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AERES report on the research unit

CoB Tek

From the

University of Nice

January 2011

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Section des Unités de recherche

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Le Président de l'AERES

Didier Houssin

Section des unités
de recherche

Le Directeur

Pierre Glorieux

January 2011

Research Unit

Name of the research unit: CoB Tek

Requested label: EA

N° in the case of renewal

Name of the director: Mr Philippe ROBERT

Members of the review committee

Committee chairman

Mr Leszek KACZMAREK, Nencki Institute, Warsaw, Poland

Other committee members

Mr Daniel CHOQUET, University of Bordeaux, FRANCE

Mr Enrique RODRIGUEZ-BOULAN, Cornell University, New York, USA

Mr Ofer MANDELBOIM, Hebrew University, Jerusalem, Isarel

Mr Nicolas LE NOVERE, EMBL-EBI, Hinxston, UK

Mr JiaYi LI, Lund University, Lund, Sweden

Mr Huib MANSVELDER, VU University, Amsterdam, The Netherlands

Mr Rodrigo A. CUNHA, University of Coimbra, Coimbra, Portugal

Mrs Daniela PIETROBON, University of Padova, Padua, Italy

Mr Jamel CHELLY, University Paris-Descartes, Paris, France

Mr Ralf JOCKERS, University Paris-Descartes, Paris, France (CoCNRS member)

Mrs Catherine PICART, University of Grenoble, France (CNU member)

Observers

AERES scientific advisor

Ms Catherine DARGEMONT

University, School and Research Organization representatives

Mr Jean Marc LARDEAUX, Nice University

Report

1● Introduction

- **Date and execution of the visit**

The site visit took place in Sophia-Antipolis on January 26, 2011 and was conducted by an international team of scientists with expertise in the area of scientific interest represented by the team of research being evaluated. The team presented its overall past activity and future strategy for the next 4 years.

- **History and geographical localization of the research unit, and brief presentation of its field and scientific activities**

The CoB Tek team, which is asking for its creation, is composed of the Pulsar unit for the INRIA (Institut National de la Recherche en Informatique et Automatique) and the Nice University Hospital Memory Centre (CMRR - CHU for Centre Mémoire de Ressources et de Recherche). The aim is to promote the organization of a Partnership between the INRIA and the Nice Sophia Antipolis University. The partnership project started in 2009 with the submission and the acceptance of an ANR TecSan project (SWEET - Home).

The Memory Resource and Research Centre (CMRR) of the University Hospital in Nice was officially established on December, 2002. The research activities of CMRR involve behavioural and affective (mood) disturbances related to dementia. The CMRR is founded on four pillars: (1) care; (2) teaching; (3) research and (4) activation and maintenance of professional networks. The Pulsar (Perception, Understanding, Learning, System, Activity Recognition) unit of INRIA is an established research project team focusing on Activity Recognition. More precisely they are interested in the real-time semantic interpretation of dynamic scenes observed by sensors.

- **Management team**

The management team is composed of the head of the CMRR and the head of the Pulsar team.

- **Staff members (on the basis of the application file submitted to the AERES)**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)		1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)		1.8
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)		2.3
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)		1.8
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)		0.8
N6: Number of Ph.D. students (Form 2.7 of the application file)		5
N7: Number of staff members with a HDR or a similar grade		

2 • Overall appreciation on the research unit

• Summary

This is a unique and novel setup bringing together clinicians and computer scientists. They try to develop translational researches in scientific domains and establish networks between clinic research unit among the Hospital, Medical School and INRIA units.

For translational research, one classically emphasizes speed up processes from basic/preclinical researches to clinical applications, ie following a "bench-to-bedside" paradigm. Instead this unit proposes an "ICT or computer-to-clinic", i.e. a direct link between such information and communication technology and clinical settings. With this setup, the information flow from different "platforms and databases" of behavioral pathology to clinics may be largely smoothened and speeded up. Therefore, it is particularly interesting to see how efficient this setup will be.

• Strengths and opportunities

The two teams from which the new unit will be composed already exist and function as independent and successful entities that have secured funding

The creation of the cob TEK team will enable the official adoption of CMRR, which already plays an important role in teaching and research, within the university.

• Weaknesses and threats

Only parts of each original team (INRIA-PULSAR and CMMR) are part of this Cob TEK project. The themes subsumed under the partnership with CMRR will only encompass health-related topics. While CMRR currently benefits from having being under the umbrella of the Ministry of Health DGOS it has not yet been identified as a university entity.

• Recommendations

The committee in principle supports the idea to create the CobTek team, however, it would welcome more precise definition of the scientific goals. The committee appreciates the efforts to bridge engineering and clinical expertise, as this is important direction for the future. Furthermore, all the efforts to better diagnose the disease progress is of great importance and the proposed studies may also lead to development of novel strategies alleviating the hardship of the patients' everyday life.

• Production results

A1: Number of permanent researchers with or without teaching duties (recorded in N1 and N2) who are active in research	
A2: Number of other researchers (recorded in N3, N4 and N5) who are active in research	
A3: Ratio of members who are active in research among permanent researchers [(A1)/(N1 + N2)]	
A4: Number of HDR granted during the past 4 years	
A5: Number of PhD granted during the past 4 years	

3 ● Specific comments on the research unit

● Appreciation on the results

The research activities of CMRR involve behavioural and affective (mood) disturbances related to dementia and most particularly apathy. The CMRR is also involved in several research networks. The three main research networks have enabled the CMRR to be positioned at the cutting edge of Alzheimer disease research. They have developed, validated and used scales and diagnostic criteria of the evaluation of behavioural problems (BPSD) in dementia (The Neuropsychiatric Inventory (NPI); the Apathy Inventory (AI); diagnostic criteria for apathy). They have also recently completed the first randomized-controlled trial evaluating the effect of a specially-trained care team for the management of behavioural disturbances in nursing home ("EHPAD") residents with dementia.

They have produced 45 papers in the last 4 years in international Journals (e.g. Lancet Neurology, Nature Review Neurology, etc) It is a very well recognized unit on Alzheimer's disease.

In parallel, the PULSAR INRIA team has published over 40 papers also in international journals. The PULSAR team focuses on the observation of activities. They are interested in the semantic interpretation of dynamic scenes in real time observed by "captors" such as video cameras). As such, they study spatio-temporal activities undertaken over the long term by human beings, animals or vehicles. PULSAR is developing new techniques in the field of cognitive vision, cognitive recognition systems for physical systems, learning systems, and systems of evaluation. They focus on two areas (1) video surveillance; and (2) the maintenance of elderly people in their own homes.

● Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners

The team is composed by clinicians and scientists (mathematicians) recognized in their field. The fact that these people with very different background develop a project together, which has been recognized and granted by ANR, is already a sign of their mutual attractiveness. It is too early to assess how this new group is perceived in the scientific community.

● Appreciation on the management and life of the research unit

The partnership between PULSAR and CMMR was initiated in 2009, thanks to an ANR TecScan. The management team of the proposed structure is thus composed of the head of the CMRR and the head of the Pulsar team. It is a virtual laboratory, since clinicians will remained attached to their clinical hospital location. No publications have yet resulted from the collaboration.

● Appreciation on the scientific strategy and the project

The primary objective of this new team is to develop translational researches in the scientific domains such as to develop new strategies in order to prevent help and assist elderly people, to improve diagnostic and treatment for behavioral and cognitive symptoms in Alzheimer disease and related disorders, to improve autonomy in the elderly. Its secondary objective is to promote scientific networks between clinic research unit of the Nice hospital and School of Medicine and the INRIA units. The two key aspects of objective are 1) to create a detailed classification of normal and abnormal behaviors in the context of Alzheimer disease and its spectrum disorders (as an automatic reference for use by the new technologies), and 2) to undertake experiments with the participants themselves in order to validate this classification of behaviors in the form of Atlas Multimedia or a database accessible to other research teams and medical actors and health-care assistants. These appear as valuable objectives.

Intitulé UR / équipe	C1	C2	C3	C4	Note globale
COBTECK	Non noté	A	A	A	A

C1 Qualité scientifique et production

C2 Rayonnement et attractivité, intégration dans l'environnement

C3 Gouvernance et vie du laboratoire

C4 Stratégie et projet scientifique

Statistiques de notes globales par domaines scientifiques
(État au 06/05/2011)

Sciences du Vivant et Environnement

Note globale	SVE1_LS1_LS2	SVE1_LS3	SVE1_LS4	SVE1_LS5	SVE1_LS6	SVE1_LS7	SVE2 _LS3 *	SVE2_LS8 *	SVE2_LS9 *	Total
A+	7	3	1	4	7	6		2		30
A	27	1	13	20	21	26	2	12	23	145
B	6	1	6	2	8	23	3	3	6	58
C	1					4				5
Non noté	1									1
Total	**42**	**5**	**20**	**26**	**36**	**59**	**5**	**17**	**29**	**239**
A+	16,7%	60,0%	5,0%	15,4%	19,4%	10,2%		11,8%		12,6%
A	64,3%	20,0%	65,0%	76,9%	58,3%	44,1%	40,0%	70,6%	79,3%	60,7%
B	14,3%	20,0%	30,0%	7,7%	22,2%	39,0%	60,0%	17,6%	20,7%	24,3%
C	2,4%					6,8%				2,1%
Non noté	2,4%									0,4%
Total	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

* les résultats SVE2 ne sont pas définitifs au 06/05/2011.

Intitulés des domaines scientifiques

Sciences du Vivant et Environnement

• **SVE1 Biologie, santé**
   SVE1_LS1 Biologie moléculaire, Biologie structurale, Biochimie
   SVE1_LS2 Génétique, Génomique, Bioinformatique, Biologie des systèmes
   SVE1_LS3 Biologie cellulaire, Biologie du développement animal
   SVE1_LS4 Physiologie, Physiopathologie, Endocrinologie
   SVE1_LS5 Neurosciences
   SVE1_LS6 Immunologie, Infectiologie
   SVE1_LS7 Recherche clinique, Santé publique
• **SVE2 Ecologie, environnement**
   SVE2_LS8 Evolution, Ecologie, Biologie de l'environnement
   SVE2_LS9 Sciences et technologies du vivant, Biotechnologie
   SVE2_LS3 Biologie cellulaire, Biologie du développement végétal

Université
Nice SOPHIA ANTIPOLIS

Nice, le 14 avril 2011

Affaire suivie par :
Eric DJAMAKORZIAN

Tél. : 04 92 07 69.05
Fax : 04 92 07 66 00

N/REF : 2011-1804

AERES
M. Pierre GLORIEUX
Directeur de la section des Unités
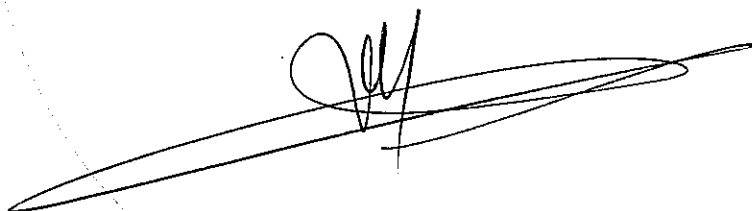de recherche
20 rue Vivienne
75002 – PARIS

Ref : Rapport d'évaluation S2UR120001733 - CoB Tek : Autonomie,
Vieillissement et Technologie - 0060931E

Monsieur le Directeur,

Faisant suite au travail effectué par le comité de visite de l'AERES et du
rapport d'évaluation émis sur l'Unité de Recherche « Autonomie,
Vieillissement et Technologie » portée par l'Université Nice Sophia
Antipolis, vous voudrez bien trouver ci-joint la réponse que nous
désirons apporter à ce rapport.

Celle-ci comporte uniquement des observations de portée générale qui
s'inscrive en droite ligne des recommandations très positives faites par
le Comité de visite que nous remercions pour son travail constructif.

Vous en souhaitant bonne réception,
Je vous prie de croire, Monsieur le Directeur, en l'expression de mes
sentiments distingués

Equipe d'Accueil CoB Tek

Response to the AERES report

- Recommendations

The committee in principle supports the idea to create the CobTek team, however, it would welcome more precise definition of the scientific goals. The committee appreciates the efforts to bridge engineering and clinical expertise, as this is important direction for the future. Furthermore, all the efforts to better diagnose the disease progress is of great importance and the proposed studies may also lead to development of novel strategies alleviating the hardship of the patients' everyday life.

IV – Scientific domains and key themes (paragraph included in the original project)

4.1 – Key words and mission statement:

Aging – Alzheimer disease – Behavioral and psychological disturbances (BPSD) – autonomy – techniques for the detection and analysis of behavior
The key objectives are as follows:

-The development of new knowledge in the area of aging and enabling the research and development of new intervention and prevention strategies using Information and Communication Technology, in particular, the analysis and interpretation of videos, image processing, and statistical analysis of data.
-The diagnosis and management of cognitive impairment and behavior and psychological symptoms of Alzheimer disease and its spectrum disorders
-Maintaining the autonomy of elderly people who present with normal aging or dementing illnesses
-To integrate technological advances at the heart of care and support services

4.2 – Specific aims:
-The **primary** aim of the partnership is to develop translational research within the scientific domain described above.

-The **secondary** aim of the partnership is to foster the establishment of a scientific collaborative network between the clinical teams of the Faculty of Medicine at the university hospital (CHU) in Nice and the teams at INRIA, as described above.

Scientific goals (new paragraph)

Not only dementia itself and its underlying diseases are increasingly shown to be complex in pathophysiology, but also dementia care is becoming more and more complex and heterogeneous, especially in an international perspective. Dementia is defined as an acquired syndrome of decline in memory and at least one other cognitive domain, such as language, visuospatial, or executive function, which is sufficiently severe to interfere with social or occupational function in an alert person (*DSM-IV-TR*). The commonest cause, Alzheimer's disease (AD) has a specific pathophysiology and clinical profile, beginning gradually and worsening over several years, thereby creating the notion of progressively passing several stages of severity.

In clinical practice, the diagnosis is based on behavioural assessments and cognitive tests that highlight quantitative and qualitative changes in cognitive functions, behaviours and activities of daily life, which are characteristic of the dementia

syndrome and its underlying diseases.

Following diagnosis, the patients, depending on actual age and co morbidity, usually have a wide range of years to live, with a median of approximately 5 years. Moreover, about 20% of Alzheimer patients show a plateau phase of stability in the clinical course of the disease.

Because of this natural course of the disease, dementia has sometimes been divided into stages (e.g. pre-dementia, mild cognitive impairment, early dementia, moderate dementia, advanced dementia), but the number and characteristics of these stages vary according to the assessment scales used. None of these staging systems has been generally accepted, and intermittently over the years, new scales or alterations and expansions of existing ones, are proposed. These standard rating scales do not fully capture the complexity of the disease as well as interaction of the patient with the environment.

Therefore, the goal of *CoB Tek* is to study how Information and communication technologies (ICT), in particular, imaging and video processing analytic techniques could be of interest in these fields.

To achieve this goal, two types of research need to be elaborated.

First basic research needs to be pursued to develop new sensor based technologies to automatically assess human behaviours in an objective manner.

Second, clinical studies are needed to establish the benefit of using these technologies to help patients suffering from dementia diseases.

Basic Research:

Concerning sensor-based technologies, the scientific goal of INRIA Pulsar team is to automatically assess a whole range of human activities using in particular cognitive vision and video analytics.

For *CoB Tek*, specific techniques will be developed to address video analytics challenges such as head, face, people posture detection as well as people dynamics (e.g. gesture, local motion, gait, trajectory detection).

These challenges consist also in advancing event recognition (e.g. standing still, walking, bending, action without goals (i.e. unaccomplished actions), repetitive actions, frailty unbalanced walk, time to sit, eating, physical activities), while preserving people privacy.

The goal is to link these recognized events with the early detection of health status degradation (e.g. apathy, depression, social isolation, erratic or violent agitation (motion), falls).

Clinical Research:

The mains goals of *CoB Tek* are in the two following domains:
- Monitoring / assessment
- Intervention

1/ monitoring: assessment:

- The overall clinical goal is to test and use multi sensor technologies to assess cognitive, behavioural, activities of daily living and environmental characteristics.

- Specific aims of the studies / protocols are:
    - Validation of these activities in relation with standard assessment tools and environmental characteristics.

- o Classification of normal and abnormal behaviors within specific situations (scenarios).

- Population: Elderly control subjects and patients with mild cognitive impairment (MCI), Alzheimer's disease (AD) and mixed dementia.

- Sensors to be used
    - o Sensors located on the patient (actigraph, camera)
    - o Sensors located in the environment (sound and video recording)

- More specifically the assessment will focus on 3 related domains:

    - Behavioral and psychological disturbances. Neuropsychiatric symptoms, also denominated as BPSD (Behavioural and Psychological Symptoms of Dementia) are increasingly recognized as an important aspect of dementia, because of their impact on the quality of life of both patients and their caregivers
    - Goal directed behavior (GDB). In neuroscience this construct used to operationalize a broad spectrum of purposeful actions and their determinants from the simplest single movement to the most complex patterns behaviors. GDB is a set of related processes (including cognition, emotion, motivation) by which an internal state is translated through actions into the attainment of a goal.
    - Activities of daily living.

The assessment of these 3 domains will be done in developing clinical scenarios to enable the participants to undertake a set of daily tasks that could realistically be achieved in the settings of the observation room and / or in the patient natural environment.

2/ Interventions

The final need of doctors and other health professional is to provide to patient better and individualized care. In a second time, *CoB Tek* will have to test sensors and related activators than can help directly the patient and/or the caregiver in their daily life.

Several targets are possible
- Prevention (for normal elderly with cognitive or behavioral complaints (age related)
- Teaching and training on how to cope with behavioral disturbances (for caregiver)
- Cognitive training and behavioral stimulation (for patients - mild stage)

Professeur Philippe Robert – CMRR Nice