

What Music Does to Us

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What is the relationship between music and autobiographical memories? Why do we like the music that we like? And what are the challenges that a psychological scientist studying music might face throughout their career?

Amy Belfi from the Missouri University of Science and Technology joined APS's Ludmila Nunes to speak about her career as a neuroscientist studying music perception and cognition as well as how poetry and other forms of art can impact the brain and behavior.

If you want to know more about this research, Amy Belfi's career and psychological science in general, see [her profile](#) in the latest issue of the *Observer* magazine.

Unedited transcript

[00:00:12.340] – Ludmila Nunes

What is the relationship between music and autobiographical memories? Why do we like the music that we like? And what are the challenges that a psychological scientist studying music might face throughout their career? This is under the cortex. I am Ludmila Nunes with the Association for

Psychological Science. Today, I have with me Amy Belfy from the Missouri University of Science and Technology. Amy is a neuroscientist studying music perception and cognition and her career was featured on the most recent issue of the Observer Magazine, APS's Magazine that you can find@psychologicalscience.org. Amy, thank you for joining us today.

[00:00:55.770] – Amy Belfi

Hi, thanks for having me. Happy to be here.

[00:00:59.360] – Ludmila Nunes

So you studied slightly unusual topic and very interesting. Do you want to tell us more about it?

[00:01:06.970] – Amy Belfi

Yeah, so I guess the broad categorization of my work was fall under music cognition, music perception, empirical aesthetics in some ways. So what that means is that I'm interested in studying how music evokes memories and emotions and why we like music, those types of questions. So those are some kind of specific things that I'm looking at under this umbrella topic of music cognition. So I've started doing work on music and autobiographical memories and emotions and kind of continued and added on new areas just over the past ten years.

[00:01:50.660] – Ludmila Nunes

So one of your topics, as you said, is relationship between music and autobiographical memories. How do you study that whenever you're.

[00:02:00.640] – Amy Belfi

Thinking about doing music, study is the first question is always like, well, what kind of music are we going to use and how can we in the lab pick songs that are pieces that are going to evoke memories for people? So the method I use is not something I came up with entirely on my own. It follows from the work of Peter Janada, who published some of the earliest papers looking at music and autobiographical memory back in the mid to late 2000s. So what I do is take popular music that was popular during the participants adolescence and early adulthood. So the stimuli we select are based on each participant's age. And so these are Billboard tracks, pop songs from when they are between 15 and 30 years old. And so we play all of these songs for people and then just kind of hope that at least some of these songs will trigger autobiographical memories. The reason why I like this approach is because I like to try and maintain some of the spontaneity of it in the real world. When this happens, it's often unexpected when you hear a song that kind of takes you back.

[00:03:05.580] – Amy Belfi

We are doing some studies in everyday life as well as in the lab, but in the lab I use this method of presenting songs and we find that about 30% of the time so if we present 30 songs to people, roughly like eight to ten will be associated with autobiographical memories.

[00:03:22.090] – Ludmila Nunes

Is there a remarkable finding that you've obtained so far.

[00:03:26.860] – Amy Belfi

So I guess my most cited paper on the topic, my first paper on this topic from 2016, people really like this area of research, and people really feel strongly that music is a magnificent way to evoke autobiographical memories. But there's really nothing comparing music to any other type of cues. That was my first question was like, is there anything different about the memories that music triggers versus other types of stimuli? So in my first paper on this topic, I compared songs to images of celebrities. Basically, I thought they were a good comparison because you could also match them based on age when they were popular, and they're also this ubiquitously, experienced component of popular culture in the same way that Billboard tracks are. So we presented these pictures of famous people, we presented the songs and we asked people to tell us about the memories that are evoked by both types of cues. And we found that the memories evoked by music tended to be more episodically detailed. They contained more cues of information about the actual experience that the person had, whereas the memories evoked by the pictures of the famous persons contained more semantic pieces of information that were not really relevant to the actual autobiographical episode.

[00:04:38.070] – Amy Belfi

And so that was kind of the main finding and I've just kind of expanded on that paradigm in my work going forward since then.

[00:04:46.410] – Ludmila Nunes

So music can evoke more vivid memories?

[00:04:49.540] – Amy Belfi

Yeah, we looked at this episodic detail and also the vividness of the memories too. So they also contained more perceptual details. The memories evoked by music had more details about the sights, the sounds, the smell, the feeling, the physical feelings you get. So yes, they're richer, more vivid memories than the memories evoked by the pictures of famous persons.

[00:05:12.420] – Ludmila Nunes

And just out of curiosity, did you find that different music, different songs might be related to more positive or negative memories?

[00:05:23.290] – Amy Belfi

So I didn't really look too much at the emotional characteristics of the memories. It's something I'm certainly interested in, I will say just totally anecdotally just from running the participants. The memories from the songs tend to be overwhelmingly positive, but there are very salient examples of

negative memories. I vividly remember one participant crying in the lab because the song reminded her of someone who had passed away. And when they evoke sad memories, it's very potent for the purposes. Again, it's just an anecdote, but I haven't actually analyzed the data in that manner.

[00:05:58.350] – Ludmila Nunes

I was asking because thinking about myself sometimes if I hear a song that was popular when I was a teenager, even if I don't like the song and didn't like it, it can still evoke a positive memory.

[00:06:11.890] – Amy Belfi

Yeah, it doesn't even have to be a song that you particularly like. It's just something that you heard a lot at the time. That's something else that I haven't really asked about is how much they actually like these songs that we're playing for them.

[00:06:26.360] – Ludmila Nunes

Another area of your research has to do with the aesthetic judgments of music. So why do we like the music that we like, for example?

[00:06:35.440] – Amy Belfi

Yeah. So this kind of work is really when I started in my postdoc, and one of the questions I had was just how long does it take for us to know if we're going to like something, a piece of music? So I was thinking in terms of if you're in the car and you're flipping through radio stations, how quickly are you going to decide, okay, skip to the next one. So I did this project where we played snippets of music that started really short and progressively got longer and longer. And after each snippet, we asked the participants to just rate how much you like this, even as short as a 250 millisecond snippet, and then we have them listen to longer excerpts and rate it. And then we wanted to see, at what point do their ratings of the shorter ones start to match their rating of the longer one? What point do they come to their final decision about the piece of music? We found that across several genres, it was about 500 to 750 milliseconds of music is enough for you to come to a decision of whether or not you're going to like it.

[00:07:37.570] – Amy Belfi

So it's pretty quick to make these snap judgments about if we like a piece of music or not. That ends up being pretty consistent with when you listen to an extended excerpt.

[00:07:48.190] – Ludmila Nunes

But besides music, you also studied poetry, visual arts.

[00:07:53.680] – Amy Belfi

Yes. It was a really cool experience. I got to work with a lot of people who were from these different fields english professor, vision science person, auditory science person. So I did a study looking at

poetry and what kind of features of a poem contribute to whether or not we're going to like it, which we specifically found that the vividness of the imagery that's evoked by a poem is a strong predictor of how much you're going to like that poem. But we also found that people disagreed in terms of what poems they liked or disliked. I'm actually kind of continuing that poetry study right now with a colleague of mine who's a poet. And then we did a study with visual arts looking at what brain regions are involved in a static appeal of visual arts. So it was cool to see how music, like aesthetic judgments of music, might be similar or different than other types of artworks. Like the study I just described, where we're looking at the timing of judgments. People have done similar stuff with visual simulation, and it's much quicker to make a judgment of a visual stimulus and in music, but it's cool to be able to work kind of an intersection of these different types of stimulus modalities and see if there's similarities or differences between the different categories of stimuli you.

[00:09:04.110] – Ludmila Nunes

Mentioned you did some brain studies with visual arts. You also conducted some neuroscientific studies with music.

[00:09:14.440] – Amy Belfi

Yeah. So in my PhD work, I did neuropsychological studies of people with brain damage. And so for those, the main question I had was looking at some recent neuroimaging studies that had come out I've ever Peter Johnata's lab that indicated that music that evoked memories was associated with activity in the medial prefrontal cortex. And so I was wondering, well, that's a neuroimaging study, but I have access to this group of people who have focal damage to the ventromedial prefrontal cortex. What happens if you play music for them? Do they kind of lose the connection between music and memory? Is this area really necessary for this ability of music to evoke memory? So I did the same study with them as I described earlier, where I was presenting faces and music. And what we found is that in people with intact brains, the music evoked memories were more episodically detailed and more vivid than the memories evoked by faces. But in the individuals with the prefrontal cortex damage, that wasn't the case. So it did seem to be that the vividness and richness of music memories was selectively kind of decreased in people with prefrontal damage.

[00:10:21.110] – Ludmila Nunes

You're currently studying music and healthy aging, right? I know you got a big grant to study this.

[00:10:27.510] – Amy Belfi

Yeah, so I recently got a grant from NIH. It's an AR 15 area grant. And that mechanism is for people who are at universities that don't have above a certain amount of funding from NIH. And it's primarily for undergraduate research. So my lab is entirely comprised of undergraduate students. And so it's kind of a new like I said, I've done a lot of work in people with focal brain lesions. I have never done healthy aging work, but I thought it would be an interesting direction to take this. There's not actually that much music cognition work in aging and healthy aging especially. So what we're doing is we're taking the similar paradigm to what I've been describing of playing people music and showing them images, and we're going to just do it across the lifespan. We're also adding two other stimuli conditions. One is

video clips. So in addition to the Billboard tracks, we're also going to present clips from popular films just to add another, a multimodal audio visual stimulus. And they're also going to do memory cues like verbal prompts. And see are the memories evoked by music kind of more similar in older adults as younger adults?

[00:11:33.640] – Amy Belfi

Whereas we know from prior research that if you give people memory prompts that the memories provided by older adults tend to be less episodically rich and contain more semantic information. So I'm wondering if music will kind of help those memories evoked by music will be more preserved across the lifespan, the memories evoked by other types of juice. So that's one of the main experiments in that grant. We're just finishing piloting the first experiment right now, so hopefully we'll have some data on that soon.

[00:11:58.210] – Ludmila Nunes

You mentioned that your lab has mostly undergraduate students or only undergraduate students. What are your strategies to work with students, to train them, to prepare them for their future?

[00:12:12.640] – Amy Belfi

Yes. It's challenging working with only undergrads. It's something I always wanted to do. So I went to St. Louis College as an undergrad. It was a small liberal arts college, and I just absolutely loved it. Loved working with professors directly. Kind of knew going into grad school that I wanted to work with only undergrads. But it's challenging because they've never done research before. They don't have as much time as a grad student who would be working full time on research. They often don't find out about research until they're late in their undergraduate careers. I try and tell all the students in my classes, like, first day of class, if you want to do research, don't hesitate to email me or other professors. Try and get them involved in as soon as possible. But yeah, my strategy is to start off with the undergrads the first time they're in the lab, start them off with tasks they can kind of easily become competent at data entry, running participants in the lab, depending on the type of study. As I gain more confidence in doing those things, then I have them do more like the writing. I try to have every undergrad in my lab be a co author on a paper, so I often have them write first draft of the methods section, doing literature reviews, helping make an outline for the introduction, or even writing the introduction.

[00:13:22.990] – Amy Belfi

And then as they've been in my lab longer and longer, I started having trained the new undergrads, and I'm working on multiple projects at once. So the undergrads can pick and choose what portion of the project they want. Like, some of my undergrads now don't really want to interact with the participants, which is fine. So they're doing like I have one doing this analysis of musical features and comparing musical features to the memory. So I let them in to pick and choose what parts of the project they're most interested in and then try and pair them up with more senior students and more junior students. It's always a learning experience trying to figure out what method is going to work best for helping them learn how to do research. But so far it's been great. We have great students. I love working with the

students. They're amazing, and I couldn't do what I do without them. So I'm super grateful to every student who's ever worked with me.

[00:14:53.620] – Ludmila Nunes

Amy, in your interview, you mentioned that at some point you had to try to convince people that the work you're doing is interesting. It's important. How is this process?

[00:15:04.530] – Amy Belfi

Yes, I think anyone who's a music cognition has experience and understands this very well. I like to think about it as like the island of Misfit toys from Rudolph movie, because it's like all the people like me who are from the science side have experienced other people in science being like, skeptical, why would you study music? And then other people from the music side or have experienced people being like, why would you use scientific methods to study music? So there's criticism from both sides. There were definitely people at a Society for Neuroscience conference or whatever who would be like, well, what's the point of studying this? Which, sure, that's not a bad question to ask of anyone, though I would be getting interrogated about why would you study something like this? What's the value in studying music? It was somewhat hostile back ten years ago. Now it's dramatically different. Like, I really don't get that type of interrogation from people. Now the scientific community has caught up. I mean, the general public has always found this interesting. It's the scientific community that has been more skeptical of it. But NIH has been pouring more funding into music related research.

[00:16:11.560] – Amy Belfi

People are starting to see the value of it as like a therapeutic tool and needing basic science research behind it in order to eventually effectively develop better therapies for using it and seeing it as just like a component of cognition. Just like anything else you would study, like language or memory or perception, there's music studies you can do under all of those types of domains. So music is becoming more accepted as a more typical area of cognition to study is definitely better than it was when I started grad school, but it's still not not it's super common.

[00:16:46.300] – Ludmila Nunes

But it worked really well for you that you persevered and engaged in this type of research. You continued doing it because you mentioned you love your work.

[00:16:55.720] – Amy Belfi

Yeah, I'm so glad I did. I mean, I was advised early on to not try and sell myself as a music person, but as some other type of person who also happens to do music. And I actually don't think that that's bad advice because getting a job this day and age is not easy for me personally. I didn't care because I wanted to work with undergrads. I wanted to be able to do the stuff I find interesting. I wanted to keep studying music. So I was like, you know, I don't care. I find position myself as a music person because that's going to lead to the job that I know that I want to have, which is the kind of job I'm doing now.

[00:17:26.140] – Ludmila Nunes

So that's very important advice for graduate students. Figuring out the type of job they would like to have, what they would like to do, and try to do that rather than doing what their mentors, other people think would be acceptable. Any other advice, career advice to graduate students? And I think in general, the number.

[00:17:51.640] – Amy Belfi

One thing is to just like, finish yourself, like finish your papers, publish your papers, doing whatever you can to get your publications out is absolutely critical. That's probably the most critical thing you do, decide yourself for getting a job. Other advice is, like, I think networking is very important, getting to know people in your field, and that makes it fun too. That's one of my favorite parts of this job, is, like, having colleagues who are awesome and who I can talk about research with, who are cool. I like meeting and talking to people. So it's not like I'm just doing this for totally selfish. I want to advance reasons. Networking and getting to know people is enjoyable, regardless of how it might help you. So I think that's another piece of advice.

[00:18:39.480] – Ludmila Nunes

To finish our conversation, I really want to ask you, what music are you listening to right now?

[00:18:46.000] – Amy Belfi

Oh, my gosh. Okay, so I have a three year old and an infant, so my thought might have been just completely wrecked over the past three years. Like, Daniel Tiger's Neighborhood Brassy Baby Shark is a popular one with my ten month old right now. So that's literally all I'm listening to right now in terms of my personal music preferences. My favorite genre music has always been sky music. So I like 90s Scott, like twotone Scott, and also like 90s punk music because it kind of goes hand in hand. So like Branson and Operation Ivy and those kind of bands. So that type of punk or ska music is what I've been listening to since I was like, ten years old. And that's just what I go back. I mean, there's research on that, right? When people form their musical preferences, there.

[00:19:32.610] – Ludmila Nunes

Is research on that.

[00:19:34.380] – Amy Belfi

That's what I listen to when I'm given the opportunity to listen away on music.

[00:19:38.730] – Ludmila Nunes

Great. It was great talking to you, Amy. Your research is really interesting. I hope we hear more about it soon.

[00:19:47.430] – Amy Belfi

Thanks so much. It was really fun chatting with you.

[00:19:49.980] – Ludmila Nunes

This is Ludmila Nunes with APS, and I've been speaking to Amy Belfi from the Missouri University of Science and Technology, where she researches the impact that audio and music have on the brain and our behaviors. If you want to know more about this research aim about his career or other psychological science, visit psychologicalscience.org.

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