- Orchestra / Instrumentation and orchestration

SCIENCE

ORCHESTRAL ARRANGEMENT

How the instruments of an orchestra are arranged in tandem with our brain functions

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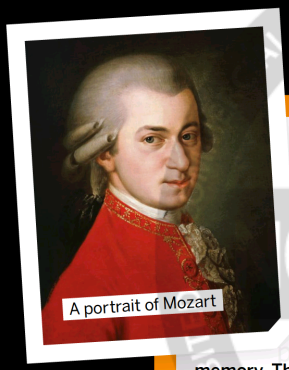
Why are the brass in the back and strings at the front of an orchestra? The reasons for the positioning of an orchestra all relate to how the brain 'hears' different sounds. A modern symphony orchestra typically consists of around a hundred different players performing with a wide variety of instruments, including those in the woodwind, string and bass families. All of these produce different pitches that work together to create a harmonious sound. In music, pitch refers to the length of a sound wavelength produced by an instrument, which correlates with the size of the instrument. For example, deep long sound waves emanate from larger instruments such as tubas and cellos, whereas higher pitches come from the short sound waves of a viola or flute.

When instruments come together to form an orchestra, the deeper pitched instruments are positioned on the right side when viewed from the audience, and the higher pitched instruments are on the left. The orchestra is orientated this way according to our brain's preferences. Within each of the brain's two hemispheres is a region known as the auditory cortex, which interprets signals generated from the ears. To make things complicated, each auditory cortex is wired to the opposite ear – the right auditory cortex is fed by the left ear and the left auditory cortex listens through the right ear. And while each ear picks up the same sounds, studies have found that the right auditory cortex processes lower pitches better, while the left is handier with high pitches.

The arrangement of an orchestra mimics this crossover of the auditory cortices. Built to benefit the players, not the audience, high-pitched instruments are placed on the right side from the players' perspective so that they are better heard, and vice versa for the lower pitched tones. The distance an instrumental section is from the front depends largely on their size and volume. Louder instruments such as percussion drums or brass tubas are placed at the back of the orchestra to prevent them from blocking the softer, quieter sounds of the strings at the front.

Did you know?

'Orchestra' is from the Greek for 'dancing place'



A portrait of Mozart

THE MOZART EFFECT

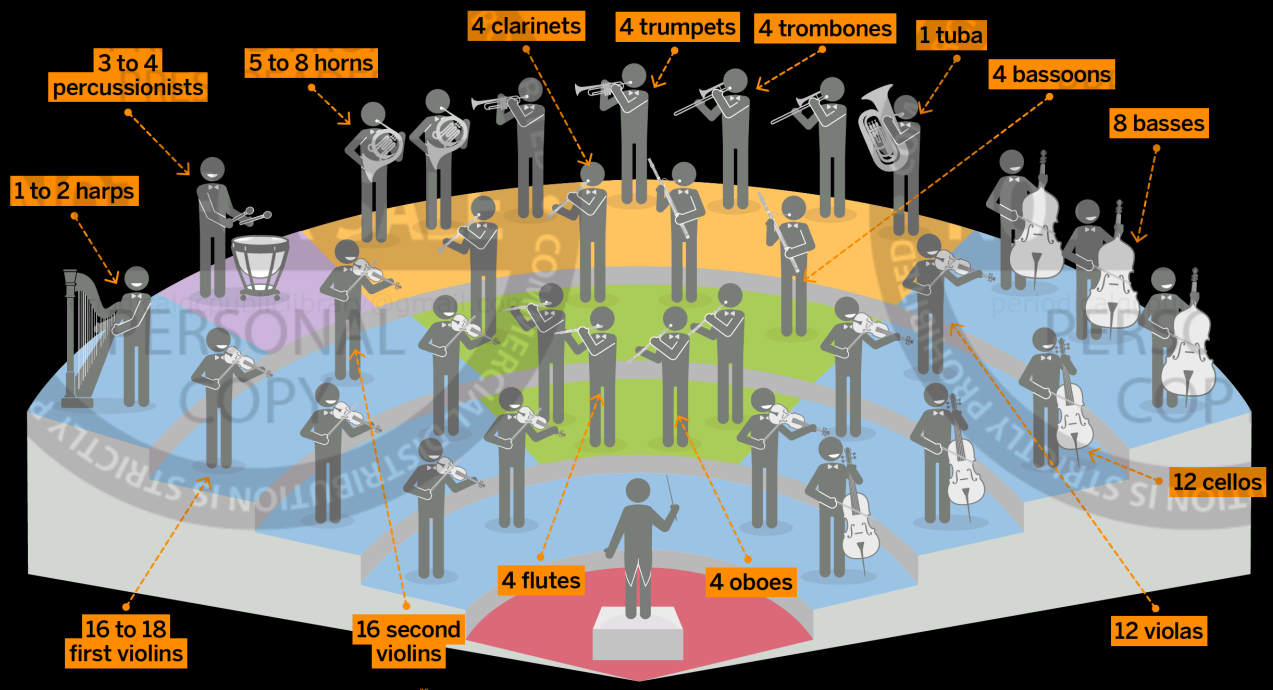
According to research conducted by London Metropolitan University in 2020, listening to Mozart can improve your short-term memory. The Mozart effect was first described in 1993 when an article in the journal *Nature* suggested that listening to Mozart's music could improve IQ test scores. Since then, many studies have been carried out to investigate the science behind his symphonies, including its role in short-term memory. In the 2020 study, researchers asked a group of 84 participants to recall a set of words following a minute-long sound clip of Mozart's *Eine kleine Nachtmusik*. They found that Mozart's music did enhance word memory. Having run *Eine kleine Nachtmusik* through sonograms and spectrograms to visually examine its frequency and sound, the researchers concluded that a positive effect on recall may be linked to the similarity between Mozart's music and the structure of words and sentences.



The auditory cortex is found in the two temporal lobes of the brain



DID YOU KNOW? The world record holder for largest orchestra is El Sistema, with 8,573 instrumentalists and singers



ALLOCATING INSTRUMENTS

How an orchestra is arranged to make the most out of its sound

CONDUCTOR

Front and centre of any orchestra is the conductor, whose job it is to set the tempo and volume for the music and maintain harmony between the players.

BRASS

The loudest instruments within an orchestra are found in the brass section, placed at the rear. Trombones can reach up to 114 decibels, whereas violins at the front of the orchestra can reach up to 95 decibels.

STRINGS

The string instruments in an orchestra range from the high-pitched sounds of violins on the left to lower pitched basses on the far right. Although they might look similar, violas are tuned one-fifth lower than a violin, hence violins begin on the left side of the string section and the violas end on the right.

WOODWINDS

The woodwinds sit in the centre of an orchestra and have the higher pitched piccolos and flutes on the left and the lower pitched oboes and bassoons on the right. Woodwinds also sit in front of the brass section to ensure they aren't drowned out by the powerful volume of trumpets and tubas.

PERCUSSION

Percussionists play a variety of different instruments in this section, including timpani drums, cymbals and xylophones. Similarly to the brass section, percussion instruments like timpani drums can produce a louder sound than other instruments, at around 100 decibels, so sit at the back of the orchestra.



THE FIRST ENSEMBLE

Although instruments have been around for thousands of years, it wasn't until around 1600 that Italian composer Claudio Monteverdi assembled the first orchestra. Playing the score to his 1607 opera *L'Orfeo*, Monteverdi's orchestra brought 40 instruments together, including bowed strings, harpsichords and trumpets. For the first time, Monteverdi used an orchestra to elevate moments in the opera with specific instruments. His orchestral innovation began a rise in popularity and laid the groundwork for other orchestral pioneers, such as Johann Sebastian Bach.



The funeral notice following Claudio Monteverdi's death in 1643

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