

Symmetry in Koloman Moser's *Flächenschmuck*

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Abstract

Koloman Moser's 1899 design *Forellenreigen* (Trout dance) may be the first published example of a tiling by animal shapes. In 1901, he published 29 periodic designs in *Flächenschmuck* (Surface Ornamentation). Here we analyze the wallpaper symmetries of these designs, noting in particular several instances of ambiguity.

Koloman Moser, born in Vienna in 1868, was one of the artists who (led by Gustav Klimt) formed the Vienna Secession¹ in 1897, breaking away from the traditional Künstlerhaus. As with the Art Nouveau movement in France and Jugendstil in Germany, a main emphasis was on the unity of fine arts and decorative arts. In 1903, Moser founded the *Wiener Werkstätte* (Vienna Workshop) along with Josef Hoffmann.

Moser and Hoffmann produced many designs for the fabric company Backhausen², which credits them with helping to “establish the company's success at the beginning of the 20th century,” and which still sells fabric with some of Moser's designs. The April 1899 issue [1] of *Ver Sacrum*, the journal of the Vienna Secession, was illustrated throughout by drawings of various designs Moser had made for Backhausen. It seems likely that the two designs in Figure 1 are the first printed examples of tilings of the plane by animal shapes, published several decades before M. C. Escher started creating his similar designs.

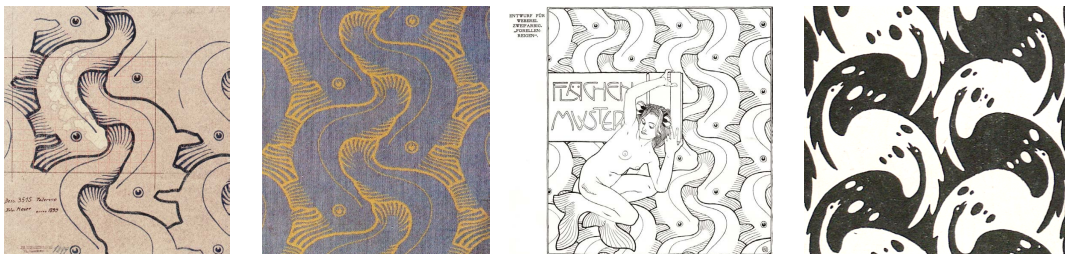


Figure 1: Moser's fabric design *Forellenreigen* (Trout dance). Far left, his original sketch on grid paper, from the Backhausen archives. Center left, some sample fabric. Center right, the print version from *Ver Sacrum*. Far right, the design *Der Vogel Bülow* (*The bird Bülow*), an exercise in figure–ground contrast, now sold by Backhausen under the name *Vogelkolonie* (*Bird colony*).

Both *Forellenreigen* and *Der Vogel Bülow* have $\times\times$ symmetry (in orbifold notation³), with glide lines running vertically. *Der Vogel Bülow* is the first of many examples we will see with two-color symmetry, here $\times\times / \times\times$. (A label of the form G/H names the full group G , including color-reversing symmetries, and the index-two normal subgroup H of color-preserving symmetries.) Here, every second glide line is color-reversing. That issue [1] of *Ver Sacrum* also includes two Moser designs (not for fabric) that have rotational symmetry (Figure 2). One is for an asymmetric wall tile that should be repeated in all four orientations to create a pattern with 442 symmetry. The other almost has 442 symmetry, but near what would be one of the four-fold centers there is only two-fold symmetry; thus the symmetry group is 2222.

¹ <https://www.theviennasecession.com>

² <https://www.backhausen.com>

³ https://en.wikipedia.org/wiki/Orbifold_notation#Wallpaper_groups



Figure 2: Two of Moser's designs from [1], with symmetries 442 (left) and 2222 (right).

Starting in 1900, Martin Gerlach published a periodical *Die Quelle* (The Source), with each issue devoted to prints by a particular artist. The third issue, entitled *Flächenschmuck* (Surface Ornamentation) [2], is from 1901 and consists of 29 color plates with periodic designs by Koloman Moser, each (with one exception) labeled for a particular use. These are listed in Table 1 (in the order they appear in *Die Quelle*), along with their symmetry groups, which cover eight of the 17 wallpaper groups. We now proceed to examine most of these in more detail, highlighting certain cases where the symmetry analysis can be considered ambiguous.

Table 1: The 29 plates in *Flächenschmuck* with their symmetry groups and stated purpose.

| | | | | | |
|---|---------|---|---|-------------|---|
| <i>Sternblume</i> (Star flower) | ★× / ★★ | Vorsatzpapier (book endpaper) | <i>Arlette</i> (Arlette) | ○ / ○ | Seidengewebe (woven silk) |
| <i>Mondblume</i> (Moon flower) | ○ | Möbelstoff (woven upholstery) | <i>Goldfische</i> (Goldfish) | ★× / ★★ | Wandbehang (wall hanging) |
| <i>Donauwellen</i> (Danube waves) | ×× | Wanddekor (wall decoration) | <i>Arachne</i> (Arachne) | ★333 | Möbelbezug (upholstery cover) |
| <i>Scylla</i> (Scylla) | ★× / ○ | Wanddekor (wall decoration) | <i>Aganippe</i> (Aganippe) | ×× / ×× | schablonierter Wanddekor (stenciled wall decoration) |
| <i>Rosenlaube</i> (Rose bower) | ○ | Farbschablone (color stencil) | <i>Masken</i> (Masks) | ★× / ★★ | Tapete (wallpaper) |
| <i>Die Reifezeit</i> (Maturing time) | ×× | Wandbehang (wall hanging) | <i>Rothe Beeren</i> (Red berries) | ○ (4★2) | Seidengewebe (woven silk) |
| <i>Liebesflügel</i> (Wings of love) | ×× | bedruckte Seide (printed silk) | <i>Ein Marienitag</i> (Mary's day) | ○ | Buntpapier (colored paper) |
| <i>Sigalion</i> (Sigalion) | ★× | Tapete (wallpaper) | <i>Silvanus</i> (Silvanus) | ○ | bedruckter Stoff (printed fabric) |
| <i>Zephyrus</i> (Zephyrus) | 2★22 | bedruckte Seide (printed silk) | <i>Frau Nolde</i> (Madame Nolde) | ×× | gewebter Wandbehang (woven wall hanging) |
| <i>Die tausend Raben</i> (A thousand ravens) | ×× / ×× | Vorsatzpapier (book endpaper) | <i>Die reciproken Tänzerinnen</i> (Reciprocal dancers) | ★× / ★★ () | |
| <i>Goldene Schmetterlinge</i> (Golden butterflies) | ★× | Tapete (wallpaper) | <i>Acricola</i> (Acricola) | ★333 | Bodenbelag (flooring) |
| <i>Neptun</i> (Neptune) | ×× | gewebter Bodenbelag (woven carpet) | <i>December</i> (December) | ○ | Wanddekor (wall decoration) |
| <i>Wunschhütlein</i> (Little wishing cap) | ×× / ×× | Gewebe in zwei Farben (fabric in two colors) | <i>Phantasmus</i> (Phantasos) | ★333 | Bodenbelag (flooring) |
| <i>Eurystheus</i> (Eurystheus) | ★632 | Bodenbelag (flooring) | <i>Alymene</i> (Alymene) | ★× | Tapete (wallpaper) |
| | | | <i>Astarta</i> (Astarta) | ★× | Tapete (wallpaper) |

All but six of the 29 plates use one of the four symmetry groups without rotations: ○, ××, ★× or ★★. Indeed, vertical glide reflections seem to be a particular favorite of Moser's. The symmetry group ★★ occurs only in four prints (Figure 3) with two-color symmetry ★× / ★★. Including these four and *Scylla* (Figure 4 left), we find a total of 17 prints with either ★× or ×× symmetry; eleven of the twelve plates intended for use on walls are in this group.

Of the thirteen wallpaper groups with nontrivial rotations, only four are found in Moser's collection, even with very generous interpretation. Figure 4 shows the three examples that can be seen as having 2★22 or 4★2 symmetry (at least when certain details are ignored). The other four prints with rotations (Figure 5) have symmetry group ★333 (*Arachne*, *Acricola*, *Phantasmus*) or ★632 (*Eurystheus*). Note that all three designs labeled as *Bodenbelag* (flooring) are among these four. The only other design Moser intended for floor use, *Neptun* (Figure 5 far right, labeled as carpeting) has ×× symmetry, but is notable as being the one case printed with horizontal (rather than vertical) glide lines.

Let us now turn to the other seven prints with ×× symmetry, three of which are shown in Figure 6. Only in *Liebesflügel* is the symmetry straightforward. In *Donauwellen* and *Die Reifezeit*, there is only half as much symmetry as it might initially seem, since half the figures have their heads up and half down. The three prints *Aganippe*, *Wunschhütlein* and *Die tausend Raben* have two-color symmetry ×× / ××. In the last of these, the ravens seems quite close in style to some of Escher's much later animal tilings.



Figure 3: Four prints from *Flächenschmuck* can be interpreted as having two-color symmetry $\star\times / \star\star$. In *Die reciproken Tänzerinnen* (far left) this is unambiguous. In *Masken* (center left), white and purple are neutral colors, not exchanged by the glides exchanging beige and yellow. In the case of *Goldfische* (center right), we are ignoring the dot patterns within the white circles, preserved only by translational symmetries \circ ; we also must replace the vertical strips they lie in by a neutral color to see the two-color symmetry. In the case of *Sternblume* (excerpt, far right), the glides do not reverse colors of the dashed white hexagons along the glide lines; this print also has many elements suggestive of 3-fold symmetry.



Figure 4: *Scylla* (left) is a four-color pattern. Only translations (\circ) preserve colors; various vertical glide reflections interchange different pairs of colors. If we ignore the pattern within each leaf-shaped tile and just look at the tile boundaries, we see $2\star 22$ symmetry, which is found unambiguously in *Zephyrus* (excerpt, center). *Rothe Beeren* (right) is based on the snub square tiling of the plane, with berries at the vertices and branches along the edges of this semi-regular tiling by squares and triangles. The tiling's $4\star 2$ symmetry is broken, however, by the details of the berries and leaves, leaving just translational symmetry \circ .

The final print with $\times\times$ symmetry – *Frau Nolda*, shown in Figure 7 – is a special case. At first glance it also seems to have twice as many glide lines as really exist. Indeed, a website that gives perhaps the only previous discussion of symmetry in Moser's work⁴ gets the analysis of *Frau Nolda* wrong, despite having “corrected” a presumably more serious error in 2012.

Among the six prints not discussed so far, all with simple translation symmetry \circ , *Arlette* is notable for having two-color symmetry \circ / \circ , while *Ein Marienitag* is notable for not using a rectangular lattice of translations, but instead an irregular lattice with no vertical vector.

Moser's 29 plates from *Flächenschmuck* are interesting and varied examples of symmetric designs, often using animal and floral motifs. Moser restricts himself, however, to a relatively limited selection of the possible wallpaper groups and two-color groups. Moser was consciously designing for particular practical uses; he preferred vertical glide symmetry for vertical surfaces, typically viewed from a fixed angle, while he used symmetry groups with many rotations mainly for floor designs, which get viewed from all directions.

⁴ <https://www.opticalillusion.net/optical-illusions/a-tessellation-pioneer/>



Figure 5: Eurythmus (far left) is the one print with $\star 632$ symmetry. Among the three with $\star 333$ symmetry, two are for flooring, including Phantasmus (center left), while one, Arachne (excerpt, center right), is for upholstery. Moser's one carpet design, Neptun (excerpt, far right), has $\times\times$ symmetry with horizontal glide lines.



Figure 6: Since half the women in Donauwellen (left) are looking down, there are glide lines through their heads but not their backs. The most obvious glide lines in Wunschhütlein (center) are the color-reversing ones through the middles of the tiles. In Die tausend Raben the color-reversing glides go near the birds' beaks.

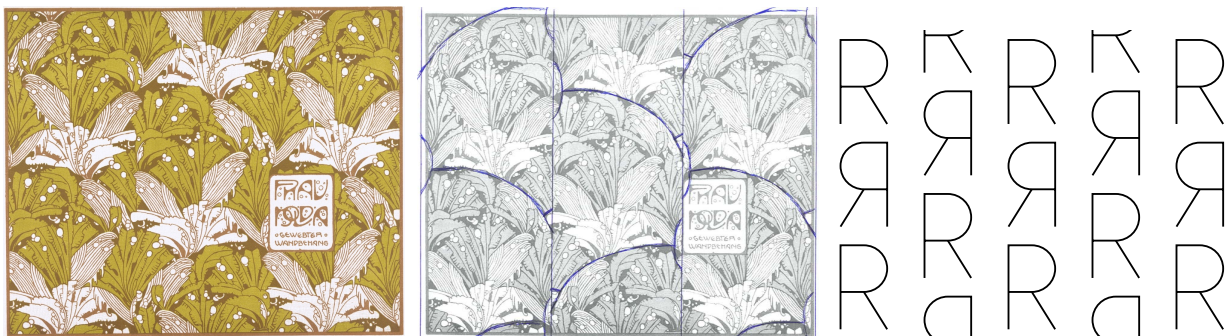


Figure 7: In Frau Nolda (left), it is tempting to see more symmetry than really exists. Center, a decomposition into large tiles (with congruent designs) and small bits (triangles and thin circular segments) with two different designs depending on context. The glide lines run halfway between the vertical blue lines (which are not glides). Right, a similar pattern of 'R's, where a fundamental domain consists of two letters, not just one. Note that half the 'R's (like half the tiles in the center image) are back-to-back with a higher 'R'.

References

- [1] Vereinigung Bildender Künstler Österreichs, *Ver Sacrum*, vol. II, no. 4, Gerlach & Schenk, Vienna, April 1899. Scans available in various online repositories:
<http://bluemountain.princeton.edu/bluemtn/?a=d&d=bmtnabf189904-01>
<http://anno.onb.ac.at/cgi-content/anno-plus?aid=vsa&datum=1899&pos=115&size=45>
- [2] K. Moser, *Flächenschmuck*, vol. 3 of *Die Quelle*, ed. M. Gerlach, 1901. High-resolutions scans available on Wikimedia and from the Cooper-Hewitt museum:
<https://collection.cooperhewitt.org/people/18044047/objects/>