Fourth meeting on the EADC-ADNI Harmonization of Protocols for Hippocampal Segmentation
AAICAD, Paris, Wednesday, July 20, 2011

Participants:

Giovanni Frisoni, Marina Boccardi – IRCCS S. Giovanni di Dio - Fatebenefratelli, BS, Italy
Simon Duchesne - Laval University, Québec City, Canada
Clifford R. Jack - Mayo Clinic, Rochester, MN, USA

Charles deCarli - UC Davis, CA, USA
Liana Apostolova - UCLA, CA, USA
Josephine Barnes - UCL Neuroscience, Dementia Research Centre, London, UK
Andy Simmons - (NEUROMED), London, UK
Enrica Cavedo - IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Alberto Redolfi - IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Annapaola Prestia - IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Michela Pievani - IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Moira Marizzoni - IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Marco Lorenzi - IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Lisa Bain - Association Science Writer
Susan Behling - Bristol-Myers Squibb
Boubakeur Belaroussi - Bioclinica
Nenad Bogdanovic - Pfizer Group
Luc Bracoud - Bioclinica
Lena Brynne - AstraZeneca
Maria Carrillo - Alzheimer's Association, Chicago, IL
Lies Clerx - University of Maastricht, the Netherlands
Patricia Cole - Imagepace
Roderick Corriveau - NIH
Allitia DeBernardo - Johnson & Johnson
Michel der Grothe - Department of Psychiatry, University of Rostock, Rostock, DE
Nick Fox - London, UK
Mirjam Geerlings - SMART-MEDEA STUDY, Utrecht, the Netherlands
Denise Head - Department of Psychology, Washington University, USA
Maria Isaac - EMA
Chi-Ming Lee - AstraZeneca
Joomi Oh - Synarc
Chahin Pachai - Bioclinica
David Raunig - Pfizer Group
Adam James Schwarz - Lilly
Lisa Silbert - Oregon Health & Science University School of Medicine
Heather Snyder - Alzheimer's Association, Chicago, IL
Holly Soares - Bristol-Myers Squibb
Hilkka Soininen - University and University Hospital, Kuopio, Finland
Joyce Suhy - Synarc
Lennart Thurfjell - GE Heathcare
Gary Tong - Bristol-Myers Squibb
Pietr Jelle Visser - University of Maastricht, the Netherlands
Lei Wang - Wash U, Northwestern U, Chicago, ILL, USA
Peng Py Yu - Lilly

Derrick Hill - Centre for Medical Image Computing, Univ College London, UK
Jerome Barakos
Laura Bonetta
Cyrille Suir
Louis Kirby
Francois Nicolas

Remote participants:

Martina Bocchetta	- IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Gabriele Corbetta	- IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Daniele Tolomeo	- IRCCS S. Giovanni di Dio – Fatebenefratelli, BS, Italy
Nicolas Robitaille	- Laval University, Québec City, Canada
Fernando Valdivia	- Laval University, Québec City, Canada
Leyla DeToledo-Morrell	- Rush UMC, Chicago, ILL, USA
Travis Stoub	- Rush UMC, Chicago, ILL, USA
Ronald Killiany	- Center for Biomedical Imaging, Boston Univ, Boston, Massachusetts
Timothy Brown	- Johns Hopkins University
Yawu Liu	- University and University Hospital, Kuopio, Finland
Wouter Henneman	- Dept of Radiology, VU Univ Medical Center, Amsterdam, NL
Timothy Brown	- Johns Hopkins University, USA
Carlton P. Frost	- University of Wisconsin-Madison, USA
Luo Feng	- Bristol-Myers Squibb
Wendy Hayes	- Bristol-Myers Squibb
Glenn Stebbins	- Rush UMC, Chicago, ILL, USA

Dr Frisoni describes the participants, the overall project, the next steps and the work done so far. Boccardi shows the Delphi methods and discusses the steps and the results of the first two Rounds carried out so far. She also encourages the participants to send suggestions regarding:

- the definition of the most rostral part of the hippocampus
- the definition of not visible structure tracing (such as the very atrophic subiculum)
- the way to exclude the internal liquor
- the reference axis of the hippocampus for the orientation of the images
- the software, which needs to be free and to allow 3D navigation and editing, subvoxel tracing and computation, and simultaneous tracings of different structures.

These suggestions will be fed to the Delphi Panel.

The presented slides are available at www.hippocampal-protocol.net.

• •

Questions/comments from the audience:
Q=question
A=answer
C=comment

VALIDATION PHASE

Q (C DeCarli): He expresses some doubts regarding the design of the Validation Phase.
A (GB Frisoni): The design has been discussed many times previously, and this meeting is meant to consider the Delphi results.

SEGMENTATION TOOL

C (T Brown): Seg3D software is good for segmenting in 3D.
A (S Duchesne): Thank you - will forward to M Boccardi/GB Frisoni. The point here is to keep the software the same for this project, so that people argue about anatomy, not technique

DELPHI QUESTIONNAIRE

C (C Jack): His question is about the opportunity of including questions to the Delphi panel about the ability of automated algorithms to carry out some of the segmentation parts that might be performed better by automated algorithms than by human tracers. He also comments about the possibility of considering, in the next Delphi round, the feasibility of execution of human tracers versus automated algorithms and the difficulties that may be encountered by automated software when dealing with some boundaries (for instance, the internal pools and the vestigial tissue). Automatic segmentation is desirable, and the Delphi panel may consider a protocol compatible with algorithms. The group should also discuss the practical implementation.

C (C DeCarli): He comments about the fact that the Delphi panel so far took decisions based on a small number of SUs data carried out by expert tracers from the same laboratory, especially regarding the reliability. He claims that some portions, such as the vestigial tissue or the internal spaces of CSF, could not be reliable traced in his laboratory. Some issues for the Delphi panel could be better solved if there were more segmentations, possibly from different laboratories, available to assess the remaining variability. He suggests to postpone the Delphi final decision until we will have a larger number of tracers.

A (GB Frisoni): Ideally, the problem is that until the Delphi panel has not reached a consensus on the final Harmonized Protocol we will not be able to have the Protocol applied to a larger number of tracers. So it's a sort of circular argument.
C (C Jack): He suggests to use the same images already traced for automatic segmentation and feed the Delphi Panel to enrich the data.

AUTOMATIC ALGORITHM - VALIDATION PHASE

Q (L Feng): Any evaluation on automatic algorithm for hippocampal segmentation? eg. LEAP?
A (S Duchesne): C Jack just addressed the same issue.

C (D Hill - C Jack): A discussion ensues regarding the need to validate, with an automated software techie audience, the final protocol - so that some issues are addressed or known. D Hill notes that some issues have an important and a practical impact on the implementation of an automated algorithm. He suggests to include in the Delphi panel and involve additional people with technical experience to contribute and to do understand how the algorithms work. The problem may be that the Delphi will come up with a Segmentation Protocol which is impossible to achieve by automated algorithms.

C (C Jack): He makes the point that this techie audience would need to be free of commercial bias. The point being that some techniques (e.g. surface vs. intensity) will be more able than others to capture some of the boundaries (e.g. straight lines vs. morphological definitions).

C (C DeCarli): His suggestion to industry representatives in the room for a general dataset (images, harmonized labels) is well received.

C (L Thurfjell): The main urgent need for companies involved in the development of automated algorithms is to have a gold standard for segmentation. Automatic algorithms for hippocampal segmentation need to be tested versus this standard, because they are unable to segment some portions of the hippocampus. Then we can discuss what to change, whether to include the algorithms or to smooth out the Harmonization, so we run a Delphi.

C (R Killiany): These are really two separate issues. It seems that the first priority is to get agreement as to the optimal boundaries of the hippocampus when using manual segmentation and then assess the ability for automated segmentation to achieve this definition. It is highly likely that automated segmentation techniques will continue to develop and the harmonized hippocampus definition could serve as a goal for segmentation to achieve.

USE OF STANDARD FOR AUTOMATIC ALGORITHMS

Q: What about the standard for the automatic algorithms?
A (GB Frisoni): 3D probabilistic maps will be developed and used as the standard.

Q (D Hill): Please clarify the use of the gold standard for the algorithms: for accuracy for atlas or for validation for medical device?
A (GB Frisoni): We planned to make all the data produced publicly available, included the probabilistic maps, which may help in the development of atlases. Following the agreement that we have with the Alzheimer's Association we are bond to make everything clear available.

C (J Barnes): She says that they use multi-atlas approach for automated algorithms. It's better changing or editing manual segmentations on a atlas to actually adapt to the Protocol, rather than using the labels here as the atlas, because there may not be the subject variability for an atlas high standing. Her suggestion is to use data coming out from this project to edit atlases rather then the other database.

C (A Simmons): He suggests to have a larger number of scans, for instance 200 scans available, segmented following the Harmonized Protocol to compare this exercise with what everyone developed in his house do far.

C (GB Frisoni): We planned to make available not only probabilistic maps, but also very individual hippocampal tracings.

Q (C Jack): He suggests the re-distribution of scans with individual tracings, but some technical issues came out, because they were now traced not in their native space, but in a Talairach space.

A (S Duchesne): We can transform the tracings and move them into another space, also their native space. At the moment the tracings are made on images only oriented along the AC-PC. We can distribute the images (transformed and not), the tracings (transformed and not) and the transformation procedure, to allow everyone to get all the material. He will discuss soon with dr Jack.

C (GB Frisoni): Invite participants to provide suggestions on possible requirements they suppose to be important, the leading group will discuss about them, but final decisions are taken by the Delphi panel. Everyone can send their comments or suggestions to: hippocampal.protocol@gmail.com