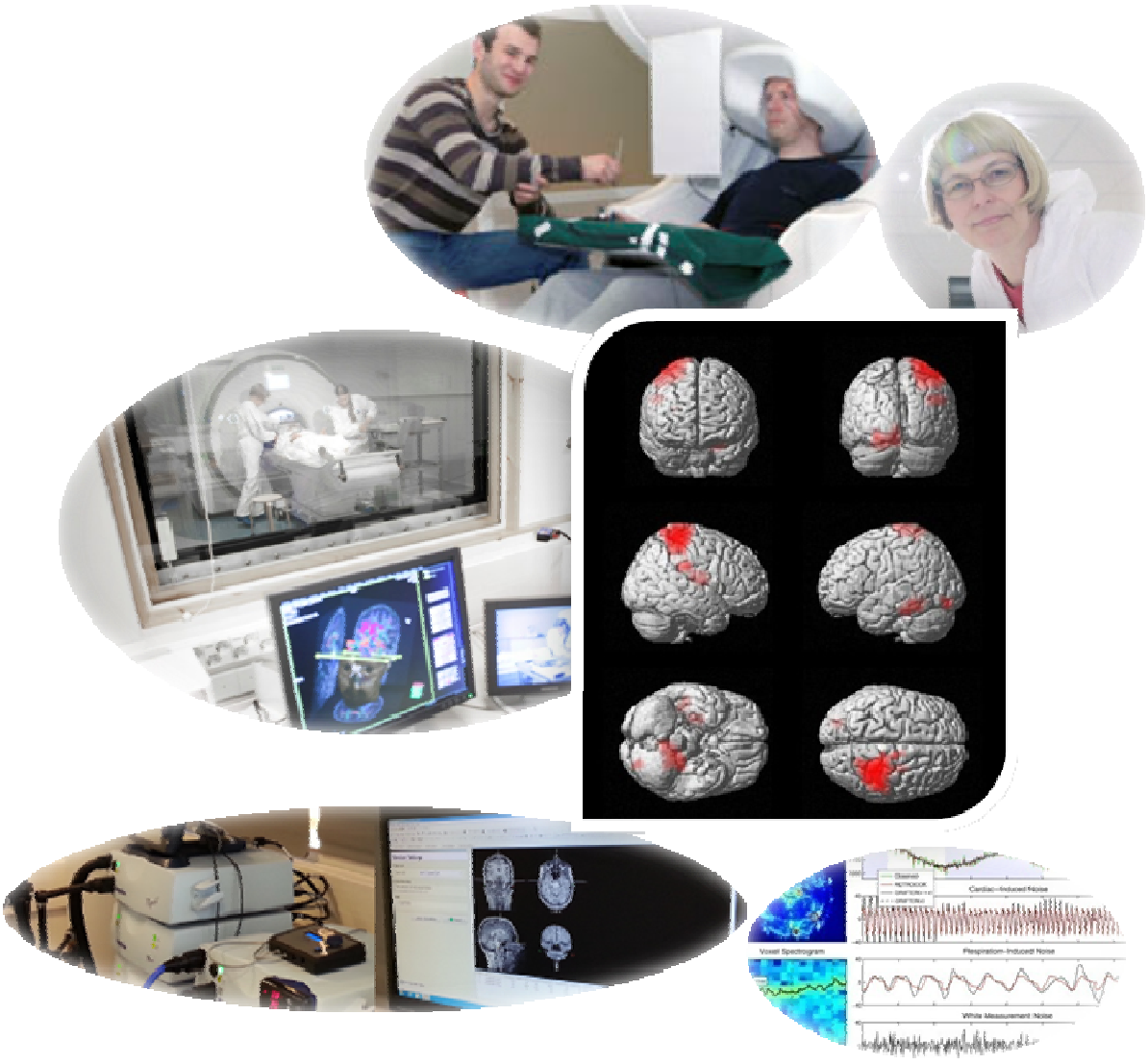
ANNUAL REPORT OF

AALTO NEUROIMAGING

AALTO UNIVERSITY SCHOOL OF SCIENCE

2013



Composed by Toni Auranen, Veikko Jousmäki and Mikko Nyrhinen

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Director's executive summary

Aalto NeuroImaging (ANI) infrastructure was very successful in 2013 to obtain recognition in the scientific community. European Strategy Forum on research Infrastructures (ESFRI) roadmap collects all major infrastructures in Europe. ANI is now part of the Finnish participation in Euro-BioImaging (EuBI) ESFRI Initiative to strengthen imaging infrastructures in Europe. The initiative is headed by Professor John Eriksson at Åbo Academy. Academy Professor Riitta Salmelin has played a major role in the initiative as a representative of the Aalto University and the Finnish functional imaging network. I would like to acknowledge their work to put our initiative to the ESFRI roadmap.

ANI, as a part of NEUROIMAGING research infrastructure, was granted with recognition on the roadmap of the Finnish Research Infrastructure (FIRI) of the Academy of Finland. As a result, we have already obtained financial resources from the Academy of Finland for a new parallel transmit system at the AMI Centre. I would like to acknowledge the work done by Staff Scientist Toni Auranen and Academy Professor Riitta Salmelin to make it possible.

Since ANI started officially in 2013, the scientific output has to be compared with the scientific output of its precursors, namely AMI Centre and MEG Core. The scientific output is close to the previous level. As scientific output is one of our key performance indexes, we track down the output very closely.

Since ANI started in 2013, the reference for the budget is more complicated to choose from. For AMI Centre we have a long history and budgetwise we are keeping up the level and income as over the past years. MEG Core has its own budget starting from 2013 although previously the costs were covered by large grants obtained by the researchers at the Brain Research Unit, OV Lounasmaa Laboratory. In 2013, all the costs were covered by user fees. Aalto TMS started in 2013 and we do not have any reference to compare with. Financially, ANI budget was successful although Aalto TMS made a loss in 2013, *i.e.*, Aalto TMS was supported heavily during its first year of operation by ANI.

In 2013, ANI received a major financial support, 40% of the budget, from the Aalto University School of Science Dean Kimmo Kaski. The support was used mainly to reduce the fees of the users from the Aalto University and NEUROIMAGING infrastructure. Hopefully, the financial support will continue in the future since it is a very important tool to support neuroscience and brain imaging at the Aalto University.

Financial contributions from Academician Riitta Hari, PhD Juha Silvanto, and Aalto University School of Science made it possible to establish Aalto TMS in 2013. In the beginning, PhD Juha Silvanto acted as a head of Aalto TMS. Unfortunately, PhD Juha Silvanto has moved to the Department of Psychology at University of Westminster, UK. Aalto TMS is headed now by Professor of Practice Synnöve Carlson. MSc Mikko Nyrhinen was hired in February 2013 to kick start Aalto TMS.

I would like to express my gratitude to ANI users and employees. Your scientific output and work have been very important and valuable both for the neuroscience community and infrastructure. Keep up with the good work and motivation.

Finally, I would like to express my gratitude to Academician Riitta Hari, the former scientific director of the MEG Core, and Docent Simo Vanni, the former scientific director of the AMI Centre, for all your efforts and progress that you have made at the MEG Core and AMI Centre. Your fundamental contributions have made it possible to establish ANI.

Magnetically yours,
Veikko Jousmäki

1 Introduction

Aalto NeuroImaging (ANI) research infrastructure was established on January 1st, 2013 at Aalto University School of Science (SCI). ANI research infrastructure houses three functional neuroimaging modalities, navigated transcranial magnetic stimulation (nTMS) at Aalto TMS, functional magnetic resonance imaging (fMRI) at Advanced Magnetic Imaging (AMI) Centre, and magnetoencephalography (MEG) at MEG Core. ANI is administrated by Brain Research Unit (BRU) at O.V. Lounasmaa Laboratory (OVLL), Aalto University School of Science. Both AMI Centre and MEG Core are well established and have a long history and tradition starting from the Helsinki University of Technology whereas Aalto TMS was started in 2013. Docent Veikko Jousmäki from the BRU was appointed by the Dean of the Aalto University School of Science to be the ANI director starting from February 1st, 2013.

ANI is also part of NEUROIMAGING research infrastructure administrated by Aalto University together with University of Helsinki (UH) and Hospital District of Helsinki and Uusimaa (HUS, Helsingin ja Uudenmaan sairaahoitopiirin kuntayhtymä) in the capital region (see, Figure 1). NEUROIMAGING (started in 2011), is based on agreement between AU, UH, and HUS, and covers, in addition to Aalto TMS, AMI Centre, and MEG Core in the Otaniemi campus, also the BioMag Laboratory located at the Meilahti hospital. The goal of the NEUROIMAGING agreement, in brief, is to enhance joint use and development of the large-scale brain imaging facilities.

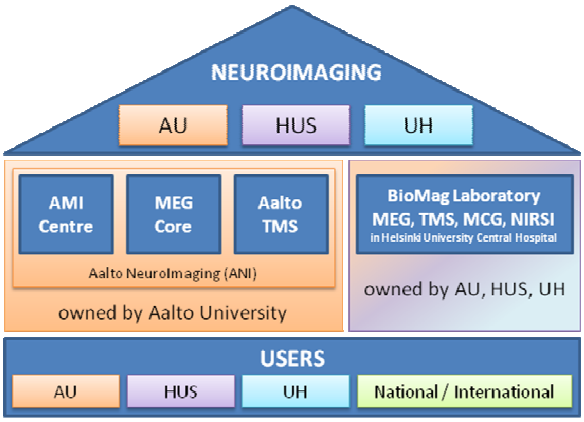

Figure 1. NEUROIMAGING infrastructure is open to both internal and external users. More information from ani.aalto.fi.

The NEUROIMAGING Steering Board comprised two members from the Aalto University (Dean Ilkka Niemelä, Professor Kimmo Kaski), two from the UH (Professor Kimmo Alho, Professor Timo Erkinjuntti whose acting deputy has been Professor Pentti Tienari), and two from HUS (Director Pekka Tervahartiala, Chief Physician Erika Kirveskari). The Directors of the units act as experts with the right to speak in Steering Board meetings (ANI: Director Veikko Jousmäki, DrTech Toni Auranen; BioMag: Director Jyrki Mäkelä, DrTech Juha Montonen). The Steering Board had five meetings in 2013; the chairman of the Steering Board for the first three-year period (2011–2013) was Dean Ilkka Niemelä and the secretary in 2013 was DrTech Juha Montonen.

Aalto NeuroImaging infrastructure brings new possibilities and openings for the brain research community. Our aim is to maintain and develop the best possible infrastructure for functional brain imaging. We have recently introduced a new reservation system, anitime.aalto.fi, for our facilities. All our units have their own budget and they are open for brain research community and other users. We have fixed user fees, our budget is transparent, and we meet the requirements set by the Academy of Finland, Tekes – the Finnish Funding Agency for Innovation, and European Research Council. We are strongly supporting neuroscience, one of the focus areas of the Aalto University, aivoAALTO, one of the research focus areas of the Aalto University, and Aalto Brain Centre, Aalto University's initiative in neuroscience and neurotechnology.

1.1 Aalto TMS

Aalto TMS laboratory was inaugurated in early 2013. It offers researchers unique possibilities for multi-modal neuroimaging techniques. The laboratory contains top-of-the-line navigated transcranial magnetic stimulation (nTMS) and electroencephalography (EEG) systems.

nTMS -system with two stimulation units (Bistim^2 and Super Rapid^2 Plus^1, Magstim Company Ltd., United Kingdom) and various coils makes numerous TMS and rTMS examination setups possible. Bistim^2 consists of two Magstim 200 units with a connection module making possible to deliver paired pulses or one high-energy pulse in to a single stimulation coil. Connection module can also be disconnected making it possible to use two Magstim 200 units as separate stimulation devices. For this purpose the laboratory has two 70 mm figure of eight coils making dual-site stimulations with the system possible. Super Rapid^2 Plus^1 consists of three power supply units which enable high-power/frequency stimulations. 70-mm air-cooled figure-of-eight coil makes high power/frequency scenarios possible without having to change the coil during or between sessions. With the two stimulation systems together, it is possible to do even triple-site stimulations in the laboratory.

In addition, the 64-channel EEG-system with 16 EMG channels (NeurOne, Mega Electronics Ltd., Kuopio, Finland), specially designed for co-registration with TMS, can be used to map stimulus event-related responses simultaneously. The laboratory also contains a dedicated system for visual studies with Matlab, E-Prime, and Presentation software available for stimulus delivery.

During the starting year of Aalto TMS, the main emphasis was put to the construction of laboratory's facilities, setting up the research equipment, and personnel training. Construction of the lab's facilities included additional four 42" LCD screens for neuronavigation and EEG. Also an additional ceiling-mounted arm for the navigation camera was installed for easier camera adjustment, and an adjustable table was acquired for visual stimulation system.

1.2 AMI Centre

AMI Centre houses a research-dedicated, modern 3T Siemens Skyra (Siemens Healthcare, Erlangen, Germany) magnetic resonance imaging (MRI) scanner (installed in 2011). For more than ten years, several research teams from Aalto University, University of Helsinki (UH), Helsinki and Uusimaa Hospital District (HUS), as well as others (other academic users and industry) have used the facilities of AMI Centre for research and education. Since it's inauguration, AMI Centre has operated smoothly with only a few notable interruptions of use, such as major system upgrades of our old 3T MRI scanner (SIGNA^{TM} GE Healthcare Ltd.) in 2004 (Excite) and 2009 (HDxt), as well as the three month downtime in 2011, when the Skyra system was installed along with modifications of preparation/waiting areas for the user groups.

The scanner houses 48 independent measurement channels, and since the purchase of our latest imaging coil, our users have had three distinct head coil arrays to choose from according to their needs; 32-channel head coil for excellent signal-to-noise ratio, a slightly more spacious 20-ch head-neck coil to be used with simultaneous EEG recordings, for example, and a custom-made modified version of the 32-channel head coil for excellent visual field of view for the volunteer. In addition, we have well-designed stimulus systems and a state-of-the-art eye tracking (EyeLink 1000, SR Research Ltd.) as well as simultaneous EEG recording capabilities (BrainAmp MR+, Brain Products GmbH). We continue to offer exquisite surroundings for functional magnetic resonance imaging studies and neuroscience research.

As expected, the magnet use was again, for a second year in a row since 2006, well over the 1000 paid hours mark in 2013. The total number of used hours, 1066, is only slightly less than in 2012 (1116). As a general trend since 2008, the usage has been increasing steadily and we are looking

forward to further boosting the usage by improving our services within the Aalto NeuroImaging research infrastructure.

1.3 MEG Core

The main research instrument of the MEG Core is a modern 306-channel neuromagnetometer (Elekta Neuromag™, Elekta Oy, Helsinki) which was upgraded in 2008. It houses 204 gradiometers and 102 magnetometers with a whole-scalp coverage. The device includes 64 EEG channels and 8 additional analog inputs for monitoring purposes. The MEG device is located within a 3-layer magnetically shielded room (MSR; Imedco AG, Hägendorf, Switzerland) that provides >100 dB attenuation of the external magnetic disturbances over a wide bandwidth. MEG Core has extremely low magnetic ambient noise level.

During MEG recordings, stimulators are available, *e.g.*, for auditory (Etymotic Research, Chicago, IL, and ADU-2, Unides Design Ay, Helsinki), tactile (constant current electric stimulator, (Medizin Technik Schwind, Germany), pneumatic tactile stimulator (built for the purpose in Germany), vibrotactile stimulator (built at BRU), manually-operated brush stimulator (built at BRU), visual (Panasonic DLP projector with a back projection screen), and pain (Neurotest thulium-YAG laser, Baasel Lasertech GmbH, Starnberg, Germany) stimulation. For monitoring purposes, MEG Core has eye trackers (SensoMotoric Instruments GmbH, Teltow, Germany and Applied Science Laboratories, Bedford, MA USA), and home-made accelerometer-based monitoring devices. In addition, MEG Core has several home-made response pads and strong knowhow in building and testing MEG compatible stimulators. More information of the MEG Core is available at meg.aalto.fi.

2 Location, facilities, organization, and mission

The Aalto NeuroImaging infrastructure facilities are located on the campus of the Aalto University in Otaniemi area. Aalto TMS (tms.aalto.fi) and AMI Centre (ami.aalto.fi) are both located in the Magnet Building (Otakaari 5 I, Espoo, Finland), AMI occupying 360 m^2 in floors 1–3 and TMS about 50 m^2 in the fourth floor. MEG Core (meg.aalto.fi) resides in Nano Building (Puumiehenkuja 2), having 120 m^2 of laboratory space. All three parts of the ANI infrastructure have a joint online reservation system at http://anitime.aalto.fi. For more detailed information, see http://ani.aalto.fi.

The main research tools at Aalto TMS are two neuronavigated transcranial magnetic stimulation systems (Bistim^2 and Rapid^2, The Magstim Company Ltd., United Kingdom) combined with electroencephalogram mapping (NeurOne, Mega Electronics Ltd., Kuopio, Finland). The laboratory is in very close proximity of our MRI scanner, making it very easy to combine anatomical MR-images to TMS neuronavigation, and to make offline fMRI-TMS studies accessible. PhD Juha Silvanto secured funding for the equipment and preceded Professor Synnöve Carlson in leading the TMS laboratory.

Currently, AMI Centre maintains the 3T MRI scanner (Siemens Skyra, Siemens Healthcare, Erlangen, Germany), develops the related infrastructure, and offers services to research teams at and outside the Aalto University. The AMI Centre aims to provide an innovative environment for development and promotion of new imaging methods based on magnetic resonance imaging. The AMI personnel develop new techniques in close collaboration with other users. In 2013, the AMI Centre's research fields included functional and structural brain imaging, diffusion tensor imaging (DTI) and tractography of white matter axon bundles, as well as development of new methods and applications of MRI technology. The technical director of AMI Centre is Staff Scientist, DrTech Toni Auranen.

MEG Core offers excellent environment for magnetoencephalographic (MEG) measurements.

MEG Core has three strong supports, *i.e.*, a modern MEG device, a variety of stimulators and monitoring devices, and magnetically quiet laboratory space. The MEG Core with its low-noise, well-equipped environment is currently one of the world's best laboratories to make MEG research. In addition to Aalto NeuroImaging duties, Docent Veikko Jousmäki acts also as the MEG Core Director.

3 Achievements

Aalto NeuroImaging serves as an infrastructure that provides top-level brain imaging facilities for multiple research teams, among them many National Centers of Excellence selected by the Academy of Finland. ANI as such, has limited own research program, and thus the scientific achievements and key performance indicators listed below, containing data collected at ANI, reflect the current research interests of all the users of the infrastructure.

Impact factors for the publication series are shown and the classification of the publications is based on the instructions by the Finnish Ministry of Culture and Education, 2010. The indication **TMS**, **AMI**, or **MEG** after the impact factor and classification mark, denote which resource or equipment was used in the work, respectively.

3.1 Scientific publications in international journals

PUBLISHED (situation in beginning of Jan 2014)

1) Boldt R, Malinen S, Seppä M, Tikka P, Savolainen P, Hari R, and Carlson S: **Listening to an audio drama activates two processing networks, one for all sounds, another exclusively for speech**. *PLOS ONE* 2013, 8: 64489. (IF 3.730, A1, **AMI**)

2) Bourguignon M, de Tiège X, de Beeck MO, Ligot N, Paquier P, van Bogaert P, Goldman S, Hari R, and Jousmäki V: **The pace of prosodic phrasing couples the listener's cortex to the reader's voice**. *Human Brain Mapping* 2013, 34: 314-326. (IF 6.878, A1, **MEG**)

3) Brogaard B, Vanni S, and Silvanto J: **Seeing mathematics: perceptual experience and brain activity in acquired synesthesia**. *Neurocase* 2013, 19: 566-575. (IF 1.050, A1, **AMI**)

4) Campi C, Parkkonen L, Hari R, and Hyvärinen A: **Non-linear canonical correlation for joint analysis of MEG signals from two subjects**. *Frontiers in Neuroscience* 2013, 7: 107. (IF not available yet, A1, **MEG**)

5) Gramfort A, Luessi M, Larson E, Engemann DA, Strohmeier D, Brodbeck C, Goj R, Jas M, Brooks T, Parkkonen L, and Hämäläinen M: **MEG and EEG data analysis with MNE-Python**. *Frontiers in Neuroscience* 2013, 7: 267. (IF not available yet, A1, **MEG**)

6) Harinen K, Aaltonen O, Salo E, Salonen O, and Rinne T: **Task-dependent activations of human auditory cortex to prototypical and nonprototypical vowels**. *Human Brain Mapping* 2013, 34: 1272-1281. (IF 6.878, A1, **AMI**)

7) Harinen K and Rinne T: **Activations of human auditory cortex to phonemic and**

nonphonemic vowels during discrimination and memory tasks. *NeuroImage* 2013, 77: 279-287. (IF 6.252, A1, **AMI**)

8) Kauppi J-P, Parkkonen L, Hari R, and Hyvärinen A: **Decoding magnetoencephalographic rhythmic activity using spectrospatial information**. *NeuroImage* 2013, 83: 921-936. (IF 6.252, A1, **MEG**)

9) Koskinen M, Viinikanoja J, Kurimo M, Klami A, Kaski S, and Hari R: **Identifying fragments of natural speech from the listener's MEG signals**. *Human Brain Mapping* 2013, 34: 1477-1489. (IF 6.878, A1, **AMI**, **MEG**)

10) Kostiainen MA, Hiekkataipale P, Laiho A, Lemieux V, Seitsonen J, Ruokolainen J, and Ceci P: **Electrostatic assembly of binary nanoparticle superlattices using protein cages**. *Nature Nanotechnology* 2013, 8: 52-56. (IF 31.170, A1, **AMI**)

11) Kätsyri J, Hari R, Ravaja N, and Nummenmaa L: **Just watching the game ain't enough: striatal fMRI reward responses to successes and failures in a video game during active and vicarious playing**. *Frontiers in Human Neuroscience* 2013, 7: 278. (IF 2.906, A1, **AMI**)

12) Kätsyri J, Ravaja N, Hari R, and Nummenmaa L: **The opponent matters: Elevated fMRI reward responses to winning against a human versus a computer opponent during interactive video game playing**. *Cerebral Cortex* 2013, 23: 2829-2839. (IF 6.828, A1, **AMI**)

13) Lindeman M, Svedholm AM, Riekki T, Raij T, and Hari R: **Is it just a brick wall or a sign from the universe? An fMRI study of supernatural believers and skeptics**. *Social Cognitive and Affective Neuroscience* 2013, 8: 943-949. (IF 5.042, A1, **AMI**)

14) Nurminen L, Kilpeläinen M, and Vanni S: **Fovea-periphery axis symmetry of surround modulation in the human visual system**. *PLOS ONE* 2013, 8: e57906. (IF 3.730, A1, **AMI**)

15) Piitulainen H, Bourguignon M, de Tiège X, Hari R, and Jousmäki V: **Coherence between magnetoencephalography and hand-action-related acceleration, force, pressure, and electromyogram**. *NeuroImage* 2013, 72: 83-90. (IF 6.252, A1, **AMI**, **MEG**)

16) Piitulainen H, Bourguignon M, de Tiège X, Hari R, and Jousmäki V: **Corticokinematic coherence during active and passive finger movements**. *Neuroscience* 2013, 238: 361-370 (IF 3.122, A1, **AMI**, **MEG**)

17) Roine U, Roine T, Salmi J, Nieminen-von Wendt T, Leppämäki S, Rintahaka P, Tani P, Leemans A, and Sams M: **Increased coherence of white matter fiber tract organization in adults with Asperger syndrome: A diffusion tensor imaging study**. *Autism Research* 2013, 6: 642-650. (IF 3.988, A1, **AMI**)

18) Ramkumar P, Jas M, Pannasch S, Hari R, and Parkkonen L: **Feature-specific information processing precedes concerted activation in human visual cortex**. *The Journal of Neuroscience* 2013, 33: 7691-7699. (IF 6.908, A1, **AMI**, **MEG**)

19) Salo E, Rinne T, Salonen O, and Alho K: **Brain activity during auditory and visual phonological, spatial and simple discrimination tasks**. *Brain Research* 2013, 1496: 55-69. (IF 2.879, A1, **AMI**)

20) Salminen N, Aho J, and Sams M: **Visual task enhances spatial selectivity in the human auditory cortex**. *Frontiers in Neuroscience* 2013, 7: 44. (IF not available yet, A1, **MEG**)

21) Salmela VR and Vanni S: **Brightness and transparency in the early visual cortex**. *Journal of Vision* 2013, 13:16. (IF 2.479, A1, **AMI**)

22) Salmi J, Roine U, Glerean E, Lahnakoski J, Nieminen-von Wendt T, Tani P, Leppämäki S, Nummenmaa L, Jääskeläinen IP, Carlson S, Rintahaka P, and Sams M: **The brains of high functioning autistic individuals do not synchronize with those of others**. *NeuroImage: Clinical* 2013, 3: 489-497. (IF not available yet, A1, **AMI**)

23) Sharifian F, Nurminen L, and Vanni S: **Visual interactions conform to pattern decorrelation in multiple cortical areas**. *PLOS ONE* 2013, 8: e68046. (IF 3.730, A1, **AMI**)

24) Shushruth S, Nurminen L, Bijanzadeh M, Ichida JM, Vanni S, and Angelucci A: **Different orientation tuning of near- and far-surround suppression in macaque primary visual cortex mirrors their tuning in human perception**. *The Journal of Neuroscience* 2013, 33: 106-119. (IF 6.908, A1, **AMI**)

25) Solin A and Särkkä S: **Infinite-dimensional Bayesian filtering for detection of quasiperiodic phenomena in spatiotemporal data**. *Physical Review E* 2013, 88: 052909. (IF 2.313, A1, **AMI**)

26) Särkkä S, Solin A, and Hartikainen J: **Spatio-temporal learning via infinite-dimensional Bayesian filtering and smoothing: A look at Gaussian process regression through Kalman filtering**. *IEEE Signal Processing Magazine* 2013, 30: 51-61. (IF 3.368, A1, **AMI**)

27) Vesanen PT, Zevenhoven KCJ, Nieminen JO, Dabek J, Parkkonen LT, and Ilmoniemi RJ: **Temperature dependence of relaxation times and temperature mapping in ultra-low-field MRI**. *Journal of Magnetic Resonance* 2013, 235: 50-57. (IF 2.300, A1, **AMI**)

28) Vuokko E, Niemivirta M, and Helenius P: **Cortical activation patterns during subitizing and counting**. *Brain Research* 2013, 1497: 40-52. (IF 2.879, A1, **MEG**)

29) Yokosawa K, Pamilo S, Hirvenkari L, Hari R, and Pihko E: **Activation of auditory cortex by anticipating and hearing emotional sounds: An MEG study**. *PLoS ONE* 2013, 8: e80284. (IF 3.730, A1, **MEG**)

IN PRESS (situation in beginning of Jan 2014)

1) Bona S, Herbert A, Toneatto C, Silvanto J, and Cattaneo Z: **The causal role of the lateral occipital complex in visual mirror symmetry detection and grouping: An fMRI-guided TMS study**. *Cortex* 2013, Electronic publication ahead of print. (IF 6.161, A1, **AMI**)

2) Cong F, Puoliväli T, Alluri V, Sipola T, Brunuat I, Toiviainen P, Nandi AK, Brattico E, and Ristaniemi T: **Key issues in decomposing fMRI during naturalistic and continuous music experience with independent component analysis**. *Journal of Neuroscience Methods* 2013, Electronic publication ahead of print. (IF 2.114, A1, **AMI**)

3) Gogulski J, Boldt R, Savolainen P, Guzmán-López J, Carlson S, Pertovaara A: **A segregated neural pathway for prefrontal top-down control of tactile discrimination**. *Cerebral Cortex* 2013, Electronic publication ahead of print. (IF 6.828, A1, **AMI**)

4) Gramfort A, Luessi M, Larson E, Engemann D, Brodbeck C, and Parkkonen L: **MNE software for processing MEG and EEG data**. *NeuroImage* 2013, Electronic publication ahead of print. (IF 6.252, A1, **MEG**)

5) Hari R, Bourguignon M, Piitulainen H, Smeds E, de Tiège X, and Jousmäki V: **Human primary motor cortex stabilizes during observation of other person's phasic motor actions**. *Philosophical Transactions of the Royal Society B* 2013. (IF 6.230, A1, **AMI**, **MEG**)

6) Lamminmäki S, Parkkonen L, and Hari R: **Neuromagnetic responses to amplitude-modulated binaural tones, speech, and music**. *Ear and Hearing* 2013. (IF 3.262, A1, **AMI**, **MEG**)

7) Malinen S, Renvall V, and Hari R: **Functional parcellation of human primary somatosensory cortex to natural touch**. *European Journal of Neuroscience* 2013, Electronic publication ahead of print. (IF 3.753, A1, **AMI**)

8) Nummenmaa L, Smirnov D, Lahnakoski J, Glerean E, Jääskeläinen IP, Sams M, and Hari R: **Mental action simulation synchronizes action-observation circuits across individuals**. *The Journal of Neuroscience* 2013. (IF 6.908, A1, **AMI**)

9) Raij TT, Korkeila J, Joutsenniemi K, Saarni SI, and Riekki TJ: **Association of stigma resistance with emotion regulation - Functional magnetic resonance imaging and neuropsychological findings**. *Comprehensive Psychiatry* 2013, Electronic publication ahead of print. (IF 2.376, A1, **AMI**)

10) Ramkumar P, Parkkonen L, and Hyvärinen A: **Group-level spatial independent component analysis of Fourier envelopes of resting-state MEG data**. *NeuroImage* 2013, Electronic publication ahead of print. (IF 6.252, A1, **MEG**)

11) Salminen-Vaparanta N, Vanni S, Noreika V, Valiulis V, Móró L, and Revonsuo A: **Subjective characteristics of TMS-induced phosphenes originating in human V1 and V2**. *Cerebral Cortex* 2013, Electronic publication ahead of print. (IF 6.828, A1, **AMI**)

12) Talja S, Alho K, and Rinne T: **Source analysis of event-related potentials during pitch discrimination and pitch memory task**. *Brain Topography* 2013. Electronic publication ahead of print. (IF 3.671, A1, **AMI**)

13) Tähkä S, Laiho A, and Kostiainen MA: **Diblock copolymer mediated self-assembly of protein stabilized iron oxide nanoparticle clusters for magnetic resonance imaging**. *Chemistry - A European Journal* 2013. (IF 5.831, A1, **AMI**)

SUBMITTED (situation in beginning of Jan 2014)

14) Boldt R, Seppä M, Malinen S, Tikka P, Hari R, and Carlson S: **Spatial variability of functional brain networks in early-blind and sighted subjects**. (**AMI**)

15) Bona S, Herbert A, Cattaneo C, Silvanto J, and Cattaneo Z: **The right (but not the left) lateral**

occipital complex is causally implicated in visual mirror symmetry detection: an fMRI-guided study. (**AMI**)

16) Gilani I and Sepponen R: **Simulation and experimental verification of a rapid in-plane motion estimation method for functional magnetic resonance image time series**. (**AMI**)

17) Hlushchuk Y, Simões-Franklin C, Nangini C, and Hari R: **Stimulus-rate sensitivity segregates area 3b of the human SI cortex.** (**AMI**)

18) Lahnakoski JM, Glerean E, Jääskeläinen IP, Hyönä J, Hari R, Sams M, and Nummenmaa L: **Synchronous brain activity across individuals underlies shared psychological perspectives**. (**AMI**)

19) Lankinen K, Saari J, Hari R, and Koskinen M: **Intersubject consistency of cortical MEG signals during movie viewing**. (**AMI**)

20) Mandel A, Helokunnas S, Pihko E, and Hari R: **Neuromagnetic brain responses to other person's eye blinks seen on video**. (**MEG**)

21) Pamilo S, Malinen S, Hotta J, and Seppä M: **A correlation-based method for extracting subject-specific components and artifacts from group-fMRI data**. (**AMI**)

22) Renvall V, Nangini C, and Hari R: **All that glitters is not BOLD: inconsistencies in functional MRI**. (**AMI**)

23) Saad E, Soto D, and Silvanto J: **Dissociating VSTM and conscious visual imagery: Bringing a memory item into the conscious realm reduces its fidelity**. (**TMS**)

24) Saad E, Wojciechowska M, and Silvanto J: **Dissociating visual short-term memory and visual imagery in the early visual cortex**. (**TMS**)

25) Salo E, Rinne T, Salonen O, and Alho K: **Brain activations during bimodal dual tasks depend on the nature and combination of component tasks**. (**AMI**)

26) Smeds E, Hari R, and Pihko E: **Observation of hands in crafting and social touch has differential effects on area 3b of the human primary somatosensory cortex**. (**MEG**)

27) Smirnov D, Glerean E, Lahnakoski JM, Salmi J, Jääskeläinen IP, Sams M, and Nummenmaa L: **Fronto-parietal network supporting context-dependent speech comprehension**. (**AMI**)

28) Vanni S, Sharifian F, and Vigário R: **What functional magnetic resonance imaging can tell us about data processing in the cerebral cortex**. (**AMI**)

29) Vartiainen N, Hlushchuk Y, Kalso E, Forss N, and Hari R: **Central processing of bilateral versus unilateral acute pain in healthy human adults**. (**AMI**)

3.2 Scientific publications in meetings and conferences

PROCEEDINGS PAPERS

1) Sipola T, Cong F, Ristaniemi T, Alluri V, Toiviainen P, Brattico E, and Nandi AK: **Diffusion map for clustering fMRI spatial maps extracted by independent component analysis**. *Proceedings of the IEEE International Workshop on Machine Learning for Signal Processing* 2013. (A4, **AMI**)

2) Puoliväli T, Cong F, Alluri A, Lin Q-H, Toiviainen P, Nandi AK, Brattico E, and Ristaniemi T: **Semi-blind independent component analysis of functional MRI elicited by continuous listening to music**. *Proceedings of International Conference on Acoustics, Speech and Signal Processing* 2013, 1310-1314. (A4, **AMI**)

3) Tsatsishvili V, Cong F, Puoliväli T, Alluri V, Toiviainen P, Nandi AK, Brattico E, and Ristaniemi T: **Dimension reduction for individual ICA to decompose fMRI during real-world experiences: Principal component analysis vs. canonical correlation analysis**. *Proceedings of European Symposium on Artificial Neural Networks* 2013, 137-142. (A4, **AMI**)

ORAL PRESENTATIONS, INVITED TALKS AND POSTERS

Our users reported **more than 40 oral presentations and invited talks** as well as **at least 35 posters** in international and national scientific conferences and meetings that contain data and/or results based on the fMRI/MRI, MEG or TMS data measured at Aalto NeuroImaging infrastructure. The reader is recommended to take into consideration that the achievements in this category are based solely on notifications from our users and the true number might be considerably higher. Therefore, they are not listed with detailed information.

3.3 Theses

DOCTORAL THESES

1) Jaana Hiltunen: **Novel diffusion tensor (DTI) approaches at 3T**. Dissertation for the degree of Doctor of Philosophy, Aalto University, School of Science, O.V. Lounasmaa Laboratory, Brain Research Unit, 2013. Supervisor and Advisor: Professor Riitta Hari. (G5, **AMI**)

2) Lauri Nurminen: **Spatial context in the early visual system**. Dissertation for the degree of Doctor of Philosophy, University of Helsinki, Institute of Behavioural Sciences, 2013. Supervisors: Professor Jussi Saarinen and Docent Simo Vanni. (G5, **AMI**)

3) Annika Svedholm: **The cognitive basis of paranormal, superstitious, magical and supernatural beliefs: The roles of core knowledge, intuitive and reflective thinking, and cognitive inhibition**. Dissertation for the degree of Doctor of Philosophy, University of Helsinki, Institute of Behavioural Sciences, 2013. Supervisor: Docent Marjaana Lindeman. (G5, **AMI**)

4) Panu Vesanen: **Combined ultra-low-field MRI and MEG: Instrumentation and applications**. Dissertation for the degree of Doctor of Science in Technology, Aalto University, School of Science, Department of Biomedical Engineering and Computational Science, 2013. Supervisor and Advisor: Professor Risto Ilmoniemi. (G5, **AMI**)

5) Jarkko Ylipaavalniemi: Data**-driven analysis for natural studies in functional brain imaging**. Dissertation for the degree of Doctor of Science in Technology, Aalto University, School of Science, Department of Information and Computer Science, 2013. Supervisor: Professor Erkki Oja, Advisor: Docent Ricardo Vigário. (G5, **AMI**)

MASTER'S THESES

1) Siiri Helokunnas: **Neural responses to observed eye blinks in normal and slow motion: An MEG study**. Master's thesis for the degree of Master of Science (Psychology), University of Helsinki, Institute of Behavioural Sciences, 2013. (G2, **MEG**)

2) Noora Ovaska: **Processing of pitch and spatial information in the human auditory cortex during auditory and visual tasks: An fMRI study**. Master's thesis for the degree of Master of Science (Psychology), University of Helsinki, Institute of Behavioural Sciences, 2013. (G2, **AMI**)

3) Jukka Saari: **Classification the brain responses to hand action video clips with fMRI:**

Application to complex regional pain syndrome diagnostics. Master's thesis for the degree of Master of Science (Technology), Aalto University, School of Science, 2013. (G2, **AMI**)

4) Maria Wojciechowska: **The use of TMS to dissociate mental imagery and VSTM**. Master's thesis for the degree of Master of Science (Technology), Aalto University, School of Science, 2013. (G2, **TMS**)

3.4 Other publications / Promoting public awareness

Aalto University School of Science: Public Youtube filming by Antti Kastari, Komia, 2013. (**AMI**)

BECS: BML Youtube film by Otto Olavinen, 2013. (**AMI**)

Forss N: Background material and interview. Prisma Studio (TV/Internet), YLE Broadcasting company, reporter Tiia Nurmilaakso, measurements Aug 15 2013 and Sep 3 2013, recorded Sep 3 2013, broadcasted Sep 17 2013. (**AMI**, **MEG**)

Hari R: Lecture: **Aivojen vuosikymmeneltä mielen vuosituhannelle**. Course Aivoaakkoset, 2013, Aalto University School of Science. (**AMI**, **MEG**)

Hari R: Invited talk: **Aivojen vuosikymmeneltä mielen vuosituhannelle**. Porvoon Kansalaisopiston luentosarja: Tiede muuttaa maailmaa, Sep 26 2013, Porvoo, Finland. (**AMI**, **MEG**)

Hari R: Oral presentation: **Monitieteinen neurotiede (alustus sessioon Neurotieteen haastet muille tieteille: sillanrakennusta vai yliselittämistä)**. Tieteen päivät, 2013, Helsinki Finland. (**AMI**, **MEG**)

Hari R: Newspaper interview for: **Laiskuus kannattaa aina**. Helsingin Sanomien kuukausiliite 12, 2013, reporter Seija Sartti. (**AMI**, **MEG**)

Raij TT: Lecture: **Aivojen merkitys mielen sairauksille**. Tieteen päivät, 2013. (**AMI**)

Salmelin R: **Mitä aivot kertovat?** Aalto University Magazine, Mar 2013. (**AMI**)

Salmelin R: **Kielen havaitsemisem ja tuoton aivokorrelaateista ja niiden mittaamisesta**. In: Stolt S, Korpijaakko-Huuhka A-M, Tarvainen S, and Lehtihalmes M: **Puhe, kieli ja aivot**. *Puheen ja kielen tutkimuksen yhdistyksen julkaisuja* 2013, 45: 13-22. (**MEG**)

Tikka P and Jääskeläinen I: Background material and interviews. Prisma Studio (TV/Internet), YLE Broadcasting company, recorded Apr 12 2013, broadcasted May 7 2013. (**AMI**)

Vanni S: **Näin aivoni tekevät minusta minut**. Systole (Magazine), 2013, 1: 16-18.

Vanni S: Lecture: **Vision for future of fMRI in research**. In Siemens MAGNETOM user workshop, Apr 25 2013, Espoo, Finland. (**AMI**)

Vanni S: Lecture: **Sensation and perception**. In Observation, Decision and the Brain in Economics/Cinematics, Feb 7 2013, Aalto University, Espoo, Finland. (**AMI**)

Vanni S: Lecture: **What is Blood Oxygenation Level Dependent (BOLD) signal?** In course

Brain Imaging Principles, Mar 19 2013, Aalto University, Espoo, Finland. (**AMI**)

Vanni S: Lecture: **Bridging the gap between physiology and functional magnetic resonance imaging**. In course Medical Imaging, Mar 25 2013, Aalto University, Espoo, Finland. (**AMI**)

3.5 Scientific awards and positions of trust

Senior Scientist **Veikko Jousmäki** was selected to be a member of the scientific advisory board of the National facility for MEG (NatMEG) at Karolinska Institutet, Stockholm, Sweden, for a 2-year period.

3.6 Summary of achievements

This table depicts a summary of the highlights of the achievements presented in this chapter.

2013	**Refereed papers***	**In-press + submitted papers***	**PhD theses**	**MSc theses**
ANI total	**32**	**13 + 16**	**5**	**4**
TMS used in	*0*	*0 + 2*	*0*	*1*
AMI used in	*25*	*11 + 12*	*5*	*2*
MEG used in	*11*	*4 + 2*	*0*	*1*

* Including refereed conference proceedings papers

4 Technical development

While keeping the infrastructure operational and of the highest quality for our users, ANI infrastructure personnel is also actively involved in many technological and methodological development projects that may not result in publications, but stand out as improved services and possibilities for the users to benefit from the infrastructure. Below, some important projects and advances made in 2013 are described. Many of these projects are done in direct collaboration with our users and, therefore, they often interact with academically funded research projects listed in the previous chapter.

AALTO TMS

Since Aalto TMS started in the beginning of 2013, the main effort has been put to construction of laboratory's facilities, setting up research equipment, and personnel training. In addition to the nTMS and stimulation systems, Aalto TMS has additional a four 42" LCD screens with control units for neuronavigation and EEG. Also a ceiling-mounted arm for the navigation camera was installed for easier camera adjustment and adjustable table was acquired for calibrated visual stimulation system. In addition, number of small improvements were done and minor equipments were purchased to improve the usability of the facility.

In 2014 Aalto TMS will aim to have more scientific projects and some improvements in the facility following the needs of the researches. In addition, another Aalto TMS seminar will be organized. Users' training will also be held to train and attract new users.

AMI CENTRE

We have been very pleased with the Siemens Skyra scanner since its installation at the end of 2011. In 2013, the scanner software were updated (April 3rd–4th) to VD13-level. AMI Centre also has trained personnel for making sequence code modifications with the Siemens IDEA environment. However, only slight modifications have been needed so far in couple of pilot projects. As previously, measurements of combined EEG–fMRI, eye-tracking, and acquisition of galvanic skin response and other physiological signals, such as respiration, plethysmography, EKG, and EMG, have been routinely performed throughout the year in AMI Centre. Our EEG-system (Brainproducts, Germany) was updated in the early 2013 to include a SyncBox making it possible to synchronize the EEG data acquisition with the scanner gradients. All our devices are available to all the users of AMI Centre.

In the end of 2013, we continued making adjustments and improvements to our stimulus systems. After tedious tasks of, *e.g.*, custom-building the optics to our new projector (to replace the old one from 2003) for delivering visual stimuli during fMRI, we finally got the new visual stimulus delivery system up and running in the end of 2013. This project was carried out mainly by Dr. Ari Laiho and Tuomas Tolvanen with great consultation help from our previous Scientific Director, Docent Simo Vanni. The old projector will be available as a backup projector and for backward compatibility for older research projects.

In 2013, AMI Centre has continued collaborating with DrTech Ville Renvall (Aalto University School of Science (AU SCI), O.V. Lounasmaa Laboratory, Brain Research Unit; and AU SCI, Department of Biomedical Engineering and Computational Science, Human Emotion Systems Lab) on developing a two-person fMRI measurement setup. This ongoing development project includes, for example, a custom-built 2-person headcoil for the Siemens Skyra scanner.

AMI Centre's quality assurance (QA) procedures have been in use for many years with no

noticeable changes. Hanna-Leena Halme (from Aalto University School of Science, Department of Biomedical Engineering and Computational Science) performed a literature review of current MR-QA routines used in the world (focusing in fMRI and DTI) in her special assignment and made a preliminary plan to improve the procedures currently in use. This project continues in 2014 with summer student efforts.

In 2014 we plan to continue improving our general stimulus systems to meet the demands from our users. In addition, we have secured funding for a new parallel transmit (pTX) update for the scanner. The update and quick commissioning of the new technique is one of the highest priorities for the year 2014. The users are expected to benefit from the update in markedly improved signal quality (less artefactual distortion and blurring as well as diminished detrimental effects of motion and flow) or, alternatively, with faster imaging times. As a particular feature, the fully dynamix pTX makes it possible to create a zoomed field-of-view to enable improved spatial resolution for targeted areas.

MEG CORE

MEG Core has tested and developed further gadgets for MEG measurements. These gagdets include meg2meg synchronization tools to connect to separate MEG systems for synchronized MEG recordings, touch screens, accelerometers, and gyroscopes for monitoring hand movements during recordings, and instruments for generating passive finger movements in MEG recrodings.

MEG Core has also continued technical research agreement with Elekta Oy. Within this contract, we have developed and tested new Elekta products. In addition, we have trained new Elekta MEG users at MEG core

In 2014, MEG Core will continue to improve the facility with the main emphasis on the stimulators and monitoring devices.

5 Equipment use and infrastructure funding

AMI CENTRE

The total use of AMI Centre's magnet was similar than before. The biggest user groups were University of Helsinki users (together 27% of the total) and Department of Biomedical Engineering and Computational Science (22%) from Aalto University in the second place. The use of aivoAALTO project (19%) and Brain Research Unit (17%) followed the trends of previous years.

Notably, radiographer assistance is still much required and extremely important part of our operation as many groups measure only during prime time (Mon–Fri, 9–16) when this service is available. Last-minute cancellations have increased during the past two years, but on the other hand, the new Siemens scanner has proven to be very stable, decreasing the need for maintenance by Siemens in comparison to the old GE scanner.

	AMI CENTRE (hours used)										**2013**
	2004	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	**2013**	**%**
Aalto users											
BECS	*173*	*168*	*194.5*	*98*	*85*	*84*	*108*	*194*	*50*	231	21.7
AivoAALTO	-	-	-	-	-	*28*	*252*	*115*	*177*	201	18.9
BRU	*286*	*529*	*479.5*	*622*	*339*	*253*	*227*	*335*	*286*	185	17.4
AMI Centre[1]	*230*	*151*	*154*	*85*	*27*	*46*	*56*	*47*	*92*	39	3.7
Acoustics	-	-	-	-	-	-	*7*	*7*	-	3	0.1
SHOK	-	-	-	-	-	-	-	*44*	*30*	-	0
BIT Research Centre	-	-	-	-	-	-	-	*2*	-	-	0
Applied Electronics Laboratory	-	*16*	-	-	-	-	-	-	-	-	0
Aalto users total	***689***	***864***	***828***	***805***	***451***	***411***	***650***	***744***	***635***	**659**	**61.8**
Outside users											
UH	*115*	*76*	*81.5*	*126*	*126*	*172*	*268*	*131*	*339*	286	26.8
HUS	*37*	*19*	*18*	*10*	*10*	*4*	*4*	*5*	*82*	60	5.6
Other academic	*283*	*35*	*27.5*	*7*	*24*	*91*	*10*	*63*	*57*	61	5.7
Others (clinical & industry)	*2*	*9*	*50*	*20*	*40*	*47*	*35*	*16*	*3*	-	0
Outside users total	***437***	***139***	***177***	***163***	***200***	***314***	***317***	***215***	***481***	**407**	**38.2**
All users total	***1126***	***1003***	***1005***	***968***	***651***	***725***	***967***	***959***	***1116***	**1066**	**100.0**
Radiographer	*n/a*	*n/a*	*n/a*	*577*	*410*	*508*	*663*	*553*	*641*	*647*	
Radiographer %	*n/a*	*n/a*	*n/a*	*60%*	*63%*	*70%*	*69%*	*58%*	*57%*	*61%*	
Maintenance[1, 2]	*n/a*	*n/a*	*n/a*	*214*	*234*	*218*	*212*	*735*[3]	*180*	*185*	
Free pilots[1]	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*5*	*13*	*6*	*5*	
Cancellations[4]	*n/a*	*n/a*	*n/a*	*~30*	*~20*	*~5*	*~5*	*32*	*55*	*65*	

[1] Not invoiced: Service times, AMI Centre's technical development projects, Complimentary phantom pilots for new users

[2] Includes (those which are in prime time): GE/Siemens maintenance, AMI maintenance, trainings, visits

[3] Including the 3-month downtime for Scanner change (approx. 575 prime time hours)

[4] Last-minute cancellations (not invoiced): 1. Subject notification (force majour) 2. Contraindication 3. Other reasons

MEG CORE

The total number of used hours in MEG Core was very close to the estimated. The biggest user group continued to be Brain Research Unit using almost half of the total number of hours.

	MEG Core (hours used)	**2013**
	2013	**%**
Users		
MEG Core/BRU	754	47.5
HUS collaboration	265	16.7
BECS	196	12.3
Outside visitors	19	1.2
Elekta (intro training)	64	4.0
Elekta (service training)	135	8.5
Service (helium refills)	156	9.8
All users total	**1589**	**100.0**

AALTO TMS

In the first year of operation, the total number of used hours in Aalto TMS was unfortunately below the expected. There are two main explanations to the low usage hours in Aalto TMS. First of all, the start up took longer than estimated and, in addition, the head of the Aalto TMS, PhD Juha Silvanto, found a new job elsewhere.

	AALTO TMS (hours used)	**2013**
	2013	**%**
Users		
BRU	118.5	46.0
Training	11	4.3
Workshops	8	3.1
Demos	20	19.4
Service	100	38.8
All users total	**257.5**	**100.0**

OPERATING COSTS 2013

In 2013, the total income (910 k€) was close to the estimated budget. The income came from user fee (480 k€) and basic funding (430 k€). Both AMI Centre and MEG Core met both ends of the budget whereas Aalto TMS was heavily supported by ANI to make the start up possible. The expenses in MEG Core were 275 k€, AMI Centre 560 k€, and Aalto TMS 130 k€.

6 Safety, teaching, seminars, visitors, and travel

AALTO TMS

Aalto TMS laboratory's own safety course, which is a prerequisite for all TMS measurements at Aalto TMS laboratory, was organized 2 times during 2013 and a total of 8 individuals (4 foreigners) passed it.

Aalto TMS organized a demo (19th April, 2013) with a title *"Aalto TMS Demo 2013: Navigated transcranial stimulation"*. The demo afternoon contained information about the Aalto TMS facilities and a demonstration of the neuronavigated TMS system with EEG co-registration. The demo was attended by 21 persons (6 foreigners). Later in the year (1st November, 2013) a workshop with a title *"Dual-site Transcranial Magnetic Stimulation"* was organized. The workshop consisted of a dual-site TMS demonstration and free-form brainstorming about research ideas and their execution. The event was participated by 14 individuals (3 foreigners).

The highlight of the year was the *Aalto TMS Symposium 2013* on *"Transcranial magnetic stimulation and neuroimaging: state of the art"*. The symposium brought together leading international figures that provided an overview of the current state of the TMS field. The invited speakers were world leaders in the use of TMS in neurophysiology and cognition, and the combination of TMS with fMRI, EEG, and animal work. The symposium consisted of 6 lectures, 6 foreign speakers and was participated by 92 individuals (20 foreigners).

In addition, Aalto TMS laboratory was also visited by 3 persons from Satakunta hospital district on 26th of April. Also 3 persons from Nexstim Oy visited the laboratory on 4th of June. Mega Electronics Ltd. and Magstim Ltd. representatives (2 persons) visited the laboratory and offered user training on 21st of May. Additional scientific talks related to Aalto TMS activities were included in the joint laboratory seminars of the Brain Research Unit and the Department of Biomedical Engineering and Computational Science.

Aalto TMS Laboratory's laboratory engineer, MSc Mikko Nyrhinen, attended to annual meeting of clinical neurophysiology society at Seinäjoki on 22nd of March. He also attended to national clinical neurophysiology days at Tampere on 6th–8th of November and to the *TMS-EEG summer school "Coupling to dynamics of the human brain with TMS-EEG"* organized by Department of Biomedical Engineering and Computational Science (BECS) in Porvoo, Biomedicum Helsinki, and Aalto University on 3rd–8th of June.

AMI CENTRE

AMI Centre organizes its own MRI safety course, which is a prerequisite for all MRI scanner users at AMI. It was organized 4 times during 2013 and a total of 32 individuals (14 foreigners) passed it (altogether 426 people have passed it since 2002). Many people who have not been doing measurements in MRI for a couple of years, have participated in the course again to refresh their safety knowledge. In addition, Aalto NeuroImaging organized a first-aid course to ANI personnel and to a couple of willing AMI users (*"EA1"*, focus on possible safety issues with MR-imaging; 13th-14th May, 2013). The course lectures were given by Juri Forsbom from EMA Group Oy, Helsinki, Finland.

AMI Centre was one of the organizers of a two-day *"fMRI School 2013"* (12 lectures; 7 speakers; 47 participants from many nationalities and six different universities) together with Brain Research Unit and Finnish Graduate School of Neuroscience (17th–18th September, 2013). Furthermore, AMI personnel hosted several informal visits by groups or individuals of students, researchers, science reporters, and television crews. To our magnet user groups, we often arrange

demonstrations of new equipment and magnet use. In May, we organized user training for the VD13 software update (teaching by Siemens application specialist, Magnus Karlsson). 4 separate groups (altogether 17 participants) from various user groups attended the hands-on training.

During 2013, the AMI Centre's safety committee (whose members were Toni Auranen, Riitta Hari, Veikko Jousmäki, Ville Renvall, and Raimo Sepponen) had email exchanges and couple of meetings (not including all members) in which safety issues and procedures of testing new devices for the MRI environment were evaluated. Additional scientific talks related to AMI activities were included in the joint laboratory seminars of the Brain Research Unit (O.V. Lounasmaa Laboratory) and the Department of Biomedical Engineering and Computational Science.

DrTech Toni Auranen, DrTech Ville Renvall, and MSc Tuomas Tolvanen visited Siemens headquarters (Erlangen, Germany) on 11th–12th of December in order to see a Skyra system with installed pTX update in action prior to purchase decision. Our personnel were accompanied by Kari Koski from Siemens.

MEG CORE

MEG Core organized a MNE Python workshop at Aalto University with several participants. MEG Core also organizes Elekta Service Trainings and Elekta Neuromag TRIUX Introductory Trainings in collaboration with Elekta Oy. In 2013, MEG Core contributed to one Service Training with 5 participants (5 foreigners) and three Introductory Trainings with 22 participants (12 foreigners).

MSc Fedaa Almohammed and Dr Salah Almubarak from King Fahad Medical City, Riyadh, Saudi Arabia, were trained at MEG Core to learn more about MEG, source modelling, and clinical applications. MSc Fedaa Almohammed had a six month training and Dr Salah Almubarak one month training. In addition, PhD Mikel Lizarazu from Basque Center on Cognition, San Sebastian, Spain, was trained at MEG Core for one month.

7 ANI personnel

7.1 Aalto TMS, AMI Centre, MEG Core

Veikko Jousmäki, ANI Director, PhD, Docent, Senior Scientist (**MEG**)

Toni Auranen, AMI Technical Director, DrTech, Staff Scientist (**AMI**)

Mia Illman, MEG Technologist (**MEG**)

Helge Kainulainen, Technician (**MEG**)

Marita Kattelus, Radiographer (**AMI**)

Mikko Nyrhinen, Laboratory Engineer, MSc (**TMS**)

Petteri Räisänen, System Administration/Technical Support (~1 day per week for **ANI**)

Ronny Schreiber, System Administration/Technical Support (~1 day per week for **ANI**)

Tuomas Tolvanen, Research assistant (**AMI**)

7.2 Users and collaborators of the Aalto NeuroImaging (N = 220)

The persons listed below are either, *authors* in scientific publications and theses where Aalto NeuroImaging is indicated in the byline or where data measured at any part of ANI (Aalto **TMS**, **AMI** Centre, **MEG** Core) were used in 2013, and/or they are members of research teams collecting data or carrying out research on data collected at ANI; the latter names have been collected from the active research permissions as well as project information and user notifications delivered to ANI in 2013. Also the employees of ANI who are performing measurements are listed here.

The total number of users and collaborators of the Aalto NeuroImaging infrastructure in 2013 adds up to 220 individual researchers (65 foreigners, 112 individual authors in 2013) with AMI Centre affiliating to 189, MEG Core to 51, and Aalto TMS to 5 of them. Out of the total, 113 were affiliated with Aalto University, 51 with University of Helsinki and 10 with HUS, some with double or triple affiliations.

Abbreviations: *AU = Aalto University*
UH = University of Helsinki
HUS = Helsinki and Uusimaa Hospital District

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