measure costly prosocial behavior. We will also annually administer the Strengths and Difficulties questionnaire, which includes a prosocial behavior scale.
Progression up to now: Since September 2014 we have recruited 239 families with 3-4-year-old twins (total N = 478). Each family was visited at home for the first pretest. Furthermore, we successfully piloted Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) for twin-families last summer. We have started year 2 of the study in September 2015, during which we invite families to the university for a lab visit. We are currently processing and analyzing data of the home visits from year 1, in which I will focus specifically on parental sensitivity and its relation with prosocial behavior.

Rani Damsteegt left the L-CID project in Aug/16 to pursue her career as a teacher in higher vocational education.

Dr. Saskia Euser, Post-doc, Nov/13 – Jan/23

Intervention effects of video feedback on social competence and behavioral control in early childhood and early adolescence: The role of children's daily experiences
Crone, Bakermans-Kranenburg, Van IJzendoorn; UL Faculty of Social and Behavioral Sciences

Aim: Within the Leiden Consortium on Individual Development (L-CID) we study the genetic, neurobiological and environmental influences on the development of social competence and behavioral control. We set-up a longitudinal twin study with an accelerated cohort-sequential design, in which a random selection of families is assigned to the VIPP-SD intervention or a control group. With this study design we are able to investigate the underlying mechanisms of differential susceptibility within and between families. In this project, I will focus on the role of children's daily life experiences in the intervention effects on children's behavioral outcomes.
Methods: During all waves we collected child data on social competence and behavioral control, parent-child interaction data to examine sensitivity and sensitive discipline, and a broad range of parent reported questionnaire data. In addition, several ambulatory assessments will be conducted during each of the pre- and posttests, such as

self-reported mood and daily activities, observational measures of auditory stimuli in the environment and the family dinner, and several neurobiological measures like physical behavior during sleep and diurnal saliva samples.
Progression up to now: For the first wave, we included 237 families with a 3-4 year old same-sex twin (early childhood cohort) and 256 families with a 7-8 year old same-sex twin (middle childhood cohort). Currently we almost completed the fourth wave of data collection of the early childhood cohort (N=400 children), and the third wave of the middle childhood cohort (N=472 children). 84 families in the early childhood cohort and 90 families in the middle childhood cohort received the VIPP-SD between wave two and three. All other families received a dummy intervention within the same time period.
I have been and am currently involved in designing, developing, and fine-tuning the SamenUniek app, which is used for daily diary assessments and to help participants in performing all ambulatory assessments. Last May, I presented data on behavioral genetics of children's sleep quality based on both actigraphy and e-diary on the conference of the World Association of Infant Mental Health, and I am currently working on a paper about this data. In addition, I am working on a paper about the intervention effect on parental sensitivity and sensitive discipline in the early childhood cohort. Together with Dr. Bianca van den Bulk I am coordinating and supervising the L-CID project. In addition, I was involved in the supervision of a PhD student (Claudia Vrijhof), who successfully defended her PhD thesis in Feb/18.

Laura Kolijn, PhD student, Apr/16 – Apr/20

Neural mechanisms involved in a parenting intervention that aims to enhance parental sensitivity and sensitive discipline
Bakermans-Kranenburg, Van IJzendoorn; UL Faculty of Social and Behavioral Sciences (until Jul/18), VU Faculty of Behavioral and Movement Sciences (Aug/18-Apr/20)

Aims: The Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) has proven effective in increasing parental sensitivity. However, the mechanisms involved are largely unknown. The focus of my PhD project is on two parental neurocognitive factors that may mediate the intervention effects on parenting behavior; face processing and response inhibition. More specifically, our first aim is to examine whether the VIPP-SD influences parents' neural processing of children's emotional expressions and the neural precursors of response inhibition. Our second aim is to test whether neural changes in these two neurocognitive factors mediate intervention effects on parenting behavior. By using electroencephalographic (EEG) we hope to gain more insight in neurocognitive factors that may underlie parenting behavior.
Methods: We tested 66 mothers of 4-6 year old same-sex twins. A random 34% of the mothers received the VIPP-SD (i.e. VIPP-SD adapted for twin families), consisting of 5 home visits in a 3-month period; the others received a dummy intervention. Neurocognitive measures were acquired approximately 2 weeks before and 2 weeks after the intervention. Mothers' EEG activity was measured while they performed a stop signal task and in response to children's facial expressions. To obtain a complementary behavioral measure, mothers performed an emotion recognition task. Parenting behavior was assessed during parent-child interactions at pre and post intervention lab visits.
Progression up to now: The data collection for this part of the L-CID project is finished and the data is further prepared and processed for analyses. In March 2017 the study protocol of this study was published in BMC Psychology (Kolijn et al., 2017). Furthermore, I presented a poster on the study design at several symposia (CID symposium Utrecht in 2016, VNOP-ISED-CAS Research Days Leiden, 2016 and at Donders Discussions Nijmegen, 2016). In May 2018, I went to the congress of the World Association for Infant Mental Health (WAIMH) that took place in Rome to be part of a symposium on ERP and parenting. At that same congress I presented a poster about neural and behavioral measures of parenting. Currently, I am working on a paper about the neural correlates of face processing and implications for parenting, which I hope to finish in October 2018.

As of Aug/18, Laura Kolijn is appointed by the Free University of Amsterdam, under supervision of Prof. Bakermans-Kranenburg. Laura will continue her PhD.-trajectory within L-CID.

Mara van der Meulen, PhD student, Jan/15 – Jan/20

Prosocial development in childhood and emerging adolescence
Crone, van IJzendoorn; UL Faculty of Social and Behavioral Sciences

Aim: The goal of this project is to study how the developing brain is shaped by the interplay of personal and environmental factors using a randomized controlled trial with longitudinal brain imaging. Specifically, my project focuses on developmental differences in compensating prosocial behavior, a hallmark of social competence.

Methods: We use a four-player Cyberball Game to investigate prosocial behavior. During the task, the participant is one of the four players in the game. Initially all players toss the ball to each other. In the second block two players no longer toss the ball to the third player, thereby giving the participant the opportunity to compensate for this exclusion. The percentage of tosses to the excluded player, compared to tosses to the other two players, is used as a measure for prosocial behavior.
Progression up to now: The paradigm was first tested in an adult sample (N = 23, all female) and in a pilot sample of 7-8 year old children (N=16, 50% male). Both studies are published (van der Meulen et al., 2016; van der Meulen et al., 2017).
We started the first wave of the longitudinal data collection (behavior and MRI) in September 2015, including 256 families (N=512 children). Results on heritability of neural reactions to social exclusion and prosocial compensation in middle childhood from the wave are now published (van der Meulen et al., 2018). Results on genetic and environmental influences on MRI scan quantity and quality in children have recently been submitted for publication (Achterberg & van der Meulen, Submitted).
In September 2016 we started the second wave of data collection (behavior), which was a home visit. During this wave, 10 families dropped out and one family was included, resulting in a sample of 247 families (N=494 children). After the second wave 70 families (30%) received the Video-Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD). We are currently finishing data collection of the third wave (behavior and MRI), which was a home visit. We expect to conclude data collection in September 2018, at which point we will have collected data of 230 families (N=460 children).

Claudia I. Vrijhof, PhD student, Nov/13 – Nov/17, Postdoc, Nov/17 – Apr/18

The way to success: Identifying factors related to individual differences in behavioral control and prosocial behavior
Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioral Sciences

Aim: The aim of this project was to explore the relations between child characteristics and children's social, physical and economic environment on the one hand and children's behavioral control (preschool period, cohort 2) and prosocial behavior (early to mid-adolescence, cohort 3 pilot) on the other hand.
Methods: We used various observational measures to assess different aspects of behavioral control, including the ability to internalize and follow rules, even when tempted (cheating game), inhibitory control (stop-signal task), and delay of gratification (marshmallow test). Furthermore, we use parent-reports on children's behavioral control (the Child Behavior Questionnaire). Prosocial behavior was assessed with a four player virtual ball game in which one of players is excluded (the Prosocial Cyberball Game).
Progression up to now: I successfully defended my dissertation in February 2018. Up till now, two papers have been published: one about the prosocial Cyberball game (2016) and one on stressful family environments and children's behavioral control (2018). A third paper focussing on parental sensitivity and children's hot and cool behavioural control is currently under revision.

Ilse van Wijk, PhD student, Feb/14 – May/18

Neural correlates of social rejection and aggression in young children
Van IJzendoorn, Bakermans-Kranenburg, Crone; UL Faculty of Social and Behavioral Sciences

Aim: The goal of this project is to study how the developing brain is shaped by genetic and environmental factors (for instance parent-child interactions) using a randomized controlled trial in a longitudinal twin study (six years). Specifically, my project focuses on brain activity differences in frontal asymmetry and the relation with social behavior (i.e. social rejection and aggression, temperamental factors like fear and effortful control and prosocial behavior).
Methods: To study frontal asymmetry a rest measurement during EEG was conducted (6x30 seconds eyes open and closed). Furthermore, social rejection and aggression was measured with a new social judgment task. Participants were shown pictures of peers that judge a personal belonging of the participant (positive, negative or neutral). Participants were requested to react to the peers' feedback by pressing a button, resulting in destroying the balloons of the peer. Balloon bursts (duration of button press) were used as a behavioral index of aggression. To measure temperament we used the CBQ questionnaires filled out by both parents. Prosocial behavior was measured with a newly developed task: Prosocial Owl Game (POG). In the POG, two cartoon owls exclude a third owl, and the participant can compensate for this exclusion by giving the excluded owl the next turn.
Progression up to now: The social network aggression task in early childhood (SNAT-EC) was tested in a pilot study (N = 50) and used in the second year (N = 215) and third year (N = 203) of the longitudinal twin study. In a replication study with three samples (pilot sample and two test samples from the second wave in which each co-twin was randomly assigned to test 1 or test 2 sample; total N=150) we examined whether frontal asymmetry mediated the

relation between social judgments and aggression; the results were published in July 2017. The data collection of year three is completed and all the EEG data is preprocessed and thus ready for analyses. Two papers with data from year 2 are now under review. One is about the behavioral genetics of temperament (fear and effortful control) and frontal asymmetry for which we use CBQ and EEG data (n = 428). This paper is already revised once and will soon be resubmitted. The other paper is under review and about the POG, a new observational task to measure prosocial behavior in early childhood. A replication design with two samples (both n = 214) consistently showed that the vast majority of the children compensated for social exclusion. We related these results to frontal asymmetry and other measures of prosocial behavior (questionnaire data and donating task). I will finalize my dissertation around the end of this year.

WP3

Annelene J.P. Bloemen, PhD student, Dec/14 – Dec/17

Determinants and consequences of (low) cognitive control
Oldehinkel, Hartman, UMC Groningen, Dept of Psychiatry, Interdisciplinary Center Psychopathology and Emotion regulation (ICPE)

Aim: Adolescence is characterized by extensive neurodevelopmental changes. It has been hypothesized that disorders with a high incidence during adolescence, such as depression and anxiety, are neurodevelopmental disorders that result from premorbid vulnerabilities of the brain. Low cognitive control is an often-used marker of such brain vulnerabilities. Within the context of CID, cognitive control is highly relevant because it is a prerequisite for behavioral control, one of the two core outcomes. Whereas prior research suggests that low cognitive control is not a strong predictor of depression and anxiety in general, it may still do so in particular subgroups, e.g. youth with a vulnerable temperament. Cognitive control is important in regulating our behaviors and emotions, which may be particularly relevant in the context of specific risk factors. The central aim of this project is to examine the role of cognitive control in relation to the question why some individuals develop psychiatric problems while others do not, and why some remit while others have chronic and even worsening psychopathology. Insight will be gained by investigating how cognitive (behavioral) control may provide a buffer in the context of a vulnerable temperament, stress exposure, comorbid childhood psychopathology, and a high familial presence of psychopathology.
Methods: Existing (multiwave) cohort data will be used from TRAILS (TRacking Adolescents' Individual Lives Survey), LifeLines, ARIADNE, and NeuroIMAGE. Cognitive control was measured using either paper-and-pencil or computerized tasks. All other variables were measured by interviews or questionnaires.
Progression up to now: Start of the project was 20th of October 2014. Current situation is: one paper submitted; and for the second paper the analyses are finished and we are halfway through writing up the manuscript.

Andrik Becht, PhD student, Sep/14 – Sep/18

Why some adolescents thrive and others don't: The role of uncertainty dynamics.
Meeus, Vollebergh, UU Faculty of Social and Behavioral Sciences

Aim: There is massive evidence that uncertainty is a major risk factor in adolescent development. However, information on the development of uncertainty, the transmission of uncertainty in parent-adolescent relationships and how uncertainty predicts adaptive development is lacking. Aim of this CID-project is to overcome these limitations.
Methods: an intensive longitudinal design is used including 75 between day measures across five years to tap into certainty-uncertainty dynamics across adolescence.
Progression:
1st paper (published in *Psychological Assessment*) investigated longitudinal measurement invariance and measurement invariance across sex of the daily diary reports on identity which are used for further study in the CID project. **2nd paper** (published in *Developmental Psychology (*2016)) investigated heterogeneity in development of daily identity certainty-uncertainty dynamics across adolescence and longitudinal associations with psychosocial adjustment. **3th paper** (published in *Child Development (*2017)) investigated socialization of self-certainty across adolescence. Specifically, we examined bi-directional within-person longitudinal associations between self-certainty and (multi-informant) quality of relationships with fathers, mothers, and peers. **4th paper** (published in *Developmental Psychology (*2017)) investigated the hypothesis that adolescents' identity exploration precedes the formation of strong identity commitments. **5th multi-sample, multi-method paper** (published in *Child Development (*2018)) investigated longitindal linkages between self-reported goal-directedness and neurobiological underpinning of identity. In a **6th systematic review paper** (published in *European Psychologist*) we reviewed theories, and

development of three key components of identity (i.e., a sense of continuity, coherence, and distinctiveness, along with the linkages between these three components and psychosocial adjustment. In our **7th paper** (under review in *Developmental Psychology*) we investigated (in two independent longitudinal samples from the Netherlands and Belgium) within-person direction of effects between identity and depressive symptoms. In an **8th paper** (under review in *Journal of Personality and Social Psychology*) we investigated whether daily identity dynamics in adolescence could predict long-term development of identity in emerging adulthood.
Another paper is in progress (not part of my dissertation, but concerns collaboration within the CID-community; to be submitted). In this opinion paper, I am the first or second author (to be decided) in which I collaborate with colleagues from CID in writing an opinion paper concerning statistical methods to study brain development in childhood and adolescence (Title: *Moving beyond the study of mean level brain development: Studying heterogeneity in developmental trajectories*).

Dr. Tina Kretschmer, Postdoc (until 1/12/2015) and **dr. Jennifer Klop-Richards**, Postdoc (1/12/15- 1/2/18)

Examining the complex interplay between relationship experiences and individual factors to understand adolescent development
Oldehinkel, Meeus, Dekovic; UMC Groningen, Dept. of Psychiatry, Interdisciplinary Center Psychopathology and Emotion regulation (ICPE) and Dept. of Sociology

Aim: This project seeks to identify predictors of positive outcomes (educational and occupational success, prosocial behavior, self-competence, empathy; all hallmarks of social competence) and problem development (internalizing and externalizing behavior). In detail, project component #1 asked whether experiences in parent-child relationships are associated with experiences in relationships with peers and intimate partners and project components #2 and #3 focus on the interplay between relationship experiences and individual factors in predicting positive and negative outcomes.
Method: Data from all waves of the Tracking Adolescents' Individual Lives Survey (TRAILS) are used, though the focus is on measures of social relationships with parents, peers, and romantic partners and measures of adjustment.
Progression up to now: An article on the link between parent-child relationships/parent characteristics and peer experiences has been published in the Journal of Research on Adolescence (co-authors Sentse, Meeus, Verhulst, Oldehinkel); an article on the link between parent positivity in early adolescence and romantic involvement, commitment, and satisfaction (co-authors Vollebergh, Oldehinkel) is published in the International Journal of Behavioral Development. A third article on bullying development and its negative outcomes (co-authors Veenstra, Dekovic) is under review. This research has also been presented at conferences (European Association for Research on Adolescence, 2014; Society for Research on Child Development, Philadelphia). By the end of 2015, Tina Kretschmer accepted a UD position at the University of Groningen and was followed-up by Jennifer Klop-Richards, who is now preparing a paper on the optimal operationalization of the concept of thriving.

Dr. Jennifer Klop-Richards, postdoc (1/10/18 – 1/5/21)

Social influences on mental health, control, and social competence from adolescence to young adulthood
Oldehinkel; UMC Groningen, Dept. of Psychiatry, Interdisciplinary Center Psychopathology and Emotion regulation (ICPE) and Dept. of Sociology

Aim: This project involves a continuation and follow-up of the tranche-1 project entitled "Examining the complex interplay between relationship experiences and individual factors to understand adolescent development", which focused on how experiences in parent-child, peer, and intimate relationships and individual factors affect adolescents' and young adults' development in interplay with each other. This project aims to elucidate how family and peer relations during adolescence and young adulthood influence the development of mental health and functioning, including social competence and behavioral control, across adolescence and young adulthood, extending into parenthood. Further, a particular focus will lie on how influences of social experiences and social competence transmit from one generation to the next.

Method: Data from all waves of the Tracking Adolescents' Individual Lives Survey (TRAILS) are used, though the focus is on measures of social relationships with parents, peers, and romantic partners and measures of adjustment.

Progression up to now: In dec 2015 I took over the project from dr. Tina Kretschmer who has published a number of articles on the subject (see progress report 2016-2017). Since then, an article on the social predictors of young adults' wellbeing and functioning has been finalized and is in press at psychological medicine. Papers in-progress

include a paper on the developmental stability of the p-factor and a review on parenting and resilience in children. In addition, I have worked on the coordination of the set-up and data-collection of TRAILS Next. At the moment data is being collected for waves T1-T3 and a coding scheme is being developed and piloted for the parent-child interactions observed at 3 and 30 months. I am also involved in the supervision of PhD-student Stefania Barveza.

Dr. Odilia M. Laceulle, Postdoc (until 1/9/2015) and **dr. Anoek M. Sluiter-Oerlemans,** Postdoc (since 15/9/2015)

Developmental models of psychopathology an life outcomes
Ormel, Oldehinkel, Vollebergh, Van IJzendoorn, Van Aken, Hartman, UMC Groningen, Dept. of Psychiatry, Interdisciplinary Center Psychopathology and Emotion regulation (ICPE) and UU Dept. of Developmental Psychology

Aim: In addition to work related to the enrichment of TRAILS study with measurements of a third generation (TRAILS Next), we started to investigate developmental models of psychopathology. The main aim was to use longitudinal data to disentangle the structure of psychopathology, the complex interplay between individuals and their environments (transactional models) in the prediction of psychopathology and life outcomes.
Methods: Data from all six waves of the Tracking Adolescents' Individual Lives Survey (TRAILS) are used, though the focus to date has been on measures of mental health, temperament/personality, social relationships, life events and early adult life outcomes.
Progression up to now: Odilia Laceulle has published and submitted four papers before accepting a UD position at the university of Tilburg (Sep 2015): one article targeted the mediating role of perceived relationship affection in the temperament-stressful events association (European Journal of Personality; co-authors van Aken and Ormel); one article investigated the structure of psychopathology in adolescence (Clinical Psychological Science; co-authors: Vollebergh and Ormel); one paper investigated the relationships between adolescent personality and basal, awakening and stress-induced cortisol responses (Journal of Personality, co-authors Van Aken and Ormel); and one paper, titled "Sequences of Mal-adaption: Pre-adolescent Self-regulation, Adolescent Negative Social Interactions and Young Adult Psychopathology", is in progress (co-authors Vollebergh and Ormel).

Her successor, Anoek M. Sluiter-Oerlemans, started September 15, 2015. Since Sep 2015, one paper on functional (adult) life outcomes of child and adolescent psychopathology has been published in Psychological Medicine (May 2017, co-authors: Ormel, Raven ,Laceulle, Hartman, Veenstra, Verhulst, Vollebergh, Rosmalen, Reijneveld, Oldehinkel). A Dutch version of this paper was published in Kind and Adolescent (May 2018). Two papers have been submitted for publication: the first paper investigates the influence of developmental trajectories of internalizing and externalizing symptoms on early-adult life outcomes (co-authors: Ormel, Raven, Wardenaar) and the second paper investigates the scar model of the relationship between psychopathology and personality (co-authors: Ormel, Raven, Oldehinkel, Laceulle). We are currently focusing on turning points (i.e., long-term, persistent changes) in mental health development from young adolescence to early adulthood. We identified subgroups of individuals who have experiences such a turning point (based on six waves of self-reported mental health symptoms). We are now examining which personal (including genetics, personality, social skills) and environmental (including social support) characteristics and life events may explain why some individuals experience a turning point in their mental health development whereas others do not. This work will result in multiple publications (co-authors: Ormel, Hartman, work in progress). *Grants*: Anoek has received a Gratama Grant in May 2017. With this grant, we were able to purchase software used for coding parent-child interactions in TRAILS Next (assessed at 3 and 30 months old). A (micro)coding scheme for social interactions has been developed and piloted in the Summer of 2018 and training of student-coders will start Fall 2018.

Dr. Stefanie A. Nelemans, Postdoc, Sep/14 – Dec/15 & Jan/17– Dec/18

Development of internalizing symptoms in adolescence and early adulthood: Over-time links with biological, psychological, and social factors
Meeus, Oldehinkel; UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to provide more insight in the development of anxiety and depressive (i.e., internalizing) symptoms from adolescence to emerging adulthood, including over-time links with individual characteristics (e.g., genetics and stress reactivity) and social relationships (e.g., parenting and the parent-adolescent relationship).
Methods: This project uses existing longitudinal data from RADAR (UU), CONAMORE (UU), and potentially TRAILS RUG/UMCG). Longitudinal questionnaire data, physiological and cognitive data during a laboratory setting, and genetic data will be used. Analyses include a combination of person-centered and variable-centered longitudinal modeling techniques.

Progression up to now: From 2017 onwards, my research has increasingly focused on biological correlates and predictors of adolescent depressive and anxiety (particularly Social Anxiety) symptom development from early to late adolescence, as well as interactions between biological and psychosocial factors (particularly parenting of parent-adolescent relationship quality) or a more in-depth focus on the relevance of the parental context in predicting this development. A number of papers have been recently accepted for publication, are currently under review, or are currently in progress on these topics. Specifically, we have focused on polygenic × parenting environment interactions predicting adolescent social anxiety symptom development (Nelemans et al., 2018; in collaboration with KU Leuven, Belgium) and adolescent depressive symptom development (Nelemans et al., under review). In addition, we are currently focusing on the relevance of the parental context in predicting adolescent social anxiety symptom development (Nelemans et al., revise/resubmit; in collaboration with KU Leuven, Belgium) and adolescent depressive and Generalized Anxiety symptom development (Nelemans et al., in progress). Furthermore, I am currently involved in an integrative CID project examining the association between parental age and offspring childhood mental health in multiple CID cohorts (Zondervan-Zwijnenburg et al., revise/resubmit), a study examining bidirectional links between adolescent and mothers' perceptions of their relationship and their depressive symptomatology (Hale et al., under review), a study on the intergenerational transmission of adolescent problem behavior (Schulz et al., in progress), and two studies focusing on genetic × parenting environment interactions predicting adolescent internalizing symptom development (Endedijk et al., under review) and adolescent social development (Endedijk et al., in progress). Finally, I have been involved in a CID collaboration focusing on neurobiological underpinnings of adolescent identity (Becht et al., 2018) and a study on links between genetic vulnerability to schizophrenia and cannabis use patterns in adolescence (Hiemstra et al., 2018).

Alexander Neumann, PhD student (PhD defense Feb/19)/Postdoc, Aug/14 – Jan/20

The epigenetics of intergenerational transmission
Hillegers, Oldehinkel, van IJzendoorn; Rotterdam Erasmus MC, Department of Child and Adolescent Psychiatry

Aim: Co-occurrence of mental disorders is commonly observed, but the etiology underlying this observation is poorly understood. Studies in adolescents and adults have identified a general psychopathology factor associated with a high risk for different psychiatric disorders. The aim of the project is to study and distinguish general and specific (epi-)genetic risk factors to develop psychological problems, as well as related hormonal and brain profiles.
Methods: We constructed latent general and specific psychopathology factors based on repeated multi-informant (parental, teacher and self-report) data in the Generation R cohort. The general factor's SNP-based heritability was estimated using the GREML method among 2,115 children at ages 6-8 years. General and specific factors were also estimated at ages 6-10 years and associated with global white matter integrity (from diffusion MRI) in a structural equation model. Global white matter integrity was defined as latent construct underlying 12 white matter tracts in 3,030 children. In addition we conducted a voxel-wise analysis using tract-based spatial statistics (TBSS, n = 2,996). Furthermore, we performed a genome-wide association study (GWAS) of a total problem sum score of child behavioral and emotional problems within the EAGLE consortium (16 cohorts, n=29,446). Additionally, we performed an epigenome-wide associations study (EWAS) of ADHD symptoms within the PACE consortium (11 cohorts), using birth and age 6-9 DNA methylation as predictors. We also investigated a hair pigmentation bias of hair cortisol measurements using a polygenic score of hair color. Additionally we investigated the SNP-based heritability of saliva and plasma cortisol using GREML in the Rotterdam Study (n=5705) and LD score regression using data from the CORNET consortium (n = 12,597). We are currently investigating the impact of stressful life events (obtained via parental interview) on methylation changes from birth to age 6 and 10 in Generation R. Finally, we are developing a statistical package to estimate the variance explained by genome-wide DNA methylation, analogous to GREML.
Progression up to now: We published following findings: we observed a significant SNP heritability of 37% (SE=0.16, p=0.01) for a general psychopathology factor (doi: 10.1016/j.jaac.2016.09.498); a 1-standard deviation (SD) higher polygenic score of hair pigmentation (darker hair) was associated with 0.08 SD higher cortisol levels (SE = 0.03, p = 0.002) independent of genetic ancestry (doi: 10.1038/s41598-017-07034-w); and the SNP-based heritability of saliva and plasma cortisol was below 10% (doi: 10.1016/j.psyneuen.2017.08.011) for acute morning and awakening levels, as well as for total daily output. We have a manuscript on white matter integrity and general psychopathology under revision. In it we report that a one SD increase of the global white matter integrity factor was associated with a β=-0.07SD (SE=0.02, p<0.01) decrease in general psychopathology. In contrast, an increase of white matter integrity predicted an increase of β=+0.07SD (SE=0.03, p=0.01) specific externalizing factor levels. Voxel-wise analyses supported these findings, with 2/3 of all tested voxels across the brain showing significant associations with the specific externalizing factor and 17% with general psychopathology. We found 3 genes (DMWD, DMPL, SIX5) significantly associated with total psychological problems in a GWAS and are finalizing a manuscript for submission. We identified 9 CpG probes which are associated with later ADHD symptoms, when using DNA methylation at birth, but none when analyzing methylation at age 6-9. Nevertheless, the correlation between regression estimates using

birth methylation and age 6-9 methylation reached almost 0.50. We ran mixed models investigating DNA methylation changes throughout childhood and are currently expanding them to incorporate stressful life events as predictor. We are currently building in collaboration with the ALSPAC cohort a tool to estimate the variance explained by genome-wide DNA methylation and have written a working test version.

Sabine Veldkamp, PhD student, May/15 – Oct/16

Why some pupils thrive and others do not. The role of genes and the environment.
Boomsma, Van Berkum; Vrije Universiteit Amsterdam, Faculty of Psychology and Education

Aim: The overall aim of my project is to study why some pupils thrive and others do not, with a focus on etiological factors underlying social-emotional (social competence) and cognitive development. This project aims to unravel causes of individual differences in academic skills (literacy and numeracy), bullying behavior and victimization (at ages 7, 9 and 12). The project will be divided in two parts: behavioral genetics and molecular genetics. The main research questions are: 1) What are the causes of individual differences in academic skills and bullying/victimization? Is the individual variation and co-variation mainly caused by genetic differences or environmental effects? Does the etiology depend on school characteristics? 2) Which genomic regions are associated with academic skills, bullying behavior and victimization?
Methods: To answer these research questions, the study will be conducted in twin pairs and their non-twin siblings in the Netherlands Twin Register (NTR) cohort. If available, parent data will also be added. The focus is on cross-sectional and/or longitudinal multiple rater data and school-test scores. This project builds on and will extend the database of the NTR on cognition and DNA/epigenetic variants. In addition, data about different school characteristics will be collected. To be more specific, data that will be collected: 1) survey data of the primary school teachers, as well as scores on tests of the Pupil Monitoring System (Cito), 2) DNA/epigenetic variants, and 3) publically available data of school characteristics. Part 1) and 2) are ongoing processes, whereas part 3) will be a new addition to the data collection.
Progression up to now: *Papers:* I studied whether twins are at high or low risk compared to non-twin children regarding bullying and victimization and whether bullying and victimization in twins depend on whether the co-twin is 1) genetically identical, 2) in same class or not, 3) of same or opposite sex, and whether 3) changes as children age. Moreover, some interactions and non-twin specific characteristics are investigated, namely gender and age (Veldkamp, TRHG 2017). I investigated, in collaboration with WP4, whether parental age has an influence on internalizing and externalizing problem behavior of the child (age 10) and whether this effect is still there after correcting for child gender and SES. (Zondervan-Zwijnenburg et al., in progress). Within this collaboration I also investigated the same research question, but then for school performance, IQ and attention problems (Veldkamp et al., in progress). In addition, I investigated in a classical twin model what the causes of individual differences are in bullying and victimization, are. *Data collection:* Teachers of 7, 9 and 12-year-old twins and their siblings filled out, after having ascertained parental consent, questionnaires on the development of the children. One wave of data collection (2016: N ~1900) has been done and pupil monitoring test scores are available for one third of these children.

Dr. Eveline de Zeeuw, Postdoc, Dec/14 – May/18

Longitudinal development and intergeneration transmission of psychopathology versus wellbeing
Boomsma, Oldehinkel; VU University Amsterdam

Aim: The aims of the project are to collect intergenerational genetically informative data, to disentangle in a multi-rater design genetic and environmental influences on psychopathology and well-being and to investigate intergenerational transmission of psychopathology and well-being.
Methods: The mechanisms will be investigated using, amongst others, gene-environment interaction moderator models (GxE), parent-offspring (PO) and children-of-twins (COT) model. Four types of intergenerational data will be collected: 1) parents of young twins who are twins themselves, 2) sisters who are mothers of twins, 3) young twins who become parents themselves and 4) adult twins with adult offspring.
Progression up to now: *Papers:* In a classical twin design I showed that the differences between children in educational achievement are largely genetic across different school subjects (de Zeeuw et al., LID 2016). Using a genetically informative design I showed that the negative association between ADHD and lower educational achievement could at least partly be explained by a causative relationship (de Zeeuw et al., BG 2017). I showed in a multi-rater design (father and mother) that the differences between preschoolers in autistic traits were largely due to genetic differences and that one third of the identical twin pairs were discordant for high autistic traits possibly due to resilience (de Zeeuw et al., JCPP 2017). I showed in a GxE and polygenic score design that socioeconomic background has an effect on the genetic and environmental variance in educational achievement and that SES had an

effect on CITO score even when taking genetic differences between children into account (manuscript submitted).
Data collection: All participants in the Netherlands Twin Register (NTR) belonging to group 1 (~700 families), 2 (~450 families) and 4 (~300 families) have been identified. Data available for these children and their parents are, amongst others, psychopathology, wellbeing, educational achievement and behavioral control (ASEBA). The data collection in group 3 is ongoing. At this time twins from the cohorts 1986-1991 (~800 persons) have been invited to register their children with the NTR and ~140 persons agreed (and ~130 persons did not agree) to participate. The next cohort (1991) will soon be invited to take part in the study. Data collected in the children of twins include measures on psychopathology, well-being, behavioral control (Childhood Behavior Questionnaire (CBQ)), temperament, the home environment and parenting styles. Teachers of 7, 9 and 12-year-old twins and their siblings filled out, after having ascertained parental consent, questionnaires on the development of the children, including the Social Skills Rating System (SSRS) questionnaire . Two waves of data collection (2017: N ~1600 and 2018: N ~1200) have been done and data on social competence are available for ~2200 children.

Dr. Eveline de Zeeuw, Postdoc, May/18 – Dec/18

Parental characteristics and its effect on behavioral control in childhood

Boomsma, Hoijtink; VU University Amsterdam

Aim: The aim of this project is to get more insight in the association between psychopathology and behavioral control in children and to investigate the direct effect of parental characteristics, more specifically psychopathology and educational level, on behavioral control in their offspring by taking into account genetic transmission from parents to offspring in genetically sensitive designs.
Methods: This project will use, amongst others, a children-of-twins (CoT) design, intergenerational Mendelian Randomization and a transmitted versus non-transmitted polygenic score design. Several samples of children of twins (i.e. twins of whom one is parent of a twin, siblings who both are parents of a twin and young twins who have become parents) and a sample of young twins and their parents will be included in the analyses. In addition, we will use trios (two parents and one offspring) with genotype data.
Progression up to now: *Papers:* I showed in a children-of-twins design that the extent to which the effect of parental psychopathology on behavioral control in children is due to genetic and cultural transmission depends on the type of disorder. I will extend these analyses with a design in which the effect of the (non-)transmitted genotypes for psychopathology on behavioral control in children will be investigated.

Susanne Schulz, PhD student, Nov/17 – Nov/21

Intergenerational transmission of psychopathology and relationships in adolescence
Branje, Meeus, Oldehinkel, Nelemans; UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to provide insights into the intergenerational transmission of psychopathology and relationships, using a systematic longitudinal approach. We investigate the reciprocal associations between parental and adolescent psychopathology and relationships to test whether they are driven by intergenerational transmission or convergence and to assess their long-term effects on adolescent development. Additionally, we examine the mechanisms that determine the transmission (or convergence) of psychopathology and relationships in adolescence (e.g., investigating the mediating role of emotional states and the moderating role of polygenic risk scores).
Methods: This project mainly uses existing longitudinal data from RADAR (UU), and potentially TRAILS (RUG/UMCG), including questionnaire, behavioral, physiological, genetic, and observational data. Analyses will be conducted using novel longitudinal modeling techniques.
Progression up to now: At the moment, we are working on two separate publications. The first paper focuses on the longitudinal (bidirectional) associations between parent and adolescent internalizing and externalizing problems throughout adolescence, using random-intercept cross-lagged panel analyses. I presented preliminary findings based on traditional cross-lagged panel analyses at the 2018 Vereniging Nederlandse OntwikkelingsPsychologie (VNOP) conference and at the 2018 European Association for Research on Adolescence (EARA) conference. The second paper is conducted in collaboration with researchers from the University of Tilburg and investigates the longitudinal associations between parent-adolescent relationship quality and adolescent peer and romantic relationship quality, using novel meta-analytic techniques (multilevel meta-analysis and meta-analytic SEM). Preliminary results of this meta-analysis were also presented at the 2018 EARA conference.

WP4

Dr. Gabriël J.L. Beckers, Assistant professor, Oct/14 – Jan/18 & Aug/18– May/23

Tracking sleep slow waves during avian vocal development
Bolhuis, Joëls; UU Faculty of Social and Behavioral Sciences

Aim: Sleep is strongly involved in learning, including vocal learning in songbirds and grammar learning in human infants. However, the underlying neurophysiological mechanisms that enable this, and that require the brain to be `off-line' during sleep, remain poorly understood. The aim of the overall project is to provide insight into the role of large-scale cortical oscillations that occur during deep sleep in perception and learning of vocalizations in zebra finches, *Taeniopygia guttata*. This songbird is a prominent animal model system for neuroscientific research into speech and language acquisition in human infants.
Methods: We previously studied sensitivity to vocal sequence structure, particularly in secondary auditory cortices, from action and local field potential activity recorded with high-density multi-electrodes of isoflurane anesthetized birds. This type of anesthesia is generally assumed to be a good model for deep sleep, but sleep and anesthesia have not been systematically compared in birds. We recorded with the same methodology as in our previous study intracerebral oscillation dynamics during anesthesia and sleep (within subject comparisons). We used a different bird species, *Columba livia,* because our methodology cannot be applied in naturally sleeping zebra finches yet, because of their small size (~15 g).
Progression up to now: We obtained good recordings in isoflurane anesthesia and natural sleep states (deep sleep and REM sleep) from the same subjects. Oscillatory dynamics of electrical activity during anesthesia are in many aspects similar to those during deep sleep (NREM), and dissimilar to those during REM sleep and wakefulness. A manuscript is almost finished and will be submitted to the journal SLEEP.

Dr. Sita M. ter Haar, Postdoc, Mar/15 – Jan/16

A neurogenetic analysis of birdsong learning as a model for infant development
Bolhuis, Joëls; UU Faculty of Social and Behavioral Sciences

Aim: This research aims to study the neurogenetic mechanisms behind song learning in zebra finches, which is extensively used as a model for speech and language acquisition in human infants. The first question to be answered is whether individual differences in learning performance are associated with differences in gene expression.
Methods: We perform neurobehavioral research in combination with innovative genetic techniques: song analyses, behavioral responses and RNA-sequencing or microarray.
Progression up to now: An ethical proposal has been written for the animal experimentation committee to be able to start the research on animals. The plans have been discussed with a genetic birdsong expert collaborator (Prof. Claudio Mello). Before we can start genetic analyses we need to develop methods to quantify individual differences in development. In order to be able to distinguish gene expression patterns in good and poor learners, it is necessary to find precursors in vocal development that indicate good or poor learning. Therefore I have started to analyze vocal development of already existing song recordings during development. I investigate whether specific song elements or syllables (the units of which song consists) are acquired early in development and if this acquisition is more accurate and/or faster in good learners than poor learners. Also, I study if fast development (i.e. early song stabilization) leads to better or worse song performance as an adult. Once we know the developmental precursors, we can start measuring genetic variation associated with individual differences.

Dr. Sofia Kanatsou, Postdoc, Aug/15 – April/16

Genetic resilience in a combined model of stress early in life and later in adulthood on behavior and neurogenesis in mice
Joëls; UMC Utrecht Dept. of Translational Neuroscience, Brain Center Rudolf Magnus (BCRM) and UvA Swammerdam Institute for Life Sciences, Center for Neuroscience

Aim: The general aim of this project is to model the neurodevelopmental aspects of behavior (social competence and behavioral control) and structural plasticity after stress early in life and later in adulthood in male mice. Mineralocorticoid receptor (MR) function is considered important in mediating stress resilience. We therefore aim to study whether combined exposure of early life stress and stress in adulthood affects memory and neurogenesis and whether these effects can be prevented by increased transgenic overexpression of MR's.
Methods: We have used a novel approach for developmental behavioral and structural analysis in which mice are assessed in adulthood on a series of behavioral tasks measuring neuroendocrinological markers, locomotor activity, anxiety, learning and memory and adult hippocampal neurogenesis.

Progression up to now: 1) We have established and validated (neuroendocrine and behaviorally) the limited nesting and bedding model (ELS) to induce early life stress in mice through fragmented mother care. 2) We have established and validated (neuroendocrine and behaviorally) the chronic unpredictable stress model (CUS) to induce stress in adulthood in mice through a combination of physical and psychological stressors. 3) We have successfully imported the genetically modified mouse lines necessary to generate the forebrain specific overexpression mice.
Recently we have shown that increased MR functionality partially prevents chronic-stress induced reductions in hippocampal memory and structural plasticity in male mice (Kanatsou et al., 2015). Moreover overexpression of MRs protects against the consequences of early life stress on spatial memory, cell maturation and synaptic function in the dentate gyrus in male mice (Kanatsou et al., in preparation). Based on these findings, it is important to further explore the genetic resilience of MRs on behavioral and structural domains in a combined model of stress early in life and later in adulthood.

Jiska Kentrop, PhD student, Jul/14 – Jul/18

The effects of early life stress on social competence; possibilities for intervention
Van der Veen, Joëls, Bakermans-Kranenburg; UMC Utrecht, Brain Center Rudolf Magnus (BCRM)

Aim: Previous studies have shown that prolonged exposure to high levels of corticosteroids early in life affects stress-sensitivity, cognitive functioning and brain structure. Both early life and adolescence are sensitive periods, where environmental influences can have a critical influence on further brain development. Studies in animal models will help us to better understand the adverse effects of early life stress (specifically on social competence and behavioral control) and explore the possibilities of manipulation of the stress system in an attempt to counteract the effects of early life challenges.
The aims of the project are 1) to determine the effects of early life stress on behavioral control, social competence and pro-social behavior in rats in adolescence and adulthood and 2) to investigate the possibility of reversing these behavioral effects using either environmental or pharmacological interventions in early adolescence.
Methods: Rats were exposed to 24h maternal deprivation (MD) on postnatal day 3. At postnatal day 26 rats underwent a pharmacological or a non-pharmacological intervention. The pharmacological intervention consisted of a 3-day treatment with Mifepristone, a glucocorticoid receptor antagonist. The non-pharmacological intervention consisted of housing the rats in a complex environment (Marlau^{TM} cages). In adolescence, social play behavior was observed and in adulthood social competence was tested with the three-chamber social approach task and behavioral control and attention were tested with the 5-choice serial reaction time task.
Progression up to now:
Behavioral control: Adult male rats that were reared in a complex environment from postnatal day 26 onwards showed impairments in behavioral control and improved attention, as measured with the 5-choice serial reaction time task (published in Van der Veen et al., 2015), but there were no effects of MD. However, in a second experiment, MD male rats did show impairments in behavioral control, yet only after the rats also received a 3-day vehicle injection treatment in early adolescence, which might have been a second hit (published in Kentrop et al., 2016). Early adolescent Mifepristone treatment did not counteract the effects of early life stress.
Social competence: MD decreased social play, while the complex housing intervention increased social play in adolescent males. However, there was no significant interaction between MD and complex housing. MD and complex housing did not affect social play in adolescent females. In adulthood, MD impaired social discrimination in both males in females. That is, compared to non-deprived controls, maternally deprived rats were less able to discriminate between an unfamiliar and familiar rat. Unfortunately, complex housing was not able to moderate the effects of MD. Data on the effects of MD and mifepristone are currently being analyzed.
Conclusions: Early life stress in the form of maternal deprivation seems to have negative effects on behavioral control and social competence, though the effects are rather small and in some cases only emerge in combination with a putative second hit. Moreover, as complex housing was not able to moderate the effect of MD in any of the measured behaviors thus far, complex housing cannot be regarded as an effective intervention strategy for the negative effects of early life stress.

Jelle Knop, PhD student, Apr/16 – Apr/20

Testing the differential susceptibility theory in mice
Van IJzendoorn, Joëls; Leiden University, Child and Family Studies and UMC Utrecht, Brain Center Rudolf Magnus
Aim: The early life environment is of crucial importance for development of an individual, in particular for those who are genetically more susceptible. Recent evidence suggests that this gene x environment interaction is important for both the negative effects of early-life stress, as well as the positive effects of a stimulating and supporting rearing environment. This *for better and for worse* principle is proposed in the differential susceptibility theory. However,

neurobiological underpinnings of differential susceptibility are poorly understood, highlighting the need of novel approaches that allow for thorough examination of neurobiology.
Therefore, the aim of this project is to establish an animal model to study the differential susceptibility theory in mice. Once established, this model will be used to study the underlying neurobiological mechanisms of differential susceptibility in greater spatiotemporal detail.
Methods: Heterozygous knockout mice of the Mineralocorticoid Receptor and Dopamine Receptor D4 are compared to wildtype siblings. After birth, litters will be exposed to either a negative, control of positive environment during postnatal day 2-9. The negative environment consists of a limited nesting/bedding model, resulting in chronic stress in pups via alterations in maternal care. The positive environment is created by a communal nesting paradigm in which two mothers and litters are co-housed, increasing maternal care. Offspring is then tested on several developmental measures and later-life behavior and neurobiology.
Progress up to now:
Review: We wrote a review on the added value of rodent models in studying the effects of parental care in offspring development (Knop et al., 2017).
Mineralocorticoid receptor: The first experiment on the mineralocorticoid receptor is finished. We found main effects of rearing conditions on puberty onset and main effects of genotype on fear conditioning and maternal care. Although there were no gene x environment interactions on the behavior of animals, this interaction was found for basal corticosterone levels. The results will soon be published.
Dopamine receptor D4: The experimental work on DRD4 KO animals is almost finished. Male offspring is tested on more parameters compared to the MRKO study to validate efficacy of the early-life stress paradigm.

Manila Loi, PhD student, Sep/13 – Sep/15

Intervention at puberty after early life adversity
Joëls, van IJzendoorn; UMC Utrecht, Dept. of Translational Neuroscience, Brain Center Rudolf Magnus (BCRM)

Aim: Early life adversity is a risk factor for the development of psychopathology in humans. The aim of this project was to understand *how* early life stress in a well-controlled rodent model affects various cognitive domains and whether this can be reversed by pharmacological intervention applied during a critical peri-pubertal developmental stage.
Methods: Wistar rat pups were removed from the mother for 24 h on postnatal day (PND) 3. Weaning was at PND21. Between PND26 and 28 the pups were treated twice daily with a glucocorticoid receptor antagonist (mifepristone), since this receptor is known to exacerbate damage to the brain. In adulthood (after PND90), rats were tested for spatial memory and decision-making.
Progression up to now: We observed that particularly in male rats (much more than in females), cognitive function was disturbed by maternal deprivation. This was normalized by brief peri-pubertal treatment with mifepristone. A very similar pattern was observed for glutamatergic transmission in key areas involved in these behaviors. Given the rapid but lasting reversal due to mifepristone treatment, we tested the possibility that this compound works through epigenetic programming. Indeed, the efficacy of mifepristone to restore cognitive function disturbed by maternal deprivation was hampered by co-treatment with a methyl-donor and facilitated by a histone deacetylase inhibitor infused into the area of interest.

Carien Mol, PhD student, Oct/15 – Jun/18

Twitter evolution: Comparative linguistics of birdsong and child language acquisition
Bolhuis, Kemner; UU Faculty of Social and Behavioral Sciences

Aim: Both human language and birdsong involve complex, patterned vocalizations, implying that human infants and songbirds must solve common tasks, such as segmenting sounds into 'chunks' and pattern recognition. The aim of this study is to investigate the role of specific acoustic features in birdsong memory and recognition. A secondary aim is to develop methods to improve behavioral analysis of birds during experiments.
Methods: We will use zebra finches as model species for human speech and language. Firstly, song recognition will be studied by exposing adult zebra finches to their father's song and an unfamiliar song in auditory discrimination tests. A behavioral response difference of the birds towards these songs will imply recognition of the father's song. The role of specific acoustic features for song recognition will be studied by systematically manipulating the songs. We assume that if certain features are important for recognition, the behavioral response of the birds will change towards the manipulated songs. Secondly, we will develop methods to be able to analyse the behaviour of the birds with more detail, and hence, more subtle differences in the behaviour of the birds will be detectable.
Progression up to now: We wrote a review of the parallels between birdsong and human speech, and proposed that future comparative research should expand its focus to include prosody, i.e. the temporal and melodic properties

that extend over larger units of song (co-authors Aoju Chen, René Kager and Sita ter Haar). Furthermore, we developed an experimental set-up to conduct auditory discrimination tests. Also, the first tests are conducted and, at the moment, we are writing a research paper about the results of these tests. Lastly, we developed a more detailed plan to improve the methods of analyzing the behavior of birds during the experiments.

Dr. Angela Sarabdjitsingh, Assistant professor, Nov/13 – Sep/18

Genetic resilience to early life stress effects on the behavioural trajectory in mice
Joëls; UMC Utrecht, Dept. of Translational Neuroscience, Brain Center Rudolf Magnus (BCRM)

Aims: The general aim of this project is to model the neurodevelopmental aspects of behavioral and cognitive domains after early life stress (ELS) in male and female mice. Mineralocorticoid receptor (MR) function is considered important in mediating stress resilience. We therefore aim to study the contribution of high/low brain-specific MR expression to ELS and the behavioral trajectory.
Methods: We have used a novel approach for developmental behavioral analysis in which mice are assessed at different developmental stages on a series of behavioral tasks (behavioral control) measuring general health, neurological reflexes, locomotor activity, anxiety, short- and long-term memory and cognitive flexibility (Molenhuis et al., 2014). We use this longitudinal testing battery to assess the effects of early stress in males and females. Additionally we look at acute stress reactivity in these mice
Progression up to now: all experimental work has been concluded and data analysis is ongoing for the behavioural assessments. Several manuscripts are being drafted in which we discuss the effect of MR and ELS on the development of behavioural domains in male and female mice. Another paper will address acute stress reactivity in this experimental setup. Additionally, one final paper will discuss the effects of MR and ELS on neuronal excitability and morphology in the mPFC (in collaboration with dr Henk Karst).

Dr. Rixt van der Veen, Assistant professor, Oct/13 – Oct/20

Influence of early life environment on later life social behaviour in animal models.
Joëls, Bakermans-Kranenburg, van IJzendoorn. Child and Family Studies (Leiden University) and Translational Neuroscience (UMC Utrecht).

Aim: In this project we bridge WP2 (human) and WP4 (animal models) by trying to capture in animal models the early life influences on the development of the social brain, as observed in human studies.
Methods: To this end, we have developed two approaches: The first is a rat model of neglect (maternal deprivation) in which we test outcome on several aspects of social behavior, both in adolescence and adulthood. The rat is the species of choice for testing (pro)-social behavior. In this study we use an environmental intervention during adolescence to possibly counteract negative early life influences. The second approach is a mouse model of genetic differential susceptibility in which we provide both an impoverished (providing limited bedding/nesting material) and a stimulating (communal nesting) early life environment and we test outcome on maternal care and behavioral flexibility. We use mineralocorticoid (MR) and dopamine receptor D4 (DRD4) heterozygous knock-out animals to study gene-early life environment interactions.
Progression up to now: The maternal deprivation (MD) protocol in our rat line let to changes in social behavior in both adolescence and adulthood. Housing in large, two stories cages with many peers and changing elements affected social behavior in itself, but did not counteract early life effects (manuscript accepted in Front in Beh Neurosc). We have set-up two pro-social tasks: a two choice task based on gaining sugar rewards for both self and cagemate and a liberation task. In both tasks rat can show their motivation for pro-social behavior by lever pressing. We are currently running our experimental groups in these tasks. In the mouse model, we have run an experiment with heterozygous MR knock-out mice. Our two conditions yielded clear differences in maternal behavior and affected the offspring in bodyweight and puberty onset (paper in progress) Fear conditioning in males was not affected by early life context.

Mariëlle A.J. Zondervan-Zwijnenburg, PhD student, Jul/14 – Mar/19

Formalization and evaluation of prior knowledge based on prior/posterior predictive inference
Hoijtink, van Berkum; UU Faculty of Social and Behavioral Sciences

Aim: The aim of this project is to formalize and evaluate prior knowledge. Formalizing prior knowledge means that we search for prior information in literature and develop methods to elicit this knowledge from experts. Evaluating prior knowledge means that we confront previous studies with replication efforts, and that we evaluate hypotheses

derived exploratory data with confirmatory data from multiple cohort studies.
Methods: We program our methods in R and R Shiny to make them accessible. For the multi-cohort studies we evaluate the informative hypotheseds in R with BaIn.
Progression up to now: We published papers on guidelines in formalizing knowledge based on literature and expert knowledge. We are revising a paper on evaluating the coherence between prior knowledge based on a previous study and new study (i.e., replication). Related to that paper is the R-package ANOVAreplication and the online application at https://utrecht-university.shinyapps.io/anovareplication/. We have revised a paper on the performance of estimation methods with and without formalized knowledge. We are revising a paper in which parental age at the birth of a child predicts the child's behavior problems with data from multiple cohorts. We are conducting analyses for a second paper based on multiple cohorts in which we predict school performance and attention problems from parental age at the child's birth. We are also writing a tutorial on evaluating the replication of studies beyond the ANOVA model.

Valeria Bonapersona, PhD student, Sep/17 – Sep/21
Department of Translational Neuroscience, Brain Center Rudolf Magnus, UMC Utrecht

Impact of early life adversity on networks: pathways, transmitters, cognitive domains
Joëls (UMC Utrecht, Brain Center Rudolf Magnus and UMC Groningen) and Hoijtink (Utrecht University)

Aim: Early life is a sensitive period for brain development, during which the brain rapidly wires. This process is essential for entraining new social and cognitive skills mediating the healthy transition from childhood and adolescence to adulthood. The dynamic wiring of the brain is strongly liable to influences of the environment, such as adverse experiences, including stress. Yet, little prospective information about the link between early life stress and wiring of the brain is available. Therefore, the aim of this project is to build an extensive and comprehensive model of early life stress effects on rodent brain function, specifically focusing on the pathways, transmitter systems involved and cognitive domains associated with these pathways.

Methods: In this project, we use wet and dry lab techniques to investigate the effects of stress in early life on the wiring of the brain. The approach is integrative and complementary as it combines research synthesis techniques (e.g. meta-analyses) with (Bayesian) statistical models and animal testing. We use existing data to build statistical models to test the theories of early life stress, which are then confirmed with animal experiments. These models can later be used to develop informed theories for human development based on knowledge obtained from animal research.

Progress up to now: We have so far conducted two extensive meta-analyses on rodent literature. The first concerned the effects of early life stress on dopamine as neurotransmitter system (currently *in press*). In the second, we investigated the effects of early life stress on behavior, and we are currently writing the manuscript. We have recently started a third meta-analysis on the effects of early life stress on the neurotransmitter system GABA, and a systematic review will begin in October concerning the network of neuronal activation involved in fear learning. Concerning the animal work, we are piloting the feasibility of the imaging techniques we would like to use in our experiments. Overall, the progress of the project is on track.

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