Creating Animated GIFs for Classroom Use
2014 ICTCM - San Antonio
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During collaboration with a colleague of mine, I was asked if I'd like to be involved in a project involving Maya geometry techniques. Even though I knew next to nothing about Mayans or their geometry, but always willing to get involved in a project with a friend, I definitely said yes and jumped right in. The first part of the project was learning how the ancient Maya used a rope to verify a right angle. They had a ceremonial piece of rope with eight equally-spaced knots (two on either end and six in the middle, segmenting the rope into seven equal portions) and formed the first (of three) equilateral triangles with knots 1-4; where knot 4 actually ended up right on top of knot 1. They'd continue by forming an adjacent equilateral triangle using knots 5-6 where knot 6 was directly on top of knot 3. The process ended with stacking a third triangle using knots 7-8 where knot 8 was directly above the original knot 1 (knot 4). These triangles were formed in such a way that a set of lines from knot 1 through knot 2 and knot 1 through knot 7 would form a perfect right angle; genius!

After getting filled in on these details of how the ancient Maya used to verify right angles, the first idea that came to my mind was to use eight student volunteers to mimic the action of the knots, and record a video showing how this "student rope" would go through the actions to verify a right angle. This video was recorded and uploaded to YouTube, and can be viewed at: *http://youtu.be/n8G0knuX3mE*

The next part of our project was to find an automated way of demonstrating this process on the computer. My colleague's original thought was for me to use JavaScript to produce some applets, but when I told another colleague of mine what I had hoped to do he thought JavaScript was not the best way to proceed; he suggested creating an animated gif. One of the major benefits of this solution is that it could be "played back" on any device, any platform and didn't rely on any specific OS or add-on. The downside was I didn't know anything about creating an animated gif. As my inquiries would discover, it was a relatively straightforward process that used only GIMP (GNU Image Manipulation Program) and Microsoft Paint (or any drawing package); the great news was that both of these were freely obtainable for almost everyone!

I would create the individual "slides" of the animation using Microsoft Paint, each time creating the next slide starting from the exact image for the previous one. The benefit in doing this is the "playback" would be seamless and not have a herky-jerky nature to it if the lines/edges didn't exactly match from one image to the next. I'd then import all of the individual picture images/gifs into the GIMP as frames, and use GIMP to stitch these frames together into one single file; called an animated gif. This gif file contained all the individual "slides" encapsulated into one file format, and this file could be "played" or "viewed" on anything that could display a gif file! It gives the affect of looking like a tiny video made up of all the frames transitioning from one to the next. Here are some of

the frames that went into constructing the animated gif for the Maya verification of a right angle image:
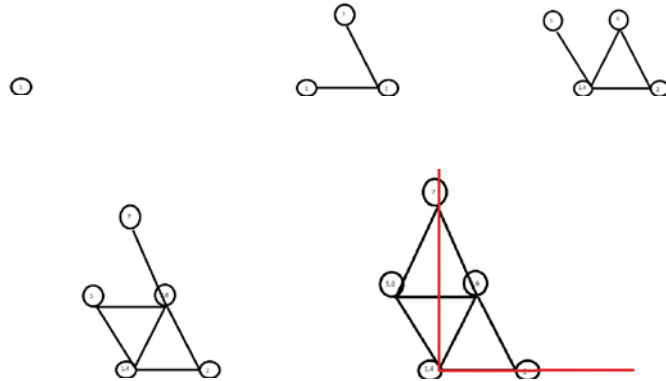
Twenty such files were "stitched" together using the GIMP in the creating of the single animated GIF file which shows the entire construction process from knot 1 to knot 8 and the verification of the constructed right angle with two red lines drawn in the last few frames.

Another part of the project was to illustrate, or animate, how the ancient Maya constructed some irrational numbers starting with a unit square. They would draw in the diagonal (of length √2), and then draw a circle of that radius which would naturally make a rectangle of dimensions 1x√2. They would draw a diagonal in this new rectangle, of length √3, and draw in a circle of that radius creating a rectangle of dimension 1x√3. They would continue this process to create the numbers: √4, √5, √6… I simulated the process by creating 15 frames using MS Paint, some of which are shown here:
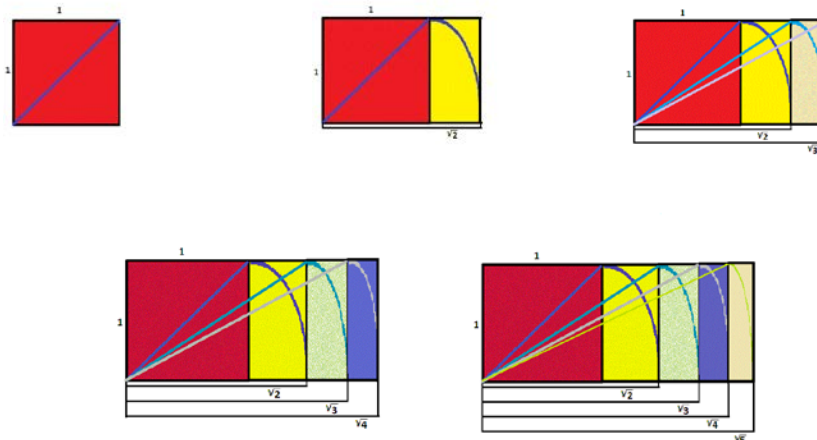
These were again stitched together using the GIMP into a single animated gif file. These and several other animated gifs were included in our peer-reviewed MAA publication that can be viewed at: *http://www.maa.org/publications/periodicals/convergence/maya-geometry-in-the-classroom* (what follows are the notes from my ICTCM workshop)

Creating Animated GIFs for Classroom Use
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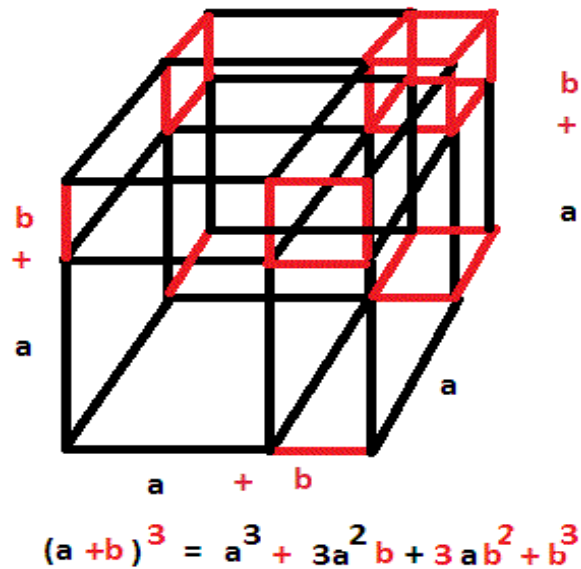Friday, March 21 at 3:30-5:15pm
John C.D. Diamantopoulos, Ph.D.
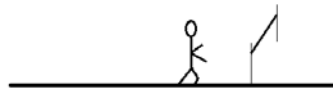Northeastern State University
diamantj@nsuok.edu

I. **Introduction**

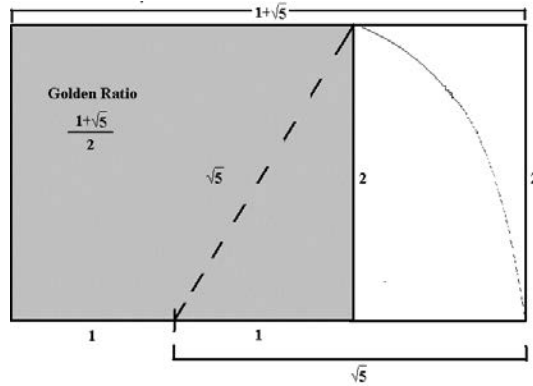   **a.** Examples of animated gifs

        i. 3D-Box: (a+b)^3

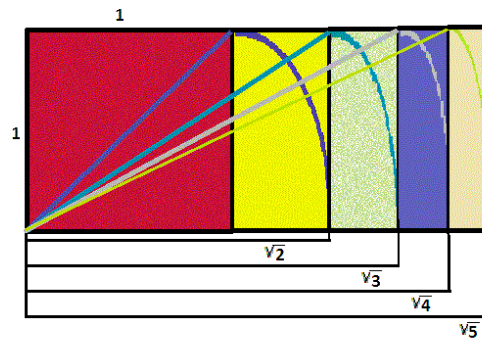$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

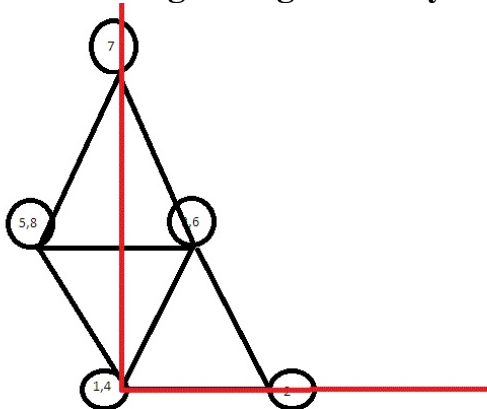   **ii. Having fun…**

b. More than just fun…

i. Golden Ratio Construction

ii. Construction of the Irrationals

iii. Verification of Right Angles – Maya Geometry

iv. Led to a publication in MAA - Convergence

http://www.maa.org/publications/periodicals/convergence/maya-geometry-in-the-classroom
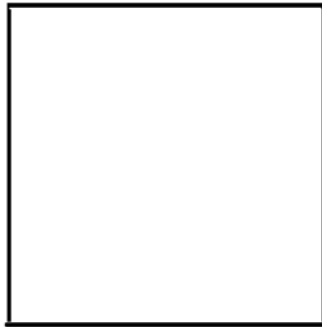
II.   **Getting Started -** Necessary programs

    a. **Microsoft PAINT**
    b. **GIMP 2.8**
        Download for free at: **www.gimp.org**

III.   **Workshop Examples**

1. ***Box***

    a. **Create individual gif files using MS Paint**
    b. **Create directory** *C:/box*
    c. **At each stage, save as** *file.gif* **in** *C:/box*
    d. **Use previous** *frame* **to construct the next**
    e. **Import the files into GIMP**
        i.   **Select** *import as frames*
        ii. **Choose all files in** *C:/box*
    f. **Select** *Filters*
    g. **Select** *Animation… Playback*
    h. **Select** *FILE…Export as gif…*
        i.   **Name:** *box.gif…*
        ii.   **Click** *Export…*
        iii. **Check** *As Animation*
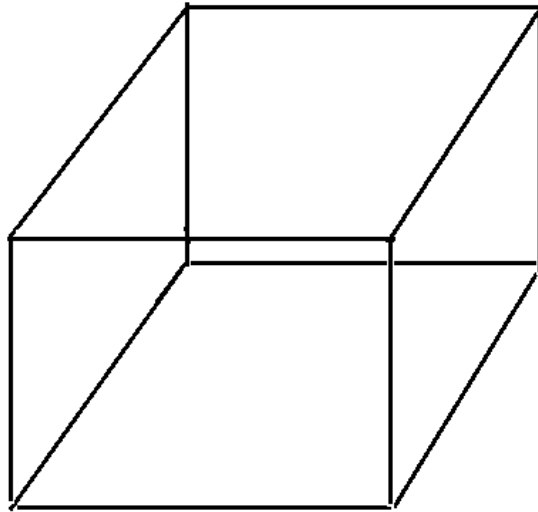   iv.   **Check** *Loop Forever*
        v.   **Delay:** *350 milliseconds*
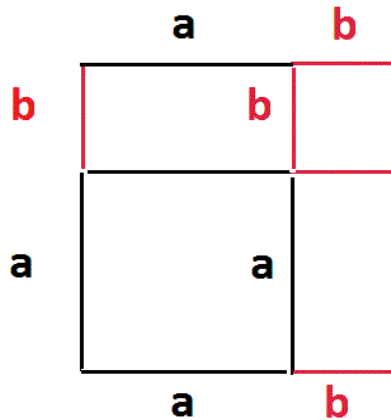   vi.   **Select** *Export …* **Close All**
    i. ***Go to WindowsExplorer and view animated gif!***

2. 3D-Box

- a. **Create individual gif files using MS Paint**
- b. **Create directory** *C:/3d-box*
- c. **At each stage, save as** *file.gif* **in** *C:/3d-box*
- d. **Use previous** *frame* **to construct the next**
- e. **Import the files into GIMP**
    - i. **Select** *import as frames*
    - ii. **Choose all files in** *C:/3d-box*
- f. **Select** *Filters*
- g. **Select** *Animation… Playback*
- h. **Select** *FILE…Export as gif…*
    - i. **Name:** *3d-box.gif…*
    - ii. **Click** *Export…*
    - iii. **Check** *As Animation*
    - iv. **Check** *Loop Forever*
    - v. **Delay:** *350 milliseconds*
    - vi. **Select** *Export …* **Close All**
- i. *Go to WindowsExplorer and view animated gif!*

3. *Terms of $(a + b)^2$*

$$(a+b)^{2} = a^2 + ab + ba + b^2$$
$$= a^2 + 2ab + b^2$$

   a. Create individual gif files using MS Paint
   b. Create directory *C:/terms*
   c. At each stage, save as *file.gif* in *C:/terms*
   d. Use previous *frame* to construct the next
   e. Import the files into GIMP
      i. Select *import as frames*
      ii. Choose all files in *C:/terms*
   f. Select *Filters*
   g. Select *Animation… Playback*
   h. Select *FILE…Export as gif…*
      i. Name: *terms.gif…*
      ii. Click *Export…*
      iii. Check *As Animation*
      iv. Check *Loop Forever*
      v. Delay: *350 milliseconds*
      vi. Select *Export … Close All*
   i. *Go to WindowsExplorer and view animated gif!*

4. *Explore…have fun!!!*