

As the Sunflower Turns on Her God
SSAATBB choir, Sop. solo, SSATB soli, a cappella

Timothy C. Takach

\$1.00

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As the Sunflower Turns on Her God

for a cappella SSAATBB choir, Sop. solo, SSATB soli



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Text:

ena, stigme, hex, ena, okto,
 zephyron, treis, treis, ennea, okto,
 okto, hepta, tettara, ennea, okto,
 ennea, tettara, okto, tettara, okto,
 dyo, zephyron, tettara, pente, okto,
 hex, okto, treis, tettara, treis,
 hex, pente, hex, treis, okto,
 ena, ena, hepta, hepta, dyo,
 zephyron, treis, zephyron, ennea, ena,
 hepta, ennea, okto, zephyron, pente,

(quintet) hepta, hex, dyo, okto, hex,
 dyo, ena, treis, pente, tettara,

(tutti) tettara, okto, hex, dyo, dyo,
 hepta, zephyron, pente,

dyo, hex, zephyron,

tettara, hex, dyo, okto, ena,

(okto, ennea, zephyron, dyo, tettara,

tettara, ennea, hepta.)

- decimal equivalent of Phi (ϕ)

Quidam posuit unum par cuniculorum in quodam loco,
 qui erat undique pariete circumdatus, ut sciret,
 quot ex eo paria germinarentur in uno anno.

- Fibonacci (Leonardo of Pisa)

- sung in Greek

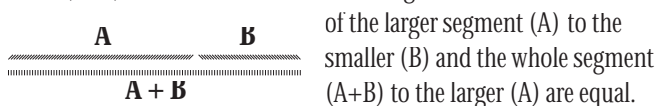
A certain person placed one pair of rabbits in a certain place
 that was on all sides surrounded by a wall, so that he might learn,
 how many pairs would be produced from it in one year.

- trans. Anne Groton

Notes:

"As the Sunflower Turns on Her God" translates two related mathematical concepts into music - the golden ratio and the Fibonacci sequence.

The golden ratio (Phi) is a precise ratio that occurs when a line segment (A+B) is divided into two smaller segments, and the ratios



The brilliant part is that the golden ratio occurs naturally in things like roses, pinecones, and other plants. It is also believed to be one of the most aesthetically pleasing proportions and is sought after and desired in art, architecture, and in this and few other cases, music. In my research, I came across a book called The Golden Ratio by Mario Livio. In one of the chapters he shows the presence of the golden ratio in the spacial distribution of leaves on plants and in the spirals

found in the head of a sunflower. The chapter's title is "As the Sunflower Turns on Her God," a line from a Thomas Moore poem.

The Fibonacci sequence was discovered by Leonardo of Pisa (Fibonacci) in the early 13th century in his book Liber Abaci. He posed a question using the reproduction rate of rabbits as his example, and discovered a sequence of numbers where, starting with 1, one adds the current number to the previous number to get the next number. So $1+0=1$, $1+1=2$, $2+1=3$, $3+2=5$, and so on. The sequence looks like this: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144...

Dividing a number in the Fibonacci sequence by its predecessor gives us a close approximation to Phi. As you perform this function higher and higher in the sequence, the answer is alternately higher and lower than Phi; approaching it, but never reaching it.

I assigned each number in the Fibonacci sequence (up to 34) to a chord based off of its corresponding scale degree. The 8th scale degree returns to tonic, so $1=i$, $2=II$, $3=iii$, $4=v$, $5=i$, $6=vi$, $7=vii$, and $8=vi$. These chords formed the progression of the piece; starting with one chord in the first phrase, and then adding an additional chord of the sequence to it in each successive phrase: i , $i-i-i$, $i-i-II-i-i$, $i-i-II-iii-II-i-i$, $i-i-II-iii-v-iii-II-i-i$, etc. As the piece began to take form, I took liberties in the major or minor tonality of each chord, decidedly crossing the line from science into art.

Having made this decision, I still needed a text. Part of the intrigue behind Phi is that the decimal approximation goes on forever without repeating, so the choir sings this number in Greek (usage of Phi can be traced back to Euclid and Pythagorus in ancient Greece) to 74 decimal places (the first "ena" and "stigme" (1.) don't count). By the end, the rhythmic alto pedal point has extended that to 82 decimal places. I also wanted to include Fibonacci's original question about rabbits, so I gave that text to the soprano solo. It is the original Latin text from his book, Liber Abaci.

Phi (decimal approximation)

1.6180339887498948482045868343656381177203091798057628
 621354486227052604628189024497...

Fibonacci sequence

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987...

Special thanks to thank Mario Livio, Anne Groton and Marquis Berry for helping me research this piece.

Dedicated to Chris Takach, my first and favorite math teacher

As the Sunflower Turns on Her God

for a cappella SATB div. choir

Leonardo of Pisa (Fibonacci)

Timothy C. Takach (2007)

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♩ = 54

Alto *p* e - na, stig - me,

Tenor *p* e - na, stig-me, hex, e - na, ok - to, ze-phy - ron, treis, treis, en - ne - a, ok - to,

4

S *p* e - na, ok - to, ze - phy - ron, *mp* treis, treis, en -

A hex, e - na, ok - to, ze - phy - ron, *mp* treis, treis, en -

T ok - to, hep-ta, tet - ta-ra, en-ne - a, ok-to, en-ne - a, tet-ta - ra, ok-to, tet-ta - ra, ok to dy-o

9

S *mf* ne - a, ok - to, ok - to, hep - ta, tet - ta - ra,

A *mf* ne - a, ok - to, ok - to, hep - ta, tet - ta - ra,

T ze-phy-ron, tet - ta - ra, pen - te, ok - to, hex, ok - to, treis, tet - ta-ra, treis, hex,

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13 *mp*

S en - ne a, ok to, en - ne a,

A en - ne a, ok to, en - ne a,

A2 *p*
dy - o, ze - phy -

T *8*
pen - te, hex, — treis ok - to, e - na, e - na, hep - ta, hep - ta, dy - o,

16 *mf*

S tet - ta - ra, ok - to, tet - ta - ra, ok - to dy - o

A *mf*
tet - ta - ra, ok - to, tet - ta - ra, ok - to dy - o

A2
ron, treis, ze - phy ron, en - ne - a, e - na, hep - ta, en - ne - a, ok - to,

T *mf*
tet - ta - ra, ok - to, tet - ta - ra, ok - to dy - o

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19

S ze - phy - ron, tet - ta - ra, pen - te, ok - to, hex,

A ze - phy - ron, tet - ta - ra, pen - te, ok - to, hex,

A2 ze - phy - ron, pen - te, hep - ta, hex, dy - o, ok - to, hex,

T ze - phy - ron, tet - ta - ra, pen - te, ok - to, hex,

B tet - ta - ra, pen - te, ok - to, hex,

mf *mf* *mp* *mf* *mf*

22

S ok - to, treis, tet - ta - ra, treis, hex, pen - te, hex, treis

A ok - to, treis, tet - ta - ra, treis, hex, pen - te, hex, treis

A2 dy - o e - na, treis, pen - te, tet - ta - ra, tet - ta - ra,

T ok - to, treis, tet - ta - ra, treis, hex, pen - te, hex, treis

B ok - to, treis, tet - ta - ra,

non dim. *non dim.* *mp* *pp* *non dim.*

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26 A *mf*

Solo *mf* Qui - dam po - su - rit un - um par - cun - i - cu - lo - rum

A *mf* ok - to, e - na, e - na, hep - ta, hep - ta, dy - o,

T *mf* ok - to, e - na, e - na, hep - ta, hep - ta, dy - o,

B *mf* ok - to, e - na, e - na, hep - ta, hep - ta, dy - o,

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31 *mp* *mf*

Solo in - quo - dam lo - co, qui er - at

S *pp* ze - phy - ron, treis, ze - phy - ron, en - ne - a, e - na, hep - ta,

A *mf* ze - phy - ron, treis, ze - phy - ron, en - ne - a, e - na, hep - ta,

T *mf* ze - phy - ron, treis, ze - phy - ron, en - ne - a, e - na, hep - ta,

B *mf* ze - phy - ron, treis, ze - phy - ron, en - ne - a, e - na, hep - ta,

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35 *f* *opt. breath* *ff* *non dim.*

Solo *f* un - di que par - ti - e - te - cum - da - tus, *non dim.*

mf *f* *ff* *non dim.*

S en - ne - a, ok - to, ze - phy - ron, pen - te,

mf *f* *ff* *non dim.*

A en - ne - a, ok - to, ze - phy - ron, pen - te,

mf *f* *ff* *non dim.*

T en - ne - a, ok - to, ze - phy - ron, pen - te,

mf *f* *ff* *non dim.*

B en - ne - a, ok - to, ze - phy - ron,

B $\text{♩} = 70$

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40 *soli mf* *f*

S hep - ta, hex, dy - o, ok - to, hex, dy - o e -

solo mf *f*

A hep - ta, hex, dy - o, ok - to, hex, dy - o e -

solo mf *f*

T hep - ta, hex, dy - o, ok - to, hex, dy - o e -

solo mf *f*

B hep - ta, hex, dy - o, ok - to, hex, dy - o e -

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45 *mp*

S na, pen - te, tet ta - ra,

A na, treis, tet ta - ra,

A2 *p* hex, dy - o, dy - o hep - ta, ze - phy - ron,

T *mp* na, treis, tet ta - ra,

B *mp* na, treis, tet ta - ra,

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49 **C** $\text{♩} = 54$ Warmly *mf* Timothy C Takach.com

Solo ut sci - ret, quot ex e - o

S *tutti mf* tet - ta - ra, ok - to, hex, dy - o, dy - o hep - ta,

A *tutti mf* tet - ta - ra, ok - to, hex, dy - o, dy - o hep - ta,

A2 pen - te, dy - o, hex, ze - phy ron, tet - ta -

T *tutti mf* tet - ta - ra, ok - to, hex, dy - o, dy - o hep - ta,

B *tutti mf* tet - ta - ra, ok - to, dy - o, hep - ta,

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52

Solo

mp par - i - a ger - mi - na - ren - tur

S *mp* ze - phy - ron, pen - te, dy - o,

A *mp* ze - phy - ron, pen - te, dy - o,

A2 ra, hex, dy - o, ok - to, e - na,

T *mp* ze - phy - ron, pen - te, dy - o,

B *mp* ze - phy - ron, pen - te, dy - o,

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55

S *mf* hex, *mp* ze - phy - ron, tet - ta - ra, *p*

A *mf* hex, *mp* ze - phy - ron, tet - ta - ra, *p*

A2 ok - to, en - ne - a, *pp* ze - phy - ron, dy - o, tet - ta - ra,

T *mf* hex, *mp* ze - phy - ron, tet - ta - ra, *p*

B *mf* hex, *mp* ze - phy - ron, tet - ta - ra, *p*

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58 *mp*

S hex, dy o, ok - - to,

A hex, dy - o, ok - - - to,

A2 tet - ta - ra, en - ne - - - a,

T hex, dy - o, ok - - - to,

B hex, dy - o, ok - - - to, e - - -

mp *p*

61 *rit.* *mp* Timothy C Takach.com

Solo in un - o an - no.

S *rit.* *p* e - - - - - na,

A *rit.* *p* e - - - - - na,

A2 *rit.* e - - - - - na,

T *rit.* *p* e - - - - - na,

B *rit.* e - - - - - na,

rit. *p*

Timothy C. Takach



Timothy C. Takach has received a number of commissions from various choral organizations including the St. Olaf Choir, Cantus, the Bowling Green State University Men's Chorus, The Singers: Minnesota Choral Artists, the Appleton North High School Varsity Men's Chorus, and the Western Michigan University Chorale. His compositions have been heard on NPR and have been recorded by various groups in North America. Takach graduated with honors from St. Olaf College, Northfield, MN in 2000 with a BA in Music Theory/Composition and a BA in Studio Art. While there he studied composition under Dr. Peter Hamlin and Dr. Timothy Mahr. He now lives in Minneapolis and sings with the professional male vocal ensemble, Cantus. As a singer with Cantus, Takach gives over 80 concerts a year and has had his works performed in concert halls across the United States, Canada, and Europe.

Other vocal works by Timothy C. Takach:

As the Sunflower Turns on Her God (2007)		SSAATBB div, Sop. solo, SSATB soli, a cappella
Titania's Lullaby (2006)		SATB a cappella
'Twas in the Moon of Wintertime (2005) Huron Carol	(Graphite Publishing)	SATB a cappella
The Darkling Thrush (2004)	(earthsongs)	SATB, SAT soli, a cappella
A Sign of Day to Come (2003)	(Graphite Publishing)	SATB a cappella
She Moved Through the Fair (2002) Irish Ballad	(Neil A. Kjos Music Co.)	SATB a cappella
Home on the Range (2007) American Folk Song	(Graphite Publishing)	2-part treble voices, piano
The Streets of Laredo (2007) American Folk Song	(Graphite Publishing)	Unison, TTB, piano
Queen of the Range (2006)	(Graphite Publishing)	SA choir, piano
Infervesco (2003)		SSAA a cappella
Serenade (2002)	(Graphite Publishing)	SSAA a cappella
Flight (2003)		Boomwhackers, optional SSAA, TTBB, or SATB choir
And Her Smoke Rose Up Forever (2007)		TTTBB a cappella
Auld Lang Syne (2007) Scottish Folk Song		TTTBB a cappella
O Tannenbaum (2007) German Christmas Carol		TBB a cappella
Susani (2007) German Christmas Carol		TBB a cappella
The World Before Me (2006)		TTBB, tenor soli, a cappella
I Can Transform (2006)		TTTTTBBB, tenor solo, 8 percussionists
'Twas in the Moon of Wintertime (2006) Huron Carol		TTBB a cappella
Salvation is Created (2006) Pavel Chesnokov	(Neil A.Kjos Music Co.)	TTBB, TTBB soli, a cappella
O Captain! My Captain! (2006)		TTTBB a cappella
The Highwayman (2004)		TTBB a cappella
I Better Go Now (2003) Howlin' Wolf		TTBB a cappella
What I Have Done (2003) Amazing Grace/House of the Rising Sun		TTTBBB a cappella
We Three Kings (2002) John H. Hopkins		TTBB a cappella
Things I Didn't Know I Loved (2001)		TTBB a cappella
What Child is This (2000) Traditional	(Neil A. Kjos Music Co.)	TTBB a cappella
She Moved Through the Fair (1998) Irish Ballad	(Neil A. Kjos Music Co.)	TBB a cappella
Veni Creator Spiritus (1998)	(Graphite Publishing)	TTBB a cappella