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Dr. Ripollés work relies on creating a joint theoretical framework to study language, reward, memory and music with a clear objective: capitalize on music to shape cognitive neuroscience, and capitalize on cognitive neuroscience to shape music



by Ana M. Vernia

PABLO RIPOLLÉS

Ana M. Vernia You have a multifaceted profile, not only in your training but also in your lines of research. What were the reasons that led you to choose your training?

PR. I studied Computer Engineering in Universitat de València (2004-2009). I wanted to do research, but I did not know which scientific field to choose. In my last year in college, I found out about an interdisciplinary Master in Biomedical Engineering. In this Master's, engineers were taught about medicine, biology and health. I thought that this Master's would be a great way to expand my horizons and to see what I liked beyond computer engineering. I did the Master's at University of Navarra (2009-2010) and, while doing it, I fell in love with neuroscience. I really liked our neurology and neuroimaging classes. For the last 6 months of the Master's I had to do a research internship, so I started to reach out to research groups that were doing neuroscientific and neuroimaging research in humans, to see if they would accept me. A few labs answered back to me, but they were offering me projects which were too much engineering and too little neuroscience. I wanted something that was really interdisciplinary, and the offers I was getting were not what I was looking for. But then, Dr. Antoni Rodríguez-Fornells, from the Cognition and Brain Plasticity Unit (CBPU) at Universitat de Barcelona, gave me the opportunity to work with them. He emphasized that, while he wanted me to capitalize on my engineering skills, for him and the rest of the team it was really important that I acquired knowledge about cognitive neuroscience (the study of the brain mechanisms that support human cognition). This was a turning point in my career.

I did my Master's internship with them and then Ruth de Diego-Balaguer, another professor at the CBPU, hired me for a year as a research assistant (2011-2012). I loved the experience, the people, and the research. The CBPU was really interdisciplinary, we had psychologists, biologists, engineers, physicist, mathematicians, occupational therapists, neurologists... all working together to study how the brain supports different cognitive skills, such as language, memory, reward, music, and brain plasticity in clinical populations. I started many collaborations with different researchers in the unit because I wanted to learn more about cognitive neuroscience. That is how I ended up working

in so many different things, and that was incredibly enriching. In 2012 I got an FPU scholarship from the Spanish government and I started a PhD in reward and language learning, supervised by Drs. Antoni Rodríguez-Fornells and Josep Marco-Pallarés. I stayed at the CBPU for 4 more years pursuing all these different lines of research.

AV In your work we observe that music is a very important element. Why the music?

Well, it is a mix of personal interest and of being in the right place at the right time. I love music and music it is a big part of my life (I am not a musician; I have tried, but I am really bad at it!). However, my interest in the cognitive neuroscience of music started through the multiple collaborations I developed while I was a PhD student at the CBPU.

As I was saying, at the CBPU I collaborated with different researchers in different topics of cognitive neuroscience. I was really hungry for knowledge and I had the opportunity to work in different subfields within the cognitive neurosciences. In the lab, different people were doing a lot of cool research at the intersection of music and cognitive neuroscience. Drs. Rodríguez-Fornells and Marco-Pallarés, along with Ernest Mas-Herrero (then a PhD, now a professor at Universitat de Barcelona) in collaboration with Dr. Robert Zatorre (from McGill University in Canada; one of the most well-known researchers in the cognitive neuroscience of music), were doing a lot of cool research regarding music and reward. Noelia Martínez-Molina joined their team later as a PhD (now a postdoc in University of Helsinki). Also, Dr. Laura Ferreri joined the unit later as a postdoc (now a professor at University of Lyon in France) to do more research regarding memory, reward and music. Dr. Clement François (then a postdoc, now a professor at Aix-Marseille University) was also part of the CBPU, doing work at the intersection of music, cognitive neuroscience and development (he has really cool work with babies). Lucía Vaquero was another PhD student at the CBPU (now a senior research fellow at Universidad Complutense de Madrid) doing work related to the neuroanatomical basis of the musician's brain. Finally, Nuria Rojo (now a clinical neuropsychologist), Julià Amengual (now a researcher at the French National Centre for Scientific Research) and Jenny Grau-Sanchez

(now a professor at the Universitat Autònoma de Barcelona), were PhDs doing work related to the use of Music Supported Therapy for motor recovery after stroke. This is the breadth of the work that was being done regarding music and cognitive neuroscience at the CBPU, while I was a researcher there.

I collaborated with all of these researchers in many of their projects and started to become more and more interested in the cognitive neuroscience of music. Then, Rodríguez-Fornells started a collaboration with Prof. Teppo Särkämö from University of Helsinki (Finland) and another PhD, Aleksi Sihvonen (now a senior researcher at University of Helsinki, Finland), and I started to work a lot with them. Over the years, we have published together several papers regarding the therapeutic effects of music listening after stroke and also about acquired amusia (a neurological condition in which, after brain damage, patients cannot properly perceive music). The topic of amusia is very relevant, as by studying which areas induce amusia when damaged, we can identify the brain regions crucial for the perception and processing of music. So, basically, by the time I started my postdoc at New York University at David Poeppel's lab (2017-2020), I had done a lot of work in music and I was really interested in not only learning about how music is processed at the brain level, but about how to use music to study the brain in general. This is how I came up with the motto of the lab that I started at the beginning of 2020 at New York University: to capitalize on cognitive neuroscience to learn about music and to capitalize on music to learn about cognitive neuroscience. With this I mean that we can use the methods of cognitive neuroscience (behavior, neuroimaging, and neurophysiology) to study the brain mechanisms that support music, but that at the same time we can use music to study the human brain. Music is a very special stimulus that involves brain regions related to audition, language, emotion and reward, memory and motor function, among others. Therefore, we can use music to learn more about how the auditory cortex works, or use musicians as a model of motor learning to assess brain plasticity at the motor cortex. In my case, I am really interested in using music to understand how the human brain handles abstract rewards (e.g., the pleasure we feel when we look at a painting, when we see a sunset or, of course, the pleasure that we feel when we listen to our favorite music). Abstract rewards are really interesting because we

can only study them in humans (there are no non-human animal models for this) and music is the perfect stimulus to do so.

AV You are currently developing your research many miles from home. How do you see musical research in Spain?

I come from a lab in which, as you can see in my response above, there was a lot of research regarding music and cognitive neuroscience. Many of the people that "grew-up" with me at the CBPU are now back in Spain and doing really cool research using music (Ernest Mas-Herrero, Lucía Vaquero, Jenny Grau-Sánchez). My former mentors in Barcelona have beautiful lines of research that capitalize on music and I know of other groups that are doing very interesting work. In the field of Music Technology, the Universitat Pompeu Fabra has a really strong group of researchers, for example. At the end of the day, what we need in Spain is more investment in research. In the USA the government spends more than twice as much as Spain in science (and I am talking about the percentage of the GDP). We are way below what the European Union spends on average. This needs to change.

AV Following this comparative line, what is your opinion about higher education in Spain, especially in the arts, in music?

I do not feel qualified to talk about the state of higher education in Spain in the arts and in music. As I said, I went to an engineering school. Now I have a joint position between Psychology and Music Technology, so I am exposed to the arts in higher education, but my experience is in the USA. What I can say about Spain is that I would love to see more collaborations between the arts, including music, and other scientific domains like the cognitive neurosciences.

AV It is inevitable to talk about the pandemic. What has music meant to you during your time of confinement?

It has been a great help, to be honest. I used music a lot to upregulate my mood, to cheer up when I was feeling low and to help me ac-

tivate, for example, to work, when I was really tired. In this vein, we ran a study of 1000 people during the first wave of the pandemic (May 2020) in Italy, Spain and the USA, to see which leisure activities were they using to cope with pandemic related stress. In this study (not yet published in a peer reviewed journal but here you have a link to the pre-print: <https://psyarxiv.com/x5upn/>), we see that the general population was using music a lot and that the levels of engagement with music correlated with better mental health outcomes. Beyond our work, other groups of researchers who collected similar data show similar trends: people have used music a lot during the pandemic to modulate their mood.

AV In your latest study, published with other authors, in July 2021, you talk about dopamine, memory improvement or reinforcements through music. Do you think that current music studies should take part in university health degrees?

We have more and more evidence suggesting that we can use music or music-related activities in clinical settings. I think it is a good idea to include this information in university health degrees. Here at New York University I teach two classes that explore the intersection of music and cognitive neuroscience, one aimed at Music Technology students (The Psychology of Music) and another aimed at Psychology graduate students (The Cognitive Neuroscience of Music).

AV Finally, where do you see yourself in a few years? and where would you like to see yourself?

I would like to keep doing research at the intersection of different scientific disciplines and I hope that music will be one of them.

AV Thank you very much for sharing your time and knowledge with ARTSEDUCA readers.

Ha sigut un plaer!