

Nataliya KOSMYNA, PhD in Computer Science

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1- Prices and Awards

- October 2016 scholarship from L'Oréal-UNESCO for Women and Science.
- September 2016 **best PhD thesis 2015** from Université Grenoble Alpes community.

2- Education

a. Studies

I started my education as a Computer Science major and then specialised in Artificial Intelligence (AI) during my research master's degree. Finally my PhD thesis was at the crossroads of AI, Human Computer Interaction (HCI) and the Neurosciences.

- Since 12/2015 **Post-doc at Inria Rennes** with Anatole Lécuyer on the tangible visualization of EEG signals.
- 2012—2015 **PhD in Computer Science from** at Grenoble Informatics Laboratory (LIG), Engineering Human-Computer Interaction research group (EHCI), Grenoble, France. The defence took place on October 23, 2015.
- Title : Co-Learning for Brain Computer Interfaces (BCIs).
 - Advisor : Franck Tarpin-Bernard, Professor at Joseph Fourier University, the president of the Happy Neuron SBT group, member in the EHCI research group.

 - Jury:
 - Dr Robert Jacob, Professor, Tufts University, USA, Rapporteur
 - Dr José Rouillard, Associate professor, Université des Sciences et Technologies de Lille, Rapporteur
 - Dr Bertrand Rivet, Associate professor, Grenoble INP, Examiner
 - Dr Bertrand David, Professor, École Centrale de Lyon, Examiner
 - Dr Jérémie Mattout, Researcher CR1, INSERM Lyon, Examiner

Description : Traditionally, BCI research has been focussed on the signal processing and medical aspects of BCIs, while the aspects pertaining to interaction, usability and convenience, have been studied more scarcely. Commonly, training sessions are slow and tiring. In the context of the *CA-ICO* (Co-apprentissage/Interfaces Cerveau Ordinateur, or in English Co-learning/Brain Computer Interfaces) project of *LIG-EHCI* in collaboration with *GIPSA-lab* and funded by the *Grenoble INP* University and of my thesis research, I am working towards putting co-learning between the system and the user at the centre of BCI system design. The aim is to minimize offline training phases and maximize the user experience of BCIs. The ultimate goal is to bring BCI systems outside of the lab with a performance level comparable to more traditional and robust interaction modalities.

- 2010–2012 **Research Master in Computer Science in Artificial Intelligence and the Semantic Web.** Joseph Fourier University / École Nationale Supérieure d'Informatique et de Mathématiques Appliquées de Grenoble (Ensimag), Grenoble, France. *With Honours*. Best grade in the promotion for the research project: 16.5/20.
- 2009–2010 **Intelligent Systems and Networks diploma (BSc hons).** Economics and Information Technology Institute in Zaporojie, Ukraine. *Graduated Top of the Class. First Class Honours.*
- 2005–2009 **Adjoined Specialist in Computer System and Network Services diploma (BSc hons).** Economics and Information Technology College in Zaporojie, Ukraine. *Graduated Top of the Class. First Class Honours.*

3- Teaching Experience

- 2014–2015 **Teaching Assistant** at Université Pierre Mendès France (UPMF). Computational Cognitive Psychology Department, Grenoble, France.
- 2013 **Teaching Assistant** at IUT 1 Grenoble (translated as *University Institutes of Technology*). Multimedia Internet programming & design Department. Grenoble, France.
- 2012 **Master Research Internship.** Multimodal Combination of Eye-Tracking and Brain Computer Interfaces for Games. Grenoble, France.
- 2011 **Master Project Internship.** Development of a 3D application controlled by Brain Computer Interaction. LIG-EHCI. Grenoble, France.

4- Research activity and projects

a. Recapitulation

Goal: Development of Brain-Computer Interfaces as an interaction modality for everyday usage.

Bottlenecks : acquisition equipment (price, non-portable), variability of the signals , limited number of applications.

Contributions :

1. A general architecture based on asynchronous BCI principles and on incremental training combined with an unsupervised blind-source separation filter and a minimum distance classifier. This architecture allows producing BCIs with minimal training session (within 5 minutes).
2. Intuitive visualization modality for classification outcomes and distance features using Wachspress coordinate projection for an arbitrary number of classes. We combine the visualization with direct feedback mechanism where users can interactively change the classification margin, change the types of features as well as edit the training trials in real-time.
3. Operational Conceptual Imagery BCI based on our architecture, visualization and feedback system that allow for more natural interactions through the imagination of semantic categories and concepts. We show that this type of BCI is more effective at detecting distinct semantic categories rather than close ones.
4. New seamless training protocol for Conceptual Imagery that uses conceptual and semantic priming in order to integrate the training in the narrative and environment of the game without the realization of the user. Our technique leads to better flow and immersion of users in the game.

Applications : Drone piloting application, BB8 droid and Millennium Falcon piloting applications, DOOM 3 game control paradigm, intelligent home control (platform in Grenoble, France).

b. Dissemination

Radio

An interview with me is available at **France Inter** on the 04/07/2016: "Acting on the connected objects with one's mind". Listen to it as a podcast.

The interview with me at **France Inter** on the 19/03/2016: "Taking off the drone with your brain".

The interview with me at **RadioNova** on the 17/03/2016: The magic of the informatics.

An interview with me is available from **France Inter** on the 22/02/2016: "Acting on the connected objects with one's mind". Listen to it as a podcast.

Live radio interview on **France Bleu Isère** on the 3rd of April 2015 about my work on Brain Computer Interfaces.

TV

“Moving the objects with the force of one’s mind” to watch at France 3 Bretagne here, **November 2016**.

“The power of one’s thought” to watch at **M6** from 12/10/2016 here.

“How to control an object with one’s thought” to watch at **E=M6** here (in french).

Controlling the robots with one’s thought at the **Village of Sciences 2016** to watch here.

Explaining how can we pilot a drone with our brain for 10-15 years old at **LCI TF1** on the 26/03/2016 here (starting at 4min09).

« Controlling a robot with your brain ». My project is explained at **iTELE** on the 17/03/2016.

«Piloting a drone with your brain is not a science fiction». My project is explained at **France3 Paris IDF** on the 15/03/2016.

“Nataliya Kosmyna pilote des objets par la pensée”. Everything about my project is explained @**ARTEfr** (in French) or @**ARTEde** (in German).

Presenting a brainy drone @**TV5MONDE**: Controlling the objects with the power of the brain, <http://www.tv5mondeplus.com/video/15-11-2015/le-controle-des-objets-par-la-pensee-956800> (french only).

Télé Grenoble, 9th of April 2015 – Interview and demonstration in the hospital regarding the BCI drone piloting application.

France 3 Alpes, 18th of March 2015 – News segment about neuroscientific research showing the BCI drone piloting application.

France 3 Rhone-Alpes, 17th of March 2015 – Live interview and demonstration about/of the BCI drone piloting application the *Week of the Brain 2015 (La Semaine du Cerveau 2015)*.

Télé Grenoble, 13th of March 2015 – Interview regarding the *Week of the Brain 2015 (La Semaine du Cerveau 2015)*, BCI drone piloting demo.

Press (written&online)

Article in december 2016 issue of **Quebec Science** featuring my work on Brain-Computer Interfaces.

Article from **Agence France Presse** about my work on Brain-Computer Interfaces appeared in **Le Parisien, Le Direct Matin, Sciences et Avenir, TV5Monde**, the 2nd of december 2016.

An article about my scholarship from **L’Oréal-UNESCO for Women and Science** appeared at Inria website, October 2016.

Article about my work appeared at the website of **Espace des Sciences, october 2016**.

Video « Controlling the robots with one’s thought » at the **Village of Sciences 2016** to watch here, october 2016.

Read how to control the objects with one’s thought in **20 Minutes** here, October 2016.

“Controlling the objects with one’s mind” to read at “**The Connexion**” here (in english), October 2016.

“Will we be able to control the objects with the force of our minds” in **Capital** magazine, special issue, July- August 2016, link.

Article from July 2016 in **Paris Match** magazine (Hors Série: Revolution of the Brain) we talk about piloting a drone as well as Sphero BB8 droid control with the force of the brain.

Article from 01/06/2016-08/06/2016 in **01Net** magazine we talk about piloting a drone as well

as Sphero BB-8 droid control with the force of the brain.

Article about piloting a drone with your brain appeared on the 03/03/2016 on the cover of MonQuotidien, a magazine for 10-14 years old. You can check some funny drawings from it here.

Article (Paper, Online) in “Dauphiné Libéré”, Thursday, 14th of March 2015 – Coverage of the drone demonstrations for the *Week of the Brain* 2015.

Article (Online) on www.placegrenet.fr, Thursday, 14th of March 2015.

Article (Paper) in “Les Affiches”, 13th of March 2015 – Coverage of the drone demonstrations for the Week of the Brain 2015.

Article on the Grenoble Doctoral School College **newsletter and website**.

Podcast of Grenoble University on the Drone Demo for the *Week of the Brain* 2015 (*La Semaine du Cerveau* 2015), **30 minute video feature**.

Article “Sciences and Brains in the Lucie Aubrac college” (in french). **18th of June 2015.**

Video Report of AgenceInfoLibre about Innorobo 2015 with a segment about my demonstration for smart home control by the brain. **July 1 to 3, 2015.**

An article about a brainy drone demo, BB-8 droid controlled by the force of one’s mind and a little bit about myself is available in **Ouest France**, L’edition du soir from the 19/01/2016 and in a paper version of Ouest France from the 20/01/2016. Check it here (more photos and a video is available) or here (in french only).

Demos and Talks

Demonstration of the brainy drone at **Futurapolis 2016** : Piloting a Drone with a Brain Computer Interface using conceptual imagery and EEG headset EMOTIV EPOC. **Toulouse 3-4 November 2016.**

Talk + Demonstration of the brainy drone at **Dassault Systèmes** during **Meets Up « New Intelligence »**, **July 2016, Paris.**

Demonstration of the brainy drone at **TEDxRennes**, **May 2016.**

Demonstration of the brainy drone at **Foire de Paris 2016**, **30 april and 1st May 2016.**

Demonstration at **WonderCon 2016** : controlling a BB8 droid with a Brain Computer Interface using conceptual imagery and EEG headset EMOTIV EPOC.. **Los Angeles Convention Centre, 25-27 March 2016.**

Demonstrations for the Week of the Brain 2016 in Paris. Piloting a Drone with a Brain Computer Interface using conceptual imagery and EEG headset EMOTIV EPOC. At **Palais de la Découverte**, **14-20 March 2016.** Approximately 1000 bystanders. About 30 people participated.

Demonstration of the brainy drone for the european aerospace group, 1 day, 140 international ingeneers, the 9th of March, Paris, 2016.

Demonstration of the brainy drone for 300 managers of the assurance group on the 26/01/2016 in Paris.

Demonstration of the brainy drone at TechShop, Paris, France. 31 October 2015.

Demonstration of the brainy drone at ImaginaScience, Annecy, France. 14-15 October 2015.

Demonstration of the brainy drone at Grenoble Mini Maker Faire. 3-4 October 2015.

Demonstration at InnoRobo in Lyon on July 1 to 3, 2015 for *smart home control by the brain*.

Demonstration of the brainy drone for the children of VIRA association. June 2015.

Demonstration of the brainy drone at the “Informatics Days” in Caen, France. June 2015.

Demonstration of the brainy drone at the **Persycup robotics cup 2015.**

Three demonstrations for the « Remue Méninges 2015 » festival (for the children) – Piloting a Drone with a Brain Computer Interface using conceptual imagery and EEG headset EMOTIV

EPOC. The purpose of the demo was introducing *children* to research in the neurosciences and in Human Computer Interaction through a practical and recreational application to piloting a drone with one's brain. About 100 bystanders for each of the demonstrations, over 40 children participated in the demonstrations.

Three demonstrations for the Week of the Brain 2015 (La Semaine du Cerveau 2015) – Piloting a Drone with a Brain Computer Interface using conceptual imagery and EEG headset EMOTIV EPOC. Grenoble Hospital, Grenoble Children Hospital, Grenoble University. About 200 bystanders for each of the demonstrations, over 40 people participated in the demonstrations.

Demonstration of Piloting a Drone with a BCI using conceptual imagery and EEG headset EMOTIV EPOC for 3rd year students in signal processing. At Gipsa-lab, March 2015.

UBICOMP 2014 Demonstration in Seattle. Piloting a Drone with a Brain Computer Interface using conceptual imagery and EEG headset EMOTIV EPOC. About 30 people participated.

CHI 2014 Interactivity Demonstration in Toronto. Piloting a Drone with a Brain Computer Interface using motor imagery and a g.tec USBamp. Photo and social media coverage on my website. About 40 people, including science fiction writer Margaret Atwood participated.

Presentation of my work during the Ph.D Students Day, 2014.

Presentation of my work during “my Ph.D thesis in 180s”, 2014.

Presentation of my work during Grenoble Cognition Day, 2013.

TEDx

July 2016 talk TEDxVannes.

June 2016 talk TEDx FHKufstein.

c. Publications

Acronymes used for the journals

Front.Hum. Neurosci Frontiers in Human Neuroscience.

TOCHI ACM Transactions on Computer-Human Interaction.

TCIAG IEEE Transactions on Computational Intelligence and AI in Games.

ACM Transactions on Computer-Human Interaction (TOCHI he flagship journal of the Computer-Human Interaction community.

Acronymes used for the conferences

EUSIPCO European Signal Processing Conference.

EMBS IEEE EMBS Neural Engineering Conference.

UBICOMP ACM International Joint Conference on Pervasive and Ubiquitous Computing.

CHI CHI SIGCHI Conference on Human Factors in Computing Systems. ACM, New York, NY, USA.

interaction. Springer-Verlag, Berlin, Heidelberg.

IHM International Conference of the Association Francophone d'Interaction Homme-Machine. ACM, New York, NY, USA.

All the conferences are A or A+ ranking except IHM (no ranking available).

* I presented the papers marked with "*" .

Journal articles

- [Front.Hum. Neurosci'16] **N. Kosmyna**, F. Tarpin-Bernard, N. Bonnefond and B. Rivet (2016) **Feasibility of BCI Control in a Realistic Smart Home Environment.** *Front.Hum.Neurosci.*10:416. doi:10.3389/fnhum.2016.00416 **Impact Factor: 3.634**
- [TOCHI'15] * **N. Kosmyna**, F. Tarpin-Bernard and B. Rivet. **Conceptual Priming for In-game BCI Training.** *ACM Trans. Comput.-Hum. Interact.* 2015. **5-year Impact Factor: 1.37**
- [TOCHI'15] * **N. Kosmyna**, F. Tarpin-Bernard and B. Rivet. **Adding Human Learning in Brain Computer Interfaces (BCIs): Towards a Practical Control Modality.** *ACM Trans. Comput.-Hum. Interact.* 22, 3, Article 12 (May2015),37pages.DOI=10.1145/2723162 <http://doi.acm.org/10.1145/2723162>. **5-year Impact Factor: 1.37**
- [TCIAG'13] **N. Kosmyna** and F. Tarpin-Bernard. **Evaluation and comparison of a multimodal combination of BCI paradigms and Eye tracking with affordable consumer-grade hardware in a gaming context.** 2013. In *IEEE Transactions on Computational Intelligence and AI in Games*. Volume 5. Issue 2. DOI <http://dx.doi.org/10.1109/TCIAIG.2012.2230003>. **5-year Impact Factor: 1.167**

Peer-reviewed full papers at international conferences

- [EUSIPCO '15] * **N. Kosmyna**, F. Tarpin-Bernard and B. Rivet. **Operationalization of Conceptual Imagery for BCIs.** *EUSIPCO'2015. In Proceedings of the 23rd European Signal Processing Conference*, Aug. 2015.
- [INTERACT'15] * **N. Kosmyna**, F. Tarpin-Bernard and B. Rivet. **Towards Brain Computer Interfaces for Recreational Activities: Piloting a Drone.** *15th IFIP TC.13 International Conference on Human-Computer Interaction – INTERACT 2015.* Springer Berlin Heidelberg (2015).

Conférence de rang A (Classement CORE) avec un taux d'acceptation de 29%.

[EMBS'13] * N. Kos'myna, F. Tarpin-Bernard and B. Rivet. **Towards a General Architecture for a Co-Learning of Brain Computer Interfaces** in *Proceeding of the 6th International IEEE EMBS Conference on Neural Engineering*, San Diego, USA, November 2013.

Peer-reviewed papers at national conferences

[IHM'12] * N. Kos'myna and F. Tarpin-Bernard. **Une combinaison de paradigmes d'interaction cerveau-ordinateur et suivi du regard pour des interactions multimodales.** in *Ergonomie et Interaction Homme-Machine ErgoIHM'2012*.

Extended abstracts for demonstrations

[UBICOMP'14] * N. Kosmyna, F. Tarpin-Bernard and B. Rivet. **Drone, Your Brain, Ring Course: Accept the Challenge and Prevail!** UBICOMP'14 ADJUNCT. 2014. 243-246.

[CHI'14] * N. Kosmyna, F. Tarpin-Bernard and B. Rivet. **Bidirectional Feedback in Motor Imagery BCIs: Learn to Control a Drone within 5 Minutes.** CHI'14 Extended Abstracts on Human Factors in Computing Systems. 2014. 479-482.

Reves for dissemination and scientific vulgarization

[ACM Interactions'15] N. Kos'myna, F. Tarpin-Bernard and B. Rivet. **Brains, Computers, and Drones: Think and Control!** *ACM Interactions* 22, 4 (June 2015), 44-47. DOI=10.1145/2782758 <http://doi.acm.org/10.1145/2782758>

Theses

N. Kosmyna. **CA-ICO : Co-Apprentissage pour les Interfaces Cerveau Ordinateur (ICO)**. PhD thesis, 2015.

N. Kosmyna. **Combinaison multimodale de suivi du regard et des Interfaces Cerveau Ordinateur (ICO) pour les jeux.** Master thesis, 2012.

References

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