Circle of Fourths

Joe Wolfe

Three flutes, one doubling piccolo
One oboe and one cor anglais
Two clarinets and one bass clarinet
Two bassoons
Four horns
Two trumpets
Two trombones and one bass trombone
Tuba
Timpani (ideally four, but playable with two)
Bass drum, cymbals, tam tam, congas, timbales. At least three players
String orchestra

The brief for composing a celebratory piece for the UNSW Orchestra's 100th concert was simple: 4 or 5 minutes of fun, using everybody and not to compete too much for rehearsal time. The orchestra's archivist (cellist Eric Sowey) was keen that the piece incorporate the number 100. The Old Hundredth is a chorale, so named because its words are from psalm 100: 'All people that on Earth do dwell'. I took the first five, four or three notes, added syncopation, and used them as seeds for the three tunes in this piece.

There was another idea that I've wanted to use in a short orchestral work. Nearly every musician spends some time, first in wonder then in worry, on discovering the circle of fourths (or fifths¹). Play four ascending notes in a major scale, say C-F. Then another: F-Bb. Continuing thus, and setting Gb = F#, we have C-F-Bb-Eb-Ab-Db-Gb=F#)-B-E-A-D-G-C. On a piano, Gb = F# so, after 12 fourths, we have covered five octaves and come back 'home' to C - hence the circle.

The worry arises because a perfect fourth has a frequency ratio of 4/3 and an octave 2/1. So 5 octaves = 2⁵ = 32, while (4/3)¹² ≈ 31.6. Out by 1.3% or a quarter of a semitone, called the Pythagorean comma – it's not a new problem! Minimising the potential mistuning thus caused is called temperament. There are many temperaments, all with disadvantages: Lakes of ink have been poured into the problem of temperament over more than two millennia.

But quite apart from the historical, physical and philosophical interest in the circle, I was attracted by the melodic and harmonic possibilities of successive fourths. Stacked up over five octaves, the circle is an interesting chord and building it from the bass creates musical tension. By keeping the pedal notes loud and distributing it through the orchestra, I expect that we shan't have serious temperamental problems. There is, however, the interesting question of where to go after a chord that contains 12 different notes: this work has a few answers.

The piece is mainly in 8/8 time (3+3+2 quavers) with, for contrast, some interjections of 3+3+3+2+2, a 3:4 slow section in the middle and some syncopated four to the end.

While I was writing this piece, Larrikin Records surprisingly won a court action against a band that had wittily quoted 11 notes from 'Kookaburra sits in an old gum tree'. So I wondered about the propriety of borrowing up to 5 notes from Lloyds Bourgeois, who wrote the Old Hundredth in the sixteenth century. Or from the unknown inventor of the descending major scale, because Bourgeois, in turn, had already borrowed the phrase! However, if Larrikin were to buy up the old chorales I expect that they would start suing Bach first, so I'm probably safe. If not, I'm pleasing syncopation. But if Pythagoras sues me for the circle of fourths, I'm in trouble.

About the composer

Joe Wolfe is a physicist by day, but has written several orchestral works. The first of these, his most notorious, is the Stairway Suite: a set of seven orchestral variations on the pop song Stairway to Heaven, each in the style of a different composer (currently being rehearsed by community orchestras in Korea and the UK). Sydney Sketches is music about the city, Conjunction is an interactive introduction to the orchestra. He also wrote a celebratory overture for the UNSW orchestra's tenth anniversary, and a jazz-flavoured concerto for SSO trumpeter Anthony Henrichs.

¹ A few people have asked: Why a circle of fourths, rather than fifths? First, a circle of fifths is seven octaves, which stretches the orchestral range and would make it difficult to balance chords. Second, when musicians depart from perfect tuning, they usually stretch intervals. Stretching a circle of fourths reduces the temperament problem, stretching fifths increases it. Third, and most importantly, I preferred melodic and harmonic possibilities of the fourths.
Wolfe: Circle of Fourths (revised)