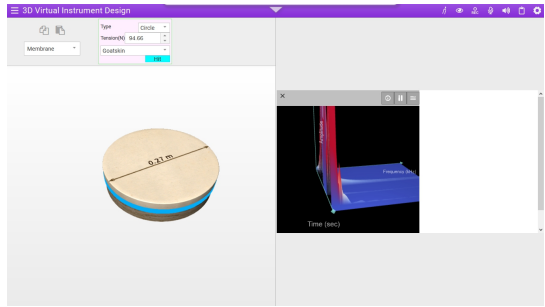
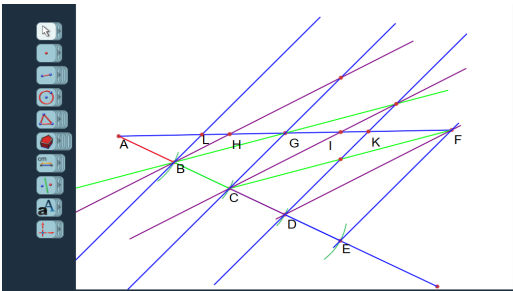
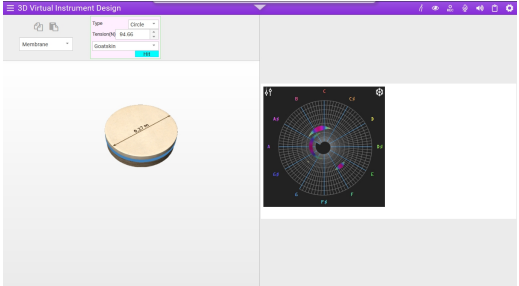
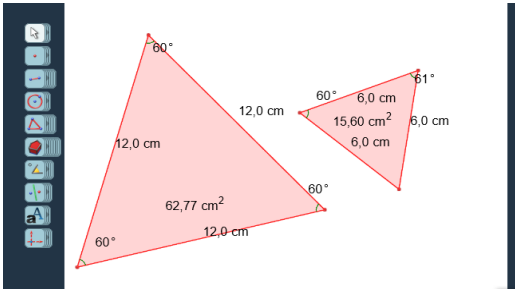
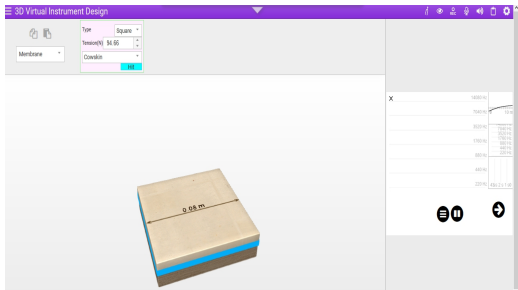
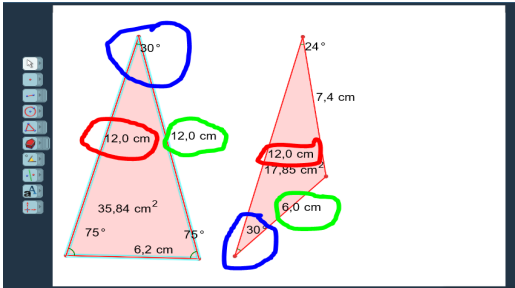
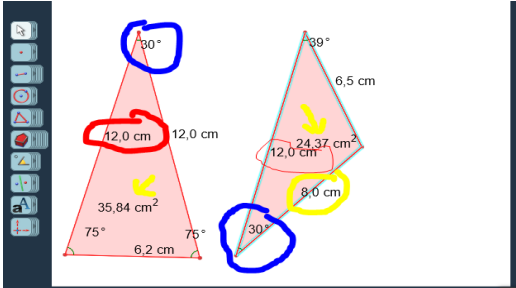


Title:	Let's play Sectio Canonis v1		
Keywords:	Monochord, frequency, tension, length, musical patterns, geometrical proportions, Division of the Canon (Sectio Canonis).		
Short Description:	Students take the division of the string using the intercept theorem by the Let's Hear Thales' theorem" scenario and start investigating synergies of consonances and dissonances derived by the triangles produced in each section. Students experiment with their own similar triangles by composing their sequences of tones derived from their sides and eventually by constructing the virtual instruments to play them. This scenario introduces an extension using areas also instead of strings. For this reason teacher introduces "round" and not exact numbers. This Scenario can also be combined with "House of Chords" from which a selection of lesson plans can be adopted at the teacher's discretion.		
Lesson Plans included:	-Explore the properties of intervals I, IV, V -Introduction to the investigation of the differences between chordophones and membranophones regarding the fundamental divisions of Sectio Canonis.	Date:	20/03/18
Educational Objectives:	Understand the differences in proximity of measurements in Music. Introducing the relations of proportions measuring areas and lengths. Transferring knowledge from strings to membranes Simple harmonic progressions	Estimated Duration:	20 hrs
Author(s):	P. Stergiopoulos	Age Group:	15-17 (14-16)
Contributor(s):		Language:	English
Status:	Final	Difficulty Level:	Medium-Advanced
Dissemination level:	Public	Special Needs Addressed:	No

Phases	Field	Time	Description	Activity	Remarks
Imagine	M	1	What are the properties of dividing the canon in the intervals of I, IV, and V?	Students start investigating the possible relations between segments produced by the Thales' intercept theorem and namely $1/2$, $2/3$ and $3/4$. Teacher uses a musical instrument to play examples of intervals: Octave, Plain Fourth, and Plain Fifth. Students observe the differences using the 3D analyzer. They investigate the differences using a percussion instrument and a chordophone instrument.	 <i>Figure 1: Using the 3D analyser to observe the intervals of an instrument</i> Teacher helps the students understand the differences between the spectrogram of a chordophone against the spectrogram of a percussion instrument.
Engage	S, E	1	Exploring proportion and their musical intervals	Teacher gives a reminder of Thales' theorem and introduces the idea of proportions in musical intervals.  <i>Figure 2: Producing the steps for the Thales theorem on Geometry & Algebra</i>	Teacher explains the use of round numbers instead of exact numerical values

					 <i>Figure 3: Using the snail to observe the fundamental properties of an instrument in relation with musical interval (e.g.related areas)</i>
Create	S,M,E	1	Transferring proportions into an area (part 1)	Students make triangles using the divisions of a fundamental line as sides.  <i>Figure 4: Exploring the areas of triangles</i> They investigate the areas between two equilateral triangles : a) 12 cm side (1/1)	Play areas of triangle “a” and triangle “b” on a rectangular membranophone  <i>Figure 5: Exploring the areas of a square membranophone</i> Students compare the sound produced of these two membranophones.

				b) 6 cm side (½) Students observe the areas produced and transfer them into two different membranophones.	Students may continue with a third and fourth equilateral triangle as follows: a) same as activity at the left cell b) same as activity at the left cell c) 8cm sides (corresponding to 2/3 aka 5th) d) 9cm sides (corresponding to ¾ aka 4th)						
Analyze	S	1	Analyzing the results (part 1)	They produce a table and write down their results. An example of the table is given below: <table><tr><td colspan="2">Part_1 Table of observations</td></tr><tr><td>Area</td><td></td></tr><tr><td>Fundamental note</td><td></td></tr></table>	Part_1 Table of observations		Area		Fundamental note		Students observe that area in equilateeral is divided by 4.
Part_1 Table of observations											
Area											
Fundamental note											

Create	S	1	Transferring proportions into an area (part 2)	Students now use isosceles and scalene triangles. They produce two triangles a) keeping the length on two sides at 12 cm b) keeping the length on one side at 12 cm and altering the second at 6cm. Both triangles share the same angle (s) of these two sides.  <i>Figure 6: Example of comparing areas of two triangles</i> Students observe the areas produced and transfer them to two different membranophones.	As above students may continue tracking down results using triangle areas keeping the same angle between the two sides (s) as follows: a) 12cm, 6cm (given already) b) 12cm, 8cm c) 12cm, 9cm  <i>Figure 8: Observing the differences from “a” to “b”</i>
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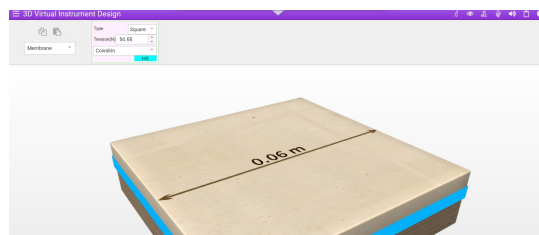
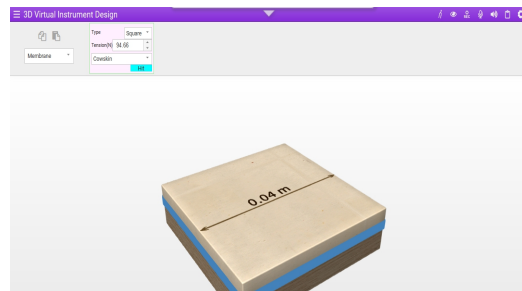
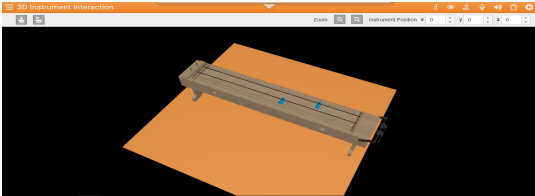
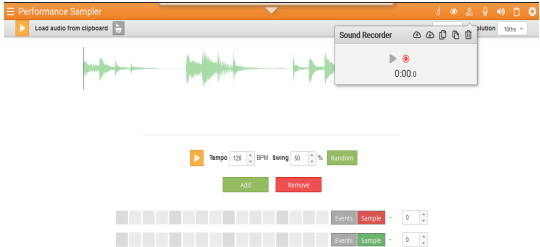


Figure 7: Comparing areas between two membranophones (

Analyze	S	1	Analyzing the results (part 2)	They measure their sounding results and write down on the table. <table><tr><td colspan="2">Part_2 Table of observations</td></tr><tr><td>Area</td><td></td></tr><tr><td>Fundamental note</td><td></td></tr></table> Question: What do you observe on the round numbers you filled in the two tables?	Part_2 Table of observations		Area		Fundamental note		Teacher helps students to observe the differences and similarities of the instrument families when producing same tones as fundamentals.
Part_2 Table of observations											
Area											
Fundamental note											

Create	E, M	1	Understanding the similarities between chordophones and membranophones	Part A Students divide in five groups playing the two families of instruments, chordophones and membranophones. The first group follows the results using the monochord for proportions $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$. The second group follows the results of the tables for the membranophones. They two groups use the 3D instrument design environment to investigate the ways to produce similar tones. Part B The third, fourth and fifth group are formed out of the similar notes produced by the 1st, 2nd and 3rd division of the canon (namely I, IV and V) Music teacher helps students produce a simple piece using the above degrees in harmony.	Students refer to their previous findings. By combining chordophones and membranophones, they form groups of “fundamental”, “fourth” and “fifth” (namely: “I”, “IV”, “V”). Music teacher helps students form a sort of a basic musical “vocabulary” by identifying the degrees of their notes in the diatonic scale (namely: Tonic, Subdominant and Dominant) as marked in bold: 1st – Tonic 2nd – Supertonic 3rd – Mediant 4th – Subdominant 5th – Dominant 6th – Submediant 7th – Leading tone 8th – Tonic (Octave) Then Music teacher perform a very simple harmonic progression, recalling the degrees (groups) I, IV, V when appropriataly needed by gesture.
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Communicate	M	1	Produce simple harmonic progressions	Students divided in groups form a sequence of degrees out of I, IV and V as they finally produce a live piece arranged by their music teacher.  <i>Figure 9: The instrument producing one pitch of a degree of a simple harmonic progression</i>	Students may arrange an event in class using live performance.
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Reflect	S,M	1	Impact of their performance	Students see the video or listen to an audio recording of their performance . Students enhance their performance by adding further notes to the recording.	The audio recording can be reused as a background to start the same scenario from the beginning, this time producing Mediant as well.  <i>Figure 10: The sample – sequencer environment can be used as a background to add new notes coming out from further division (e.g.: 4/5, etc).</i> At this point teacher may consult Scenario “Let’s Play Sectio Canonis v2”
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