Visualizing Rhyme Patterns in Sonnet Sequences

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Abstract

In this paper I visualize rhyme patterns of sonnet sequences as rectangular colored bands. My examples from three different poets, Sir Philip Sidney (1554–1586), William Wordsworth (1770–1850), and Rainer Maria Rilke (1875–1926), demonstrate the expressive freedom poets have even under the constraints of rhyme patterns for sonnets. These colored bands in the plane provide a comprehensive view of dozens of sonnets at a glance. In the second half of the paper I use the colored bands just for their visual effect, "painting" them onto surfaces in space. Appropriate choice of parameters for a band produces a self-intersecting surface while keeping the band sequence intact. When the band of rhyme patterns is wrapped around a surface, covering the same surface mesh periodically, small computational differences in the coordinates of the mesh points can lead to intriguing, non-uniform color patterns.

Introduction

This paper is an expansion and continuation of Section 4 of my paper [1]. In the first part of the current paper I introduce basic terminology and fundamental properties of sonnets and present visualizations of the following three sonnet sequences: (1) *Astrophil and Stella* by Sir Philip Sidney [2], written in the early 1580's and published in 1598, (2) *Ecclesiastical Sonnets* by William Wordsworth [3], as published in 1822, and (3) *Die Sonette an Orpheus* by Rainer Maria Rilke [4], written in 1922 and first published in 1923. The three sonnet sequences comprise 108, 132, and 55 sonnets, respectively, and I present them horizontally, left to right, with the rhyme patterns top down. In the second part of the paper I only consider Rilke's *Die Sonette an Orpheus* for the design of 3-dimensional images of rhyme patterns along smooth closed curves and projected on surfaces. Rilke uses a large number of rhyme patterns so that, in my view, the colored bands abstracted from his poetry have a visual impact far greater than the more conservatively uniform patterns employed by Wordsworth and, particularly, by Sidney. I hope to be able to illustrate Rilke's poetic genius by combining two disparate elements: the rectangular flat bands that represent sequences of rhyme patterns of individual sonnets by these poets, and the smooth curves to which the bands are tethered or the surfaces on which they are laid out.

I use Mathematica for all computations, transformations and graphics rendering. The 2-dimensional bands are represented as matrix grids of colored squares. In the 3-dimensional images the squares are transformed into rectangles so that the entire band fits the arc length of the closed curve along which the band is rendered and into general quadrangles on surfaces. I represent the closed curves by parametric equations and compute tangents and normals along the closed curves parametrically [5].

Visualizing Sonnet Sequences as Colored 2D-Bands

Giacomo da Lentini, employed at the court of emperor Frederick II, invented the sonnet form in the 13th century. A century later Francesco Petrarca (1304–1374) used the form in the collection called *Rime sparse* (366 love poems written 1327 through 1374) that has immensely influenced poets from the Renaissance to the present. A Petrarchan sonnet consists of 14 lines that are generally divided into 2 groups of 4 lines, called the quatrains or the octave, and 2 groups of 3 lines, called the tercets or the sestet. Literary tradition represents rhyme sounds by the consecutive letters of the alphabet: "a", "b", "c", … , where "a" always represents the first rhyme sound, "b" the second, etc., in the sonnet. Typical Petrarchan

sonnets have the form “abba abba cde cde” or “abba abba ccd cdd” with sestets of 2 or 3 rhyme sounds while William Shakespeare (1564–1616) employed the pattern “abab cdcd efef gg” of 7-rhyme sounds divided into 3 quatrains and a final couplet [6].

Figure 1 makes immediately visible that Sir Philip essentially adheres to the structural requirements of the octave in the Petrarchan sonnet form: of the 108 sonnet forms, 75 are “abbaabba”, 25 are “abababab”, only 7 use the mirror “ababbaba” and just 1 sonnet uses the mirrored “abbabaab”. In contrast, the sestets in all but 5 sonnets have 3 rhyme sounds, and all but 23 sonnets end in a couplet. Even though 82 sestets ending in a couplet follow the pattern “xyxyzz” later used by Shakespeare the 2-triplet Petrarchan form “xxzyyz” is well represented. For example, the extraordinary 2-sound sonnet #89 that expresses the antithetical roles of "day" and "night," uses just these two words as rhyme words. |

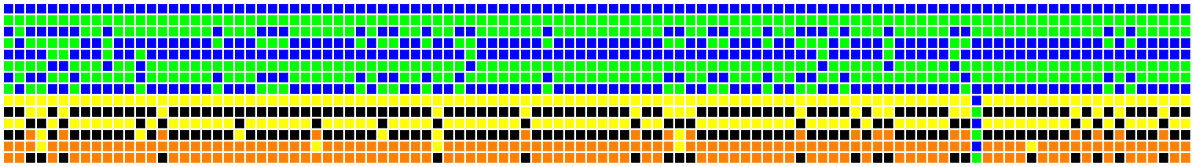

Figure 1: *Rhyming patterns of Sidney’s 108 sonnets in “Astrophil and Stella” as a colored band.*

In the early 19th century the romantic poets revitalized the sonnet form. Figure 2 shows the sequence of 132 sonnets by William Wordsworth as published in 1822 [3]. In this rendering we clearly see Wordworth’s adherence to the tradition of Petrarch with its near uniform consistency of two patterns in the first two quatrains – “abbaabba” occurring 55 times and “abbaacca” 65 times – though sonnet III.21 starting with four sounds, “abbacddc”, is a unique exception. In contrast there is the extraordinary variety of 22 distinct rhyme patterns for the sextet/quatrain-couplet endings of the sonnets, 18 of which end in a couplet, 37 have only 2 rhyme sounds, while only 4 sestets are in the Petrarchan “cdecde” pattern. Of the 132 sonnets 51 have 6 rhyme sounds while 64 sonnets have 5 rhyme sounds and only 17 have 4 sounds while Shakespeare’s sonnets commonly have 7 rhyme sounds.

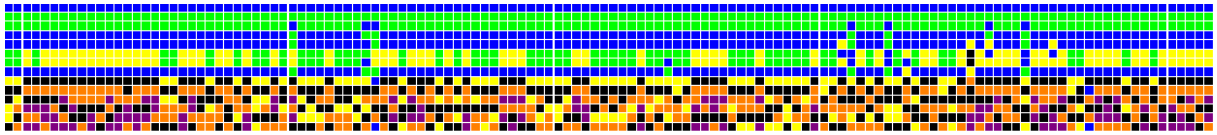

Figure 2: *Rhyming patterns of Wordworth’s 132 sonnets in “Ecclesiastical Sonnets” as a colored band.*

The final example of Rilke’s 20th century sonnet sequence shows even more variety in the rhyme patterns of the sonnets. The first two quatrains in 53 of the 55 sonnets of the sequence have 4 rhyme sounds, just as in the Shakespearean pattern; indeed, Rilke uses 5 of the 9 possible (see Table 3 in [1]) distinct 4-sound rhyme patterns with the Shakespearean “ababcdcd” occurring 31 times.

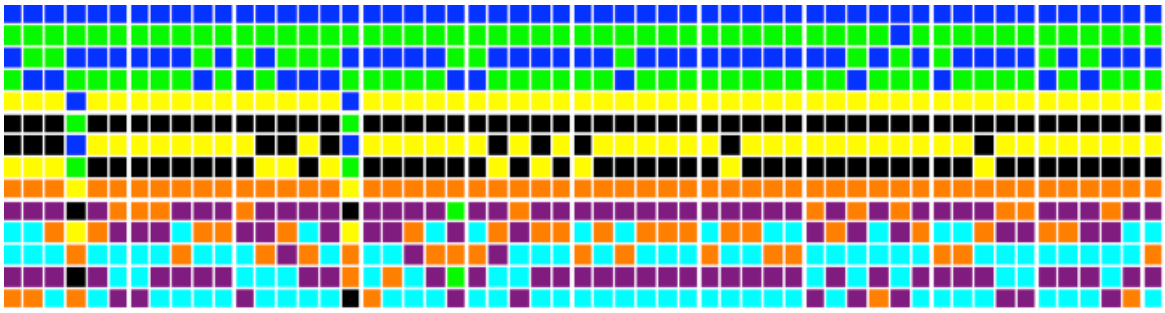

Figure 3: *Rhyming patterns of Rilke’s 55 sonnets in “Die Sonnette an Orpheus” as a colored band.*

Rilke uses 11 of the 15 possible (see Table 2 in [1]) distinct 3-sound rhyme patterns in the sestets of the 55 sonnets in the sequence, and all sestets have 3-sound rhymes. Rilke wrote the first part of the sequence in a few days and, after a short interlude, wrote the second part in a few days. It is interesting to note that all 11 patterns occur already in the 26 sonnets of the first part. He used only 5 of these patterns in the second part of 29 sonnets. In addition, there are only 4 exceptions to the 4-4-3-3 pattern, all in the first part. Rilke uses the maximum of 7 paired rhyme sounds possible in the sonnet structure in all but 3 of the sonnets (#4, #17 & #22) in the sequence. They stand out in the band visualization of the sonnet sequence.

One additional structural requirement for the standard form of a sonnet is that each line must have 5 stressed syllables that alternate with unstressed syllables so that each line generally contains 10 syllables. Sir Philip and Wordsworth adhere to that requirement while Rilke's lines have between 5 and 14 syllables. Any attempt to visualize that aspect of Rilke's sonnet sequence would require another representational tool that, in my opinion, would distort the crispness and beauty of the colored band and obscure the rhyme patterns.

Rilke's *"Die Sonette an Orpheus"* as Closed, Colored Bands in Three Dimensions

Though the flat, rectangular 2D bands discussed in the previous section provide a unique view into the rhyme structure of sonnet sequences, I will use another mathematical concept to exhibit the beautiful patterns that the inspired language of the poet encodes in the bands. Imagine first a band with its mirror image where the axis of reflection is at the end of the sestets, thus resulting in two identically colored edges.

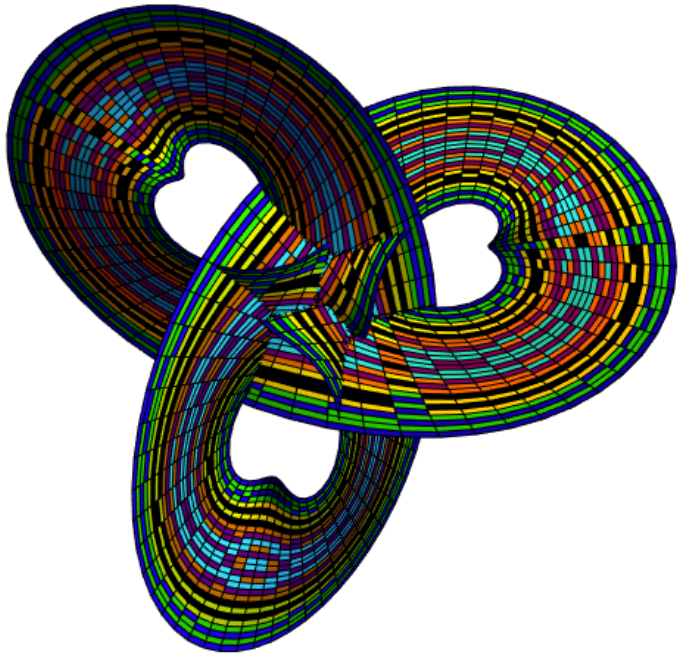

Figure 4: *Representation of Rilke's sonnet sequence in the normal plane of a trefoil*

The next step is to paste the center of the symmetric band along a smooth closed curve in 3-dimensional space. Among the many possible orientations I choose the osculating plane [5] for the resulting surface. Standard formulas from calculus are the basis for computing these planes for every sonnet in the sequence. Rilke's sonnet sequence commemorates the death of his daughter's young female friend. Because the title of the sequence evokes the Greek myth of Orpheus, Euridice and Hades, three figures entwined in tragedy, I choose the trefoil as the backbone of my image of the sonnet sequence.

With my next visual representation of Rilke's poem sequence, not tied to the three characters of the myth, I create a skewed color pattern on a surface in space that obscures the linearity as well as the orientation of the sonnet sequence. The equation f(s,t) = (cos(3t)*cos(s), sin(3t)*cos(2s), sin(t)) defines a self-intersecting surface that I cut open through its center. I compute the locations of the corner points of the squares of the 2D band in Figure 3, while wrapping the entire band around the surface three times, use equidistant subdivisions of the parameters defining the 55x28 surface mesh, and color the resulting quadrangles on the surface according to the rhyme pattern of the sonnet sequence. Small computational differences in the coordinates of the mesh points create the non-uniform colors on the mesh of Figure 5.

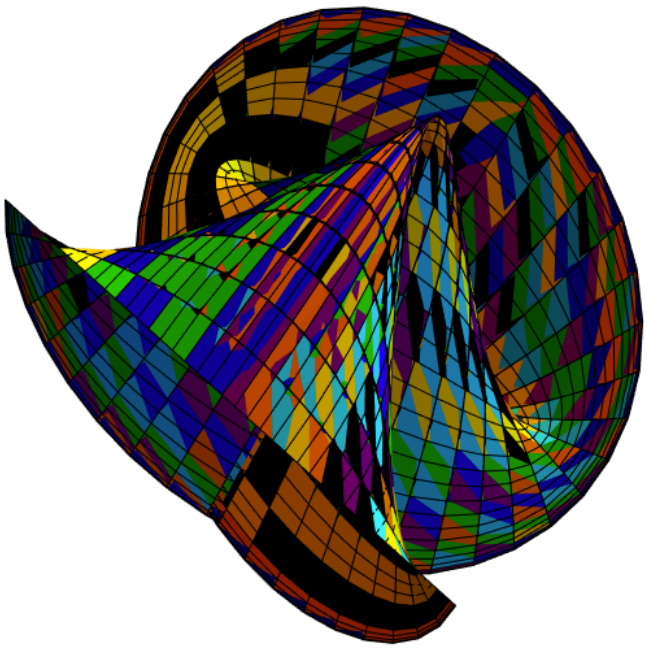

Figure 5: *Representation of Rilke's sonnet sequence on portions of a self-intersecting surface*

Conclusion

The 2D bands provide a visual qualitative, analytical tool to study patterns in sonnet sequences and may help us to understand their compositional structure. To my mind the images of poetry structures transformed into colored and patterned surfaces in 3D show avenues to endow abstract mathematical objects with ornamentations of emotive human expressions.

References

[1] Hartmut F. W. Höft, *Combinatorica Poetica – Counting and Visualizing Rhyme Patterns in Sonnets,* Bridges Banff Proceedings 2009, pp. 79–86, Tessellations Publishing, Phoenix, Arizona, 2009.

[2] Sir Philip Sidney, webpages http://www.theotherpages.org/poems/sidney01.html through http://www.theotherpages.org/poems/sidney05

[3] William Wordsworth, *Sonnet Series and Itinerary Poems 1820–1845,* Geoffrey Jackson, editor, Cornell University Press, Ithaca and London, 2004

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[5] James Stewart, *Calculus, 6th edition,* Chapter 11: Parametric Equations and Polar Coordinates, pp. 656–709, Thomson Learning Inc., 2008.

[6] Michael R. G. Spiller, *The Development of the Sonnet, An Introduction*, Routledge, London, 1992.