

Circle of Fourths

Joe Wolfe

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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 Soweby) 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 = $2^5 = 32$, 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 at 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 pleading 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.

Circle of Fourths

Joe Wolfe , 2010
revised 2011

Steady (about 84)

The musical score for "Circle of Fourths" is divided into two systems, both marked "Steady (about 84)".

System 1:

- Flutes:** Flute 1, Flute 2, Flute 3/Piccolo. All are silent throughout.
- Oboe:** Silent throughout.
- Cor Anglais:** Cor Anglais (bass clef, B-flat key signature), Cor Anglais transposed for clarinet 3 (treble clef, F# key signature), 2 Clarinets in Bb (bass clef, B-flat key signature), and Bass Clarinet in Bb (treble clef, B-flat key signature) all play a melodic line starting at measure 147 with a *mf* dynamic. The Cor Anglais parts have a *mf* dynamic.
- Bassoons:** Bassoon 1 and Bassoon 2 play a melodic line starting at measure 147 with a *mf* dynamic. Bassoon 2 has a *ff* dynamic at measure 160.
- Horns and Trombones:** 4 Horns in F (bass clef, F key signature) and 2 Trumpets in Bb (treble clef, B-flat key signature) play a melodic line starting at measure 147 with a *f* dynamic. 2 Trombones (bass clef) and Bass Trombone (bass clef) play a rhythmic pattern starting at measure 147 with a *mf* dynamic. Tuba (bass clef) plays a melodic line starting at measure 147 with a *mf* dynamic, reaching *ff* at measure 160.
- Timpani:** Timpani (bass clef) plays a melodic line starting at measure 147 with a *p* dynamic, reaching *ff* at measure 160. Instruction: "mf tune E, A and B,D if there are four".

System 2:

- Drum Set:** Bass Drum (bass clef), Congas (bass clef), Timbales (bass clef), Cymbals (bass clef), and Tam-tam (bass clef) all play a rhythmic pattern starting at measure 147. Dynamics range from *p* to *mf*.
- String Quartet:** Violin I (bass clef), Violin II (bass clef), Viola (bass clef), and Violoncello (bass clef) play a melodic line starting at measure 147 with a *mf* dynamic, reaching *f* at measure 160. Violoncello has a *mf* dynamic at measure 147. Instructions include "div." (divisi) and "pizz." (pizzicato).
- Double Bass:** Double Bass (bass clef) plays a melodic line starting at measure 147 with a *mf* dynamic, reaching *f* at measure 160. Instructions include "pizz." (pizzicato) and "arco" (arco).

This is a page of a musical score for 'Circle of Fourths (revised)' by Wolf. The score is written for a large ensemble, including woodwinds, brass, strings, and percussion. The page is numbered '9' in the top left corner. The music is in 4/4 time and features a complex harmonic structure with many trills and triplets. The woodwind section (Flutes, Clarinets, Bassoons, Saxophones) and brass section (Trumpets, Trombones, Tuba) play intricate melodic lines with frequent triplets. The string section (Violins, Viola, Cello, Double Bass) provides a harmonic foundation with sustained notes and some movement. The percussion section includes Congas, Timbales, and a Tom-tom (T.-t.), with the Tom-tom part marked 'l.v.' (largo vivace). The score includes dynamic markings such as *ff* (fortissimo) and *f* (forte), and performance instructions like 'on picc.' (piccolo) and 'div.' (divisi). The piece concludes with the instruction 'al niente' (fading to nothing) for several instruments.

15

FL.

Fl.

Fl3/
picc

Ob.

C. A.

CA->Cl

Cl.

B. Cl.

Bsn.

Bsn.

Hns.

Tpts.

Tbns.

B. Tbn.

Tba.

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I

Vln. II

Vla.

Ve.

Db.

mf

pp

ppp

p

mf

p

mf

mf

mf

mf

p

pizz.

p

damp

damp

23

Fl. Fl. Fl13/picc. Ob. C. A. CA->Cl. Cl. B. Cl. Bsn. Bsn. Hns. Tpts. Tbns. B. Tbn. Tba. Timp. B. D. Congas Timb. Cym. T.-t. Vln. I Vln. II Vla. Vc. Db.

p *mf* *ppp* *solo*

damp if 4 timps else tacet if 4 timps

32

Fl. *f*

Fl. *f*

Fl3/
picc *f*

Ob. *f*

C. A. *f*

CA->Cl *f*

Cl. *f* a 2

B. Cl. *f*

Bsn. *f*

Bsn. *f* a 2

Hns. *mf* a 2

Tpts.

Tbns.

B. Tbn. *mf*

Tba. *mf*

Timp. *mf* damp if 4 timps if 4 timps *f*

B. D. *mf*

Congas

Timb.

Cym.

T.-t.

Vln. I *f* *fp*

Vln. II *f* *fp*

Vla. *f* *fp* div.

Vc. *f*

Db. *f* arco div.

40

Fl.

Fl.

F13/
picc

Ob.

C. A.

CA->Cl

Cl.

B. Cl.

Bsn.

Bsn.

Hns.

Tpts.

Tbns.

B. Tbn.

Tba.

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I

Vln. II

Vla.

Vc.

Db.

sempre *fficc.*

f

al niente muta in flauto

mf

f

tune E, A (and D, G if 4)

ff

l.v.

ff

mf

ff

pp

pp

f

ff

f

47 **poco rit.** **Meno mosso**

Fl. *ppp* *pp*

Fl. *ppp* *mp*

Fl3/
picc.

Ob. *mf* solo

C. A.

CA->Cl. *pp*

Cl. *ppp* solo *mp* *a 2* solo *mf* *pp*

B. Cl. *ppp* solo *mf*

Bsn. *pp* play if no bass clarinet *mf* play *mp*

Bsn. *pp* *mp* *mf*

Hns. *ppp* solo *mp* *ppp* *ppp* solo *mp*

Tpts. *ppp*

Tbns. *ppp*

B. Tbn. *ppp*

Tba. *ppp*

Timp.

B. D. *l.v.* *pp*

Congas

Timb. *l.v.*

Cym. *suspended* *l.v.* *pp*

T.-t. *ppp* *pp* *ppp* *p*

Vln. I *ppp*

Vln. II *al niente*

Vla. *al niente*

Vc. *ppp* *al niente* solo touch 5th on A *pp* *a 1*

Db. *ppp* *al niente* *ppp* *p* *a 1*

ppp *sempre ppp*

59

Fl. *pp*

Fl. *p*

Fl3/
picc. *pp* sul flauto *pp* *p* solo

Ob. *f*

C. A. *f*

CA->Cl. *f*

Cl. *mf* solo *p* play *mp* *a 2*

B. Cl. *p*

Bsn. *f*

Bsn. *f*

Hns. *p* *a 1*

Tpts. *p* *a 1*

Tbns. *p*

B. Tbn. *p*

Tba. *p*

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I *mp* *pizz. div.*

Vln. II *mp* *pizz.*

Vla. *mp* *pizz.*

Vc. *ppp* *mp* *tutti pizz. div.*

Db. *mp*

69

Fl. *p* *pp*

Fl. *p* *pp*

Fl3/
picc. *pp*

Ob.

C. A.

CA->Cl.

Cl.

B. Cl.

Bsn.

Bsn. *pp*

Hns.

Tpts. solo *mf*

Tbns.

B. Tbn.

Tba.

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I arco *mf*

Vln. II div. *p* arco *mf*

Vla. *mf*

Vc. arco *mf* pizz.

Db. *mp*

79

Fl. *pp* *mf* *p* *solo*

Fl. *pp* *p*

F13/
picc. *musa in picc.*

Ob.

C. A.

CA->Cl

Cl. *pp* *a 2* *pp*

B. Cl. *pp*

Bsn.

Bsn.

Hns. *mf* *a 1* *ppp*

Tpts. *mf* *solo* *mf* *p*

Tbns. *a 1* *p*

B. Tbn.

Tba.

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I *pp*

Vln. II

Vla. *pizz.* *p*

Vc. *pizz. div.* *p*

Db. *p*

89

Fl. match discord with picc

Fl. sul picc match discord with fl2

Fl3/picc p

Ob. ppp

C. A.

CA->Cl.

Cl. pp

B. Cl.

Bsn.

Bsn.

Hns.

Tpts.

Tbns.

B. Tbn.

Tba.

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I pizz. div.

Vln. II p pizz. p

Vla. p

Vc. p

Db. pp

arco div.

pp arco

pp

div.

pp

99

poco rit. *Tempo 1*

Fl.
Fl.
Fl3/ picc. *muta in flauto*
Ob.
C. A.
CA->Cl.
Cl.
B. Cl.
Bsn.
Bsn.
Hns. *a2*
Tpts.
Tbns. *horns* *a 1*
B. Tbn.
Tba.
Timp.
B. D.
Congas
Timb. *hands, not sticks!*
Cym. *p suspended damp*
T.-t. *l.v.*
Vln. I.
Vln. II
Vla. *arco*
Vc. *sempre pizz*
Db.

p *mf* *pp* *mp* *f* *mf*

115

Fl. *solob*

Fl. *pp* *f*

Fl3/picc *pp* *f* *muta in piccolo*

Ob. *pp*

C.A. *pp*

CA->Cl *pp*

Cl. *pp* *f* *a 2*

B. Cl. *pp* *f*

Bsn. *pp* *f* *a 2*

Bsn. *pp* *f* *a 2*

Hns. *f* *a 2*

Tpts. *f*

Tbns. *f* *a 2*

B. Tbn. *f*

Tba. *f* *con corni*

Timp. *f*

B. D. *f* *damp* *ppp* *mf* *f* *lv* *sempre l.v.*

Congas *f* *ppp* *mf* *mf* *sticks*

Timb. *f* *mf*

Cym. *f*

T.-t. *damp* *f* *sempre arco*

Vln. I *f* *pizz.*

Vln. II *ff* *pizz.*

Vla. *ff* *pizz.*

Vc. *ff* *sempre pizz.*

Db. *ff*

121

This page of a musical score, numbered 121, is for the piece 'Circle of Fourths' by Peter Dinklage. It features a large ensemble of instruments. The woodwind section includes two Flutes (Fl.), Flute III/piccolo (Fl3/picc), Oboe (Ob.), Cor Anglais (C.A.), Clarinet in C (CA->Cl), Clarinet in Bb (Cl.), Bass Clarinet (B. Cl.), Bassoon (Bsn.), and Horns (Hns.). The brass section includes Trumpets (Tpts.), Trombones (Tbns.), Baritone (B. Tbn.), Tuba (Tba.), and Timpani (Timp.). The string section consists of Double Bass (B. D.), Congas, Timbales (Timb.), Cymbals (Cym.), and Tom-toms (T.-t.). The string ensemble includes Violin I (Vln. I), Violin II (Vln. II), Viola (Vla.), Violoncello (Vc.), and Double Bass (Db.). The score is written in 2/4 time and features dynamic markings such as *f*, *p*, *pp*, and *mf*. The percussion parts include Congas, Timbales, Cymbals, and Tom-toms.

134

Fl.

Fl.

Fl3/
picc

Ob.

C. A.

CA->Cl

Cl.

B. Cl.

Bsn.

Bsn.

Hns.

Tpts.

Tbns.

B. Tbn.

Tba.

Timp.

B. D.

Congas

Timb.

Cym.

T.-t.

Vln. I

Vln. II

Vla.

Vc.

Db.

if enough players
these could be crash

ff

div

140

Fl.
Fl.
Fl3/
picc
Ob.
C. A.
CA->Cl
Cl.
B. Cl.
Bsn.
Bsn.
Hns.
Tpts.
Tbns.
B. Tbn.
Tba.
Timp.
B. D.
Congas
Timb.
Cym.
T.-t.
Vln. I
Vln. II
Vla.
Vc.
Db.

a 1
p a 1
pp
p
2nd
4th
pp
p
play
damp tune E & A
p
mf
mf
fp
div fp
fp
mp
sempre pizz.
p

152

Fl. Fl. Fl13/picc Ob. C. A. CA->Cl. Cl. B. Cl. Bsn. Bsn. Hns. Tpts. *sempre f, non ff* *ff* Tbns. *sempre f, non ff* *ff* B. Tbn. Tba. Timp. damp i.v. *ff* damp *ff* B. D. *ff* *p* *ff* Congas *<ff* *mf* *ff* Timb. *<ff* *mf* Cym. *ff* damp solo *ff* damp T.-t. Vln. I Vln. II Vla. Vc. Db.