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# COLORING MANDALAS: A CIRCULAR SHAPE MODEL WITH COMPLEX PATTERNS AND ANALYSIS METHOD.

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Coloring books for adults are increasingly proposed in care services such as oncology<sup>1</sup>. These books highlight that coloring can reduce stress and improve well-being.

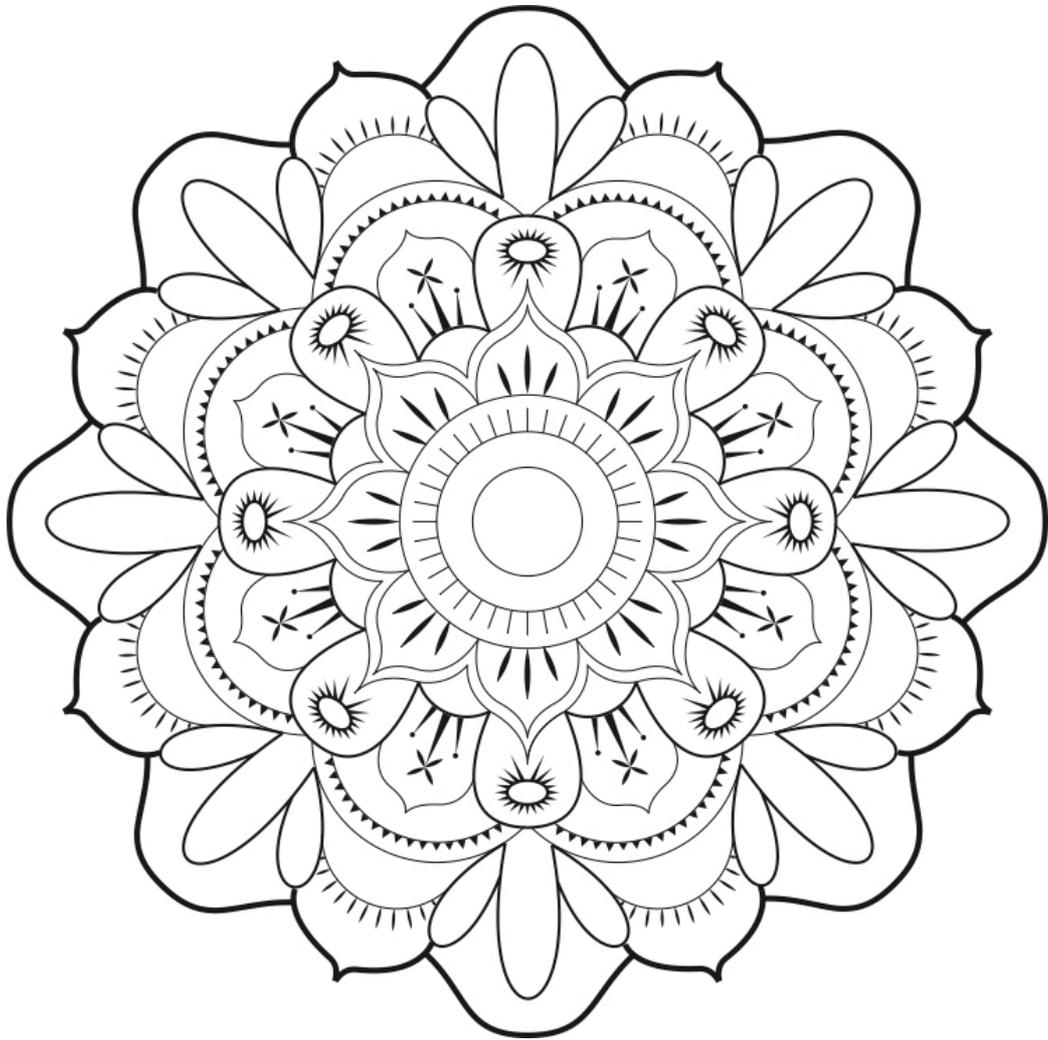
In particular, studies have shown that coloring a circular shape with complex patterns commonly known "mandalas" can reduce anxiety in students<sup>2-4</sup>. This effect is stronger with complex shape than drawing on a blank sheet<sup>2</sup>. However, mechanism of this effect is not clearly defined. Curry and Kasser as well as Mantzios and Giannou claim that the coloring of a circular shape with complex patterns would have a meditative effect by focusing attention<sup>2,4</sup>. This state reminds the *flow* concept defined by Csikszent-Mihaly<sup>5</sup>. *Flow* is defined as an optimal state of activation in which the subject is completely immersed in the activity<sup>6</sup>. Another hypothesis could be that coloring provokes the production of a hypnotic effect with a process of defocusing attention and the occurrence of a reverie.

Nevertheless, the results of the studies that demonstrated efficacy of coloring mandalas on anxiety are based on the repeated measurement of the Stai-Trait Anxiety Inventory scale<sup>7</sup> before and after coloring<sup>2-4</sup>. No data from the colored shape obtained such as the colors or area of the surface used were collected and analyzed in these studies. These data could help to understand the mechanism of the effect induced by coloring. In this context, we have developed a shape and a method for collecting and analyzing these data.

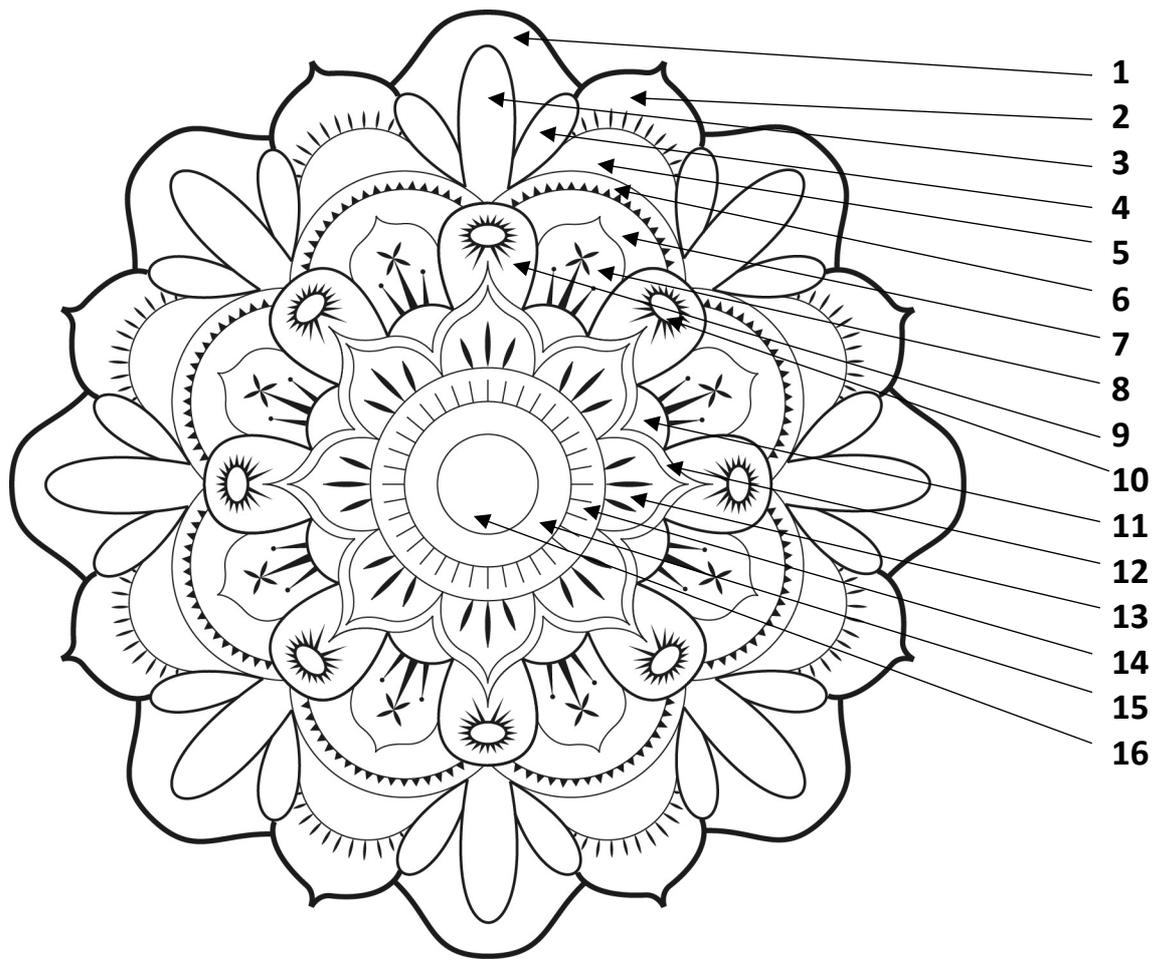
A circular shape with complex patterns was created in vector format then simplified so that its coloring lasts about twenty minutes (in a healthy subject). This shape with complex patterns obtained is shown in figure 1. It contains 108 patterns with 16 reference patterns (figure 2). The area of each reference pattern was calculated by a script. The results are shown in Table 1. The distribution of colors according to the colored surface can be deduced by multiplying each area by the number of colored patterns of the same color. The number, the type of colored patterns and the total surface area colored can also be deduced.

This shape and the proposed analysis method could allow for a collection of more data for further studies interested in the effect of coloring complex patterned circular shape.

This method has been use in a recent work and show the differences in different groups of patients, depending on pathologies and conditions of hospitalization<sup>8</sup>.



**Figure 1.** Circular shape with complex patterns (1:1 scale).



**Figure 2.** Numbering of the complex patterns.

Pattern	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Area (cm <sup>2</sup> )	1,7	1,2	1,2	0,5	1	0,6	0,9	1,1	1,1	0,1	0,2	2,5	0,8	3,4	2,3	1,3
Number of repetitions of the pattern	8	8	8	16	8	8	8	8	8	8	8	1	8	1	1	1

**Table 1.** Numbering, area and number of repetitions of the patterns of the shape.

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