Adapted to STEMAZing ECE Format by
Amanda McPherson and DaNel Hogan

DaNel.Hogan@schools.pima.gov
Director of The STEMAZing Project

Spin Top Spin, Mix Color Mix

NOTE: Children should always be given ample time to experiment, notice, and wonder before they are provided an explanation.

Always engage children with our two favorite questions:

What do you notice?

What do you wonder?

Resist the urge to answer any questions children have while exploring. Instead, respond back with questions to children and let them make sense of the world. Sample questions you might use: What do you think? Do you notice any patterns? What could we change? Can we test something else? What can we try next? If children ask a testable question, which they could answer by doing an experiment, talk through with them how they might design a test to help answer their question. As much as possible and within reason, let them test their questions by trying the experiments they propose.

Learning Objectives

Children will…

- construct a simple spinning top.
- learn to use and experiment further with the spinning top.
- make observations about how colors on the top combine as it spins.

Vocabulary (See **What the heck? Explanation of Science** at the end for definitions.)

Body	Axle	Weight
Tip	Crown	

Materials

Plastic Lid	Pencil sharpener	Optional: Top Topper Templates
Wooden dowel	Pushpin	
Colored dot stickers	Pennies or paperclips or binder clips for weights	

Key Question

Can you create a top that spins? What happens when you make changes to the top?

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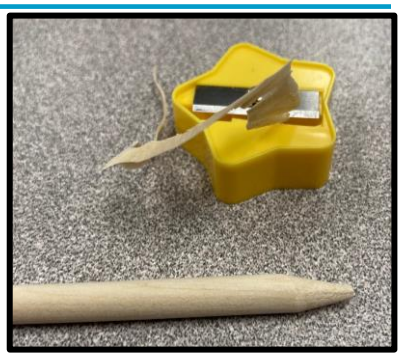
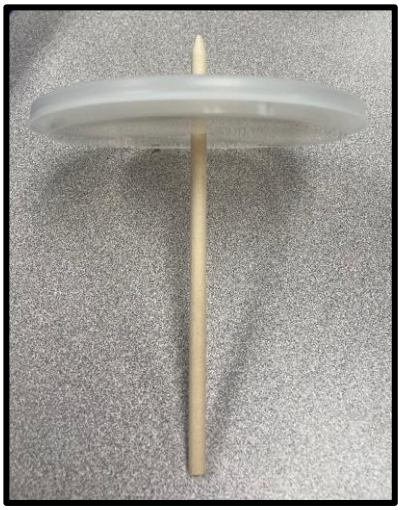
Notice and Wonder Developmentally Appropriate Practice





Build it!

1. Use the pencil sharpener to put a point on the dowel. (NOTE: This does not need to be a perfect point and should be left blunt for safety reasons.)
2. Make a small hole in the middle of the plastic lid with a pushpin, then insert pointed end of the dowel. Twist it back and forth to get it expand the hole and fit through the lid snuggly. NOTE: If the lid gets loose you may have to secure it with tape or glue.
3. Add colored dots to the inside of the plastic lid, around the rim. (See picture on the first page.)

Spin it!

4. Try to spin your top.
    - What do you notice?
    - What do you wonder?
    - What would you like to change?
5. Allow children to make changes as they suggest. These could include:
    - Adjusting the height of the lid on the dowel.
    - Changing the lid to one that is bigger/smaller.
    - Changing the material of the lid – use cardboard or something else.
6. Keep experimenting until you can make it spin.

Engineer it!

7. Using weights – like taping pennies or paperclips to the lid or adding binder clips to the edge of the lid – see if you can add weight to the top and still get it to spin.
    - What do you notice?
    - What do you wonder?
    - What would you like to change?

Color it!

8. Change the colors of the dots on the body of your top.
    - Use just one color.
    - Use two colors – every other one.
    - Use two colors – two, one, two, one
    - Use all three colors – every other one.
9. Let children color in paper circles the size of the top in various patterns. Attach them to the body (lid) of the top and see what colors they create when the top spins.

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10. Use the Top Topper Templates, at the end of this lesson, to let students explore how the primary colors of light (red, green, and blue) combine in pairs of two to create the secondary colors of light (green + blue = cyan, red + green = yellow, and red + blue = magenta)! They can also color their own topper. Folding the topper in half and then punching half a hole in the middle should allow the topper to slide right onto the dowel. You will want to tape it down to the top of the lid on the top.

NOTE: The REAL primary colors are NOT red, yellow, and blue. They are red, green and blue for light and cyan, yellow, and magenta for paint. We have lots of lessons on the REAL primary colors which can be found here: https://stemazing.org/primary-colors/

Children should notice…

- the top needs to be balance to spin.
- the top works better when the body is lower on the dowel rather than higher up.
- the weights have to be balance for the top to spin.
- with weights added and balanced, the top spins longer.
- the colored dots seem to “mix” and create new colors when the top spins fast enough.
- changing patterns of the colored dots on the top changes the colors created.

Extensions for Additional Learning

As always, ask the children throughout the experiment what they notice and what they wonder. If their wonder questions are testable, as much as possible and within reason, let them test their questions by trying new experiments.

See below for examples of what they might wonder and experiments they might do to test their wonderings.

- I wonder what would happen if I used a smaller lid?
- I wonder what would happen if I turned the lid upside down?
- I wonder what would happen if I add two or three lids to the same top?
- I wonder what would happen if I tried something different for the body or axle or weights?
- I wonder what would happen if I added more weight?
- I wonder what would happen if I use different color patterns?
    - Let them try it

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#STEMAZingPictureBook Recommendations:

Spinning Tops by Jackie Tidey, Jan Anderson, & Annette Smith

Differentiating Developmentally Appropriate Practice

For younger children, you may have to make the top for them and perhaps even spin it at first.

For older children, give them many different materials and have them engineer the best top they can. You can define "best" top by the one that spins the longest. For students old enough to write, you could have them record their modifications and engineering in the IDEAS Engineering Journal found here: https://bit.ly/IDEASEngineeringJournal

References

https://www.exploratorium.edu/tinkering/projects/spinning-tops

SAFETY CONCERNS

The dowels are sharp once turned through the pencil sharpener. There is a risk of children poking themselves or others.

AZ Early Learning Standards

Science Standard - Strand 1: Inquiry & Application - Concept 1: Exploration, Observation & Hypotheses
The child observes, explore, and interacts with materials, others, and the environment.

Science Standard - Strand 1: Inquiry & Application - Concept 2: Investigation
The child researches their own predictions and the ideas of others through active exploration and experimentation.

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Exploring Spinning

What the heck? Anatomy of a Top (Vocabulary in bold.)

The top spins on the point or **tip** of the wooden dowel. This is the smallest part of the spinning top. The other end of the spinning top is the **crown** (flat side of wooden dowel). You hold onto the crown to give the top the spin it needs. The **body** of the spinning tops the children made is the plastic lid. If you have a store bought top, the body would be the part between the shoulder and the tip. The shoulder is rounded corner at the top of the body and the tip is the pointed end of the tapered body that touches the table.

What the heck? The Science of Spinning

When you spin a top, you are applying a torque to the top in order to get it to rotate or spin. Once it is spinning, it has what we call angular momentum – it wants to keep spinning. The more angular momentum the top has (the faster it spins), the more stable it should be. Adding weight to the top is another way to increase its angular momentum when it is spinning. This also helps keep the top stable longer. The weight added, and the top itself, do need to be balanced or the top will not work well at all.

The sharp point of the top reduces the friction the top experiences between the table and the tip. This friction is what eventually slows the top down and makes it topple. So, the more that can be done to reduce that friction the better the top should work. You could have children try covering the tip with aluminum foil and then plastic wrap to see dramatic differences in friction and the impact it has on the top.

When the top begins to slow down, it will start to tip a bit and the force of gravity applies torque to the top. This torque, along with the top losing its angular momentum as it slows down, causes the top to precess or wobble. Once it slows down enough, the wobbling gets much worse and then it eventually tips until the body comes in contact with the table and then it quickly stops moving.

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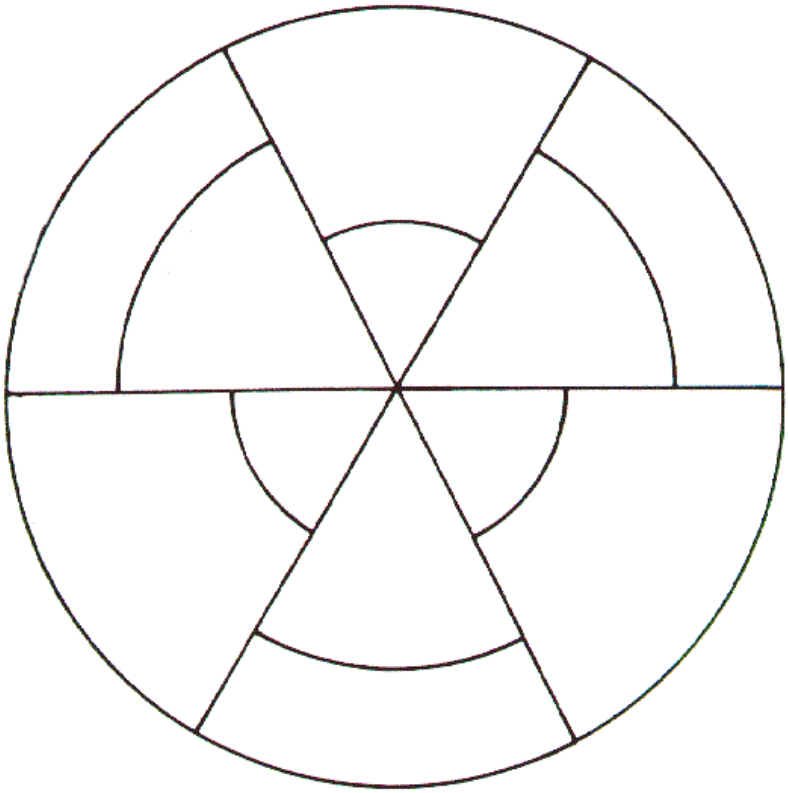

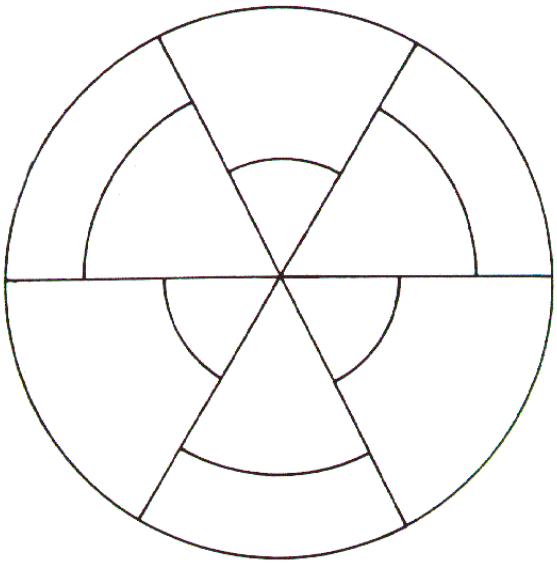

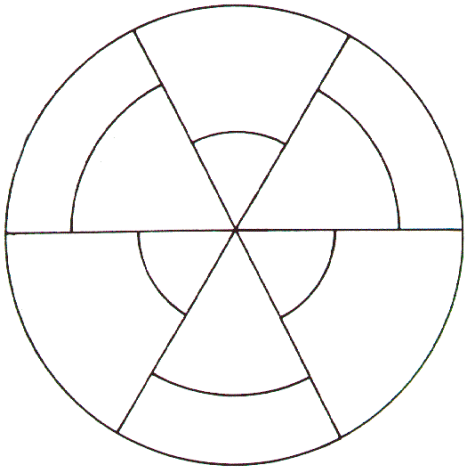

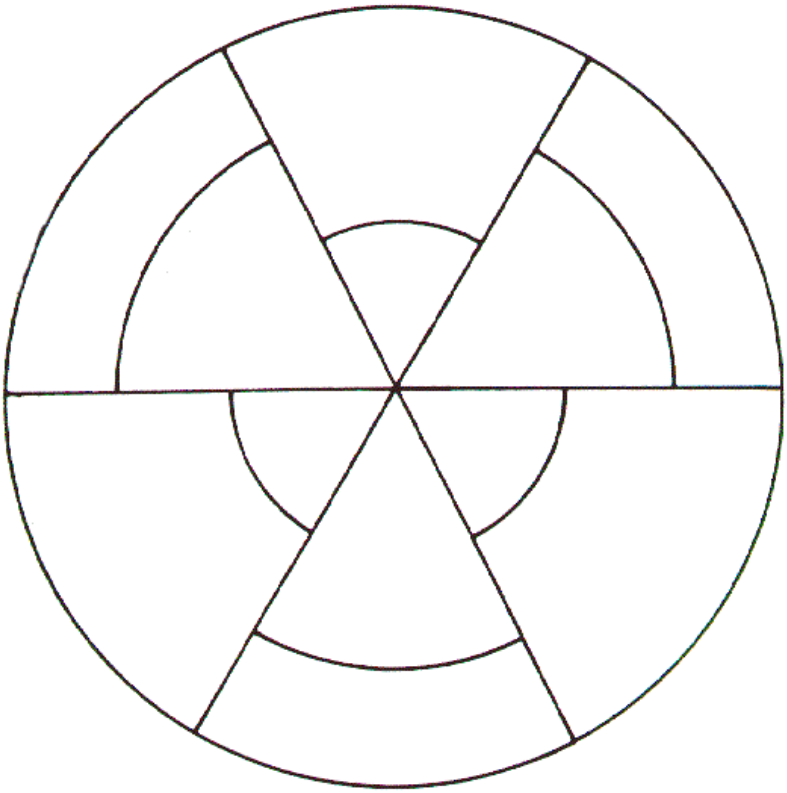

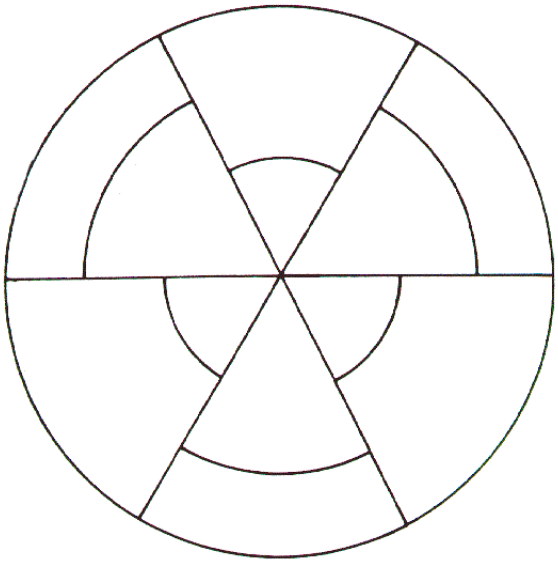

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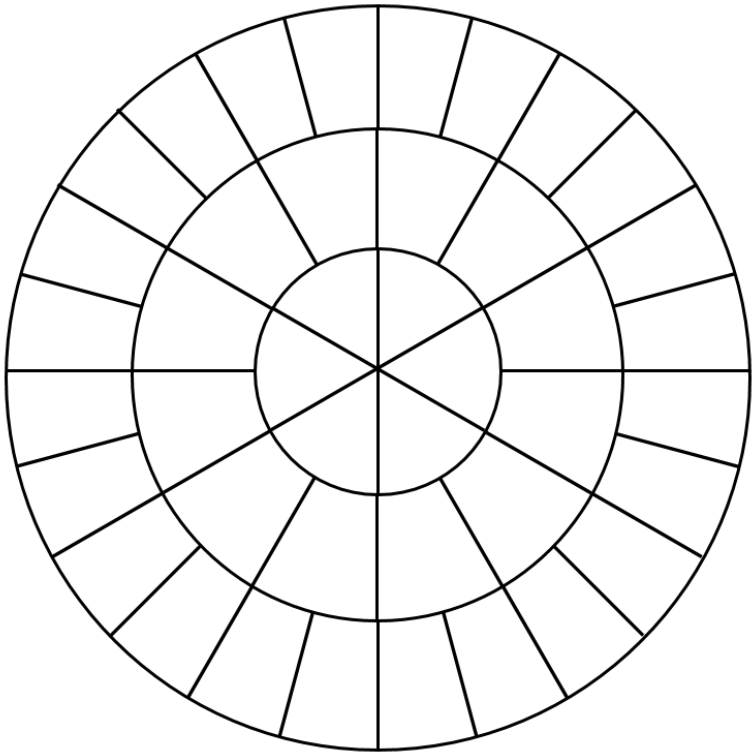

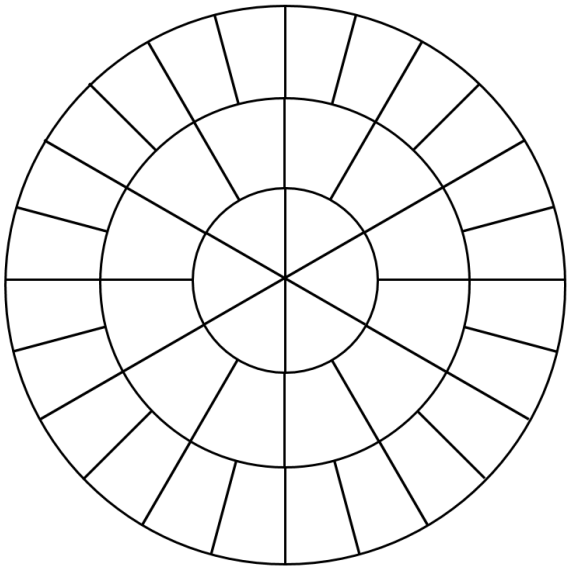

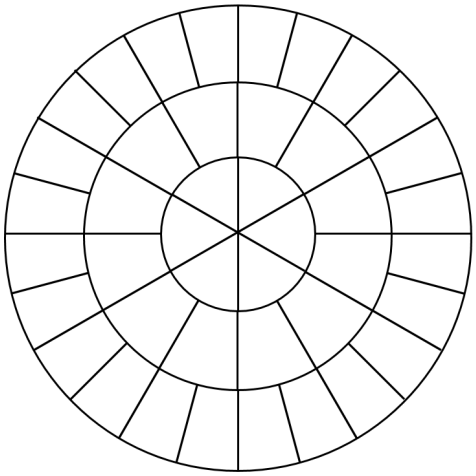

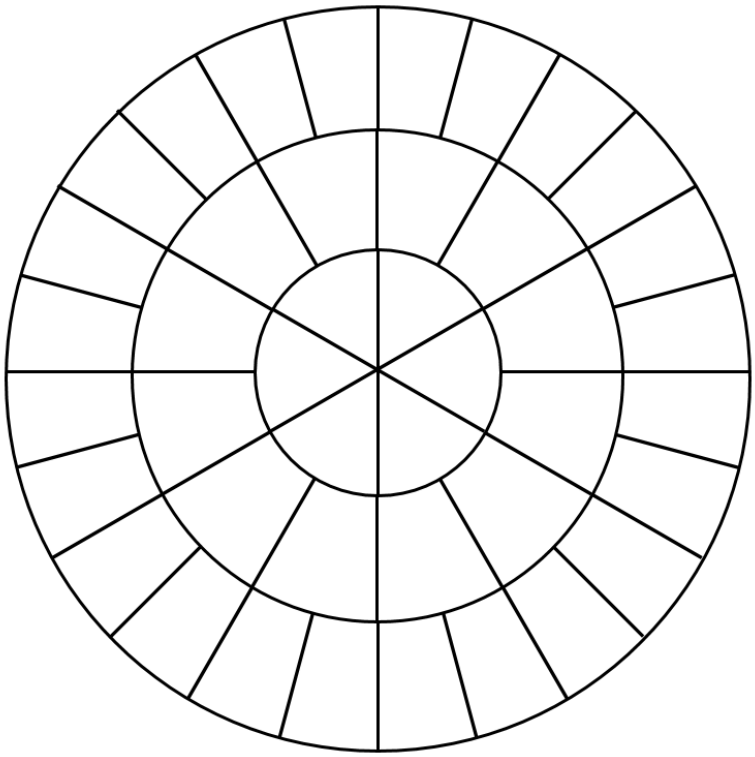

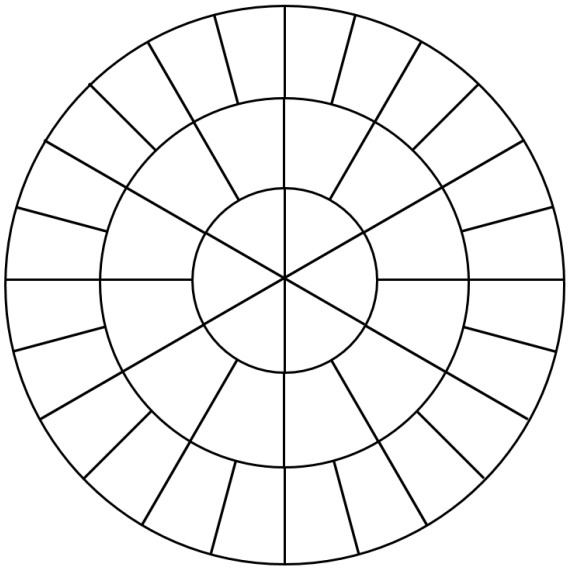

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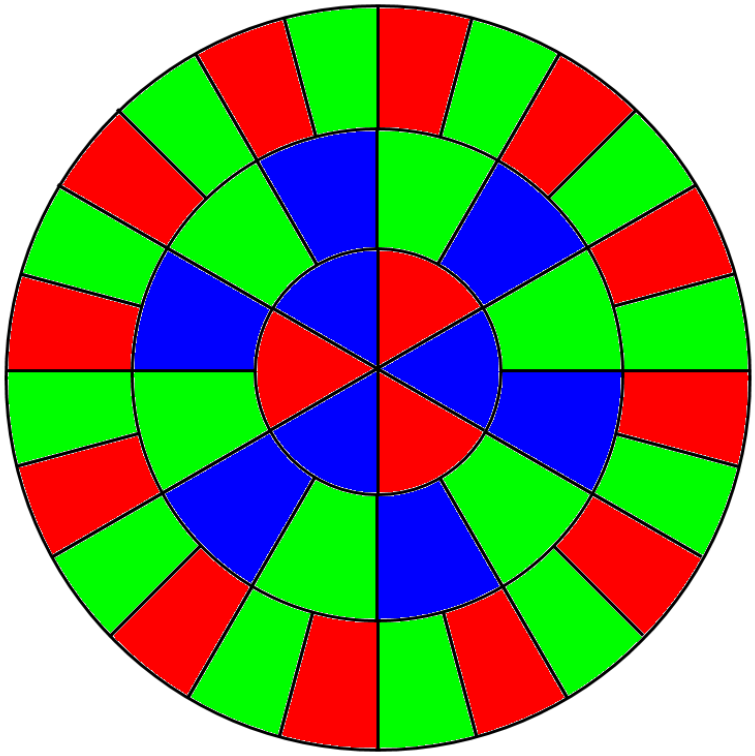

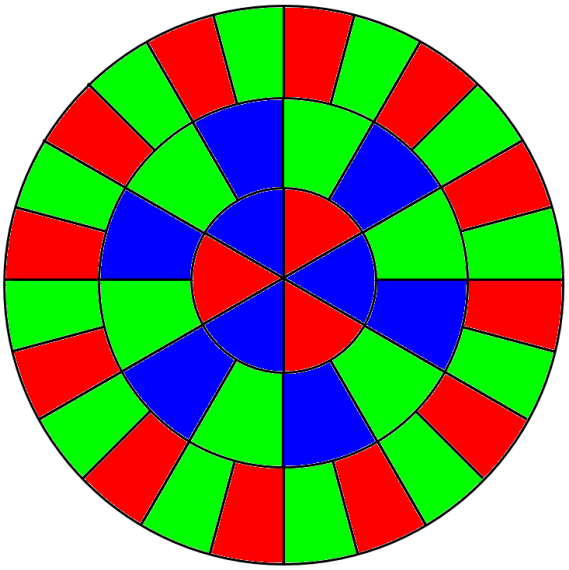

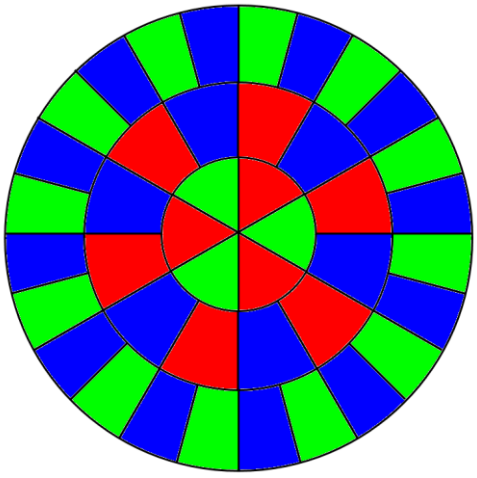

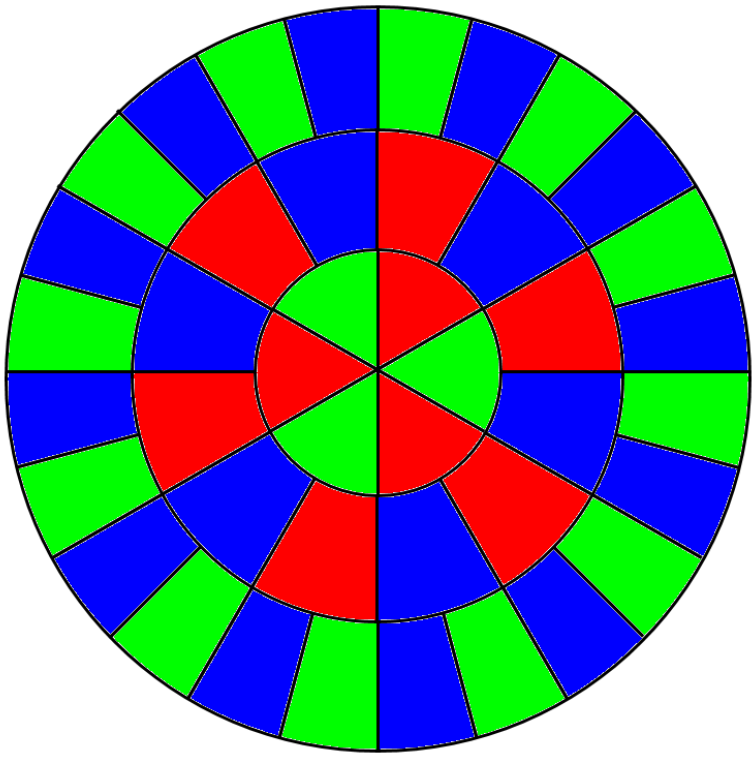

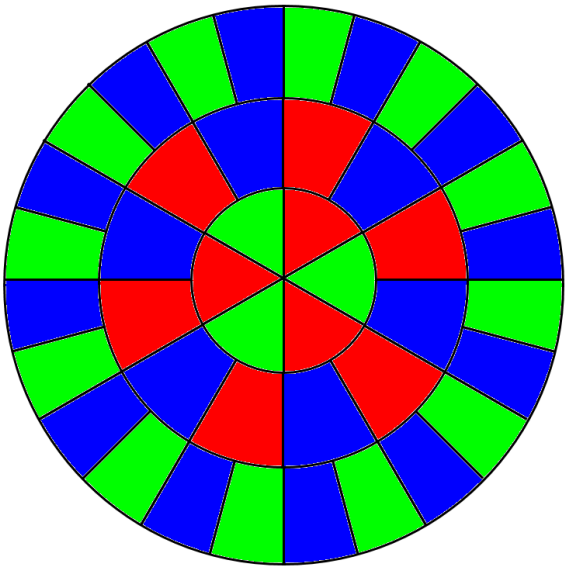

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