Anna M. Chupa **Michael A. Chupa**	**Juxtaposes: Visual Granular Synthesis, Vernacular Architecture, and Girih Tilings** **Paper + Installation**

Abstract:

For GA2014, we produced *Wearables* using textile designs based on Islamic girih tilings constructed with bilateral symmetries using a subdivision rule to render self-similar designs. For GA2015, this textile-based work has found another avenue of expression in *Juxtaposes*, blending visual samplings of neighbourhood vernacular architectural deposits and two-dimensional Girih tilings. Using a process similar to granular synthesis in the audio realm, architectural ornamentation is sampled and reconfigured at varying spatial scales and orientations to create visually ambiguous compositions representing a neighborhood's essence. These architectural elements are blended with biomorphic structures found in the neighbourhood to produce texture mappings for Girih tilings placed alongside the more familiar forms from the built environment.

Topic: Art

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Keywords: Girih, tiling, vernacular

Juxtaposes: Visual Granular Synthesis, Vernacular Architecture, and Girih Tilings

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Pieces, Petals, Leaves and Eaves is a collection of textiles designed from photographs of flowers, foliage and vernacular architecture in historical Pennsylvania neighborhoods, specifically Allentown, Bethlehem, Harrisburg and Philadelphia. The textile designs are digitally printed on cotton and silk fabrics for wall hangings. For *Juxtaposes*, we will discuss the cotton pieces. These are quilted using a longarm quilting machine with hand-guided techniques and are displayed as wall hangings. The images are constructed with three basic elements or juxtaposes:

1. A girih tiling background in which architecture and botanicals are sampled at various scales, where sampling equals naïve granular selection with the addition of edge/object detection, (see Figure 1, left)
2. Architectural elements selected out from photographic images based on object/subject features and composited into a new urban landscape, (see Figure 1 center), and
3. A transitional layer with opacity and alpha blending between the girih "sky" on top and architectural montage on the bottom. (see Figure 1, right)
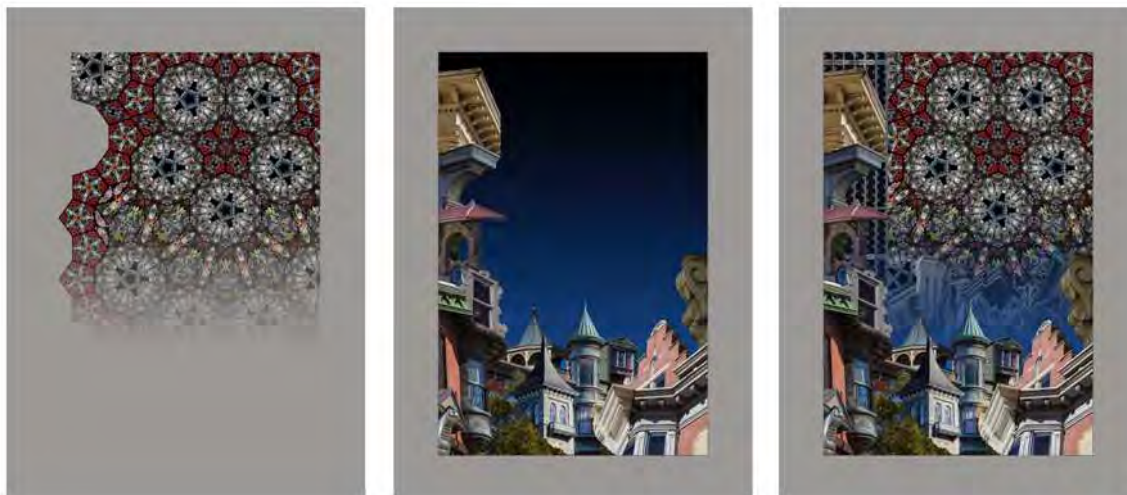

Figure 1. Three image elements.

The word *girih* is an Arabic word for knot used by Peter J. Lu in his 2007 paper on Decagonal and Quasi-Crystalline Tilings in Medieval Islamic Architecture. [vii] The visual "grains" selected for each of the three image elements evoke granular synthesis in the audio domain [viii], especially the techniques for remixing grains in varied order and at various physical scales.

The girih tile set consists of five tiles (see Figure 2): a regular decagon, a regular pentagon, a rhombus, an elongated hexagon and a bowtie (concave hexagon). Typically, these tiles are flat-colored. Our tiles are filled with photographically based floral still life compositions juxtaposed with architectural fragments from Pennsylvania urban neighborhoods of Philadelphia, Harrisburg, Allentown and Bethlehem. The effect of

applying photographic textures to the girih tiles is to break the several rotational and line symmetries possessed by flat-colored tiles. This symmetry-breaking exercise preserves some of the geometric symmetries, but removes others, injecting visual energy into the tiling composition.

Figure 2. Set of five girih tiles with image textures.

Vernacular architectural elements that make up the bottom montage portion of the composition come from the same neighborhoods. Most of the details are from rooftops and upper floors, hence the use of eaves in the title. The space created is fanciful but plausible where buildings and parts of buildings maintain their vertical orientation. There are scale discontinuities and reflections over a vertical axis but no rotations. Depth is compressed as in Byzantine mosaics and lighting is often arbitrary; that is, image and subimage selection and juxtaposition was performed without regard for synthesizing a realistic tableau with consistent light direction and intensity. During the compositing process edges are enhanced or hidden using alpha blending. There are distinct compositions for each neighborhood such that the characteristics of vernacular architecture in Bala Cynwyd and Mantua (see Figure 3) in Philadelphia are readily recognizable. Other neighborhoods that have been completed are West Park in Allentown, South Bethlehem in Bethlehem, and Belleview and Downtown in Harrisburg. Vernacular architecture of northeastern Pennsylvania largely dating from the early 20th century is emphasized.

> The architectural description "vernacular style" is often used to describe all non-architect designed buildings, or hybrids displaying bits and pieces of various styles. This term is used to describe workaday urban housing forms like row houses and duplexes and also utilitarian single family dwellings lacking any particular stylistic elements. …In truth, vernacular buildings include a wide array of structures across a long span of time. [ix]

Figure 3. Mantua (L) and Bala Cynwyd (R) compositions.

Of particular interest to us are details such as cornice mouldings, dentils, gingerbreading, grilles, distinctive brick work and other decorative motifs, the "bits and pieces" of a broad range of styles. To this we add garden photography gathered from the same neighborhoods.

The next part of the process is isolating details in Photoshop, rotating and flipping them to create complex tiling symmetries to fill a surface. The architectural detail is utilized twice, first stacked in a montage to create a landscape albeit with scale and lighting discrepancies, and second on the insides of tiles.

As the architectural montage at the base and the girih "sky" at the top of the composition seem unrelated visually, a transition is needed to tie them together. A gradient fade applied between the girih tiling and the architectural sampling layers provides a transition between fading girih tiles and apparent atmospheric perspective in the top of the architectural landscape.

Figure 4. Transition region with gradient fade.

Each image in this series distills the structure of background space or universe (the non-built elements of the neighborhoods under study) into a two-dimensional tiling that compresses space even further, and which provides an abstraction incorporating architectural and botanical elements at radically different scales. Operations on the girih themselves include free and restricted rotations and reflections. Scaling is achieved through two level designs whereby what is created at the smaller scale repeats on a larger scale that extends past the frame. Image-based operations within each girih include retouching, color-balance and luminosity changes, and alpha operations for blending, overlapping and drop-shadows.

Quilted borders are generated from collected leaves. The gingko is one of the most ancient species still extant. The pebble fill is a common quilting filler. Given the absence of negative space in the main composition, a suitable border needed to have detail without competing with the composition.

Figure 5. Ginko leaf and "pebbles" border

In order to achieve this result, the thread color matches the border color, which was also selected from one of the fragments of architecture in the girih tiles. (See Figure 5) The border has both trapunto effects and dense surface pebbling. All of the image borders will have leaves collected from the Northeastern Pennsylvania region.

While each of the images incorporates grain selection and sampling to produce each of the three image elements, our naïve granular selection actually begins with location-based photographic image collection. Objects and parts of objects are selected with the camera by the photographer. The camera is not used to frame a finished composition; it is only used to collect objects. This habit of selecting on the basis of aesthetic choice is uniquely human, so much so, that Ellen Dissanayake labels our species Homo Aestheticus. [x] There are records of prehistoric collections of objects that have no other purpose other than their apparent beauty, shells, colored stones much the same as we collect shells at a beach. This selection process happens in camera with the flowers, leaves, and pieces of architecture to be used in montage. The aesthetic recognition and selection of distinctive properties is not a chance procedure. The single flower in the camera frame is the first grain in the visual granular synthesis of work produced here.

Acknowledgements

We gratefully acknowledge the following sources of support for this work:

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2 Roads, Curtis. *The Computer Music Tutorial*. Cambridge and London: The MIT Press, 1996.

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