

What if every pre-schooler could keep a beat?

In 2016 I had the incredible privilege of taking my first roadtrip to visit labs in the US and Canada who were conducting the neuromusical research. Until I took this first trip, my only interaction with the research had been through peer review journal articles and the few videos of researchers discussing their work.

“An auditory–motor synchronization task may serve as an important, early indicator of a child’s ability to understand spoken and written language.”

Bonacina, S., Huang, S., White-Schwoch, T., Krizman, J., Nicol, T., & Kraus, N. (2021). Rhythm, reading, and sound processing in the brain in preschool children. *npj Science of Learning*.



The first lab I visited was the Auditory Neuroscience Lab at Northwestern University. This lab is known as Brainvolts and is headed up by Professor Nina Kraus. It was then, and still is, a leading hub of incredible researchers who have a simple question to explore – how do we understand the world through our ears.

When I visit a lab I stay for 3 to 4 days. Before I arrive the lab sets up a timetable for me and I ask if I can speak to everyone who will see me, from Professor to Lab Technician, and to allow me to experience any and all experiments that they do in the lab.

This has seen me watch eye tracking research with six month old babies, dance around in the largest motion capture array outside

Hollywood in a motion capture suit to being handed the controls for the LiveLab to change the acoustics from English meadow to New York train station.

Beat Synchronisation Test

One of the experiments I got to experience was the Beat Synchronization Test. This is a test where I was sitting in a sound booth and I had a drum in front of me. I then had to complete a number of tasks such as finding a beat when I listened to a piece of music, copy a beat that was given to me by a researcher and continue a beat after the researcher stopped playing.

These tasks are not hard for a musically trained adult, but they are very tricky and incredibly illuminating in terms of neural development for children between the age of 3–5 years.

The reason that beat synchronisation is a fantastic task is because it requires precise integration of auditory perception and motor circuitry. We have to process the sound of the beat, and importantly the period of time or silence between the beats, and then we have to talk to our bodies to create that beat on a drum, which required predicting how far and fast our hands need to move to hit the drum at exactly the right time, and then do it again.

Beat synchronisation is an external representation of a level of internal cognitive connectivity. Put another way, we can now assess the level of cognitive connectivity in a young child through their ability to complete beat synchronisation tasks.

I was incredibly lucky to interview the lead researcher, Dr Kali Carr, before I got to experience the experiment itself. She, and the team researching in this area, had found exciting evidence that a beat synchronisation test could identify the level of cognitive connectivity in a child’s brain. This specific type of cognitive connectivity related directly to reading readiness or preliteracy skills.

We can predict a young child’s (3–4 years of age) language processing and potential reading skills through the level of beat synchronisation they can demonstrate.

How are beat and reading connected?

Dr Carr’s research was completed in 2014 and the findings have been both replicated and expanded over the last seven years. In 2021, a research study based on Carr’s work has been released, also from the Brainvolt’s team, which has made a number of big leap forward in this area of research.

The first leap was with the number of participants. The 2021 study included over 150 preschoolers, whereas the 2014 study had 35 preschoolers. The larger the number of participants in a research study the lower the possibility of bias in the findings. Put another way, the more participants in a study the more robust or reliable the findings are.

Another leap was the additional findings that children who were classified as synchronisers, meaning they could synchronise with the different types of beats I mentioned above, also scored higher on preliteracy tests.

This demonstrated greater precision with their encoding of speech, they had less degradation of the speech signal processing as well as greater phase-locking consistency.

This final two areas need explanation. Degradation of speech signal processing means a child has to work a lot harder to process speech sounds. Phase-locking consistency means a child can detect changes in speech sounds faster and with greater accuracy.

Possibly the most interesting leap is the deeper understanding about how beat and reading are connecting in the brain. While it is vital to share the research findings with educators, having the depth of understanding behind why beat synchronisation and language processing and reading skills are connect can only strengthen our teaching and advocacy.

The answer is that the auditory processing system analyses language through synchronous firings that are tied to the motor circuits that are involved in beat synchronisation.

You may need to read that sentence a few times to understand it, so let’s break it down a bit more.

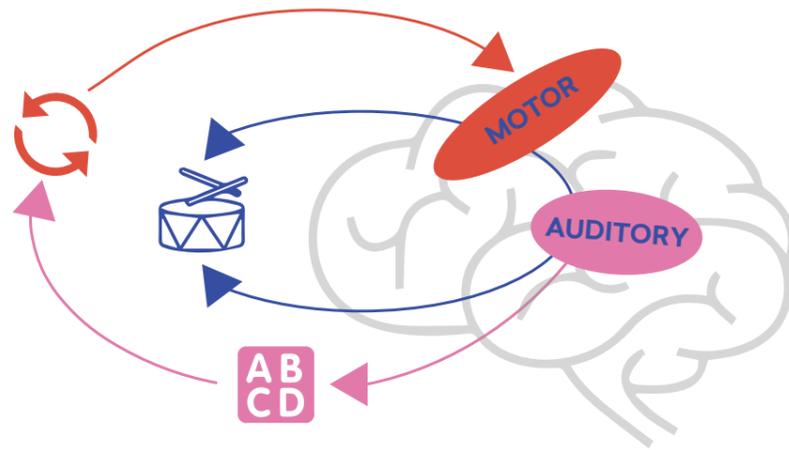
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How to explain the connection between beat and reading readiness

For the brain to process the parts or components of language, a huge number of messages need to fire around the brain at the same time. If the messages are not synchronised correctly, then the messages don't converge to make the correct meaning. In my head it would look like a group of ballet dances doing all the same patterns of steps but at different times. It would make no visual sense, but if they move together they create meaning from their collective movements.

Rhythm, Pre-Literacy & Auditory Processing - interconnect in early childhood

The auditory processing network analyses language through synchronised firings tied to the motor cortices which is involved in beat synchronisation



This level of synchronisation in the brain is tied to our motor circuits. Yes, just like it takes a level of synchronisation to catch a ball, it takes a level of synchronisation for our brains to work effectively.

Therefore for young children to learn language, they first have to develop these synchronised circuits in order for the messages to make correct sense of converging information. We hear language through our ears and we need the help of our motor circuits to process the information efficiently and correctly.

What does this research mean in preschools, childcare centres and for parents?

The Bonacina (2021) study found that rhythm, preliteracy and auditory processing are interconnected during early childhood. This is a short but very powerful sentence. As children who are heading towards big school there is significant pressure and anxiety about making sure each child is school ready.

There are many components of school readiness but one of the most significant is pre or early literacy. Pre or early literacy is what children know about reading and writing before they can actually read and write.

One of the commonly utilised ways to help children experience language, either spoken or written, is to read to young children and allow them to play with letters, books and words in all sorts of ways. However Bonacina, and her teams, research puts forward a

powerful argument that the cognitive development of preschoolers when it comes to preliteracy should also include musical activities that focus on auditory processing and accurate beat keeping.

If we are all teachers of literacy, which is an expression used in curriculum across Western education systems, then let's acknowledge that music learning is a foundation learning experience in the preliteracy period and help others understand how beat keeping primes the brain for reading.

What if every preschooler could keep a beat?

Many of you would have seen my TED Talk titled "What if every child had access to music education from birth?"

In the TED mantra, this was my idea worth spreading and I still maintain it is a question that could alter our entire societies.

Using this theme, and in light of this recent research, what if every preschooler could keep a beat? It could mean that every child that enters their first year of big school is cognitively ready to read.

If I was an early childhood teacher I would definitely feel more confident to embark on the reading journey with my class if I was confident that they were cognitively ready for the task.

It could mean that sometime between the age of 3 and 4 years, children who may not be cognitively ready to read, which could be identified easily and by their class teacher or carer through a simple beat keeping assessment, could begin beat/reading interventions before they got to big school.

Imagine the gratitude from parents and effectiveness of a music and language intervention for these children before they got to their first year of big school.

It could mean that children who had not yet been identified as experiencing dyslexia, because they have not commenced formal reading learning yet, could be identified earlier than before. Earlier interventions may prevent them from experiencing the emotional strain, poor self-concept and sometimes many years and tests before being diagnosed with dyslexia.

"We suggest that interventions, which may support [preliteracy skills and auditory processing] development (e.g., music and rhythm training), be implemented early in childhood."

Bonacina, S., Huang, S., White-Schwoch, T., Krizman, J., Nicol, T., & Kraus, N. (2021). Rhythm, reading, and sound processing in the brain in preschool children. *npj Science of Learning*.

Bigger Better Brains

What if every pre-schooler could keep a beat?

It could mean that a 10 or 12 or 14 year old child who has always struggled with their reading and has fallen behind in all of their academic learning, could undertake a beat keeping intervention that could adjust the neural synchronisation that has been delaying their reading development.

It could mean that less pressure and time needs to be put towards preparing for standardised literacy tests because the students' literacy levels are at standard because they never fell behind.

It could mean that more students would remain engaged in school, which helps them remain engaged with their own learning and less likely to seek distracting and risky behaviours. It could mean less young adults going to jail, experiencing isolation and depression, poor health and an inability to maintain healthy relationships.

*The domino effects of a literate and engaged society are enormous.
And it all starts with one little beat.*

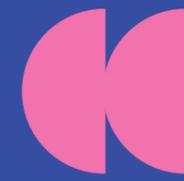
Read More

Bonacina, S., Huang, S., White-Schwoch, T., Krizman, J., Nicol, T., & Kraus, N. (2021). Rhythm, reading, and sound processing in the brain in preschool children. *npj Science of Learning*.

Carr, K. W., White-Schwoch, T., Tierney, A. T., Strait, D. L., & Kraus, N. (2014). Beat synchronization predicts neural speech encoding and reading readiness in preschoolers. *Proceedings of the National Academy of Sciences*.

Researcher to Follow

Dr Silvia Bonacina Auditory Neuroscience Laboratory Northwestern University



Reading ability and phonological awareness are related to a variety of rhythmic abilities, including reproduction of rhythmic patterns. tempo reproduction [and]; tapping to the beat of music.



Hallam, S. (2019). Can a rhythmic intervention support reading development in poor readers?. *Psychology of Music*, 47(5), 722-735.

**Bigger
Better
Brains**

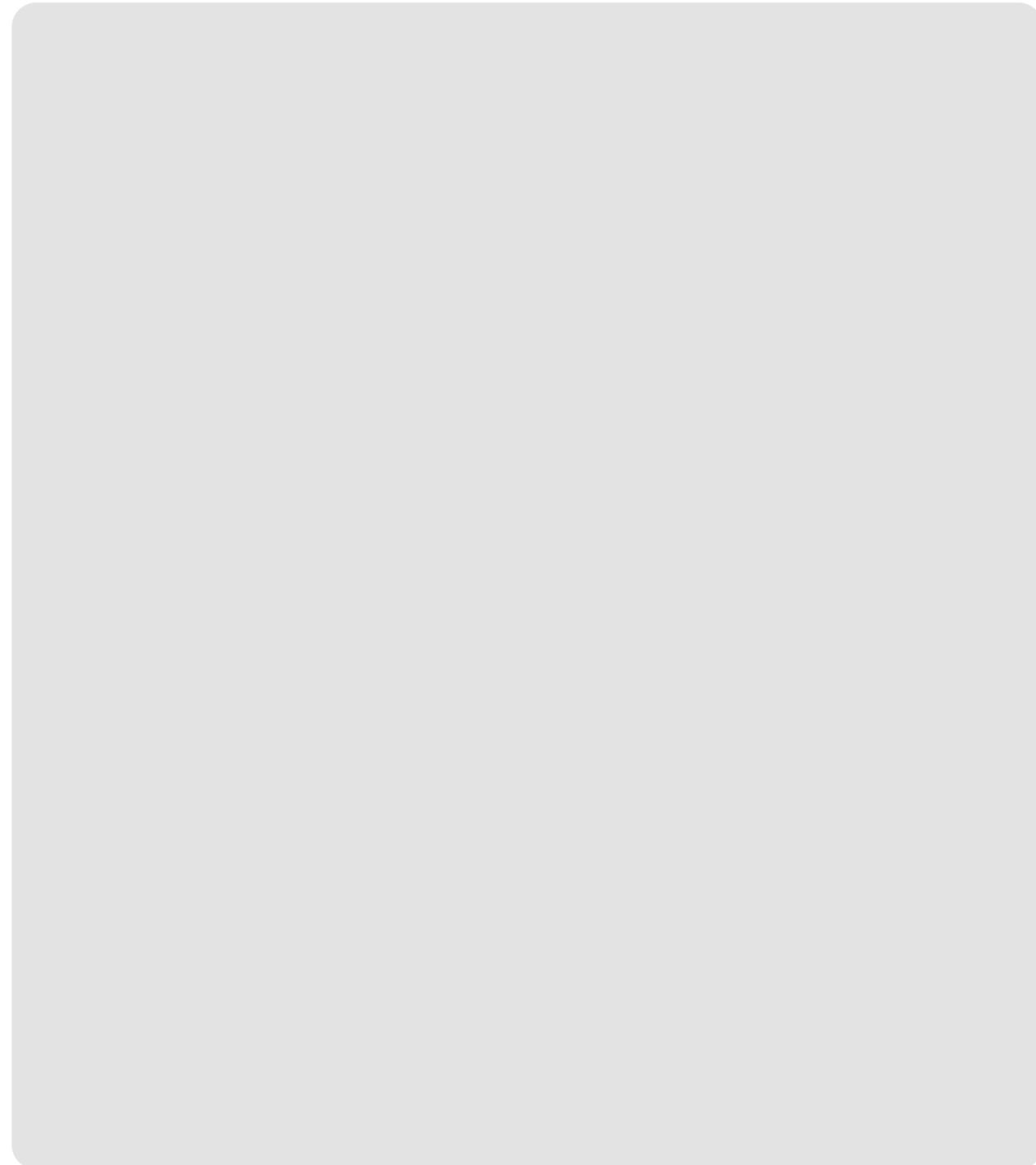
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Professional Reflection • Part 1

Personal Brain Buzz

Write the explanation I suggested in *How to explain the connection between beat and reading readiness* in your own words.

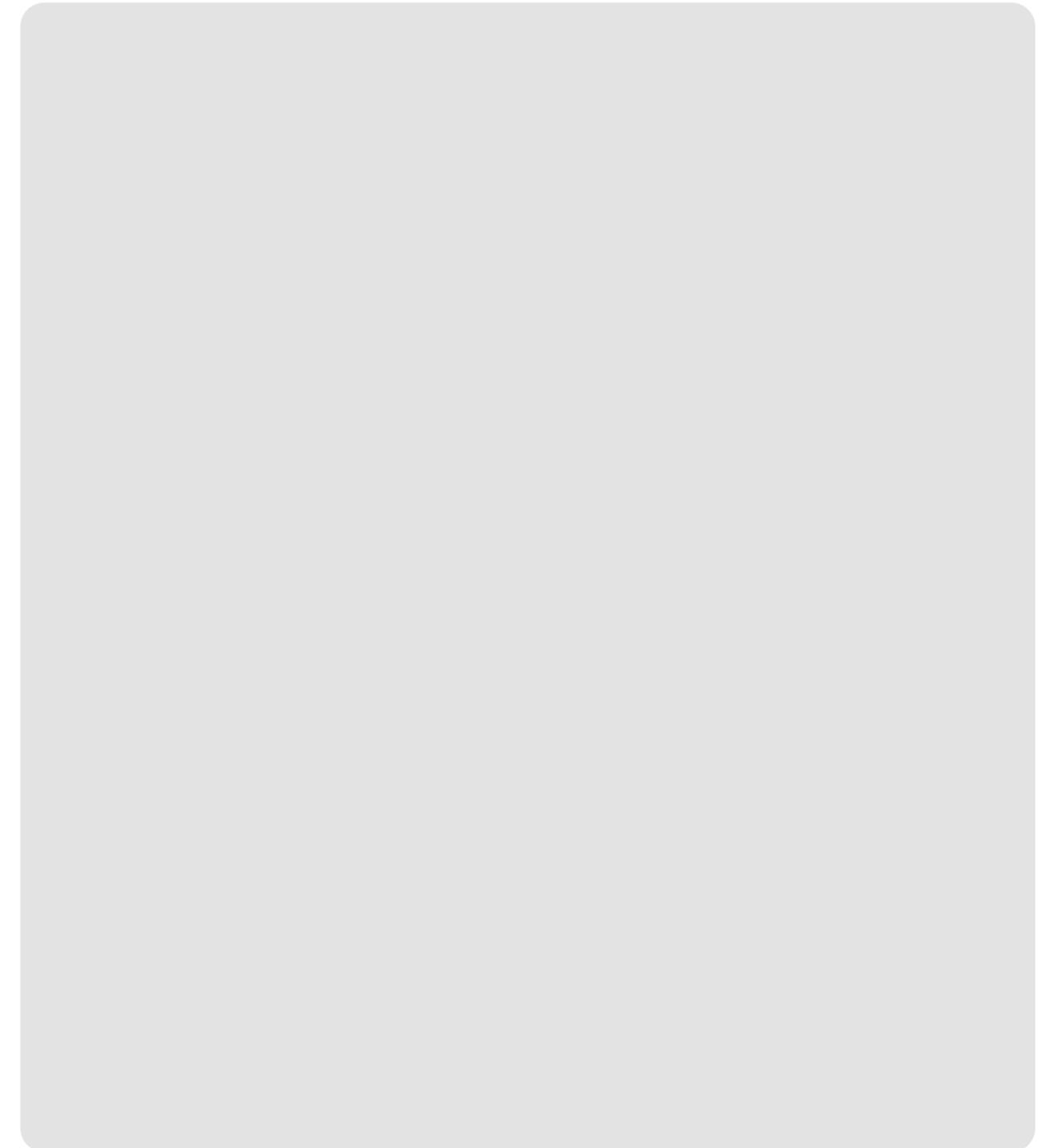
Choose your own wild analogy just as I did with the ballet dancers.



Experiment Time

Read your description to a colleague, friend or family member, then get them to reflect back to you what they understand about the process.

If they miss a step or get confused, try writing your description again to make it clearer.



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Professional Reflection • Part 2

Teaching Brain Buzz

Choose one class or ensemble and select which students you believe struggle with their reading. The age group does not matter.

Now use an existing exercise you are going to do, or add an activity into your teaching which can demonstrate those students ability to do the following things.

Low readers and rhythm abilities

How focusing on rhythm skills can improve reading skills

BBB Professional Reading
March 2021





Repeat a rhythm back



Replicate a given tempo



Maintain beat after 1 repeat



Initiate a beat



Identify rhythm changes

Experiment Time

Read your description to your students and get them to draw their understanding of what you have described.

Which student came up with the closest to correct representation and which students representation was innovative, unexpected or surprising?

Questioning Brain Buzz

After completing this professional reflection, write at least two questions you have about this topic.