Alice and her mathematical musical humps!

Discover the powerful connections between music and maths, and how to make the most of these parallels in your classroom – by **Jennie Henley**, **Caroline Hilton** and **Robert Newell**

Alice the camel has got five humps. What would happen if you took one of those five humps away – would Alice still be a camel? What would happen if you took all of those humps away, what would Alice be – a horse?

The relationship between music and maths is much deeper than we sometimes think. It may not be immediately apparent, but when children sing *Alice the camel*, they are using a number of mathematical processes:

Repetition –
- The words are repeated;
- The whole tune is repeated;
- Individual phrases are repeated.

Translation –
- The tune repeats, but a note higher;
- The words repeat with a slight change each time;
- As Alice looses her humps, the tune modulates – it changes key. This means that the tune is the same, but the notes are a step higher.

Symmetry –
- The tune starts and ends on the same note;
- The first phrase is sung at one pitch, then sung a note higher, then sung again at the first pitch.

Reflection –
- The link between the verses is a melodic reflection of the last phrase: 'go, Alice, go' starts high and descends, ending on the key note; the linking tune starts low and ascends, taking us back to the key note for the start of the next verse.

Prediction –
- The repetition in the tune allows children to predict where the tune will go next;
- There is a sequence to the verses and children can predict what will happen in the next verse.

These processes are not just mathematical processes; they are also musical processes.

Think of any piece of music. You will likely find repetitions, translations, reflections, and symmetry. You will probably be able to predict what might happen next. What happens when your prediction is not correct, how do you make sense of the music? You look for the familiar patterns.

The European Music Portfolio – Maths project funded by the EU is looking at the deeper links between music and maths. Through an exploration of the brain processes used, and mapping the findings onto maths and music curricular, it has become clear that the two subject areas are more than linked: it can be argued that the processes used in both maths and music, as Alice the camel shows, are the same.

This is very powerful for Primary teachers. Through exploring music, children can develop understanding of both musical and mathematical structures, patterns, devices and transformations. What's more, by thinking mathematically about music, teachers can access music in a way that doesn't require an in-depth knowledge of musical terminology.

Think of it this way; next time you ask your children to compose a piece of music, you will know exactly how to help them develop their ideas using repetition, reflection and/or translation. You can help them make it predictable, or ask them what they might do to make it unpredictable. If they don't know how to end their composition, they could make it symmetrical.

Try it out for yourself in this activity:
- Ask children to compose a pattern using their bodies (clapping, stamping, etc.) or un-tuned percussion instruments;
- Ask them if they can play a *reflection* of the pattern (play it backwards);
- Ask them to play both the pattern and the reflection of the pattern;
- Ask children to translate that pattern and reflection by playing it on a different part of their body/instrument;
- Ask the children to put together the original and the translated pattern and reflection;
- Continue with different *transformations*

By using mathematical musical processes, you will be able to support your children in developing their musical ideas whilst at the same time deepening their understanding of mathematics and mathematical problem solving. Both teachers and children alike will benefit, so give it a go!

Jennie Henley *has taught music in a variety of different Primary, Secondary and out of school contexts. She has 16 years experience of leading children's, youth and adult choirs. She now works at the Institute of Education, developing music provision for PGCE Primary students and is Programme Leader for MA Music Education.*

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LISTEN UP

High score!

Find out how computer games can take children's musical engagement to the next level…

Computer games often receive a bad press in terms of their perceived negative impact, but their soundtracks subtly introduce children to a tremendous breadth of musical cultures and genres, from classical favourites to cutting-edge contemporary music. We talked to two top game music composers – **Jessica Curry** and **Stephen Baysted** – about the benefits of game soundtracks and the compositional techniques involved in writing for this medium. Jennie Henley then takes some of the principals of game music and translates them into fantastic activities that you can try with your students!

For Jessica Curry, director and composer at acclaimed studio 'The Chinese Room', computer games can prompt children to discover music they might not otherwise encounter: 'children and young people love games, so it's a terrific opportunity to introduce them to music… and there's such a wonderful breadth of styles and orchestration within the medium.' This host of music ranges from the nineteenth-century Russian folksong *Korobeiniki* heard in 'Tetris' to the elegant string quartets of Hideki Sakamoto, which accompany puzzle-game 'Echochrome'.

Jessica also emphasises the vibrant connection between soundtrack and player experience: 'the licensed songs in the FIFA games do a great job of supporting the buzz and excitement of the match… [They're] a huge hit with my 11-year-old!' On this theme, award-winning composer Stephen Baysted notes the challenges of composing for games, spotlighting the lessons budding young composers can glean from listening carefully to soundtracks: 'One of the roles of music in games is to create an atmosphere which helps the audience follow the narrative, as well as heightening the emotion of a scene – or perhaps even undermining what's happening on screen: so a character might seem fine and dandy but the music hints that someone's about to creep up behind them… it's about finding a way to push the right buttons at the right time.' Stephen also highlights the imaginative use of 'soundscapes' in computer games: 'sound effects are often used to underpin or replace the 'musical' elements of a score. I find it intriguing how sounds from 'captured sources' can be used to create musical effects.'

A number of computer games now seek to support children's musical engagement more directly, including composition tool Isle of Tune (**www.isleoftune.com**) and interactive music-making game Joy Tunes (**www.joytunes.com**). Jessica also lists an app called AutoRap (**bit.ly/auto_rap**) '[it] changes your speech into rap. It's so clever – and great fun!' Computer games can thus be far more than just entertainment; let's celebrate the imaginative possibilities of gaming and use this popular activity as a vehicle for learning and creativity. Below are a couple of ideas to get you started…

FIND THE ARTEFACT

This activity explores musical changes that signal proximity to an object, developing understanding of how music is used as signals and signposts in games, and honing children's ability to change dynamics, tempo and pitch together.

- Take any song that your children know well.
- Arrange the children into groups and ask them to choose a musical change – dynamics, tempo or pitch – and practice the song with the musical change. If this proves challenging, suggest someone leads, using eye contact or gestures. Advanced groups might even try different songs.
- Each group chooses a 'player'. Then they choose an object in the room (eg. the smart board, the sink, etc.), but don't tell the player!
- The game: The player moves around the room. When the player gets closer to the chosen object, the rest of the group increases the tempo or dynamics, or raises the pitch. As the player gets further away, they do the reverse. The player must then guess what the chosen object is.
- Discuss with the children what effect the different musical changes had, how easy it was to find the object, and how all this relates to game music.
- This could easily be done with instruments or with recorded music, exploring software that alters pitch and tempo (such as Amazing Slowdowner or Speed Shifter).

CREATING SOUNDSCAPES

This activity explores narrative using captured sources. Children develop an understanding of how everyday sounds can be used to create an atmosphere, and develop their composing skills in layering and manipulating sampled sounds.

- Go on a sound walk, recording the sounds in the school environment on a digital recorder or iPad.
- As a class, listen to the recorded sounds and discuss what stories they might tell.
- Individually or in groups, import the sound clips into programmes such as Audacity, Soundation or GarageBand and arrange them to fit your stories.
- Experiment with altering the sound clips or adding different samples (such as menacing strings, or thunderous timpani).
- Share each group's/child's work and discuss the narratives behind the music.
- This could be taken further with creating storyboards, animations, role-plays or dance.

Words and interviews by ***Kate Wakeling****: Kate has led music and dance education projects for LSO Discovery, the Shoreditch Trust and Hackney Music Development Trust, and is currently Research Fellow in Learning and Participation at Trinity Laban Conservatoire of Music and Dance.*

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