

## PsyKolo3D—Interactive Computer Graphical Content of “Kolam” Design Blocks

Yasuo KAWAI<sup>1\*</sup>, Kosuke TAKAHASHI<sup>2</sup> and Shojiro NAGATA<sup>3</sup>

<sup>1</sup>*Bunkyo University, 1100 Namegaya, Chigasaki, Kanagawa 253-8550, Japan*

<sup>2</sup>*Free*

<sup>3</sup>*InterVision Institute, 5-4-24 Katase, Fujisawa, Kanagawa 251-0032, Japan*

*\*E-mail address: kawai@shonan.bunkyo.ac.jp*

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**Abstract.** A 3D Computer Graphical tool was developed for creating “Kolam” patterns of the southern India or Celtic knot patterns in Europe on digitalization of them. The 3D CG pattern consists of six primitive stroke patterns on the six sides of a block (called as PsyKolo3D). A user is able to change the patterns with rotating each block in an array to create a single stroke pattern as a cycle on a “smooth” tracing rule excluding acute angle curves. This software checks automatically if the pattern is a cycle (unicursal). This interactive content was designed for anyone including a child and the aged to operate naturally for enjoying it and activating his/her brain.

### 1. Introduction

#### 1.1. Background and purpose of the research

Kolam is a traditional pattern in South India, which is daily drawn using rice powder on ground. It is, however, difficult to distinguish the complexity of Kolam at glance. Creating Kolam pattern is expected to be useful for activating/training human brain. This research is to design an interactive content using Kolam pattern block image (called PsyKolo3D) on computer graphics.

#### 1.2. Related works

As the basic works for this paper, NAGATA and YANAGISAWA (2004), or NAGATA and THAMBURAJ (2006) reported the digitalization, analysis of Kolam patterns and Kolam designer software were reported as well as Kolam pattern block tool (PsyKolo). This pattern is composed of the simple patterns and any complicated Kolam pattern is formed with a single stroke or multi-stroke as a cycle pattern(s).

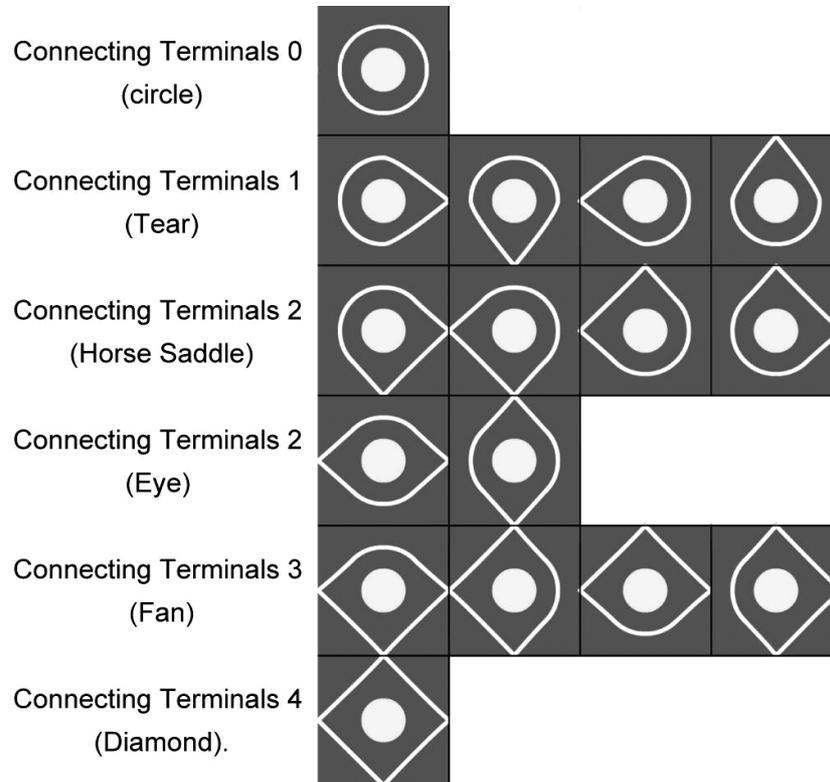


Fig. 1. Basic elements of kolam.

## 2. PsyKolo3D

### 2.1. Six basic elements of kolam pattern

Figure 1 shows six kinds of basic patterns of Kolam. A point, at which a stroke of a basic pattern goes to a neighbor basic pattern, is called as a connecting terminal. We classify them into six kinds of basic patterns in the number and the form of the connecting terminals. Connecting Terminals 0 are called “Circle”. Connecting Terminals 1 are called “Tear”. Connecting Terminals 2 are called “Horse Saddle” and “Eye”. Connecting Terminals 3 are called “Fan”. Connecting Terminals 4 are called “Diamond”.

Each of the six basic patterns is pasted on each of the six sides of a PsyKolo block. The six basic patterns become 16 patterns, considering rotated patterns into 4 directions. These patterns are represented with rotating of PsyKolo block.

### 2.2. Kolam pattern block

The rules of this content are to arrange PsyKolo3D blocks in the field and then to form a pattern drawn with a single stroke on the upper sides of all blocks. Shows six basic

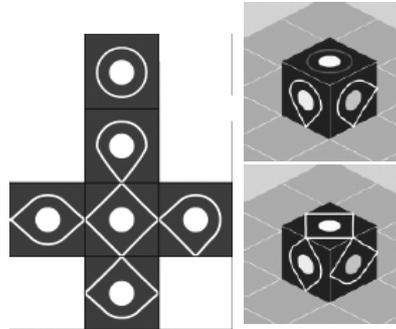


Fig. 2. Block pattern.

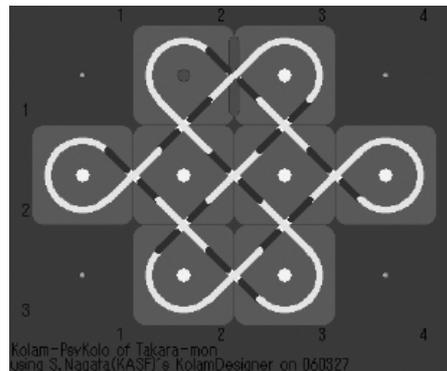


Fig. 3. Creation and tracing in animation soft (Kolam Designer by Nagata).

patterns pasted on the surface of a block. The user makes a single pattern by rotating these blocks and placing them properly.

### 2.3. Kolam pattern with a single stroke

Figure 3 shows Creation and Tracing in Animation Soft (Kolam Designer by Nagata). The PsyKolo3D referenced this software. The stroke must be a continuous curve. The pattern is verified if it is drawn with a single stroke based on the segment number of tracing Kolam pattern in real time animation by this software. All of the basic patterns on the upper sides of the blocks were divided to 4 segments of the lines corresponding with the 4 edges and each segment was assigned with one status switch (memory). When a segment was traced once, a switch of the segment was memorized, and the number ( $S$ ) of the memorized switches was counted as well as the traced block number ( $B$ ). When tracing could come back to the beginning segment, the PsyKolo3D decides if  $S$  is equal to  $4 \times B$  and then the traced pattern should be a single stroke pattern (cycle/unicursal). Figures 4, 5 and 6 show

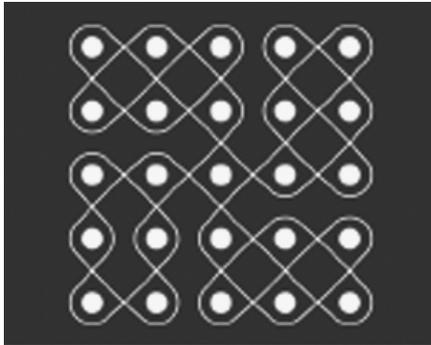


Fig. 4.

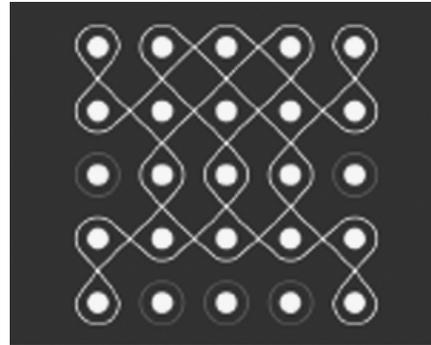


Fig. 5.

Fig. 4. Single stroke pattern (1).

Fig. 5. Single stroke pattern (2).

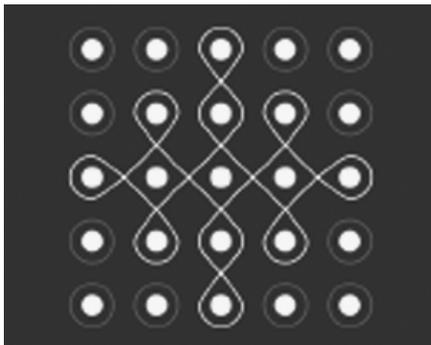


Fig. 6.

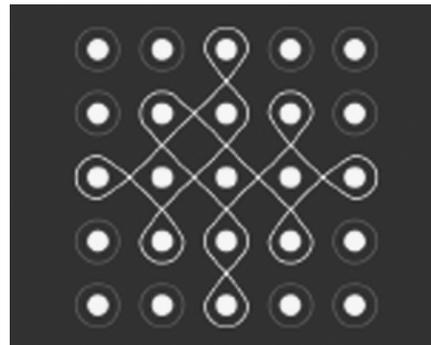


Fig. 7.

Fig. 6. Single stroke pattern (3).

Fig. 7. Double stroke pattern.

single stroke patterns. These lines constitute smooth curve. Figure 7 shows a double stroke pattern. This pattern has two lines and hence is a double stroke pattern. Figure 8 shows a threefold stroke pattern. In the same way, this pattern has three lines and hence is a triple stroke. Figure 9 shows non-formation(non-traceable) pattern. Tracing stroke must make smooth curve. Nevertheless this pattern has acute angles on stroke line.

The user is able to make more complicated single stroke patterns.

#### 2.4. Design of user interface

This content was designed for a user in the range from a child to an aged person. The user rotates PsyKolo3D blocks in the working field to make Kolam pattern. They can

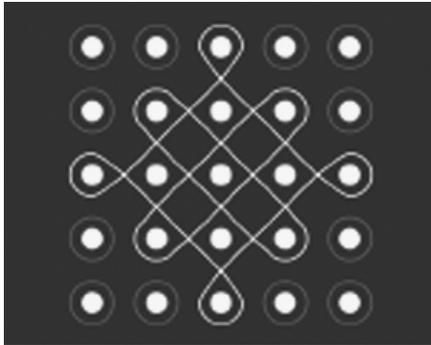


Fig. 8.

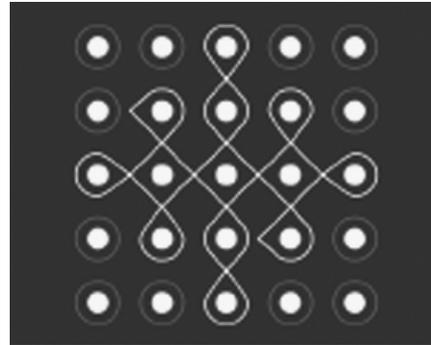


Fig. 9.

Fig. 8. Triple stroke pattern.  
Fig. 9. Non-formation pattern.

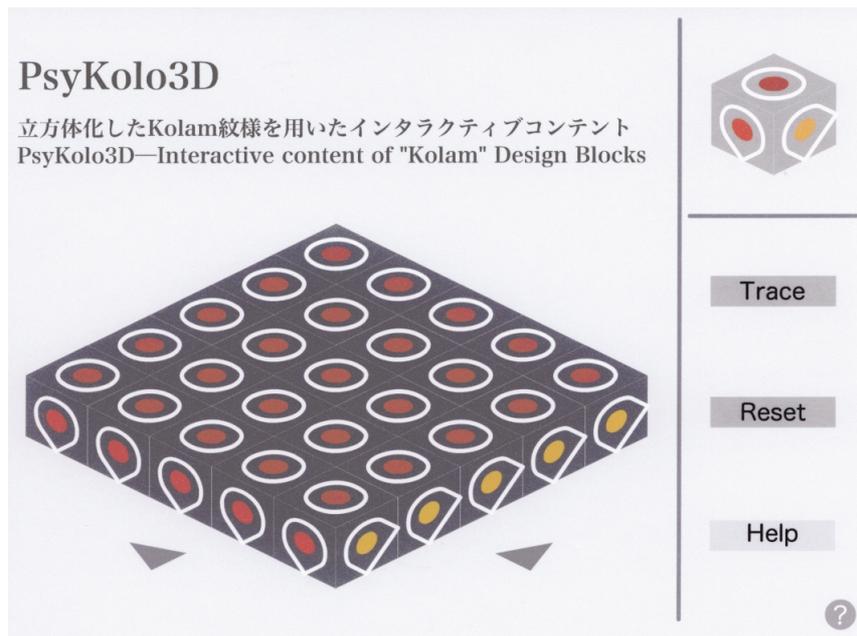


Fig. 10. PsyKolo3D interface.

operate it only with a mouse or a touch pen to click some command buttons, or to slide on a target block to rotate it or on the agent block of the target in upper-right corner in the screen. Two arrows in a lower part of the screen can be confirmed from the different 4 viewpoints of 90 degrees' turning a field. The user can confirm if the picture is drawn with

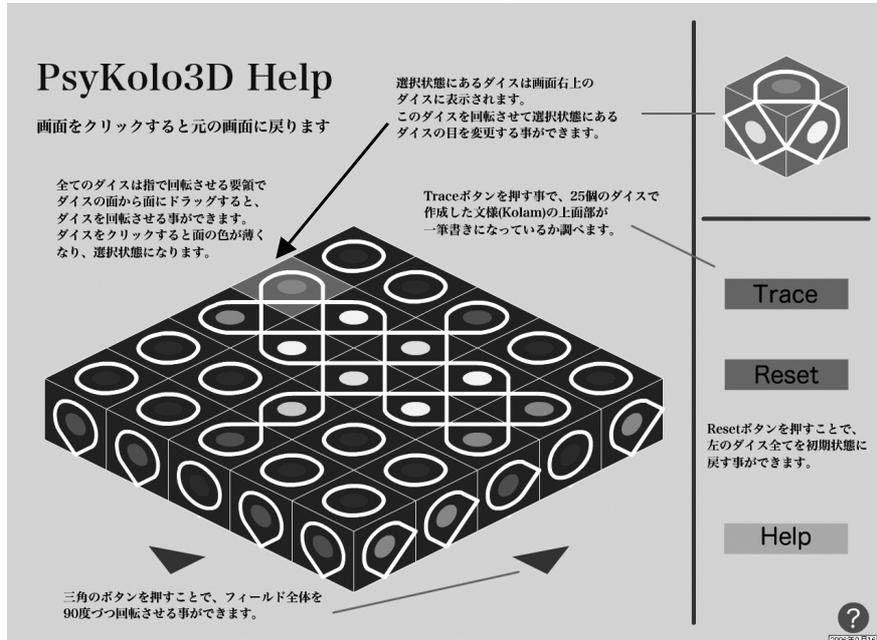


Fig. 11. PsyKolo3D help screen.

a single stroke on tracing image of the stroke of Kolam in animation. This PsyKolo3D has also HELP mode for the user who wavers in the operating method.

### 3. Conclusion and Future Work

Some users operated this content actually in environments with a touch pen and a mouse for a PC machine. It was easy for them to operate with the touch pen rather than the mouse. Based on this observation, it is supposed that PsyKolo3D operation using the touch pen makes the user feel as if he/she is operating directly with his/her hand. In the future, we will compare usability of both. And there are other types of Kolam patterns which are drawn by joining points and not by drawing curves around the points. Developing software for drawing them can be considered.

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