# COGNITIVE NEUROSCIENCE

FACULTY OF SOCIAL SCIENCES

**RADBOUD UNIVERSITY**

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This report was finalised on 21 April 2020.

# REPORT ON THE MASTER'S PROGRAMME COGNITIVE NEUROSCIENCE OF RADBOUD UNIVERSITY

This report takes the NVAO's Assessment Framework for the Higher Education Accreditation System of the Netherlands for limited programme assessments (September 2018) as a starting point. Since this report considers a research master's programme, the NVAO's Specification of additional criteria for research master's programmes (May 2016) are considered additionally as supplementary to this framework.

## ADMINISTRATIVE DATA REGARDING THE PROGRAMME

**Master's programme Cognitive Neuroscience**

| | |
|---|---|
| Name of the programme: | Cognitive Neuroscience (research) |
| CROHO number: | 60506 |
| Level of the programme: | master's |
| Orientation of the programme: | academic |
| Number of credits: | 120 EC |
| Specialisations or tracks: | Language and Communication<br>Perception, Action and Control<br>Plasticity and Memory<br>Brain Networks and Neuronal Communication (per September 2019: Neural Computation and Neurotechnology) |
| Location(s): | Nijmegen |
| Mode(s) of study: | full time |
| Language of instruction: | English |
| Submission deadline NVAO: | 01/05/2020 |

The visit of the assessment panel Cognitive Neuroscience to the Faculty of Social Sciences of the Radboud University took place on the 28th of November 2019.

## ADMINISTRATIVE DATA REGARDING THE INSTITUTION

| | |
|---|---|
| Name of the institution: | Radboud University |
| Status of the institution: | publicly funded institution |
| Result institutional quality assurance assessment: | positive |

## COMPOSITION OF THE ASSESSMENT PANEL

The NVAO has approved the composition of the panel on the 14th of October 2019. The panel that assessed the master's programme Cognitive Neuroscience at Radboud University consisted of:

- Prof. dr. S.F. (Susan) te Pas, professor Cognitive Psychology at the University Utrecht [chair];
- Prof. dr. R.T. (Rudi) D'Hooge, professor Biological Psychology at the KU Leuven (Belgium);
- Prof. dr. R. (Rufin) Vogels, professor Cognitive and Visual Neuroscience at KU Leuven (Belgium);
- Prof. dr. F.A.J. (Frans) Verstraten, professor and McCaughey Chair in Psychology at the University of Sydney (Australia);
- E. (Ekin) Tünçok BSc, master's student Cognitive and Clinical Neuroscience at Maastricht University [student-member].

The panel was supported by P. (Petra) van den Hoorn MSc, who acted as secretary.

# WORKING METHOD OF THE ASSESSMENT PANEL

The site visit and assessment of the master's programme Cognitive Neuroscience of the Faculty of Social Sciences of Radboud University was part of the cluster assessment Cognitive Neuroscience (WO OZM Cogn/Neurowet 1)[1]. Between October and November 2019, the panel assessed four programmes at four universities. The following universities participated in this cluster assessment: Maastricht University, Vrije Universiteit Amsterdam, Erasmus University Rotterdam and Radboud University.

On behalf of the participating universities, quality assurance agency QANU was responsible for logistical support, panel guidance and the production of the reports. P. (Petra) van den Hoorn MSc was project coordinator for QANU and acted as secretary in the cluster assessment. Mr. H. (Hester) Minnema supported her as secretary during the site visits at Maastricht University and Vrije Universiteit Amsterdam. Both are certified NVAO secretaries.

*Panel members*
The members of the assessment panel were selected based on their expertise, availability and independence. The panel consisted of the following members:

- Prof. dr. S.F. (Susan) te Pas, professor Cognitive Psychology at Utrecht University [chair];
- Prof. dr. R.T. (Rudi) D'Hooge, professor Biological Psychology at KU Leuven (Belgium);
- Prof. dr. T. (Tobias) Kalenscher, professor Comparative Psychology at Heinrich Heine Universität Düsseldorf (Germany);
- Prof. dr. E.A. (Eddy) van der Zee, professor Molecular Neurobiology at University of Groningen;
- Prof. dr. N.J.A. (Nic) van der Wee, professor Biological Psychiatry at Leiden University Medical Centre;
- Prof. dr. C. (Christian) Steinhäuser, professor and director of the Institute of Cellular Neurosciences at the University of Bonn (Germany);
- Prof. dr. R.A.H. (Roger) Adan, professor Molecular Pharmacology at Utrecht University;
- Prof. dr. C.M.A. (Cyriel) Pennartz, Hoogleraar Cognitive and Systems Neuroscience at the University of Amsterdam;
- Prof. dr. R. (Rufin) Vogels, professor Cognitive and Visual Neuroscience at KU Leuven (Belgium);
- Prof. dr. F.A.J. (Frans) Verstraten, professor and McCaughey Chair in Psychology at the University of Sydney (Australia);
- M. (Mesian) Tilmatine BSc, master's student Cognitive Neuroscience at Radboud University Nijmegen [student member];
- E. (Ekin) Tünçok BSc, master's student Cognitive and Clinical Neuroscience at Maastricht University [student-member].

*Preparation*
On 16 September 2019, the panel chair Prof. dr. S.F. (Susan) te Pas was briefed by QANU on her role, the assessment framework, the working method, and the planning of site visits and reports. A preparatory panel meeting was organised on 14 October 2019. During this meeting, the panel members received instruction on the use of the assessment frameworks. The panel also discussed their working method and the planning of the site visits and reports.

The project coordinator composed a schedule for the site visit in consultation with the Faculty. Prior to the site visit, the Faculty selected representative partners for the various interviews. See Appendix 4 for the final schedule.

Before the site visit to Radboud University, QANU received the self-evaluation report of the programme and sent it to the panel. A thesis selection was made by the panel's chair and the project

[1] The cluster WO OZM Cogn/Neurowet 2 will be assessed in 2023.

coordinator. The selection existed of 15 theses and their assessment forms, based on a provided list of graduates between 01-08-2018 and 31-08-2019. A variety of topics and tracks and a diversity of examiners were included in the selection. The project coordinator and panel chair assured that the distribution of grades in the selection matched the distribution of grades of all available theses. For the specialisation Language and Communication 2 out of 8 theses were selected, for the specialisation Perception, Action and Control 4 out of 13, for the specialisation Brain Networks and Neuronal Communication 1 out of 4, and for the specialisation Plasticity and Memory 8 out of 25 theses were selected.

After studying the self-evaluation report, theses and assessment forms, the panel members formulated their preliminary findings. The secretary collected all initial questions and remarks and distributed these amongst all panel members.

*Site visit*
The site visit to Radboud University took place on the 28th of November 2019. Before and during the site visit, the panel studied the additional documents provided by the programme. An overview of these materials can be found in Appendix 5. Prof. dr. F.A.J. (Frans) Verstraten could not attend the site visit. Just like the rest of the panel, he did read the self-evaluation report and a selection of theses and reported his findings to the panel and the secretary.

At the start of the site visit, the panel discussed its initial findings on the self-evaluation report and the theses, as well as the division of tasks during the site visit. During the visit, the panel conducted interviews with representatives of the programme: students and staff members, the programme's management, alumni and representatives of the Examination Board. It also offered students and staff members an opportunity for confidential discussion during a consultation hour. No requests for private consultation were received.

The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the panel's preliminary findings and general observations. In 2020, (probably June) the visit will be concluded with a development day, held together with all participating universities in this cluster, in which panel members and representatives of the cluster's programmes will discuss various development routes for the programmes during so-called development dialogues. The results of this development day will be published through the programmes' communication channels.

*Consistency and calibration*
In order to assure the consistency of assessment within the cluster, various measures were taken:
- The panel composition ensured regular attendance of (key) panel members, including the chair;
- The project coordinator was present during all site visits.

*Report*
After the site visit, the secretary wrote a draft report based on the panel's findings and submitted this to a colleague for peer assessment. Subsequently, the secretary sent the report to the panel. After processing the panel members' feedback, the project coordinator sent the draft report to the Faculty in order to have it checked for factual irregularities. The project coordinator discussed the ensuing comments with the panel's chair and changes were implemented if deemed necessary. The report was then finalised and sent to the Faculty and University Board.

*Definition of judgements standards*
In accordance with the NVAO's Assessment framework for limited programme assessments (2018), the panel used the following definitions for the assessment of the standards:

**Generic quality**
The quality that, from an international perspective, may reasonably be expected from a higher education Associate Degree, Bachelor's or Master's programme.

**Meets the standard**
The programme meets the generic quality standard.

**Partially meets the standard**
The programme meets the generic quality standard to a significant extent, but improvements are required in order to fully meet the standard.

**Does not meet the standard**
The programme does not meet the generic quality standard.

The panel used the following definitions for the assessment of the programme as a whole:

**Positive**
The programme meets all the standards.

**Conditionally positive**
The programme meets standard 1 and partially meets a maximum of two standards, with the imposition of conditions being recommended by the panel.

**Negative**
In the following situations:
- The programme fails to meet one or more standards;
- The programme partially meets standard 1;
- The programme partially meets one or two standards, without the imposition of conditions being recommended by the panel;
- The programme partially meets three or more standards.

# SUMMARY JUDGEMENT

*Intended learning outcomes*
The panel agrees with the programme's profile and the four specialisations. It established that the programme places a strong emphasis on the cognitive aspects of neuroscience, which is recognisable in the different specialisations. It prepares the students for a research career in the interdisciplinary field of the domain of cognitive neurosciences and caters to the needs of society. To stay in touch with the expectations of the professional field, the programme's alumni could be consulted more in this respect. The panel has established that the intended learning outcomes are in line with the Dublin descriptors and with the Domain-Specific Framework of Reference. They are clearly formulated and highly specific. They adequately represent the high standards suitable for a research master's programme, aimed to train students to become independent researchers.

*Teaching-learning environment*
The panel established that the research context in which the RMa is being taught is excellent. The Donders Graduate School hosts the programme, which is embedded in the Donders Institute for Brain, Cognition and Behaviour (DI). For many students, the affiliation with the DI was the very reason to opt for this programme. The DI has many state-of-the-art lab facilities of high quality, which the students may use for their research. The centre has an outstanding research productivity, in terms of both third-party funding success and publication output. The panel applauds the programme's decision to link the programme's specialisations to the four research themes at the DI, because it enhances the relationship between theory and practice.

The panel concludes that the programme provides state-of-the-art content, which fits a research master. It's curriculum enables the students to achieve the intended learning outcomes. It provides them with the essential skills to become a researcher in the field, in or outside academia. The panel advises devoting more time to the topic of ethics, however. It appreciates the way the programme is structured. Because the students enter the programme with such variety in their educational background, the panel appreciates the fact that the specialisation courses and electives offer them the opportunity to create a tailored programme which best fits the students' prior knowledge, interests and career plans. At the same time, the programme ensures that all students gain the same level of knowledge and skill to become excellent researchers in the field. The panel concludes that the students are thoroughly prepared for a PhD position. However, they receive little information about their job opportunities outside academia. The panel advises the programme to pay more attention to this, because the skills and knowledge taught in the programme can be well applied in non-academic settings as well.

The teaching methods show little variety, and the panel thinks the staff should invest time and effort in pursuing other methods of teaching throughout the programme. The Innovation Teaching Day and the Teaching and Learning Centre could prove to be a useful source of inspiration in this respect. In addition, the panel established that the amount of feedback given to the students largely differs between courses and lecturers and recommends that the programme management increases its effort to streamline the amount of feedback and the way it is given throughout the programme.

The panel is satisfied with the programme's choice to have students complete one long internship, in which they experience the entire research cycle. The internships usually take place at the DI, but an external internship is also allowed. The students write their master's thesis based on the results of the research performed during the internship. They are supervised by a Principal Investigator (PI) of the DI. The panel thinks the internship and thesis adequately prepare the students for a career as an independent researcher, by offering a good balance between guidance and freedom. The students mentioned that the amount and type of supervision offered, differs between supervisors. The panel recommends designing more guidelines for supervision to make sure all students are guided and supervised in a consistent way.

According to the panel, the selection and admission requirements are well chosen, transparent and adequate for this programme. It appreciates the fact that candidates are not simply rejected over one deficiency, but get the chance to catch up during the programme. The students are provided with enough freedom to build their own programme and are stimulated to take the lead in this: the courses, lab visits and the internship are open for choice. The panel considers this a strength of the programme. In its opinion, the programme is feasible, and delay is unnecessary in most cases. In order to help the students to finish on time, the panel suggests communicating a more formal deadline for handing in the thesis.

The panel is satisfied with the programme's teaching staff. Professors and PI's at the Donders Institute embody the core team of lecturers in the courses and are actively involved in the supervision of the graduation trajectories. The staff is easily approachable and very committed to helping the students when needed. In the internship, the supervisors make the students feel a member of the research group and carefully monitor their well-being. The panel advises monitoring more closely whether staff members who are also appointed as examiners possess a UTQ.

*Student assessment*
According to the panel, the programme has a solid set of documents and procedures in place which secure an adequate assessment system. All of the programme's intended learning outcomes are being assessed throughout the separate courses. The panel observed that the assessment methods are sufficiently varied and suitable for the learning outcomes that they are meant to assess and reflect the level of the programme. It appreciates the two- or threefold assessment in several courses. It recommends monitoring the balance between formative and summative assessments more. The panel advises the specialisation coordinators and the examination board to look for ways to further equalise and standardise assessment formats across the different courses.

The panel is of the opinion that the evaluation procedure of the internship and thesis is sound and detailed and reflects the academic level of the programme. The forms used are well-designed and clear, and generally speaking, the panel agreed with the final grades given by the examiners. The programme management should pay more attention to the amount of feedback the examiners provide on the assessment form.

The panel ascertained that the examination board adequately handles all of its legally mandated tasks. It appreciates the board's plans to move from the quality assurance of assessment on a programme level towards the quality assurance of the courses' assessment on the specialisation level. Annually, the board randomly selects theses for re-examination. The panel recommends that it organise calibration sessions with the programme's staff, during which theses and their assessment forms are reviewed, to equalise the standards and expectations of the master's thesis. With regard to the course assessments, the panel advises the board to evaluate a number of courses in terms of their content, level and grading, in order to make the assessments more consistent across the programme.

*Achieved learning outcomes*
The panel determined that the programme's final project (the internship and master's thesis) lets the students perform a full research cycle. It assessed that the level of the theses is more than adequate; most of them are of good to excellent quality. The theses show that the students achieve the intended learning outcomes and thus the research master's level.

Most of the programme's alumni end up in PhD positions. A large percentage of alumni have positions related to research (inside or outside academia). Therefore, the panel concludes that the programme achieves its goal to educate researchers. Some graduates pursue a career in the field of health care, policy making, or work for the government. Others set up their own business. For various reasons, the panel suggests that the programme management should strengthen their relationship with graduates.

The panel assesses the standards from the *Assessment framework for limited programme assessments* in the following way:

*Master's programme Cognitive Neuroscience*

| | |
|---|---|
| Standard 1: Intended learning outcomes | meets the standard |
| Standard 2: Teaching-learning environment | meets the standard |
| Standard 3: Student assessment | meets the standard |
| Standard 4: Achieved learning outcomes | meets the standard |
| | |
| General conclusion | positive |

The chair, Susan te Pas, and the secretary, Petra van den Hoorn, of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 21 April 2020.

# DESCRIPTION OF THE STANDARDS FROM THE ASSESSMENT FRAMEWORK FOR LIMITED FRAMEWORK ASSESSMENTS

**Standard 1: Intended learning outcomes**
The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

**Findings**

The Research master's programme (RMa) Cognitive Neuroscience aims to acquaint students with state-of-the-art research techniques in the key research areas of cognitive neuroscience. It provides students with an in-depth theoretical background and thorough hands-on experience with research. Ultimately, the programme's objective is to train students to successfully embark on a research career in this domain, in or outside academia. It acknowledges the interdisciplinary nature of the domain of cognitive neurosciences. Therefore, the students learn about topics and methodological techniques in various disciplines such as cognitive psychology, neurobiology, biophysics, neuroscience, neuropsychiatry, neuropsychology, linguistics, psycholinguistics, and artificial intelligence. The programme emphasises the study of cognitive functions such as perception, memory, action, and language at multiple, inter-related levels. The students receive elaborate practical training in setting up, conducting and reporting on research in cognitive neuroscience. The programme aims to prepare students for PhD projects or comparable research positions in cognitive neuroscience.

The programme offers four specialisations. The first, Language and Communication, aims to understand language. Research in this specialisation focuses, for instance, on how the human language capacity is rooted and how it is evolving, and how we produce, understand, and learn language in speech, sign and gesture. The second specialisation, Perception, Action and Control, focusses on understanding how the world is perceived, and how these perceptions are translated into decisions on motor action. It has a focus on disorders of movement, such as Parkinson's disease. The third specialisation, Plasticity and Memory, looks at long-term changes in neural structure and function. It aims to understand adaptation to environmental challenges, and how neuroplasticity supports development during childhood. The research focuses on fundamental knowledge, as well as topics related to Alzheimer's disease, neurodevelopmental disorders and stress-related disorders. The fourth and final specialisation, Brain Networks and Neuronal Communication[2], focuses on the interaction between and within groups of neurons. It studies the working principles of cognitive key functions such as perception, memory, language, and targeted action from a multidisciplinary perspective. The panel appreciates the programme's choice to have four separate specialisations. Students can choose in whichever topic of cognitive neuroscience they want to submerge themselves. Three specialisations are oriented towards functions of the brain, one specialisation (the fourth) is more methodically oriented. The Donders Institute (DI) hosts the programme. This research institute is embedded in the Radboud University and the Radboudumc. The programme's four specialisations correspond directly with the research themes of the DI. The panel thinks this is a strength because it ensures a close relationship between the programme's content and state-of-the-art research in the field.

The panel agrees with the programme's choice of profile and the four specialisations. It thinks the profile is clearly defined and fits the needs of society. It established that, compared to related programmes in the Netherlands, this programme places a relatively strong emphasis on the cognitive aspects of neuroscience. The curriculum is primarily geared towards preparing students for a PhD trajectory. The panel thinks the skills and knowledge taught can also be used in other professional careers, such as a research career outside academia or a position in the field of clinical or mental

[2] The DI recently changed the focus of the fourth research theme, by placing a larger emphasis on neurotechnology. Following this revision, the focus and name of the fourth specialisation changed accordingly. From September 2019, this specialisation was renamed Neural Computation and Neurotechnology.

health. It applauds the fact that since the last reaccreditation, the programme has become more and more inclined to provide students with insight into the societal impact of the research in the field of cognitive neuroscience. Recently, the programme started a collaboration with a related master's programme at Glasgow University, to discuss the course contents, teaching methods and possible career trajectories. The panel thinks the programme could also use its alumni in this respect, as they provide a rich source of information regarding the relationship between the curriculum and the expectations of the professional field.

*Intended learning outcomes (ILOs)*
The programme defined 17 final qualifications (intended learning outcomes; ILOs) divided into six categories: general cognitive skills, skills based on knowledge and insights pertaining to the field of cognitive neuroscience, research methods related to the field, general communication skills, reflection on society and societal problems, and professional attitude (Appendix 2).

According to the panel, the ILOs are well in line with and structured according to the Dublin descriptors. They are also aligned to the Domain-Specific Framework of Reference for master's programmes in Neurosciences (Appendix 1).

The panel is positive about the clearly described intended learning outcomes: they are very specific, stating exactly which skill or knowledge the students should master. The panel ascertained that all aspects of academic skills are covered in the ILOs, from retrieving general and domain-specific knowledge and critically reflecting on this to drawing inferences from research and deriving applications in society. To the panel, the ILOs adequately represent the high standards suitable for a research master's programme. In its opinion, they emphasize the programme's aim to train students to become more independent researchers compared to a regular master's programme, which suits an RMa.

**Considerations**
The panel agrees with the programme's profile and the four specialisations. It established that the programme places a strong emphasis on the cognitive aspects of neuroscience, which is recognisable in the different specialisations. It prepares the students for a research career in the interdisciplinary field of the domain of cognitive neurosciences and caters to the needs of society. To stay in touch with the expectations of the professional field, the programme's alumni could be consulted more in this respect. The panel has established that the intended learning outcomes are in line with the Dublin descriptors and with the Domain-Specific Framework of Reference. They are clearly formulated and highly specific. They adequately represent the high standards suitable for a research master's programme, aimed to train students to become independent researchers.

**Conclusion**
*Master's programme Cognitive Neuroscience:* the panel assesses Standard 1 as 'meets the standard'.

**Standard 2: Teaching-learning environment**
The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

**Findings**

*Structure of the programme*
The two-year programme (120 EC) entails a mix of courses on basic knowledge, skills training, and a number of electives (Appendix 3). To familiarize the students with the overall structure of the programme and to get acquainted with the programme management and each other, the students follow a five-day introduction course before the start of the academic year. This course encompasses informative meetings on the content of the programme and social events to build a sense of community. This is followed by a one-week course on Neuroanatomy, in which students get to

examine the human brain up close. Both the introduction course (no credits) and the Neuroanatomy course (3 EC) are electives.

The programme has a set of general compulsory courses (27 EC) in place, providing the students with knowledge and skills on a variety of neuroscience-related topics. For instance, they are acquainted with the latest research developments in the field (Trends in Cognitive Neuroscience) and contemporary imaging techniques (Neuroimaging I and II). Neurophilosophy challenges students to think critically about and discuss ethical issues that emerge when studying the (human) brain. Through the Lab Rotations course (3 EC), they are exposed to current neuroscience research at the Donders Institute. They visit three labs at different research groups (each lab visit encompasses 1 EC) and perform small assignments in order to get hands-on research experience. The panel feels the lab visits are a good way to let the students learn about the main research questions of the research group and the type of experiments they conduct. This gives them a broad overview of the domain of neuroscience and the type of internship they might want to embark on in their second year. Although the lab visits can be carried out throughout the entire programme, the students are advised to complete all three lab visits within the first year.

Next, for each specialisation, 30 EC worth of courses need to be chosen from a set of seven (6 EC each). These courses provide students with the required theoretical knowledge considered essential to embark on a career related to the specialisation. The rest of the curriculum comprises of skills training courses (6 EC), free electives (12 EC) and the internship combined with the writing of the master's thesis (45 EC). Courses on skills training provide training in, for example, academic writing, mathematics, and neuroanatomy. The student may choose one of six courses per year (3 EC each). With the electives, the students can either deepen their knowledge (e.g. by completing the set of seven courses offered within their specialisation) or broaden their knowledge (by choosing electives offered within or outside the programme). At the start of the programme, they design their own Training and Supervision plan (TSP), in which they state all planned courses which best fit their interests and career plans. The programme coordinator checks the feasibility of the plan and can also be consulted for advice. When choosing electives, students are advised to select courses which serve the preferred domain of their internship or their envisioned career. Those who feel they lack knowledge of certain topics or skills can use the elective space for courses on those topics. During the site visit, the students told the panel that they felt there is sufficient space and opportunity to follow the courses they are most interested in.

For each course, learning objectives are formulated that contribute to the realisation of one (or more) intended learning outcome(s). The panel noted that, with the set of compulsory courses, all ILOs are already covered, so the courses related to the specialisations and the electives are all supplementary, allowing students to choose the particular field in which they want to strengthen their knowledge or skills and create their own niche.

The panel read the programme's prospectus and concludes that the programme provides state-of-the-art content, which fits a research master. All ILOs are covered in multiple courses, and the set-up of the programme is very clear. The curriculum enables the students to achieve the ILOs. The general courses provide a good overview of the field, the specialisation-specific courses are geared towards a specific aspect of the domain of cognitive neuroscience, and the electives provide room to deepen or broaden the student's knowledge, or to remedy any deficiency. The panel appreciates the programme's decision to link its specialisations to the four research themes at the Donders Institute. Therefore, it is easy for the students to connect the theoretical knowledge they gain during the courses with the practical skills of doing research during the internship. This also adds to the programme's coherence across both years.

According to the panel, the programme's courses and the internship provide the students with excellent skills to become researchers in the field, in or outside academia. The general courses provide them with knowledge and skills and familiarise them with the scientific methods which are typically used in the field. The specialisation-related courses take this a step further and introduce

them to the methods related to their specific theme. Many courses pay attention to both the theoretical content and the research skills related to it. This enables the students to absorb all there is to know about the specialisation-related topics and be fully prepared for a career in that particular area. Because the students enter the programme with such a variety in educational background (see *Admission requirements)*, the panel appreciates the fact that they are free to choose whichever skill they think will be most helpful for their study or their career. For instance, those who already have advanced knowledge in the field of statistics are not obliged to follow another course in this area and can spend their time on courses they are actually interested in. After interviewing the students, the panel concluded that they are clearly capable of making such informed choices, and it appreciates the freedom the students receive from the programme. To guarantee a coherent programme for all students, the individual choices are always checked by the programme coordinator, via the TSP. The panel believes the programme could devote more time to the topic of ethics. Currently, it is covered in the Neurophilosophy course, but the panel thinks this course is rather short for in-depth discussions of ethical issues. Therefore, it advises the programme to consider possibilities to get the students thinking about ethics in more courses, for example by letting them read an ethical dossier of one of the research projects of a senior researcher or write an ethical proposal themselves.

During the last accreditation, the review panel recommended that the programme management put more effort into safeguarding the programme's coherence. In response, the programme now has specialisation coordinators in place. Since the programme's specialisations correspond one-to-one with the research themes within the Donders Institute, each specialisation is represented by one researcher from the corresponding theme group. The four coordinators are tasked with coordinating monthly team meetings in order to improve the programme's coherence. Nevertheless, the panel thinks the structure of the programme could be further improved. Both in the student chapter of the Self-evaluation Report (SER), and during the site visit, the students indicated that the aim of some courses could be stated more clearly. And occasionally, course contents were already known to the students, because they had already been discussed in a previous course. The panel encourages the programme management to find a way to enable staff members to fine-tune their courses more effectively.

*Research project*
The students complete the programme by carrying out a research project supervised by senior researchers (i.e. Principal Investigators) of the DI and/or its affiliated institutes. The research project entails an internship and writing a master's thesis based on the results of the research performed during the internship. The student is asked to actively work under minimal guidance on a challenging problem in the domain of the cognitive neurosciences, related to their specialisation of choice. The goal for the research project is a comprehensive thesis that should in principle be eligible for submission to an international journal. To help students find an internship, researchers from the Donders Institute present their internship possibilities during a virtual internship market. The students can browse through the offers which are in line with their chosen specialisation and contact the Principal Investigator (PI) who offers the internship they are most interested in. Together, they draft the research project proposal, which is checked by a second reader (an expert in the field, but not involved in the project itself) and sent to the programme coordinator for final approval. Internships usually take place at the Donders Institute, but when it better fits their personal goals, the students may also choose to perform their internship at an external organisation. In that case, a PI at the Donders Institute is appointed as supervisor.

Every internship starts with a literature study and a solid research project proposal. When this proposal has been approved, the student starts by setting up and running the experiment, (pre)processing the data, and interpreting the results. The PI acts as on-site supervisor and is regularly present to discuss the interpretations and make decisions throughout the experiment. Based on the results of the internship, the student writes a thesis using the basic format of a research paper. Main elements such as a sound theoretical framework, well-argued research questions, and a critical discussion of the results should be present. Upon completion of the thesis, the student presents her/his project to the research group in which the project was performed.

The panel is satisfied with the programme's choice to have students conduct one long internship. Worth 45 EC, it covers most of the programme's second year and the panel has ascertained that this allows the students to personally experience a full research cycle hands-on. The internship starts with drafting a research proposal, followed by carrying out the research itself, and finally interpreting the data. Ultimately, this results in a master's thesis intended to culminate in a peer-reviewed scientific publication (albeit somewhat modified). The panel concluded that the internship trains the student to independently perform neuroscientific research from beginning to end.

During the research project, the students conduct their internship under the supervision and responsibility of a PI of the Donders Institute (who is in some cases also a lecturer of the programme). The PI has regular contact with the student, usually once a week, to discuss the process and progress of the research project. Daily supervision is provided by a PhD student or a postdoc. The research proposal (drafted before the start of the internship) assures a solid and clear research plan for both the student and the supervisors. According to the student chapter in the SER, the students experience a good balance between guidance and freedom in their internship and thesis writing. They stated that this part of the programme really prepares them for a career as an independent researcher. They learned a lot about the practical side of doing research, such as a proper recording of data, integrity, and privacy regulations. On a critical note, the students mentioned that the amount and kind of supervision differ between supervisors. Some students see their supervisor frequently because they schedule regular appointments with their supervisor in advance. Others do not use such a predetermined schedule and arrange impromptu meetings with their supervisor when they feel this is necessary. The panel has no preference for either method. It appreciates the fact that students can tailor the degree of supervision to their own needs. During the site visit, the students indicated that they can schedule spontaneous meetings with their supervisor without any difficulty. However, the students pointed out that more formal guidelines for supervision would be helpful for both the students and the supervisors. The panel agrees with this recommendation, since it will ensure that all students are guided and supervised in a consistent way.

*Admission requirements*
Generally around 60 students are selected each year to enrol in the programme. About 38 percent of them come from abroad. Most courses build to a large extent on a bachelor's level regarding knowledge and skills and a basic understanding of topics in the field of cognitive neurosciences. Therefore, the general requirement for admission to the RMa programme is a university bachelor's degree related to the cognitive neurosciences (psychology, artificial intelligence, linguistics, medicine or a related discipline). Successful applicants must proof of English language proficiency (TOEFL: 100; IELTS: 7.0). Aspiring students are asked to send in a letter of motivation, a recent CV, transcript of the courses they completed as part of their bachelor's programme accompanied by the grades, and two letters of recommendation. They also need to choose the specialisation they wish to enrol in. Eligible candidates are invited for an interview with the programme director or coordinator, in which background knowledge, motivation, expectations of the RMa programme, preference for a specific specialisation and future career plans are discussed. Selected candidates receive a letter of acceptance, which also states the specialisation of the programme for which they have been admitted. During the site visit, the programme management explained they wish to select active, ambitious, and autonomous students. In some cases, candidates are selected even though their prior knowledge is not up to standard, but they make up for it by a high level of motivation. In that case, the letter of acceptance states which courses they are advised to include in their TSP in order to remedy any deficiency. Over the past six years, the acceptance rate has been 35 percent.

According to the panel, the selection and admission requirements are well chosen for this programme. The procedures for admission are transparent and adequate. The panel thinks the interview is a good tool for selecting the right students, because it focuses on the strengths of each candidate. For example, candidates can show they are motivated enough to overcome one or two deficiencies. The panel truly appreciates the fact that these candidates are not simply rejected, but get the chance to catch up by including deficiency courses in their TSP. According to the programme,

the number of applications has been increasing over the past six years. So far, this has not affected the student-staff ratio (1:17) very much, but the panel thinks this is a point of attention for the future. When the number of applications increases, the selection might have to become stricter. As a result, there will probably be less room for students to address deficiencies. The panel would consider this an unwanted development, so it recommends the programme to think about possible scenarios to maintain a good student-staff ratio, while keeping a fair selection procedure in mind.

The courses of the programme are open to non-RMa programme students as well. In order to maintain a high enough quality of the student population in the courses, these students go through a short selection procedure before being allowed to take part in the course. The RMa programme coordinator makes this decision, based on a letter of motivation, transcript of records, a CV and proof of permission by their own programme coordinator. The panel appreciates this procedure. It emphasizes the higher level of the RMa courses and ensures that all students who enrol for the courses have the same ambitions and have an adequate level of prior knowledge.

*Student-centred learning and study progression*
The population of students shows a large variety in terms of educational background, nationalities, and culture. Naturally, their prior knowledge and skills vary: students with a bachelor's degree in psychology will have had more education in statistics and mathematics than those with a bachelor's degree in linguistics. During the admission procedure, this is carefully monitored by the programme. When the programme spots a deficiency in prior knowledge, it advises the student to use the elective space to follow certain courses to remedy this. This is also checked by the programme coordinator when the student hands in his/her TSP. The students told the panel they appreciate this. They feel that their talents, and shortcomings, are seen individually, and that the programme is willing to think along about how each student could be helped to complete the programme successfully. At the same time, they feel they are provided with enough freedom to build their own programme and are stimulated to take the lead in this. In the SER and during the site visit, the students expressed their satisfaction with the freedom to choose courses they are interested in, to select the labs for the Lab Rotations, to apply for an internship and conduct research on a specific matter that best suits their interests and future career plans. This allows them to deepen their understanding and expertise on the topics they are most interested in, which the panel considers a strength of the programme. On top of that, it was positively surprised to hear that when one of the students the panel met during the site visit could not find an internship to his liking at the virtual internship market, that student was allowed to design his own research project with his supervisor. The panel admires the fact that the programme and the Donders Institute (who made funds available to carry out the research) are interested in individual ideas and ambitions. This stimulates the students to become independent researchers.

Whenever they experience problems with their study, the students can turn to the programme coordinator or, in case of sensitive issues, the study advisor. The panel admires the initiative of the programme to have an annual brainstorm session (a retreat known as 'Studenten Heidag') at which the students are invited to share their experience with the programme and discuss their ideas for further improvement.

In the period between 2003-2017, 60 percent of the students graduated on time. With an extra three months, this number increased to 79 percent. According to the students, the programme is demanding, but feasible. Delays are usually due to a student's personal choices. In most cases, they wanted extra time to complete their thesis or decided to extend their internship period or work on a manuscript for publication. The panel is of the opinion that in many cases, the delay is unnecessary. In order to help students finish on time, the panel suggests communicating a more formal deadline for handing in the thesis. In its opinion, the students could still be given the freedom to decide to work on a research paper or extend their internship, but the graduation date is then set. In addition, the panel advises the programme to advertise its graduating ceremonies (in April and November) more as a rewarding event students should want to attend. The panel thinks these measures will improve the programme's success rate fairly easily.

*Teaching staff and guidance*
The courses and lectures are provided by researchers and other staff from the Donders Institute. For the Language and Communication specialisation, the Donders Institute has two affiliated institutes that are closely involved in the design and education of this particular specialisation: the Max Planck Institute for Psycholinguistics and the Centre for Language Studies. In this specialisation, the students are lectured by researchers from the Donders Institute as well as the affiliated institutes.

The panel met with highly qualified and dedicated teaching staff. The lecturers are actively involved in conducting and publishing their research in leading international journals, and the panel is therefore assured that they have a good command of the English language. For the sake of transparency, however, it would be wise to create a formal procedure for teachers stating when they need to do a language test for English proficiency or when they are eligible to be granted a waiver. About 64 percent of staff possesses a University Teaching Qualification (UTQ), 13 percent is in the process of obtaining it. Especially in the case of examiners, it is important that they possess a UTQ, so the panel advises the programme management and the examination board to monitor this more closely. In addition, the panel thinks that when more staff members obtain a UTQ, this will ultimately benefit the quality of feedback the students receive (see below).

The panel is very pleased with the fact that senior researchers and professors at the DI make up the core team of lecturers in the courses and are actively involved in the supervision of the graduation trajectories. The programme's staff regularly meet up to discuss educational issues and evaluate the programme's content. The recently appointed specialisation coordinators (see above) organise monthly PI meetings. Team meetings, planned by course coordinators, are devoted to evaluating and updating the content and set-up of a course.

The panel praises the staff members' commitment to the students. During the site visit, the students told the panel that they are very pleased with their teachers. The staff is very motivated and show a high level of commitment in helping the students when needed. This was confirmed during the conversation between the panel and the lecturers, who stated that they very much enjoy teaching their students. Discussing their own research topics with students who will become the next generation of researchers is very satisfying to them. According to the students, the lecturers are very approachable and take the time to answer questions or give advice, also outside the classroom. During the internship, the students feel that they become a member of the research group and that they are involved in its daily activities. In general, there is much informal interaction between the staff and students, and the staff members carefully monitor the students' well-being by tracking their study progress and addressing their overtime. The students value the fact that they are educated by high-level researchers in the field. At the same time, because the lecturers are top researchers, they sometimes have less time to teach. Therefore, the panel and the students feel that most courses have a very classical way of teaching. They consist of formal lectures, and in some cases the students are asked to present their work towards the end. The students would prefer the courses to move towards a more active student involvement in class. The students and the panel understand the difficulty teachers experience when trying to divide their time between teaching and conducting research. However, the panel believes the staff should invest time and effort in pursuing other methods of teaching throughout the programme. During the site visit, several options were discussed with the programme management, who agreed to the panel's opinion. During the proposed annual break-out session, the so-called Innovation Teaching Day, there could be workshops on innovative learning activities, and the lecturers could share their current teaching methods. Radboud's new Teaching and Learning Centre could also prove to be a useful source of inspiration in this respect. This centre, which opened its doors in January 2020, aims to improve the quality of teaching at the university. It wishes to inspire, facilitate and stimulate all lecturers at the university in their professional development, for instance regarding innovative teaching methods and helpful tools (including online ones). By implementing activating teaching methods, such as a discussion group, or a quiz to activate prior knowledge, the students will experience a smoother learning curve, which will positively affect both the students' and teachers' motivation for the course.

The students noted in the student chapter that they would like to receive more feedback concerning their skills (e.g. writing, critical thinking). In the Trends in Cognitive Neuroscience course, the panel observed that skills assessment is implemented in a fitting manner, and it advises other courses to use this as an example. Overall, the amount of summative feedback the student receives differs greatly between courses and lecturers. In some courses the feedback is part of a final assessment, in other cases it does not seem to be a regular part of the course. According to the panel, it is reasonable that the format and amount of feedback differ between courses. However, it got the feeling that in some courses, feedback is not provided at all, or only casually. In its opinion, all students should receive the same amount of feedback and in the same manner at certain points in the programme. This ensures that the students are informed about their learning progress at defined points in time and can adjust their learning process if need be. This was discussed during the site visit, and the panel was pleased to hear that the programme management agreed with the panel's advice to enhance its effort in streamlining the amount of feedback and the way it is given throughout the programme.

*Programme's language*
The choice to make the RMa an English-spoken programme is directly derived from the programme's intended learning outcomes, which expect graduates to be able to discuss a scientific topic in English (ILO 13). Other ILOs stating that students should be able to take a critical stance towards established scientific insights and have a good overview of the scientific literature (ILO 1) and be able to understand scientific articles on the chosen specialisation (ILO 8) can only be achieved when the students are introduced to international research in the field. For the panel, the choice for English as the language of instruction is self-evident since all research in the field of neuroscience is performed in English and the main aim of the programme is to prepare the students for a research career. Only an English-spoken research master can keep up with the high international standards, attract top researchers from different countries, and accommodate the highly international student population. As stated earlier, the panel is assured that the programme's lecturers, with their status of international researcher in the domain, have a good command of the English language.

*Research context and programme-specific facilities*
The Donders Graduate School hosts the programme, which is embedded in the Donders Institute for Brain, Cognition and Behaviour (DI). The panel established that the research context in which the RMa is being taught is excellent. This is supported by the latest external evaluation report (2013), in which the committee stated that the DI is staffed by top researchers, who have an important and substantial impact on the international field. The committee assessed the research on the four main criteria as ranging from very good to excellent.

The DI is a research centre focussed on the brain-, cognitive- and behavioural sciences. Over 600 researchers from 35 countries are devoted to understanding the mechanistic underpinnings of human cognition and behaviour in health and disease. The centre has an outstanding research productivity, in terms of both third-party funding success and publication output. Its senior researchers and professors are closely involved in the educational programme and the training of PhD students. Principal investigators at the DI are rated as excellent by their peers. In 2019, based on the number of peer-reviewed publications, five scientists at the DI ranked in the top 10 of scientists in their field, three of them are active in the RMa programme. Furthermore, three researchers of the institute (and staff members of the programme) recently received a NWO VICI grant. The DI was recently awarded with a EU's Horizon 2020 grant of €6 million, a ZonMw grant of €1.5 million, and a EU grant of nearly €3.5 million, for a research project led by the DI. The panel concludes the DI is an excellent context for students who wish to embark on a research career in the field of cognitive neuroscience.

The DI has many state-of-the-art lab facilities of high quality that are available to use for students, some of which the panel was able to observe during the site visit. These facilities include functional neuroimaging facilities, such as Magnetic Resonance Imaging (MRI) at 1.5, 3 and 7 Tesla, Electroencephalography (EEG) and Magnetoencephalography (MEG), and Transcranial Magnetic Stimulation (TMS) to modulate brain activity. Other instruments include motion- and eye-tracking

devices. The panel appreciates the variety in equipment the students have access to. RMa students are free to use all facilities which they think are useful for their research. A certified staff member trains and supervises the students. After a certain time, the students may use the equipment more independently and are allowed to "push the buttons" themselves. When operating the equipment, the students are always supervised by an experienced staff member or a senior student. For RMa students and PhD students, the same protocol is in place which states the number of hours the equipment may be used. The panel applauds the easy access and the large amount of independence the students receive when using these high-end facilities. For many students, the affiliation with the DI was the precise reason they opted for this programme.

*Job market orientation*
The students are thoroughly prepared for a PhD position, which the panel certainly finds a strength of the programme. It is convinced that the skills and knowledge taught in the programme can be very well applied in non-academic settings as well. However, the panel established that the students receive little information about their job opportunities outside academia.

Because of a limited number of PhD positions and for reasons of personal ambition, not all students end up in a PhD programme, and of those who do, not all continue in academia upon receiving their doctorate. The panel is pleased to hear that the programme wishes to facilitate careers outside academia more. It thinks it is important to make students fully aware that the knowledge and skills they acquire during this prominent master's programme can be extremely valuable in professions other than PhD positions, e.g. by bringing them more in touch with companies and other organisations. This is also in line with the current societal impact agenda in the DI.

The Donders Graduate School organises workshops and coaching sessions for all master and PhD students, covering topics such as personal ambitions, writing a grant proposal and networking. The programme also has its own study association: Dondrite. It comprises an active group of students who arrange many aspects for and by students, such as study groups, educational trips abroad, and meetings with alumni of the programme on career perspectives. The panel thinks the programme could stay in touch with its alumni more, because they offer a rich source of information regarding all career opportunities after graduation. It wishes to add the suggestion that a larger variety of internships could offer such insights as well. Adding more opportunities for external internships, also outside academia, will make the students more aware of their opportunities in different settings. According to the panel, the programme's alumni might be a good place to start looking for those internship placements.

**Considerations**
The panel established that the research context in which the RMa is being taught is excellent. The Donders Graduate School hosts the programme, which is embedded in the Donders Institute for Brain, Cognition and Behaviour. For many students, the affiliation with the DI was the very reason to opt for this programme. The DI has many state-of-the-art lab facilities of high quality, which the students may use for their research. The centre has an outstanding research productivity, in terms of both third-party funding success and publication output. The panel applauds the programme's decision to link the programme's specialisations to the four research themes at the DI, because it enhances the relationship between theory and practice.

The panel concludes that the programme provides state-of-the-art content, which fits a research master. It's curriculum enables the students to achieve the intended learning outcomes. It provides them with the essential skills to become a researcher in the field, in or outside academia. The panel advises devoting more time to the topic of ethics, however. It appreciates the way the programme is structured. Because the students enter the programme with such variety in their educational background, the panel appreciates the fact that the specialisation courses and electives offer them the opportunity to create a tailored programme which best fits the students' prior knowledge, interests and career plans. At the same time, the programme ensures that all students gain the same level of knowledge and skill to become excellent researchers in the field. The panel concludes that

the students are thoroughly prepared for a PhD position. However, they receive little information about their job opportunities outside academia. The panel advises the programme to pay more attention to this, because the skills and knowledge taught in the programme can be well applied in non-academic settings as well.

The teaching methods show little variety, and the panel thinks the staff should invest time and effort in pursuing other methods of teaching throughout the programme. The Innovation Teaching Day and the Teaching and Learning Centre could prove to be a useful source of inspiration in this respect. In addition, the panel established that the amount of feedback given to the students largely differs between courses and lecturers and recommends that the programme management increases its effort to streamline the amount of feedback and the way it is given throughout the programme.

The panel is satisfied with the programme's choice to have students complete one long internship, in which they experience the entire research cycle. The internships usually take place at the DI, but an external internship is also allowed. The students write their master's thesis based on the results of the research performed during the internship. They are supervised by a Principal Investigator (PI) of the DI. The panel thinks the internship and thesis adequately prepare the students for a career as an independent researcher, by offering a good balance between guidance and freedom. The students mentioned that the amount and type of supervision offered, differs between supervisors. The panel recommends designing more guidelines for supervision to make sure all students are guided and supervised in a consistent way.

According to the panel, the selection and admission requirements are well chosen, transparent and adequate for this programme. It appreciates the fact that candidates are not simply rejected over one deficiency, but get the chance to catch up during the programme. The students are provided with enough freedom to build their own programme and are stimulated to take the lead in this: the courses, lab visits and the internship are open for choice. The panel considers this a strength of the programme. In its opinion, the programme is feasible, and delay is unnecessary in most cases. In order to help the students to finish on time, the panel suggests communicating a more formal deadline for handing in the thesis.

The panel is satisfied with the programme's teaching staff. Professors and PI's at the Donders Institute embody the core team of lecturers in the courses and are actively involved in the supervision of the graduation trajectories. The staff is easily approachable and very committed to helping the students when needed. In the internship, the supervisors make the students feel a member of the research group and carefully monitor their well-being. The panel advises monitoring more closely whether staff members who are also appointed as examiners possess a UTQ.

**Conclusion**
*Master's programme Cognitive Neuroscience:* the panel assesses Standard 2 as 'meets the standard'.

**Standard 3: Student assessment**
The programme has an adequate system of student assessment in place.

**Findings**

*Assessment and assessment system*
The RMa programme drafted its assessment policy based on the Examination policy and guidelines provided by the Radboud School of Psychology and Artificial Intelligence. This document describes how each course contributes to the acquisition of the 17 Final Qualifications (FQ, or ILOs) and provides an overview to prove that all ILOs are indeed being assessed throughout the separate courses. The Assessment Policy and Guidelines specify the procedures and guidelines to implement these assessments and monitor their quality. The Education and Examination Regulations and the

Rules and Regulations describe the formal regulations regarding the course assessments as well as all rights and obligations of students.

The assessment policy gives an overview of the types of assessments that are being used in the programme's courses. It also demonstrates how the FQs are covered throughout the programme. The 17 ILOs fall under six overarching Learning Objectives (LO). For each LO, one course that mainly addresses this LO is selected, and a description is given of how the course's learning objectives and assessment(s) contribute to the LO. All courses provide assessment matrices in which the assessment is related to the course's learning goals. The panel observed that the assessment methods are sufficiently varied and suitable for the learning outcomes that they are meant to assess. In its opinion, the assessments clearly reflect the level of the programme and ensure that the students have a good theoretical foundation and master a large set of skills. Many courses end with a written exam with open questions and/or writing a research proposal. Other assignments are used as well, such as writing an essay and giving an oral presentation. In several courses there is a combination of assessment types (e.g. an assignment and a presentation, or two separate exams), which together determine the final grade. The panel appreciates this, since a two- or threefold assessment provides the opportunity to assess the course in different formats, ensuring the students fully master the course's content.

Apart from the summative assessments there are also formative tests, mainly in the form of assignments that do not count (or only minimally) towards the final grade. The panel thinks the proportion of formative versus summative assessments could be more balanced, and more attention could be paid towards giving feedback (see standard 2). In addition, the students mentioned there are some discrepancies between the way the different lecturers assess assignments and implement the rules on assessments. They would like more structure and clarity on how their work is being assessed. The panel applauds the work the specialisation coordinators have already carried out to align and fine-tune assessments between courses, and it advises them to look for ways to further equalise and standardise assessment formats across the different courses. According to the panel, the examination board could also help in this respect (see below).

*Assessment of the internship and thesis*
For every internship, an educational supervisor who is an expert in the domain of the research project is responsible for verifying that the performed research project meets the programme's standards. The examination board officially appoints all educational supervisors as examiners. The Regulations for Research Projects describe all procedures related to the performance and assessment of the research project.

The thesis is independently assessed by the on-site supervisor (PI) and the second reader (the educational supervisor). Prior to defending their thesis, students give a presentation to their fellow students and staff of the research group in which the key ideas, research question(s), findings and implications are presented. The audience provides feedback, which the student can use to prepare for the final oral examination (i.e. the defence), where (s)he is critically questioned about her/his project. Afterwards, the on-site supervisor evaluates the thesis and the student's performance during the final oral examination and during the internship. The second reader follows a similar procedure, though excluding the evaluation of the internship. Ultimately, the on-site supervisor and second reader mutually decide upon the final grade for both the internship and the thesis. Especially in the case of external internships, the role of the second assessor is quite important to check for different (international) grading standards and monitor that the grade truly reflects the quality of the student's work according to the programme's own standards.

To assess the student's work, a specific form is used: the student and thesis evaluation form. For both assessors, the form is identical, except for the assessment of the internship, which is left out of the second assessor's form. The form asks the assessors to rate several aspects of the thesis which cover the entire research cycle, from the problem statement, to the methods used, and the clarity of the results, conclusions and discussion. The overall structure (preferably that of a scientific paper,

APA-style) is also assessed. When assessing the defence, the student is rated on his/her ability to explain how theories differ in their predictions for specific experimental results, show a critical attitude towards the research literature, and give a proper interpretation of the results presented in his/her thesis in the context of the main theories in the field. The student's internship is assessed on aspects such as his/her experimental skills, ability to conduct research independently, and creativity in case of unexpected circumstances.

The panel read a representative sample of theses and is of the opinion that the evaluation procedure of the internship and thesis is sound and detailed and reflects the academic level of the programme. However, some forms did not seem to be filled in according to the procedures (both examiners used the same form or old forms were used). The panel advises the programme management and the examination board to address this. Although some students did receive a somewhat generous grade, generally speaking, the panel agreed with the final grades given by the examiners. The forms used are well-designed and clear. At the bottom of the assessment form, the assessor is invited to motivate the given grades in a textbox, thereby giving qualitative feedback. The panel noticed there is quite some variety in the ways this box is filled in. On some forms, the examiner's feedback was very detailed, about all aspects of the assessments. On others, the comments were very short or too general. This is unfortunate because the student can still use this feedback to improve their learning curve as they embark on a professional career. According to the panel, the programme management should take this inconsistency seriously and pay more attention to this, so that the students receive sufficient individual feedback on their final work.

*Examination Board*
The RMa programme's Examination Board meets twice a year and is responsible for ensuring that everyone who receives a diploma meets the programme's qualifications. According to the panel, it adequately handles all of its legally mandated tasks. The board systematically evaluates the quality of assessments and examinations by evaluating the assessment matrices of the programme's courses. In addition, it ensures that all ILOs are achieved when the programme is successfully completed. Currently, this is done at the programme level, because the general courses (applicable to all students) ensure that everyone achieves all of the programme's ILOs. The panel appreciates the fact that the board is aware of the benefits of also checking the assessment on the level of the specialisations and is planning to check the specialisation-related courses more thoroughly in the near future. The panel applauds these plans.

Every year, the board randomly selects theses for a re-examination. The panel praises the fact that the board also has calibration sessions with the University of Amsterdam, in which theses of both universities are exchanged and marked again. The panel thinks the board could organise such calibration sessions within the programme as well, for both the thesis assessment and the assessments on course level. For the thesis assessment, examiners (PI's and second assessors) can be invited to review theses and their assessment forms and discuss the outcomes in order to equalise standards and expectations for all staff. In addition, a standard for the amount of qualitative feedback that should be given in the form could also be discussed. For the assessment of courses, the panel thinks the board should take the lead in this because of its expertise. Together with the responsible lecturers, at least one or two courses every year could be evaluated in terms of content, level, and grading. This will make the assessment more structured and transparent for students.

**Considerations**
According to the panel, the programme has a solid set of documents and procedures in place which secure an adequate assessment system. All of the programme's intended learning outcomes are being assessed throughout the separate courses. The panel observed that the assessment methods are sufficiently varied and suitable for the learning outcomes that they are meant to assess and reflect the level of the programme. It appreciates the two- or threefold assessment in several courses. It recommends monitoring the balance between formative and summative assessments more. The panel advises the specialisation coordinators and the examination board to look for ways to further equalise and standardise assessment formats across the different courses.

The panel is of the opinion that the evaluation procedure of the internship and thesis is sound and detailed and reflects the academic level of the programme. The forms used are well-designed and clear, and generally speaking, the panel agreed with the final grades given by the examiners. The programme management should pay more attention to the amount of feedback the examiners provide on the assessment form.

The panel ascertained that the examination board adequately handles all of its legally mandated tasks. It appreciates the board's plans to move from the quality assurance of assessment on a programme level towards the quality assurance of the courses' assessment on the specialisation level. Annually, the board randomly selects theses for re-examination. The panel recommends that it organise calibration sessions with the programme's staff, during which theses and their assessment forms are reviewed, to equalise the standards and expectations of the master's thesis. With regard to the course assessments, the panel advises the board to evaluate a number of courses in terms of their content, level and grading, in order to make the assessments more consistent across the programme.

**Conclusion**
*Master's programme Cognitive Neuroscience:* the panel assesses Standard 3 as 'meets the standard'.

**Standard 4: Achieved learning outcomes**
The programme demonstrates that the intended learning outcomes are achieved.

**Findings**

*Final project*
The panel believes that the size (45 EC) of the research project (internship and master's thesis) is large enough for the students to have gone through the full research cycle and to assess whether they have achieved all the intended learning outcomes.

As mentioned earlier, the panel read a representative sample of 15 theses. It was generally pleased with their high level. Most of them were of good to excellent quality. Because of the fact that they are carried out in the labs of the DI, their research topics fell exceptionally well within the scope of the programme and ambitions of this research master. Overall, they were clearly structured and well-written and presented relevant discussions. According to the panel, they all showed that the students master state-of-the art methods and data analyses and can write a scientific text. Most of the theses were publishable. For the theses which were deemed unpublishable, this was properly reflected in relatively lower grades. In a small number of theses, the panel thought the introduction was somewhat superficial or the thesis as a whole could be structured better. Generally speaking, the panel is convinced that the students show that they have achieved the intended learning outcomes and thus the research master's level.

*Alumni success*
According to the panel, the performance of the research master's alumni is very positive. Around three-quarters of the graduates obtain a PhD position within the first year after graduation. Of the 2003-2017 cohorts, 98 percent of the graduates found a job or are enrolled in other programmes. Around 70 percent of the graduates is working in academia (as a postdoc, PhD student, research assistant, post-doc, assistant professor or principal investigator). Other graduates pursue a non-academic research career (e.g. as a data scientist), work in sectors other than research (e.g. health care, policy making, government), or set up their own business. The panel is impressed by these results and thinks that they fit with the programme's aim to educate researchers.

Since 2014, a Life after the Master event has been organized to which alumni are invited to talk about their career (inside or outside academia) since they graduated. This event is organised every

year, led by Dondrite together with two other master's programmes from the faculty. The panel thinks the programme could step up its activities to foster the relationship with graduates, in order to be better informed about the way alumni experienced their education and what kind of career they chose. Concurrently, these stories will give insight into the societal requirements and the way the curriculum is geared to the expectations of the professional field (see standard 1).

**Considerations**
The panel determined that the programme's final project (the internship and master's thesis) lets the students perform a full research cycle. It assessed that the level of the theses is more than adequate; most of them are of good to excellent quality. The theses show that the students achieve the intended learning outcomes and thus the research master's level.

Most of the programme's alumni end up in PhD positions. A large percentage of alumni have positions related to research (inside or outside academia). Therefore, the panel concludes that the programme achieves its goal to educate researchers. Some graduates pursue a career in the field of health care, policy making, or work for the government. Others set up their own business. For various reasons, the panel suggests that the programme management should strengthen their relationship with graduates.

**Conclusion**
*Master's programme Cognitive Neuroscience:* the panel assesses Standard 4 as 'meets the standard'.

# GENERAL CONCLUSION

The panel assessed standards 1, 2, 3, and 4 as 'meets the standard'. Based on the NVAO decision rules regarding limited programme assessments, the panel therefore assesses the programme as 'positive'.

**Conclusion**
The panel assesses the *Master's programme Cognitive Neuroscience* as 'positive'.

# APPENDICES

# APPENDIX 1: DOMAIN-SPECIFIC FRAMEWORK OF REFERENCE

## Domain specific reference frame for master's level educational programmes in the Neurosciences and intended learning outcomes

At the master's level, the field of Neurosciences in the Netherlands focuses on a multidisciplinary approach of research questions pertaining to the workings of the brain in health and disease. The field ranges from research at the interface between genetic, molecular and cellular processes to computational, system-level neuroscience with cognitive and behavioral analyses. The Neurosciences investigate all aspects of the brain, the nervous system and the senses: anatomy, physiology, biochemistry, genetics, cell biology, and molecular biology, and also investigate the interrelations between these aspects, as well as how these give rise to, e.g., perceptions, cognition, emotions and movement.

The Neurosciences address three main questions:

1. How does the brain work, and how does it give rise to, for instance, cognition, perception, emotions, learning, memory, consciousness and behaviour?
2. What goes wrong in brain diseases, and how does this affect, for instance, cognition, perception, emotions, learning, memory, consciousness and behaviour?
3. How can we influence the brain, and cure brain diseases or treat their symptoms?

In research to answer these questions, the brain is not viewed as an isolated organ; rather, the brain continuously interacts with the body and its environment, throughout an individual's lifespan. Concrete neuroscientific research projects are motivated by the three big questions in Neurosciences mentioned above, but they are aimed at answering smaller, more defined sub-questions. Neuroscience research ranges across all biological levels. At the molecular and cellular level, the Neurosciences investigate the processes within and between cells. At the organ level, the investigations focus on how brain cells organize in networks and circuits. At the level of the organism, the Neurosciences investigate brain function such as cognition, emotion and social interaction, including specific abilities such as movement, perception, language, or memory. Finally, at the population level, the field encompasses studies where epidemiological, qualitative approaches, as well as society-directed approaches may be used to investigate financial and political decision-making, and the societal consequences of brain disease. In addition, research in the Neurosciences provides technological innovations that can be used in a broad range of applications; from molecular and genetic approaches for drug/treatment development, to, e.g., artificial brain implants, or to new designs in robotics based on neural principles.

Due to its translational character, the strength of the Neurosciences lies in connecting parts of different sub-disciplines, such as biology, (bio)informatics, psychology, (bio)chemistry, medicine, mathematics, physics, and philosophy. Hence, the Neurosciences cover many elements from those disciplines and are characterised by a profound integration of these elements. In this way, Neuroscience research provides innovative methods and approaches to understanding the brain, behaviour and disease, based on developing insight into brain mechanisms. The Master of Sciences level of education in the Neurosciences aims to teach students about the aforementioned aspects, including the technological, methodological, societal and ethical developments in modern Neuroscience research. Note, however, that each Master programme has its own specific scope and foci, which are reflected by the content and name of the programme.

## General intended learning outcomes of Neuroscience Master programs in the Netherlands

Graduates of the research master within the domain of Neurosciences have an academic attitude and are academically skilled researchers in the field of Neuroscience.

**Knowledge and Understanding**
Master's graduates:
1. have an overview of the conceptual framework in the field of Neuroscience, including new theories, processes, instruments, and current research challenges;
2. appreciate the integrative scope of the Neurosciences bridging disciplines such as biology, biomedical sciences, psychology, medicine, philosophy, mathematics, and physics.

**Applying Knowledge and Understanding**
Master's graduates have demonstrated the ability to:
3. acquire, structure and integrate information in the field of the Neurosciences to generate novel hypotheses that further the field, both orally and in writing;
4. conceive, design, implement and adapt neuroscientific experiments;

**Making judgments**
Master's graduates have demonstrated the ability to:
5. critically analyse and interpret neuroscientific research, in relation to the design and execution of experiments or computational modelling, and the results obtained thereof;
6. reflect on ethical aspects of neuroscience research, and include these in decision-making processes;

**Learning focus**
Master's graduates have the learning skills:
7. to work in a team and to collaborate with researchers from other disciplines and/or countries;
8. to pursue a career as independent neuroscience researcher either in- or out-side of academia;

**Communication**
Master's graduates have demonstrated the ability to:
9. discuss neuroscience related topics with peers, the larger scholarly community and with non-researchers who are interested in the Neurosciences, both orally and in writing;
10. efficiently communicate in interdisciplinary research teams.

# APPENDIX 2: INTENDED LEARNING OUTCOMES

*In the MSc CNS programme's Education and Examination Regulations, 17 final qualifications are outlined and grouped in six learning objectives. These six learning objectives, at the programme level, adhere to the five so-called Dublin descriptors, which describe the level of bachelor and master programmes in general. Below a description of the FQs (1-17) and LOs (AF) is given.*

**A. General cognitive skills**

1. Theoretical skills: Students will have acquired a way of thinking that will enable them to comprehend and solve problems, while maintaining a critical stance towards established scientific insights. They have a good overview of the scientific literature to develop a critical attitude to well-established theories and to develop new theoretical concepts for open problems in the field of CNS;

2. Analytical skills: Students will be able to formulate and analyse scientific problems at an abstract level by dividing them into testable sub-problems, differentiating between major and minor aspects;

3. Synthesizing skills: Students will be able to synthesize solutions to sub-problems within a scientific framework and thus contribute to the formulation of general theories;

4. Scientific skills: Students will possess knowledge about paradigms, theory, experimental methods and techniques, methods for data analysis and modelling, insofar as relevant for CNS at the Master's level;

5. Computational skills: Students will possess sufficient skills in the fields of computing and computer science, which will enable them to design and implement computer programs and use current application programs;

**B. Skills based on knowledge and insights pertaining to the field of CNS**

6. Basic knowledge: Students will have gained adequate knowledge and insights pertaining to the basic subareas of CNS. The scope of this basic knowledge will be sufficient to allow them to do practical training in one of the research groups;

7. Specialized knowledge: Students will possess sufficient skills in at least one sub-area of CNS to conduct scientific research under supervision;

8. Advanced knowledge: Students will be able to understand scientific articles on the chosen specialisation. Furthermore, they will be able to follow the developments the chosen specialisation;

9. Generalizable knowledge: Students will be able to assimilate newly acquired knowledge of CNS and to integrate this knowledge with the knowledge they already possess. In addition, they will have the learning ability to orient themselves at specialist level in a subarea of CNS that lies outside the chosen specialisation;

**C. Research methods in CNS**

10. Literature skills: Students will be able to find relevant scientific sources relating to CNS problems that need to be solved;

11. Research skills: Students will be able to formulate new questions and hypotheses in the fields of CNS, and to select the appropriate pathways and research methods for solving these questions, taking into account the services and means available;

12. Inference skills: Students will be able to set up experimental or theoretical scientific research, to systematically process and critically interpret the research results, and to formulate conclusions;

**D. General communication skills**

13. Communication skills: Students will be able to communicate with colleagues in the same discipline about scientific knowledge, both at basic and specialist levels. They will be able to report orally and in writing, and to discuss a scientific topic in English; Students will also be able to hold an oral presentation and to write a lucid article on the research conducted and modern concepts in CNS for a general non-specialist public;

14. Dissemination skills: Students will be able to promote their work via various channels such as scientific journals, conferences contributions, and public events (e.g. science festivals).

**E. Reflection on society and societal problems**

15. Reflective skills: Students will have gained sufficient knowledge of and insights into the role of CNS in society in order to function adequately in their future professions and reflect on societal problems;

**F. Professional attitude**

16. Ethical attitude: Students have developed an attitude of scientific integrity;

17. Critical attitude: Students have the ability to realise any shortcomings or limitations; they have developed a critical attitude towards their performance as a scientist and have learned how to work on improvement in case of limitations in knowledge or expertise.

# APPENDIX 3: OVERVIEW OF THE CURRICULUM

| First Year | | Second Year | |
|---|---|---|---|
| ***Theoretical training*** | | ***Practical training*** | |
| General (compulsory) | | General (compulsory) | |
| Trends in cognitive neuroscience | 6EC | Practical training and Thesis | 45EC |
| Neuroimaging I | 6EC | | |
| Neurophilisophy | 6EC | | |
| Lab rotations | 3EC | | |
| Neuroimaging II (choose one of two) | 6EC | | |
| Electrophysiological methods | | | |
| Haemodynamic methods | | | |
| **Specialisation** | | | |
| Choose 30EC of specialisation courses | 30EC | Free choice (elective courses) | 12EC |
| ***Skill training*** | | | |
| (two 3EC courses in total, 1 per year) | | | |
| Neuroanatomy | 3EC | Practical ERP training | 3EC |
| Advanced math | 3EC | Academic writing | 3EC |
| Basic mathematics | 3EC | Basic statistics | 3EC |
| **Total** | 60EC | **Total** | 60EC |

# APPENDIX 4: PROGRAMME OF THE SITE VISIT

| | |
|---|---|
| 08:30 08:45 | Welcome |
| 08:45 09:45 | Preparatory session of the review panel (part 1) with the opportunity to browse additional documents (09:00-09:30 open consultation) |
| 09:45 10:30 | Interview with programme's management |
| 10:30 11:15 | Preparatory session of the review panel (part 2) |
| 11:15 12:00 | Interview with students and alumni |
| 12:00 12:30 | Lunch break |
| 12:30 12:45 | Preparatory session of the review panel for the afternoon interviews |
| 12:45 13:30 | Interview with lecturers |
| 13:30 14:00 | Lab tour (given by a PhD-student & alumnus) |
| 14:00 14:45 | Interview with Examination Board |
| 14:45 15:15 | Review panel deliberation |
| 15:15 16:00 | Final interview with formal management |
| 16:00 17:30 | Drawing up provisional conclusions and preparation of verbal report |
| 17:30 17:45 | Verbal report provided by the panel chair |
| 17:45 --- | Drinks |

# APPENDIX 5: DOCUMENTS STUDIED BY THE PANEL

Prior to the site visit, the panel studied 15 theses of the master's programme Cognitive Neuroscience. Information on the selected theses is available from QANU upon request.

During and prior to the site visit, the panel studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):

- Self-evaluation report
- Domain specific reference frame for master's level educational programmes in the Neurosciences and intended learning outcomes
- Objectives and final qualifications of the programme
- Overview of the correspondence between the Dublin descriptors, the six intended learning outcomes and seventeen final qualifications of the programme
- Overview of the contribution of all courses within the programme to each of the programme's Final Qualifications and corresponding Learning Objectives
- Course schedule overview
- Access to all current courses in the digital learning environment Brightspace
- Course assessment matrices & teacher reports 2017-2018
- Overview of all courses within the programme and their type of assessment(s).
- Assessment Programme of the research master's programme Cognitive Neuroscience 2015-2016
- Student and Thesis Evaluation Forms (for on-site supervisor and second reader)
- List of Allocated Staff (stating PI and UTQ status)
- Course evaluations 2017-2018
- Course evaluations – running average scores
- Training and Supervision Plan Form
- Enrolment statistics
- Gender distribution statistics
- Programme duration & judicium statistics
- Study association Dondrite flyers
- Position of CNS graduates 1 year after graduation
- Copies of programme brochure
- Copies of student journal
- Donders graduate school flyers
- Action Letter to Students
- Access to the student community site within the digital learning environment Brightspace