Abstracts

Résumé (français)

L'IEA proposée est un échange entre une unité CNRS INS2I (STMS UMR9912, IRCAM/CNRS/SU) à Paris et un laboratoire de neurosciences (Institute of Neuroscience and Psychology) de l'Université de Glasgow en Ecosse. Cette IEA est basée sur une collaboration émergente entre les "PI" Jean-Julien Aucouturier (CNRS) et Philippe Schyns (Glasgow). Depuis quelques années, le groupe de P. Schyns développe un remarquable paradigme dit "data-driven" pour révéler le traitement de l'information visuelle dans le cerveau (Adolphs et al. Nature 2005; Zhan et al. Current Biology, 2019). Afin d'étendre ce paradigme à l'étude du traitement de l'information auditive et du langage, il faut y intégrer des techniques de manipulation du signal sonore, qui sont justement celles récemment développées par le groupe de JJ. Aucouturier à l'IRCAM (Ponsot et al. PNAS 2018). L'IEA se propose d'intégrer ces 2 méthodologies en finançant un séjour de JJA à Glasgow, puis, en retour, l'organisation d'un workshop à Paris.

996 char.

Abstract (anglais)

The proposed IEA is a two-year international exchange between a CNRS INS2I unit (Science and Technology of Music and Sound, IRCAM/CNRS/SU) in Paris and a neuroscience laboratory (Institute of Neuroscience and Psychiatry) at the University of Glasgow, Scotland, is based on the new collaboration of PIs Jean-Julien Aucouturier (CNRS) and Philippe Schyns (Glasgow). In recent years, the group of P. Schyns has developped new and important data-driven techniques to track visual information processing in the brain (Adolphs et al. Nature 2005; Zhan et al. Current Biology 2019). To be extended to auditory processing and language comprehension, these techniques require advances in audio signal processing of the sort recently introduced by the group of JJ. Aucouturier in IRCAM (Ponsot et al. PNAS 2018). To integrate these two methodologies, the proposed IEA will fund a 4-month visit by JJ.A. in Glasgow and the reciprocating organization of an international workshop in Paris.

977 char.

NEWDEAL: New data-driven techniques to track auditory information processing in the brain

IEA Proposal

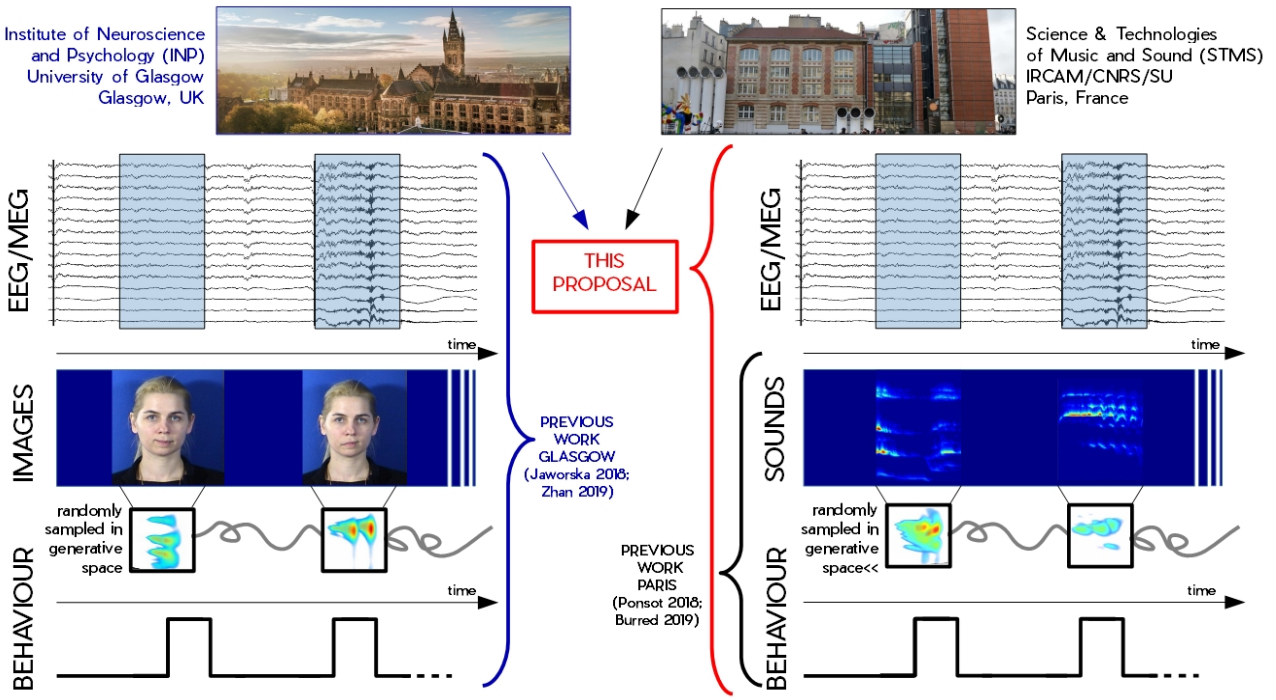
Jean-Julien Aucouturier, STMS UMR9912 (IRCAM/CNRS/SU)
& Philippe Schyns, University of Glasgow, UK

The dominant paradigm in brain imaging and human cognitive neuroscience is to measure brain activity related to the presentation of certains stimuli, e.g. sounds or images. However, the aim of neuroscience is not to discover brain activity per se, e.g. to see that a brain area like the fusiform gyrus (FFG) is activated when seeing the picture of a face, but to understand the processing of information that this activity reflects, i.e. what neural activity in the FFG codes for what exact physical feature in the picture, and when. To this aim, in recent years, a series of powerful data-driven paradigms, based on techniques such as reverse-correlation, bubbles or classification images (Murray, 2011), were introduced to isolate the specific stimulus information that is processed by brain activity for a given task (Adolphs et al. 2005; Zhan et al. 2019). The key idea of such techniques is to randomly sample information from the stimulus presented to the participants, e.g. generate an infinity of faces with systematically-varied emotional expressions, and then use information-theoretic measures to reveal what facial information is associated with what brain activity. In vision neuroscience, these paradigms were made possible by existing tools for image signal processing and synthesis (Yu, Garrod & Schyns, 2012) and data analysis (Ince et al. 2017). In auditory neuroscience, however, these techniques have not yet been fully exploited, because of a lack of tools to manipulate the properties of audio stimuli.

In recent years, a parallel research trend in the audio computing and psychoacoustics community has lead to the emergence of new signal-processing techniques to transform the expressivity of vocal and musical stimuli (Mohammadi & Kain, 2017; Arias et al. 2019), and these techniques have recently been combined with reverse-correlation to sample e.g. all possible ways to say the word "hello" (Ponsot et al. 2018), to pronounce a vowel in a given language (Brimijoin et al., 2013) or to sing a song (Burred et al. 2019). The time is therefore ripe for an integration of these two research strands, in which the brain of participants can be scanned while they listen and respond to larget sets of systematically-varied sounds (e.g. all possible pronounciations of the word really!/really?, with the task of detecting when it is meant as a question), and brain activity can be reverse-correlated on the properties of the sounds to reveal where and when this task-relevant information is processed in the brain. Such a paradigm has the potential to generate profound new insights in how the human brain processes speech and music, as well as critical innovations at the interface of signal processing and neuroscience to treat e.g. patients with hearing loss, language comprehension deficits after a brain stroke, or to interact acoustically with patients irresponsive in a coma.

On the one hand, the group of Philippe Schyns (Rank Prize in Vision Science, European Conference on Visual Perception 2019) at the Institute of Neuroscience and Psychiatry, University of Glasgow has been at the forefront of the use of data-driven techniques in the visual neurosciences, and has a fully functional brain imaging (MEG/EEG/fMRI) and data analysis pipeline to conduct such experiments (Jaworska et al. 2018; Zhan et al. 2019). On the other hand, the group of JJ Aucouturier (Prix d'Emergence Scientifique, Fondation pour l'Audition, 2018) at IRCAM/CNRS in Paris has recently developped several new audio signal processing techniques (Rachman et al. 2018; Arias et al. 2018; Burred et al. 2019) of the sort needed to apply the Glasgow methodology to auditory stimuli. Our two groups are therefore in an ideal position to spearhead the application of data-driven techniques in the field of auditory neuroscience and, doing so, open avenues for collaboration between, and beyond, our two institutions.

Our proposed exchange programme spanning years 2020 and 2021 consists, first, in a 4-month visit by PI JJ Aucouturier in Glasgow (April-August 2020) and, second, the reciprocating visit of the Glasgow group in Paris to co-organize an international workshop (tentatively, April 2021). Beyond these two main events, punctual visits by PhD students, postdocs and young researchers of both groups will also be supported.



Stage 1: Paris -> Glasgow (April-August 2020). Budget requested: 7,000€

The first part of the exchange consists in a 3-4 month research stay in Unversity of Glasgow by PI JJ Aucouturier, during which the Paris and Glasgow methodologies will be integrated. Prior to the visit, the IRCAM group will collect (Jan-March 2020) experimental data in Paris in which participants will be tasked to respond to systematically-varied vocal stimuli (inspired by our previous work; Arias et al. 2018; Ponsot et al. 2018) while, crucially, their brain activity is measured with electroencephalography (EEG). This joint acoustical/EEG data will then be analysed during the stay in Glasgow, using the analysis pipeline of the Glasgow group. In addition, data from a second experiment will be collected while in Glasgow, at the University's Center for Cognitive Neuroimaging (CCNi), this time extending the paradigm to the magnetoencephalography (MEG), a brain-imaging modality used by the Glasgow group and not available in the Paris laboratory (Zhan et al. 2019). At the end of this research stay, the consortium will therefore have two complete EEG and MEG experimental datasets and a working analysis pipeline, and will start working on one or two joint publications. Budget requested for this action will fund transportation and living costs in Glasgow, as well as costs for the Glasgow experiment (participant fees, brain-imaging plateform).

Stage 2: Glasgow -> Paris (April 2021). Budget requested: 7,000€

The second part of the exchange consists in the reciprocating visit of the Glasgow group in Paris and the co-organization of an international workshop on applications of data-driven techniques in the visual and auditory neurosciences. In this workshop, we will invite leading experts in the fields of visual and auditory reverse-correlation, incl. R. Adolphs (Caltech), F.Gosselin (U.Montreal), A.Todorov (Princeton), P. Belin (Aix-Marseille), as well as organize hands-on training sessions for emerging young scientists & students from Europe and beyond, thus providing a founding act for our new methodology. Proceedings from the workshop will be published as a journal special issue or review article, such as in Topics or Trends in Cognitive Science (Wiley, Cell Press). Budget requested for this action will fund transportation and accommodation of the Glasgow group in Paris before and around the workshop, transportation and accommodation for invited speakers, as well as organization costs (dinner, coffee breaks, etc.) during the workshop.

Integration of PhD students and postdoctoral researchers :

Young researchers concerned by the collaboration in the Glasgow group include PhD students Yaocong Duan, Yuening Yan and Christoph Daube, and postdocs Jayiu Zhan, Kasia Jaworska and Andrew Webb. Young researchers concerned by the collaboration in the IRCAM group include former PhD student Pablo Arias (now: postdoc, Lund University), former postdocs Emmanuel Ponsot (now: postdoc, Ecole Normale Supérieure) and Louise Goupil (new: Marie-Curie postdoc, Oxford Uni.), who remain close collaborators, as well as incoming PhD students Melissa Jeulin (sept. 2020~), Estelle Pruvost (sept. 2020~) and one postdoctoral researcher to be recruited on ANR SEPIA (Sept. 2020). The timing for the stage-1 visit of PI JJA to Glasgow corresponds to an ideal period between the end of current supervision responsibilities (ERC CREAM, ends Oct. 2019; ANR REFLETS, ends Feb. 2020) and the starting point of new supervisions in Sept. 2020.

On both sides, these young researchers will benefit from the exchange by being provided training in the methodologies of the other group (audio <-> brain imaging), being associated to the experimental work conducted during the stage-1 visit, with joint authorship in subsequent publications, and to the organization of the stage-2 workshop. Beyond the two events, punctual visits to Paris and Glasgow will also be organized for these young researchers to attend meetings and present their work. After the project, it is expected that young researchers from both groups will become natural candidates for postdoctoral positions in the other group/country, thus promoting further academic exchange.

Supplementary sources of funding:

In a spirit of co-funding, additional funding for the exchange will be sought, on the British side, from the Royal Society International Exchange Program (deadline: October 2019) and the British Academy Visiting Fellowship Scheme (deadline: Jan. 2020). Funding for research expenses not eligible by the IEA program will be provided, for the Paris group, by ANR SEPIA (2020-2014) and, for the Glasgow group, by the Wellcome Trust Brain Algorithmics project (2016 - 2021).

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Adolphs, R., Gosselin, F., Buchanan, T. W., Tranel, D., Schyns, P., & Damasio, A. R. (2005). A mechanism for impaired fear recognition after amygdala damage. Nature, 433(7021), 68.

Arias, P., Rachman, L., Liuni, M. & Aucouturier, JJ. (2019). Beyond correlation: voice-transformation methods for the experimental study of emotional speech. Emotion Review, in press.

Arias, P., Belin, P., & Aucouturier, J. J. (2018). Auditory smiles trigger unconscious facial imitation. Current Biology, 28(14), R782-R783.

Brimijoin, W. O., Akeroyd, M. A., Tilbury, E., & Porr, B. (2013). The internal representation of vowel spectra investigated using behavioral response-triggered averaging. Journal of the Acoustical Society of America, 133(2), EL118-EL122.

Burred, J. J., Ponsot, E., Goupil, L., Liuni, M., & Aucouturier, J. J. (2019). CLEESE: An open-source audio-transformation toolbox for data-driven experiments in speech and music cognition. PloS one, 14(4), e0205943.

Ince, R. A., Giordano, B. L., Kayser, C., Rousselet, G. A., Gross, J., & Schyns, P. G. (2017). A statistical framework for neuroimaging data analysis based on mutual information estimated via a gaussian copula. Human brain mapping, 38(3), 1541-1573.

Jaworska, K., Yi, F., Ince, R. A., van Rijsbergen, N. J., Schyns, P. G., & Roussele, G. A. (2018). Neural processing of the same, behaviourally relevant face features is delayed by 40 ms in healthy ageing. bioRxiv, 326009.

Mohammadi, S. H., & Kain, A. (2017). An overview of voice conversion systems. Speech Communication, 88, 65-82.

Murray, R. F. (2011). Classification images: A review. Journal of vision, 11(5), 2-2.

Ponsot, E., Burred, J. J., Belin, P., & Aucouturier, J. J. (2018). Cracking the social code of speech prosody using reverse correlation. Proceedings of the National Academy of Sciences, 115(15), 3972-3977.

Rachman, L., Liuni, M., Arias, P., Lind, A., Johansson, P., Hall, L., Watanabe, K. & Aucouturier, J. J. (2018). DAVID: An open-source platform for real-time transformation of infra-segmental emotional cues in running speech. Behavior research methods, 50(1), 323-343.

Yu, H., Garrod, O. G., & Schyns, P. G. (2012). Perception-driven facial expression synthesis. Computers & Graphics, 36(3), 152-162.

Zhan, J., Ince, R. A., Van Rijsbergen, N., & Schyns, P. G. (2019). Dynamic construction of reduced representations in the brain for perceptual decision behavior. Current Biology, 29(2), 319-326.

Résultats attendus

Résultats déjà obtenus (français)

Cette proposition d'IEA concerne une nouvelle collaboration, et les deux groupes de Paris et Glasgow n'ont pas encore co-publié. Nous listons ici quelques publications récentes concernant le travail indépendant des deux groupes sur les aspects les plus directement liés au travail que nous proposons de faire ensemble, afin d'en montrer la faisabilité et d'illustrer le type de résultats qu'il sera possible d'obtenir.

[Glasgow] Résultats obtenus par reverse-correlation visuelle:

1. Rychlowska, M., Jack, R. E., Garrod, O. G., Schyns, P. G., Martin, J. D., & Niedenthal, P. M. (2017). Functional smiles: Tools for love, sympathy, and war. Psychological science, 28(9), 1259-1270.
2. Jack, R. E., Garrod, O. G., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. Proceedings of the National Academy of Sciences, 109(19), 7241-7244.
3. Adolphs, R., Gosselin, F., Buchanan, T. W., Tranel, D., Schyns, P., & Damasio, A. R. (2005). A mechanism for impaired fear recognition after amygdala damage. Nature, 433(7021), 68.

[Glasgow] Résultats obtenus par reverse-correlation de l'imagerie cérébrale:

1. Zhan, J., Ince, R. A., Van Rijsbergen, N., & Schyns, P. G. (2019). Dynamic construction of reduced representations in the brain for perceptual decision behavior. Current Biology, 29(2), 319-326.
2. Jaworska, K., Yi, F., Ince, R. A., Van Rijsbergen, N. J., Schyns, P. G., & Rousselet, G. A. (2019). Healthy ageing delays the neural processing of face features relevant for behaviour by 40 ms. BioRxiv, 326009.
3. Ince, R. A., Jaworska, K., Gross, J., Panzeri, S., Van Rijsbergen, N. J., Rousselet, G. A., & Schyns, P. G. (2016). The deceptively simple N170 reflects network information processing mechanisms involving visual feature coding and transfer across hemispheres. Cerebral Cortex, 26(11), 4123-4135.

[Glasgow] Outils de traitement du signal visuel et d'analyse de données:

1. Ince, R. A., Giordano, B. L., Kayser, C., Rousselet, G. A., Gross, J., & Schyns, P. G. (2017). A statistical framework for neuroimaging data analysis based on mutual information estimated via a gaussian copula. Human brain mapping, 38(3), 1541-1573.
2. Yu, H., Garrod, O. G., & Schyns, P. G. (2012). Perception-driven facial expression synthesis. Computers & Graphics, 36(3), 152-162.
3. Gosselin, F., & Schyns, P. G. (2001). Bubbles: a technique to reveal the use of information in recognition tasks. Vision research, 41(17), 2261-2271.

[Paris] Résultats obtenus par reverse-corrélation auditive:

1. Goupil, L., Ponsot, E. & Aucouturier, J.J (2019). Hearing reliability: a common prosodic code automatically signals confidence and honesty to human listeners. submitted.
2. Ponsot, E., Arias, P., & Aucouturier, J. J. (2018). Uncovering mental representations of smiled speech using reverse correlation. The Journal of the Acoustical Society of America, 143(1), EL19-EL24.
3. Ponsot, E., Burred, J. J., Belin, P., & Aucouturier, J. J. (2018). Cracking the social code of speech prosody using reverse correlation. Proceedings of the National Academy of Sciences, 115(15), 3972-3977.

[Paris] Résultats obtenus par transformation émotionnelle de voix:

1. Arias, P., Belin, P., & Aucouturier, J. J. (2018). Auditory smiles trigger unconscious facial imitation. Current Biology, 28(14), R782-R783.
2. Aucouturier, JJ., Johansson, P., Hall, L., Segnini, R., Mercadié, L. & Watanabe, K. (2016) Covert Digital Manipulation of Vocal Emotion Alter Speakers' Emotional State in a Congruent Direction, Proceedings of the National Academy of Sciences, vol. 113(4), 948-953.
3. Boidron, L., Boudenia, K., Avena, C., Boucheix, J.M. & Aucouturier, JJ. (2016) Emergency medical triage decisions swayed by manipulated cues of physical dominance in caller's voice, Scientific Reports, 6, 30219.

[Paris] Outils de traitement du signal vocal:

1. Burred, J. J., Ponsot, E., Goupil, L., Liuni, M., & Aucouturier, J. J. (2019). CLEESE: An open-source audio-transformation toolbox for data-driven experiments in speech and music cognition. PloS one, 14(4), e0205943.
2. Arias, P., Soladie, C., Bouafif, O., Roebel, A., Seguier, R., & Aucouturier, J. J. (2018). Realistic manipulation of facial and vocal smiles in real-world video streams. IEEE Transactions on Affective Computing, (99).
3. Rachman, L., Liuni, M., Arias, P., Lind, A., Johansson, P., Hall, L., ... & Aucouturier, J. J. (2018). DAVID: An open-source platform for real-time transformation of infra-segmental emotional cues in running speech. Behavior research methods, 50(1), 323-343.

4523 char.

Résultats attendus

D'un point de vue méthodologique, notre collaboration permettra de créer de nouveaux outils informatiques pour analyser conjointement la reverse-correlation auditive des stimuli, les réponses des participants écoutant ces stimuli, et les réaction cérébrales mesurées pendant l'écoute. Ces résultats seront mis à disposition sous la forme de code python open-source, basé sur les outils existants CLEESE (Burred et al. 2019) et MNE (Gramfort et al. 2014). Leur publication sera envisagée dans des revues méthodologiques comme Behavior Research Methods, IEEE Transactions on Biomedical Engineering ou PLOS Computational Biology.

D'un point de vue fondamental, nous utiliserons cette méthodologie dans 2 expériences permettant de mettre en évidence où et quand l'information auditive est intégrée dans le cerveau humain pendant la compréhension de la prosodie. La publication de ces résultats sera envisagée dans des revues généralistes comme PNAS, Current Biology ou Nature Neuroscience.

986 char.

Budget

Première année

Mission à Glasgow (Avril-Août 2020)
Missionnaire: JJ Aucouturier (CNRS)
Transport: 500€ / aller-retour x 4 = 2,000€
Coût de vie sur place: 2,000€/m x 4m = 8,000€
Coût total = 10,000€.
Demande au CNRS = 5,000€.
Demande complémentaire prévue auprès de Royal Society (Oct. 2019) et British Academy (Jan. 2020)

Coûts de recherche sur place (Avril-Août 2020)
Defraiement participants : 50€/part x 6 part. = 300€
Couts d'imagerie MEG/EEG : 300€/h x 2h/part. X 6 part. = 3,600€
Coût total = ca. 4,000€.
Demande au CNRS = 2,000€. Demande complémentaire Royal Society et British Academy.

Missions ponctuelles à Paris pour réunions de recherche (Sept-Dec 2020)
Missionnaires : Philippe Schyns (Glasgow) + 3 pers. parmi collègues, doctorants et postdoctorants.
Coût total : 500€/ pers. X 4 = 2,000€
Demande au CNRS = 0. Demande complémentaire Royal Society et British Academy.

Demande totale CNRS = 7,000€.
Demande financeur étranger = 9,000€

Deuxième année

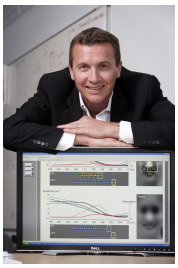
Workshop à Paris (Mars 2021)
Mission (organisation): Philippe Schyns (Glasgow) + 5 personnes parmi collègues, doctorants et postdoctorants.
Coût: 500€ / pers x 6 pers. = 3,000€
Missionnaires (invités): 2 orateurs invités depuis les USA
Coût: 1500€ /pers x 2 = 3,000€
Total mission: 6,000€
Frais de réception et d'organisation: 1,500€
Coût total: 8,000€
Demande au CNRS = 5,000€. Demande complémentaire Royal Society et British Academy.

Missions ponctuelles pour réunions de recherche (Avril – Dec 2021)
Missionnaires: JJA (CNRS) + 3 pers. parmi doctorants et postdoctorants CNRS
Coût total: 500€/ pers. X 4 = 2,000€
Demande au CNRS = 2,000€

Demande totale CNRS = 7,000€.
Demande financeur étranger = 3,000€

Short CVs

Glasgow PI: Prof. Philippe Schyns, University of Glasgow, UK



Philippe Schyns is Professor of visual neuroscience, Director of the Institute of Neuroscience and Psychology and Head of the School of Psychology at the University of Glasgow. He did his undergraduate training in Psychology at University of Liege (Belgium) and in Computer Science at University of Louvain-la-Neuve (Belgium). In 1992, he completed a PhD in Cognitive Science at Brown University. Following a post-doc with Tommaso Poggio in the Department of Brain and Cognitive Sciences at MIT he joined the faculty at University of Montreal. A year later, he moved to Glasgow University. He leads a team researching the behavioural and neural aspects of information processing in vision. In August 2019, he was the recipient of the Rank Prize Award in Vision Science at the European Conference on Vision Perception (ECVP).

Five representative publications: (Citations: 14942, H-index=57)

1. Schyns, P. G., Bonnar, L., & Gosselin, F. (2002). Show me the features! Understanding recognition from the use of visual information. **Psychological science**, 13(5), 402-409. Citations : 426
2. Adolphs, R., Gosselin, F., Buchanan, T. W., Tranel, D., Schyns, P., & Damasio, A. R. (2005). A mechanism for impaired fear recognition after amygdala damage. **Nature**, 433(7021), 68. Citations : 1452
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5. Zhan, J., Ince, R. A., Van Rijsbergen, N., & Schyns, P. G. (2019). Dynamic construction of reduced representations in the brain for perceptual decision behavior. **Current Biology**, 29(2), 319-326.

Paris PI: Dr. Jean-Julien Aucouturier, STMS UMR9912 (IRCAM/CNRS/SU)

Jean-Julien Aucouturier is a permanent CNRS Researcher (chargé de recherche, section 7) at the Science and Technology of Music and Sound Laboratory (STMS) in IRCAM, Paris. He did his undergraduate training in electronic engineering at Ecole Supérieure d'Electricité (Supélec) in Rennes (France) and hold a MSc in Audio Signal Processing from King's College University of London (UK). In 2006, he completed a PhD in Computer Science with François Pachet at Université Paris 6. He then received postdoctoral training in Cognitive Psychology and Neuroscience in Japan (University of Tokyo 2006-2008 ; RIKEN Brain Science Institute, 2008-2011) and France (Université de Bourgogne, 2012). He joined STMS in 2012, where he leads a team researching the acoustical and neural aspects of emotion perception in speech and music (ERC Starting Grant, CREAM 2014-2019). In 2018, he was the recipient of the Prix d'Emergence Scientifique from Fondation Pour l'Audition.

Five recent publications: (Citations: 3300, H-index=26)

1. Arias, P., Belin, P. & Aucouturier, JJ. (2018) Auditory smiles trigger unconscious facial imitations. **Current Biology**, vol.28(14), R782-R783.
2. Ponsot, E., Burred, JJ., Belin, P. & Aucouturier, JJ. (2018) Cracking the social code of speech prosody using reverse correlation. **Proceedings of the National Academy of Sciences**, vol. 115 (15), 3972-3977.
3. Arias, P., Soladié, C., Bouafif, O., Roebel, A., Séguier, R. & Aucouturier, JJ. (2018) Realistic manipulation of facial and vocal smiles in real-world video streams. **IEEE Trans. Affective Computing** (early access).
4. Aucouturier, JJ., Johansson, P., Hall, L., Segnini, R., Mercadié, L. & Watanabe, K. (2016) Covert Digital Manipulation of Vocal Emotion Alter Speakers' Emotional State in a Congruent Direction, **Proceedings of the National Academy of Sciences**, vol. 113(4), 948-953.
5. Boidron, L., Boudenia, K., Avena, C., Boucheix, J.M. & Aucouturier, JJ. (2016) Emergency medical triage decisions swayed by manipulated cues of physical dominance in caller's voice, **Scientific Reports**, 6, 30219.

University of Glasgow | Institute of Neuroscience & Psychology

10th September 2019

Dear Dr. Aucouturier,

RE: International Emerging Action (IEA)

As initially discussed during my visit to your laboratory in IRCAM (Paris, France) and then more extensively over your reciprocating visit to the Institute of Neuroscience and Psychology (INP) in Glasgow, I am writing to confirm that I will be delighted welcome you in Glasgow. Specifically, we will offer office space and grant you access to the neuroimaging facilities of the Centre for Cognitive Neuroimaging (CCNi) at the INP (including electroencephalography, magnetoencephalography, functional magnetic resonance imaging and access to our extensive GRID for associated computations) to carry out the research projects that we have fleshed out. I understand that you are planning this visit to last from around the beginning of April 2020 to the end of August 2020. We could then organise together an international seminar in Paris to discuss this innovative research with world-leading experts in the fields of visual and auditory reverse correlation, including application to brain imaging. We are therefore engaging together with an IEA in order to obtain the required funding to carry out our innovative and ambitious research project.

Best regards,

Philippe G. Schyns
Prof. Philippe G. Schyns, FRSE

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The Queen's Anniversary Prizes
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