Analysis of The Locust Grove Crop Circle Formation

A Study To Determine Its Relationship To Musical Notes

By Dee Gragg, P.E.

Executive Summary: This study shows a strong link between the crop circles analyzed by Dr Gerald Hawkins in southern England in 1981-88 and the Locust Grove, Ohio, USA crop circle formation found in 2003. This link was established by studying the Locust Grove formation using methods identical to those used by Dr. Hawkins in southern England. This work, along with the known crop circle theorems, gives a total of 13 of the possible 29 musical notes over a four octave range

My objective was to determine if the United States, 2003 Locust Grove crop circle formation contained diatonic ratios which could be related to musical notes. My study used the same methods as those employed by Dr. Gerald Hawkins in his classic study of 1981-88 crop circles of southern England (Hawkins p.5 and Andrews p.5).

By using the same methods as Dr. Hawkins, any diatonic ratios and their relationship to musical notes will then be comparable to his work.[1] Thus we may establish a link between this current work and his classic work.

Dr. Hawkins took the diameter of the large circle and divided it by the diameter of the satellite circle and used this result to determine any integers.[2] Using the integers found, he searched for diatonic ratios by raising 2 to the n/12 power where n is the integer just found. For example if:

Large Circle = 10 Satellite Circle = 2

Then: 10/2 = 5; And the diatonic ratio = $2^{5/12} = 2^{.4166} = 1.335$

This is the diatonic ratio 4/3, which is F just above middle C.

I began my analysis with Circle A which had the smallest diameter and was deemed to be the satellite circle (Figure 1). I then divided it into the next larger circle, Circle D. This gave 17/11 = 1.545. There is certainly no integer nor diatonic ratio here. Likewise going to the next larger Circle C, which gave 19/11 = 1.727. No integer here. Likewise Circle B 20/11 = 1.818.

But beginning with Circle E the ratios begin to look promising i.e. 43/11 = 3.909. In a perfect world this ratio would have been 4.000. But we are not in a perfect world and I did not want to miss any important data while trying to hold it to perfection. This brings to mind all sorts of clichés…don't throw out the baby with the bath water. Don't measure with a yard stick, mark with chalk, cut with an ax and then check for accuracy with a micrometer etc., ad nauseam and I promise no more clichés for the rest of the paper.

Prior to beginning this study Mr. Ted Robertson and I agreed that from their measurements on the ground and our studying photographs of the formation that Circle A might vary as much as 6 inches.[3] Mr. Robertson was one of the researchers on the ground that made the measurements.

So by reducing the diameter of Circle A by three inches I found the 4.000 which we are looking for: That is 43/10.750 = 4.000. Thus $2^{4/12} = 2^{.333} = 1.259$ which is almost 5/4 = 1.250 = Musical Note E. But notice that even though I used the perfect 4.000 ratio, that we still missed the 5/4 diatonic ratio by 0.009!

In fact in order to be exact I would have needed to use $2^{.322}$ which equals exactly 1.250. In that case the "integer" would need to be 3.864 and the diameter 11.128. That is 43/11.128 = 3.864. Wow! I should have made the 11 foot diameter an inch and a half larger not three inches smaller as I did.

So here's the deal: You can have an exact diameter, or an exact integer or an exact diatonic ratio. But you cannot have all three. You can have **only one** exact and the other two will be slightly off. This is the general case for any analysis of crop circles. For a rather esoteric study of this, see Appendix A. Dr. Hawkins must have been aware of this problem because in his study of 1981-88 there were 9 points somewhat off, and 16 were exactly on for a total of 25 points. For a really amazing coincidence (?) see Footnote 4.

By now you are probably wondering where I got accuracy to the 0.001 of a foot which I used in my calculations. The accuracy was created, rather artificially, by the calculations. It should not be implied that a crop circle was measured to 0.001 of a foot in the field.

So before we all get lost in the Land of Little Numbers and are unable to find our Home Circle let's PRESS ON.

I have arbitrarily chosen to use the exact integer in my calculations for no better reason than I think maybe that's what Dr. Hawkins would have done. Certainly three decimal place accuracy is not necessary to establish diatonic ratios but, for illustrative purposes I am going to carry it through the calculations.

So for the 43 foot diameter of Circle E the satellite circle diameter is 10.75 feet, the integer 4 and the diatonic ratio 1.259 (Table 1). This corresponds to a Middle C fraction of 5/4 and a musical note of E at a frequency of 330 Hz..

The next larger circle is the cornea of the "eye" which is 75 feet. For the exact integer of 7 the satellite circle diameter is 10.714 and the diatonic ratio is 1.497. This corresponds to a Middle C fraction of 3/2 and a musical note of G at a frequency of 396 Hz.

The next larger circle, G which has a diameter of 150 feet is also the bottom of the eye. The arc of the top of the eye if extended to be a circle would also have a 150 foot diameter. The left and right arcs of the cat-like pupil would also have a 150 foot diameters.

For the exact integer of 14 the satellite circle diameter is 10.714 and the diatonic ratio is 2.243. This corresponds to a Middle C fraction of 9/4 and a musical note of D at a frequency of 594 Hz.

The final and largest circle, H is 192 feet. For the exact integer of 17 the satellite circle diameter is 11.294 and the diatonic ratio is 2.668. This corresponds to a Middle C fraction of 8/3 and a musical note of F at a frequency of 704 Hz.

Table 1

Circle	Diameter (Feet)	Satellite Diameter (Feet)	Integer	Diatonic Ratio	Fraction of Middle C	Musical Note	Frequency (Hz)
B	20	Not Diatonic					
C	19	Not Diatonic					
D	17	Not Diatonic					
E	43	10.750	4	1.259	5/4	E	330
F	75	10.714	7	1.497	3/2	G	396
G	150	10.714	14	2.243	9/4	D	594
H	192	11.294	17	2.668	8/3	F	704

As mentioned before I still have one last possible diatonic ratio to consider. Circles B and E are concentric. When I previously considered them individually and not concentric, Circle E was diatonic but Circle B was not. What will they be if considered together in their concentric formation?

Remember that with concentric circles we must look at the ratio of diameters squared to find diatonic ratios. Dr. Hawkins and I have both verified this (Gragg p.5).

So, dividing the diameter of Circle E by the diameter of Circle B I got 43/20 = 2.15. Squaring gives $(2.15)^2 = 4.622$ which is far from being an integer so obviously there is no diatonic ratio present.

So what can be concluded with regards to future circle patterns which are both concentric and nonconcentric. Not much I'm afraid. This is only one data point. Conclusions on this must await more data.

Appendix B is a modified version of the Appendix B from my previous paper on theorem proofs (Gragg p.5). To the previous Appendix B I have added Dr. Hawkins 1981-88 work and the four notes from this Locust Grove analysis. **To my knowledge this brings together all of the work using Dr. Hawkins methods.**

Analysis and Conclusions

The first thing which jumps out is the four F's. In my previous work on theorems I remarked about the three F's and now that I have added the Locust Grove work I have four. Notice that **the F appears in all the work:** the theorems of Dr. Hawkins, the theorems I proved, Dr. Hawkins crop circle work and the Locust Grove work.

What do these 4F's mean? I don't know, but here are a couple of conjectures.

- Our former USA draft system for forcing young men to serve in the military had a classification of 4F. This meant unfit for service in the military. Is there a message that we are unfit for something or other?

- In the USA school systems, at all levels the F means a failing grade. Have we been deemed to be failing in something?

Both of those sound kind of depressing. Perhaps you have a conjecture you would like to share. I would be most pleased to hear from you and I hope your conjecture is happier and more optimistic than mine.

In an interesting observation Dr. Hawkins found in his work that only integers, (n's), for the diatonic ratios appeared. Those were for an "n" equal to 0, 2, 4, 5, 7, 9, 11, and 12. The nondiatonic integers 1, 3, 6, 8, and 10 were never found.

I found the same occurrence in the Locust Grove analysis. The two notes found in this octave for "n's" of 4 and 7 are notes E and G just above Middle C. As with Dr. Hawkins I found no nondiatonic integers.

I found two more notes in the next higher octave with "n's" of 14 and 17 which are notes D and F. Here I need to extend the work of Dr. Hawkins to this octave in which the diatonic "n's" are 12, 14, 16, 17, 19, 21, 23, and 24. The nondiatonic "n's" are 13, 15, 18, 20, and 22. Again, as with Dr. Hawkins's work I found only diatonic "n's" and no nondiatonic "n's".

For the few of you who might be interested, I have computed the 25 "n's" for these two octaves in Appendix C. This includes both diatonic and nondiatonic "n's" and their relationship to the musical notes. I have not seen this work computed and compiled anywhere so I am including it even though I realize that it will be of limited interest to most of you.

Notice the strong link being created between these two crop circle studies. Two of the notes of the Locust Grove study, E and G, are identical to those found in the 1981-88 Hawkins' study. The other two notes, D and F in the higher octave, are nestled between Hawkins' Theorems III and II.

From the Locust Grove analysis I conclude:

- This study strengthens the already existing link between crop circles and musical notes.

- This study verifies that the crop circle and musical note link found in 1981-88 in southern England has now been found in a crop circle formation in 2003 in the United States.

Footnotes:

1. I see in books and on the Internet where diatonic ratios are being determined all sorts of ways. This may be all well and good. But work which does not follow Dr. Hawkins' methods (so far I haven't found any that did) cannot be compared to his results.
2. This method is used for circles that are not concentric. If they are concentric the ratio must be squared to look for the integer. We have two such circles which I will deal with later in the paper.
3. Mr. Robertson was a part of the team which made the original ground measurements. He also did the complete construction line drawing showing the relationship of all the circles. I used this to construct Figure 1 which represents the formation as seen in the field. Mr. Robertson supplied this information to me and encouraged me in this research. Clearly without his help none of this would have happened.
4. Do you recognize the number sequence 9, 16, 25? The Pythagorean Theorem states that in a right triangle the sum of the squares of the two legs are equal to the square of the hypotenuse. That is $A^2 + B^2 = C^2$. This works for all right triangles of any measurement but the smallest integers that can be used in the equation are 3, 4, and 5. Look what happens when I put them in this equation. $3^2 + 4^2 = 5^2$ and squaring the numbers gives $9 + 16 = 25$. Isn't that astounding to find in the work of a famous scientist who was at that very time *searching for integers?* It was a very humbling experience when I realized what I had just discovered.

References:

1. Hawkins, Gerald, Phd., D.Sc. "The Diatonic Ratios in Crop Circles", Circles Phenomenon Research International Newsletter, Volume 5, No. 2, Fall/Winter 1996/97. This work has been reprinted in Reference 2.
2. Andrews, Colin with Stephen J. Spignesi, "Crop Circles: Signs of Contact", Chapter 12, The Career Press, Inc., Franklin Lakes, NJ, 2003.
3. Gragg, Dee, "Crop Circle Theorems - Their Proofs and Relationship to Musical Notes", Appendix A, Crop Circle News, June 17, 2004.

Locust Grove, Ohio

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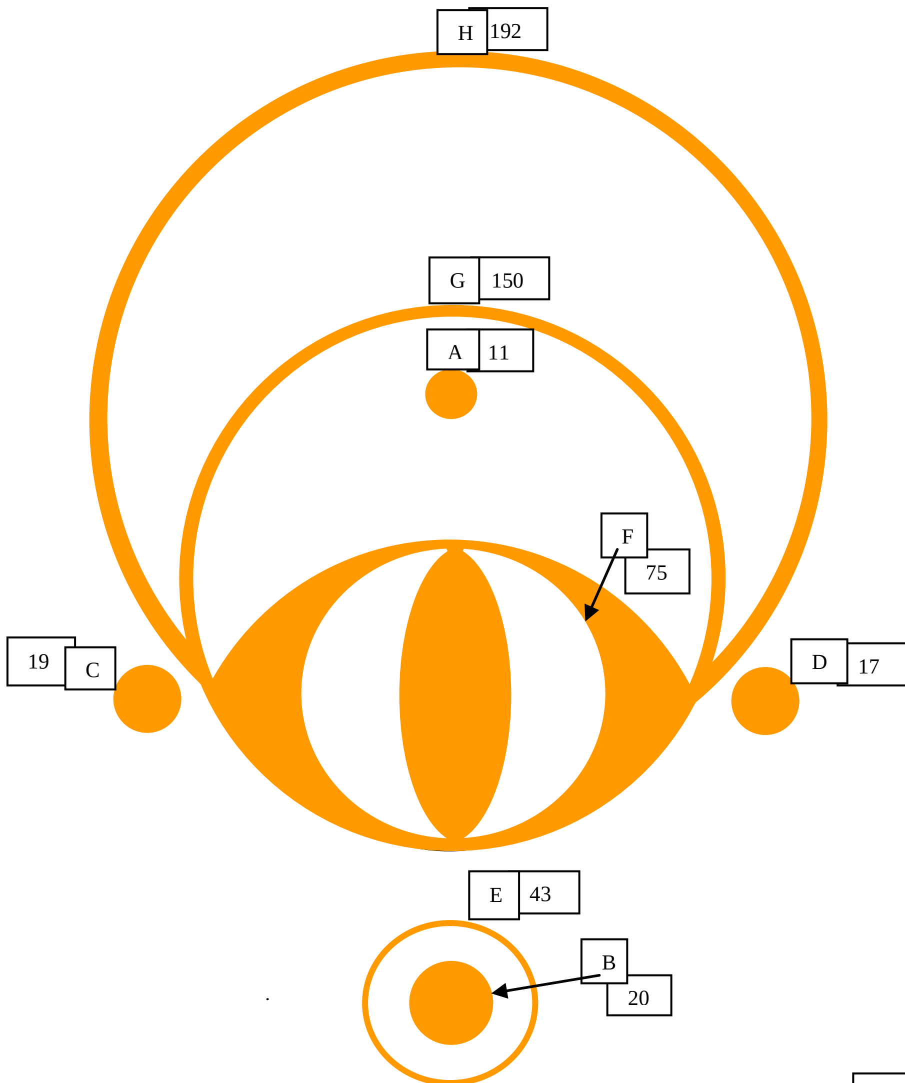

Scale: 1" = 50 '

Notes:
1. Originally drawn by Ted Robertson.
2. Computer WORD drawn by Dee Gragg with help from Ted Robertson
3. Measurements by:
   Roger Sugden
   Jeffery Wilson
   Ted Robertson
   Delsey Knoechelman
   Tony Knoechelman

Figure 1

Appendix A

Circle E

	Exact Diameter	Exact Integer	Exact Diatonic Ratio
Diameter	11	10.750	11.128
Integer	3.909	4	3.864
Diatonic Ratio	1.253	1.259	1.250

In the Exact Diameter column if we want to have the 11 exact, then the "integer" must be 3.909 which gives a diatonic ratio of 1.253. In the Exact Integer column if we want the integer exact at 4, then we must use a diameter of 10.750 giving a diatonic ratio of 1.259. If we are really a purist and want the diatonic ratio exact at 1.250, then we can work backwards and determine the diameter to be 11.128 and the "integer" to be 3.864.

This same study can be made for all of the circles (in fact I did) or any other formation of circles. However, please remember that the accuracy shown here was created rather artificially by the calculations. It should not be implied that a crop circle was measured to 0.001 of a foot in the field.

Appendix B

Frequencies In The Fields

Note Name	C	D	E	F	G	A	B	C
Diatonic Ratio	1/4	9/32	5/16	1/3	3/8	5/12	15/32	1/2
Frequency (Hz)	66	74.25	82.5	88	99	110	123.75	132
Note Name	C	D	E	F	G	A	B	C*
Diatonic Ratio	1/2	9/16	5/8	2/3	3/4	5/6	15/16	1
Frequency (Hz)	132	148.5	165	176	198	220	247.5	264
Note Name	C*	D	E	F	G	A	B	C
Diatonic Ratio	1	9/8	5/4	4/3	3/2	5/3	15/8	2
Frequency (Hz)	264	297	330	352	396	440	495	528
Note Name	C	D	E	F	G	A	B	C
Diatonic Ratio	2	9/4	5/2	8/3	3	10/3	15/4	4
Frequency (Hz)	528	594	660	704	792	880	990	1056

* Middle C

Denotes found in the fields

Theorem/Crop Circle Summary

Frequency (Hz)	Musical Note	Theorem/Crop Circle Used For Discovery
88	F	Theorem IVB, Gragg
176	F	Theorem IB, Gragg
264 to 528	C, D, E, F, G, A, B, C	1981-88 Southern England Study, Hawkins
330	E	Locust Grove, 2003
352	F	Theorem IA, Theorem IVA, Hawkins
396	G	Locust Grove, 2003
528	C	Theorem III, Hawkins
594	D	Locust Grove, 2003
704	F	Locust Grove, 2003
1056	C	Theorem II, Hawkins

Appendix C

Integer (n)	Computed Diatonic and Nondiatonic Ratios	Exact Diatonic Ratio	Note
0	$2^{0/12} = 2^{0} = 1.000$	1/1 = 1.000	C*
1	$2^{1/12} = 2^{.0833} = 1.060$		
2	$2^{2/12} = 2^{.1666} = 1.122$	9/8 = 1.125	D
3	$2^{3/12} = 2^{.250} = 1.188$		
4	$2^{4/12} = 2^{.333} = 1.256$	5/4 = 1.250	E
5	$2^{5/12} = 2^{.416} = 1.335$	4/3 = 1.333	F
6	$2^{6/12} = 2^{.500} = 1.414$		
7	$2^{7/12} = 2^{.583} = 1.498$	3/2 = 1.500	G
8	$2^{8/12} = 2^{.667} = 1.587$		
9	$2^{9/12} = 2^{.750} = 1.682$	5/3 = 1.666	A
10	$2^{10/12} = 2^{.833} = 1.782$		
11	$2^{11/12} = 2^{.917} = 1.888$	15/8 = 1.875	B
12	$2^{12/12} = 2^{1.000} = 2.000$	2/1 = 2.000	C
13	$2^{13/12} = 2^{1.083} = 2.119$		
14	$2^{14/12} = 2^{1.167} = 2.245$	9/4 = 2.250	D
15	$2^{15/12} = 2^{1.250} = 2.378$		
16	$2^{16/12} = 2^{1.333} = 2.519$	5/2 = 2.500	E
17	$2^{17/12} = 2^{1.416} = 2.668$	8/3 = 2.666	F
18	$2^{18/12} = 2^{1.500} = 2.828$		
19	$2^{19/12} = 2^{1.583} = 2.996$	3/1 = 3.000	G
20	$2^{20/12} = 2^{1.666} = 3.175$		
21	$2^{21/12} = 2^{1.750} = 3.364$	10/3 = 3.333	A
22	$2^{22/12} = 2^{1.833} = 3.563$		
23	$2^{23/12} = 2^{1.916} = 3.775$	15/4 = 3.750	B
24	$2^{24/12} = 2^{2.000} = 4.000$	4/1 = 4.000	C

* Middle C