Chapter 12
String Art and Linear Iterative Systems

Samer Habre
Lebanese American University, Lebanon

ABSTRACT

String art dates back to the 19th century when it was initially invented to ease the delivery of some mathematical ideas. Since then, the art has evolved and so has its use in mathematics. In this chapter, the authors see how some of the phase portraits for 2 x 2 linear homogeneous iterative systems exhibit some artistic behavior that resembles this form of art. The investigation gives a sufficient condition for the solutions of such systems to form closed cycles. However, in other situations the cycles formed are infinite, producing some fascinating examples of string art.

INTRODUCTION

String art has its origins in the "curve stitch" activities invented by Mary Everest Boole (1832–1916) at the end of the 19th Century. String art or "mathematical embroidery" is a family of lines created by attaching strings to artfully located sets of pins forming abstract geometric patterns (Pedoe, 1976). Even though straight lines are formed by the string, yet the eyes of the observer pick a phantom curve or an "envelope". Mathematically, the envelope of a one parameter family of lines is the curve which is mutually tangent to that family (Struik, 1950). In simpler terms, strings can be woven so as to envelope various geometric figures such as a polygon (Figure 1a), the shape of a hyperbola (Figure 1b), or simply some beautiful design (Figure 1c).

Figure 1. (a) String art that envelops a polygon; (b) string art that envelops a hyperbola; (c) a beautiful string art design
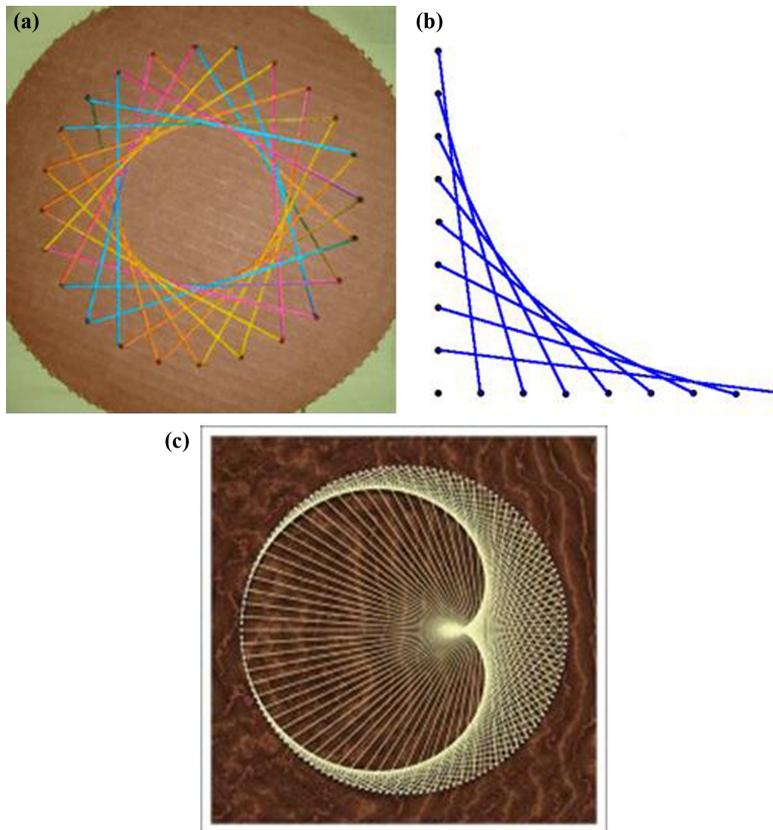
String art was initiated by Mary Boole to make mathematical ideas more accessible to children. Boole, the wife of mathematician George Boole, was a self-taught mathematician; she wrote many didactic works on mathematics, such as The Preparation of the Child for Science (Boole, 1904), and Philosophy and Fun of Algebra (Boole, 1909). The latter book encouraged children to explore mathematics through playful activities such as "curve stitching".

In the 20th century, this art was popularized as a decorative craft. There are however many instances where curve stitching is used for elementary and middle school mathematics. In more elaborate instances, string art has been used to introduce more advanced mathematical ideas such as Bézier curves. In this chapter, I present to the reader yet another mathematical instance that is associated with this

Related Content

Social Interactions in Online Gaming
Mark Griffiths, Zaheer Hussain, Sabine M. Grüsser, Ralf Thalemann, Helena Cole, Mark N.O. Davies and Darren Chappell (2011). *International Journal of Game-Based Learning (pp. 20-36).*
www.igi-global.com/article/social-interactions-online-gaming/60132?camid=4v1a

Blended Learning Internationalization from the Commonwealth: An Australian and Canadian Collaborative Case Study
Shelley Kinash and Susan Crichton (2013). *Cases on Cultural Implications and Considerations in Online Learning (pp. 101-132).*
www.igi-global.com/chapter/blended-learning-internationalization-commonwealth/68061?camid=4v1a

Using Game Mechanics to Measure What Students Learn from Programming Games
Jill Denner, Linda Werner, Shannon Campe and Eloy Ortiz (2014). *International Journal of Game-Based Learning (pp. 13-22).*
www.igi-global.com/article/using-game-mechanics-to-measure-what-students-learn-from-programming-games/117696?camid=4v1a

Designing Tutorial Modalities and Strategies for Digital Games: Lessons from Education