LAYERING: SHOWING AND HIDING OBJECTS

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Abstract

All GeoGebra objects are assigned to a layer, which can be made visible or invisible. In this article, the authors highlight this feature by example and suggest four tasks in which layers can be implemented.

Keywords: GeoGebra Layers, Scripting

Showing and *hiding* objects such as points, lines, polygons, and text can be powerful pedagogical tools. Using an object's visibility can reveal constructions in a step-by-step manner. In addition, the technique declutters sketches to help students focus attention on meaningful relationships. Furthermore, showing and hiding objects is a valuable animation tool (for instance, see the "Next" button in: `https://www.geogebra.org/m/nZNzyjez`). The standard way to *show* (or *hide*) an object in GeoGebra is to use the "Condition to Show Object" field under the Advanced tab of the object's properties window (See Figure 1). Using *layers* is another effective method.
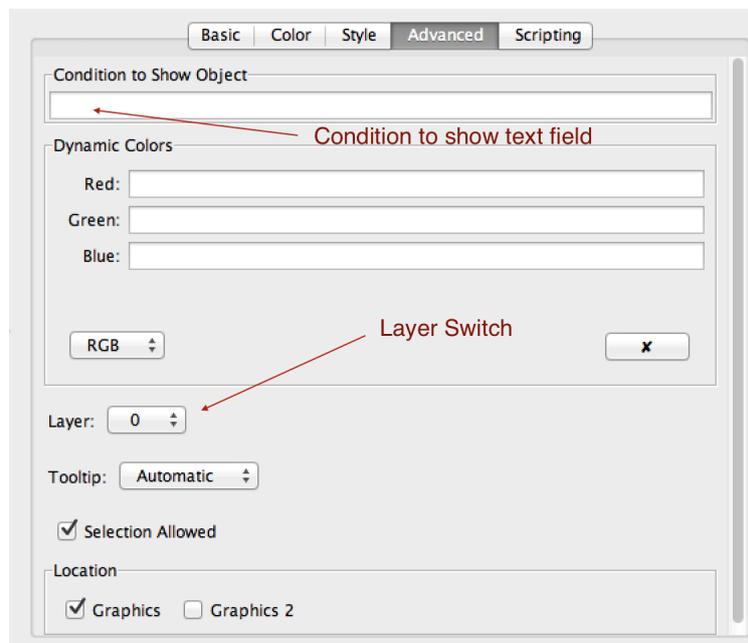
Figure 1. Object Properties → Advanced → Condition to Show Object

Layers in GeoGebra, like in Photoshop, are independent "sheets" stacked as overlays. By default, all objects are placed on Layer 0. However, whenever there is at least one object on a higher layer (e.g.,

Layer 1), all new objects are created on the highest layer. Because layers are "transparent," lower layers can be seen through upper layers.

GeoGebra currently supports 10 layers, $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. Layers are beneficial when a large group of objects needs to be presented (or hidden) simultaneously. Instead of specifying a condition to show for each object, turn "on" contains the object(s). Use Layer 0 for objects that are to be present at all times. Use subsequent layers to control which objects are shown or hidden. Because the use of layers requires GeoGebra scripting (i.e., `ShowLayer[n]` and `HideLayer[n]`, where $n \in \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$), it can be considered an advanced technique.

EXAMPLE

Consider the example of nine concentric circles of various radii (e.g., Figure 3). First, create a slider control named `Layer` and set the bounds from 0 to 9 increment by 1 that corresponds to the layer number. Next, create a number `Current` that indicates the "current" layer. Then, create the 9 circles centered at the origin with a radius of $1, 1/2, 1/3, \ldots, 1/9$, respectively, using the natural correspondence between the radius and the layer. For example, the circle with a radius $1/5$ should be placed on the 5th layer. The command for the circle centered at the origin with a radius of $1/3$ is `Circle[(0,0),1/3]`. Construction protocols are listed in Table 1. Each time the user drags the slider, the code in Figure 2 is executed.
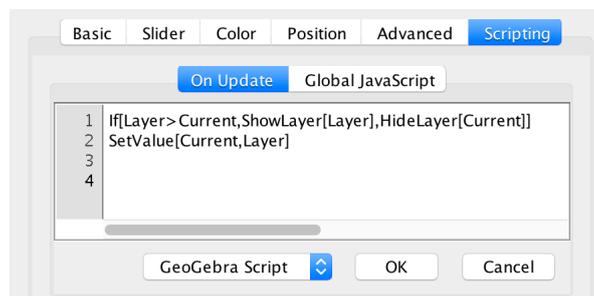

**Figure 2.** Object Properties $\rightarrow$ Scripting $\rightarrow$ On Update
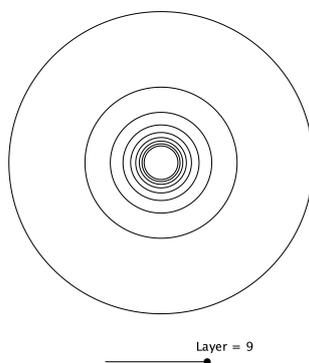
Figure 3. Nine concentric circles each placed on one of nine separate layers. See `https://www.geogebra.org/m/dxzdtncv`.

No.	Name	Description	Value
1	Number Layer	Slider	Layer = 0
2	Number Current	Number	Current = 0
3	Circle a	Circle center $(0,0)$, radius $1/1$	$x^2 + y^2 = 1$
4	Circle b	Circle center $(0,0)$, radius $1/2$	$x^2 + y^2 = 0.25$
5	Circle c	Circle center $(0,0)$, radius $1/3$	$x^2 + y^2 = 0.11$
6	Circle d	Circle center $(0,0)$, radius $1/4$	$x^2 + y^2 = 0.0625$
7	Circle e	Circle center $(0,0)$, radius $1/5$	$x^2 + y^2 = 0.04$
8	Circle f	Circle center $(0,0)$, radius $1/6$	$x^2 + y^2 = 0.027$
9	Circle g	Circle center $(0,0)$, radius $1/7$	$x^2 + y^2 = 0.02$
10	Circle h	Circle center $(0,0)$, radius $1/8$	$x^2 + y^2 = 0.0156$
11	Circle i	Circle center $(0,0)$, radius $1/9$	$x^2 + y^2 = 0.0123$

Table 1. Construction Protocols for concentric circles

ADDITIONAL IMPLEMENTATION IDEAS

A short list of ideas to begin using layering with other sketches follows. Other ideas may be harvested from the GeoGebra website `https://geogebra.org`.

- Placing triangles, quadrilaterals, pentagons, etc. on separate layers and control the visibility with a dropdown menu.
- Place the solution curve on hidden layer, then reveal after students attempt to solve problem. For example, a common task is to have students determine the trajectory of an object (such as a basketball). Use a button to reveal the actual path.
- As students explore polynomial functions, layering and hiding can be used to display examples of graphs by degree (e.g., degree n polynomials in Layer n).
- Construct a sketch that include tasks and their solutions—with solutions hidden until the student indicates readiness to view the solution (by dragging a slider). Such a use of layering and hiding supports self-paced instruction.