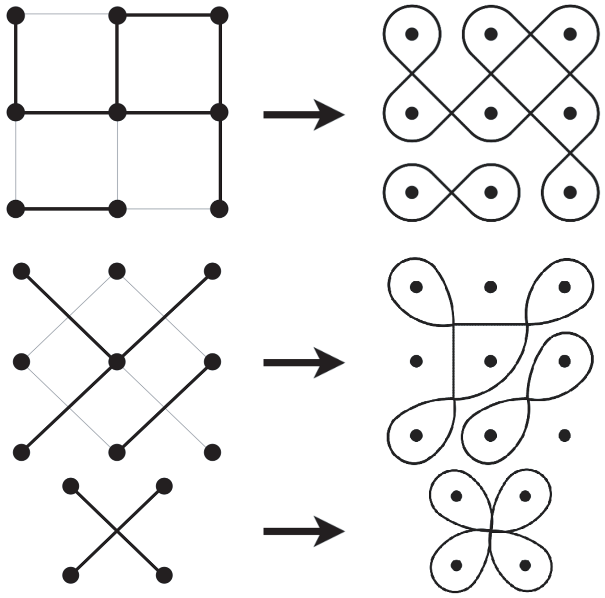

Fig. 8. An extrapolation of the N-line technique to the diagonal kolam space. Examples of (a) Orthogonal N-lines (b) Diagonal N-lines, and (c) a unique challenge that diagonal patterns cause. Note that diagonal N-lines cross, and crossing breaks Yanagisawa and Nagata's first rule (lines never retrace the same route). Despite this rule-break, the pattern (c) is found in practice in Tamil Nadu.

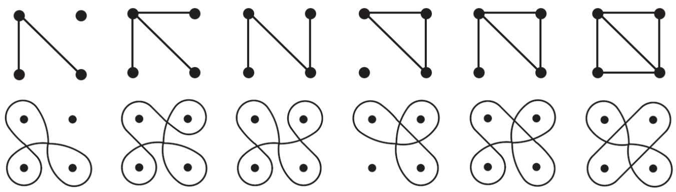

Fig. 9. The unique set of six mixed-gesture kolam patterns on a 2×2 matrix. Of the 32 total possible mixed-gesture patterns, only these six patterns and their rotational or chiral duplicates (N-lines displayed above each pattern) do not violate the no-retrace rule, and also contain both orthogonal and diagonal gestures.

tile-based approach to kolam construction to compute the size of kolam design space for dot matrices of various dimensions. Below, I expand upon this approach by including the additional fundamental position and orientation information from the diagonal gestures. The calculations are not influenced by transitional or stylitic gesture sets because neither add new fundamental positions or rotations to the starting and ending points of gestures. Nonetheless, stylistic differences in kolam design are a prominent and important means by which kolam artists distinguish their work.

To calculate the growth of design space that diagonal gestures allow, I follow Yanagisawa and Nagata's (2007) method. Yanagisawa and Nagata calculate the size of design space for orthogonal space-filling kolam by designating crossing points between dots, and represent kolam patterns using a navigating line, or N-line, around with kolam loops are systematically drawn. Orthogonal kolam patterns have one crossing point between every two orthogonal nearest-neighbor dots. There are thus four orthogonal crossing points in a 2×2 square dot matrix, and 16 crossing points in a 1-5-1 diamond matrix. Since the lines on each point either cross (1) or do not (0), the total number of possible orthogonal patterns in any size or shape dot matrix is simply, 2 raised to the number of orthogonal crossing points, c_o. Nagata (2006) calculates c_o for a rectangular grid as 2nm-n-m, where n and m are the length and width of the dot matrix measured in dots. Diagonal kolam gestures, by contrast, begin and end in the middle of four neighboring dots (Fig. 4b), and thus there are fewer diagonal crossing points, c_d, per dot. By combining these two sets of binary crossing points we arrive at a total of six binary crossing points on a 2×2 dot matrix for the extended lexicon (Fig. 7).

Yanagisawa and Nagata's N-lines help to visualize the realization of a kolam pattern across a given matrix. Figure 8 highlights the differences between the N-lines for both orthogonal and diagonal lexicons. Because diagonal crossing points overlap, so do diagonal N-lines, causing a conflict with standard kolam theory. Figure 9 catalogs a complete set of unique mixed-gesture kolam patterns on the 2×2 matrix.

5. Results

Analysis reveals both theoretical and empirical benefits of the extended SLK lexicon. The theoretical value of the extended lexicon is that it allows researchers to explore a larger space of possible SLK patterns. Table 1 enumerates the possible patterns using the extended lexicon for a few rectangular matrices, and provides the forumulae for the computations. The orthogonal kolam space constrains