Worlds in Collision: Music and the Trauma of War

Friday 28 June 2013, The Mansion House

TRANSCRIPT

The cognitive neuroscience of the effects of war – Hugh McManners and Professor Morten Kringelbach

HUGH McMANNERS: Good morning, I'm Hugh McManners, I'm the Director of the Scars of War Foundation at Oxford University. I would just like to reiterate the previous performance. I was in the Army for 18 years, including during the Falklands War, and the role that the Royal Marines Band played, keeping everybody going in the build-up to the war, during as stretcher bearers, and afterwards on the way home, playing all the favourite tunes to us as we tried to unwind after our experiences, was absolutely incredible. I think it is the most stupid thing in the world when they try to save money by cutting military bands and military music. It is unbelievably ridiculous. Also, I'm a long-time, long-serving rock musician so I do have to say to Guy, thank you very much mate, hard act to follow. Here I am trying to wind you up after all of that.

We are the Scars of War Foundation. We are looking at the cognitive neuroscience, the way the brain is affected by war and disaster. We are part of Oxford University and we are also spreading ourselves outwards to other universities. Professor Kringelbach in Denmark and people at UCLA; we need to spread it out because it is a very new area and everybody needs to co-operate. My interest in this came actually as a serving soldier, realising that lots of people I knew were having serious problems afterwards. So I ended up doing a lot of research and I wrote a book, *The Scars of War*, so that is why we decided to call the Foundation what we did. So this, if you like, is how we look at it.

You talk about pain in many different facets but, in fact, if you just think about it as being pain and then we sub-divide pain, then you can see how we look at it and probably about how you in your various perspectives might think of it too. So at the top of this we have got the acute pain. At the bottom we have long-term, lingering chronic pain. Then on your left-hand side we have got pain which is invisible – people just suffer it. Then the visible side, which is much easier for everybody to cope with; a chap in a wheelchair, no legs, obviously in pain, he looks like somebody who needs help. The chap who is on the other side, suffering pain just the same but it is invisible – it is difficult to quite see him in the same context. He is the person I suppose primarily that we are looking at.

So at the top, when it is acute, let's talk about first of all what's visible. A gunshot wound or the pain that you get when you have lost a leg or a limb. Gunshot wounds – high-velocity weapons create massive shockwaves throughout the body. They damage the nerve endings over a huge area. In time, particularly if it is not treated absolutely correctly, but in time anyway, it can turn into intractable pain that can't be relieved by opiates, as it goes chronic. Then to the bottom, we get something like phantom limb

pain – very interesting, you have lost your leg but your toe still itches. But actually that's the cuddly way of thinking of it. What happens if you have lost your leg but your toe still really hurts and it won't stop and the drugs don't do any good because you haven't got a toe or a leg? Then on the other side of things, battleshock, mild traumatic brain injury. In the First World War there was a huge debate as to whether or not the psychological problems caused by war were, in fact, caused by impact. Explosions or bangs on the head, all of which are endemic on a battlefield and whether or not stress had a part to play in that. The answer is that the symptoms for mild traumatic brain injury or post-traumatic stress disorder are pretty much the same, very difficult to differentiate between, and the one if not treated properly turns into the other. So it then moves down in time and you get post-traumatic stress disorder a year or more after the event. The average self-declaring time period is 13 years, that's because soldiers don't like to admit they have weaknesses. It occurs, according to criteria, a year or more. That is why we put alcoholism above PTSD, because self-medication is a fairly standard way of coping with that kind of thing.

So what we do, and I would like to really stress this is, we do hard science on finding out what is going on. It may well be that you know what is going on in terms of psychology, but what we are trying to find out is the hard science of why these things happen organically. Here is a classic example of having found out something definite and then doing something, a direct intervention. I'm not saying we will find solutions for PTSD that involve putting electrodes into our brain like Professor Tipu Aziz, one of our team in Oxford, is doing there. But it is the route towards finding things that you can do. So this is where we have the largest case series of using direct deep-brain stimulation to control intractable pain. We have done it on quite a number of soldiers from Afghanistan who would otherwise have suffered pain that couldn't be controlled and facing a whole lifetime of it. It is amazingly effective. We do this by putting people in very high-tech machines, gathering vast amounts of data from their brains and then processing that data in all manner of extremely clever ways which are being invented and reinvented, perfected as we go, and that is how we find out what is going on. We are currently doing a neuro-imaging five-year project with veterans who have chronic PTSD, comparing people with chronic PTSD with those with similar military experience with no PTSD. The next thing we are going to do is a five-year study of British veterans before they deploy on an operation and then scanning the same brains a number of times after, over a number of years, so that we can see the progress of the condition as it develops.

MORTEN KRINGELBACH: So what is it we do when we put them in the scanners? One of the things we find out is that lots of their brain is affected. This is the result of a study, a meta-analysis we did where we looked at what happens to the brains when we scan them after PTSD. We find there is a connected set of regions in the brain that changes. Partly, of course, in the brainstem as was mentioned by Nigel Osborne, but also in other parts, more cortically in the front of the brain and in the back of the brain. Understanding that and understanding how that deviation is really a deviation from normal is one of the things we are interested in. By the way, when we stick the electrode in, as you saw for the patient with the pain, we find if we stimulate at 20Hz we get pain relief or pleasure, but at 90Hz it becomes more painful, suggesting that pain and pleasure really are two separate things, which inspired this artwork that Annie Cattrell, a Scottish sculptress, did with us. Strange how it looks like a teabag, really!

What is it that is deviating? Well, clearly as you are sitting here, and especially before when we heard the wonderful band, your pleasure centres were going along like crazy. With work spanning other animals and certainly humans, which is the kind of work I do, most of this neurochemical work is done in rats by a guy called Kent Berridge from the University of Michigan. What we found is there are these regions, because that part of the brain can go wrong, and of course when it goes wrong that's when we call it PTSD or chronic pain or acute pain. But of course it can also go right. It can be made right by music. Whatever music you like, that is clearly what is happening. Some people like Steven Pinker would say that music could vanish from our species and the rest of our lifetime would be virtually unchanged. I think that is as false a thing as has ever been said. When you then start to look at what happens when you put people into brain scanners you can start to look at probably the kind of thing that happens, not so often, but yet of course we can predict when it happens, because you get that kind of chill feeling. I certainly got it when the band was here, even though some of the tunes were not that well known to me. When that happens, that orgasm-like chill, that musical chill, basically gets activity in this whole reward circuit of the brain which tells us that music really is one of those interesting pleasures that are in fact activating the same systems as you would get with food, as you would get with sex, but what is interesting about music is that it can go on for a very long time, unlike some of the other pleasures!

One of the things that really gets music very exciting is not just the chill, because of course what do you do after the chill, but the funny thing about music is you stay in the zone, as it were, and the way you stay in the zone is, of course, to do with the rhythm. It points to something really quite peculiar and very important about music, namely that expectation and anticipation is at the root of every level of musical composition. Now, rhythm is an understudied thing and yet I would argue that it is probably one of the most important things because it also shows us what Nigel, again, showed very nicely with the kids, that it gets us moving and that there is a very strong connection between emotions and movement. Take the Parkinson's patient that we showed you earlier. 60-70% of those Parkinsonian patients will be shown as clinically depressed even before they get any of the motor symptoms. Again, linking emotions and movement very closely together.

So what is it then about rhythmic displacement, and expectations? It's a bit like the Rubin’s face-vase, you can either see the face or the vase but not both. You can either hear the rhythm or the displacement. So what is it about that? Working together with Peter Vuust in the University of Aarhus where I also have part of my research group, we tried to work out the magical ingredient, and we took the classic drum breaks in funk music, and we played them with a snare and a high hat. I'll just play you an example where we didn’t have a lot of syncopation.

[Music plays]

It’s almost like a marching band. Kind of funky, but not really. What if we added a bit of extra syncopation?

[Music plays]

Suddenly there's some wiggling in the audience. So surely a little of a good thing is good, a little more is better, so a lot of it must be a lot better, right? So what if we did that? We took again the same amount of information if you like, so if you look at the entropy of these, they have the same entropy, but we placed the beats in different parts. Here is one with a lot of syncopation.

[Music plays]

It's sort of more like the Crouch dance really, isn't it? So we asked people – unfortunately there is a difference between wanting something and liking it. What you find is there is this inverted U shape. It's the one in the middle, the one I played you second, which is the one that most makes people want to move, but it is also the one that they really like. So that's quite interesting. So how do we get to that top of the curve, and what happens when we are at the top of the curve and how do we stay there? So we had people dancing around with Wii controllers so we could actually see whether they were in or out of the beat, the kind of biosocial that Nigel was talking about, but we also then put them in brain scanners and what we were able to show was what was happening as you were in the zone was that the reward circuitry was going again, which points to this unitary experience of pleasure that is the same mechanisms that are being brought together. So really what we are doing is we are modulating the whole circuitry. We are allocating our resources so that we can actually be in that particular zone and of course, if something is wrong with our brain, we can't do that any more. When in fact one of our brain parts, called the default mode network, doesn't seem to be working, like in depression or trauma, that's really when things go wrong. And then, of course, the question becomes, what can we do about that? And for this, because my time is up now, my PhD student Kira from the University of Aarhus will tell you a little bit about what we might be able to do with traumatised refugees.