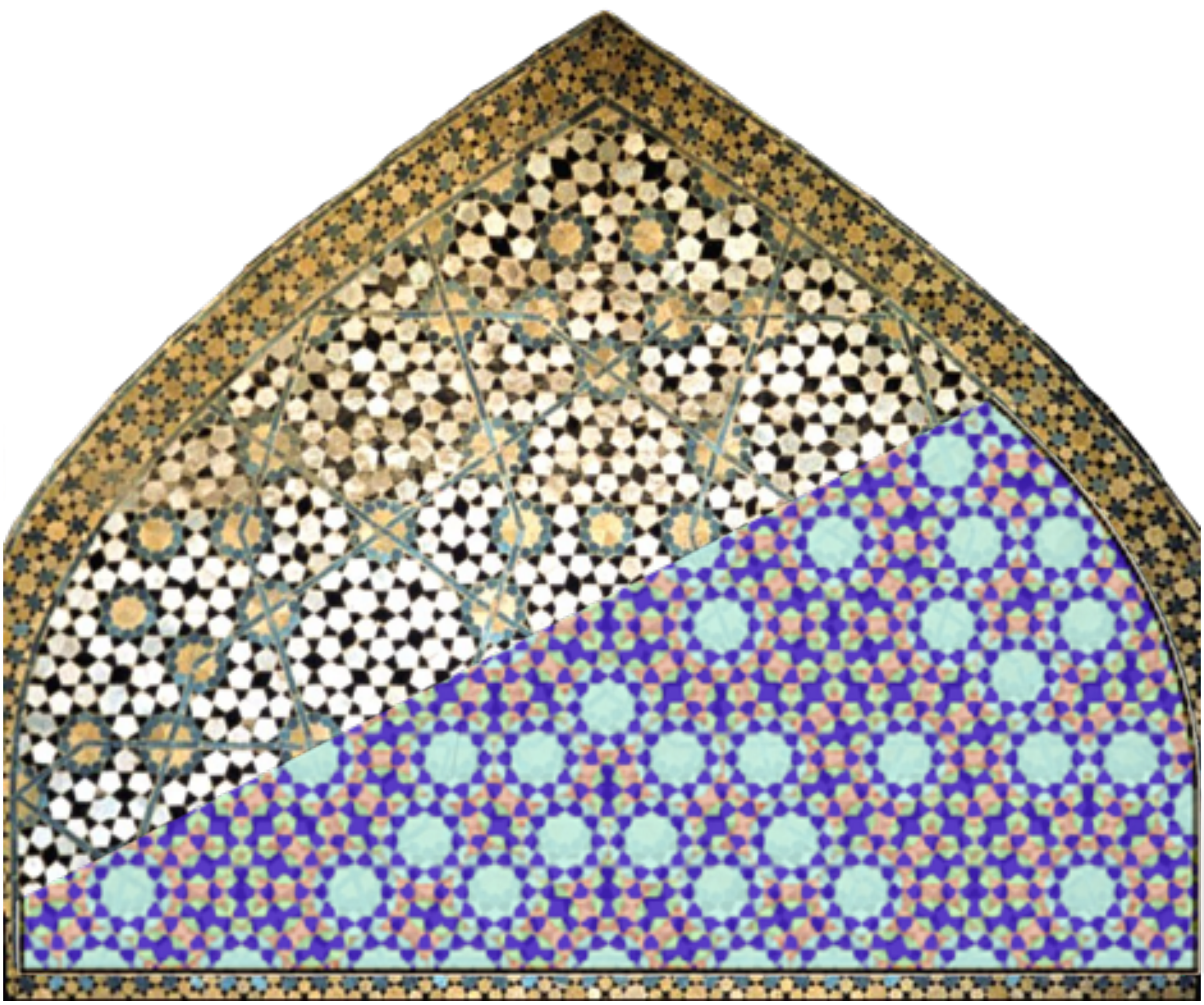
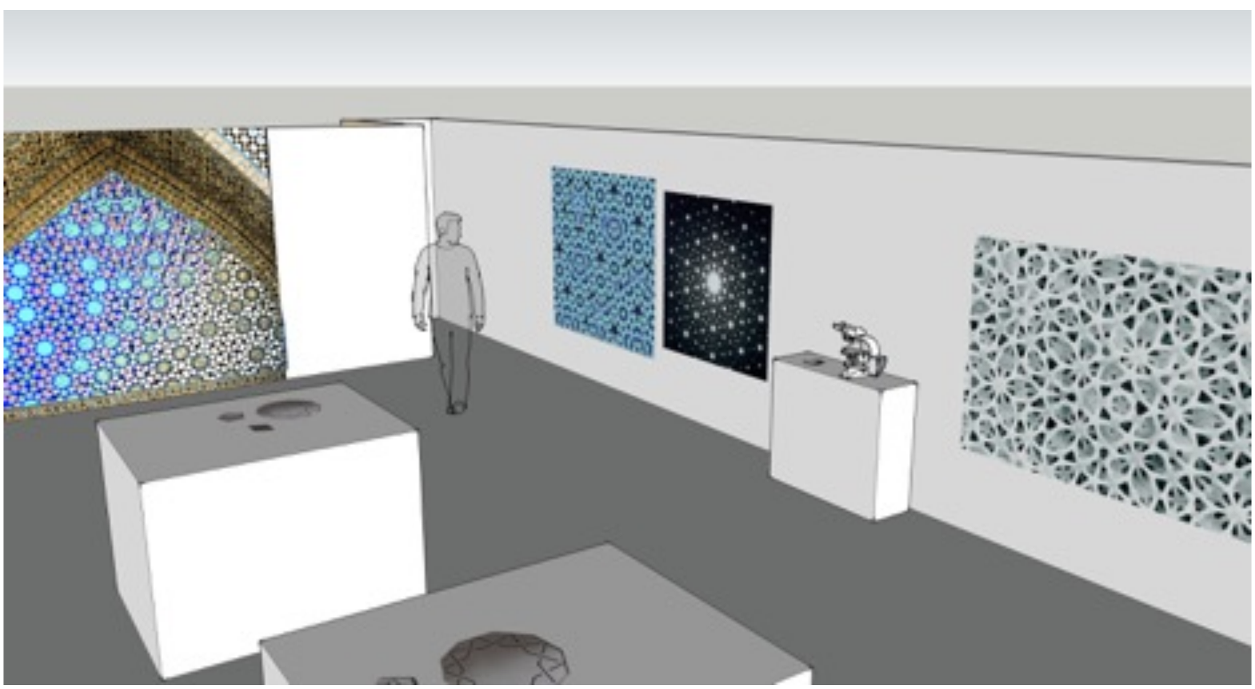
Islamic Symmetries

Oct.14 - Nov. 23

Gallery 318



Situated on your local University campus, the Gallery 318 curates interdisciplinary shows, hoping to attract students, faculty, and visitors alike regardless of their areas of interest. We provide an interactive environment with the sole goal to educate all who walk through our doors. Our latest exhibition explores the similarities between Medieval Islamic art and modern quasi-crystallography.



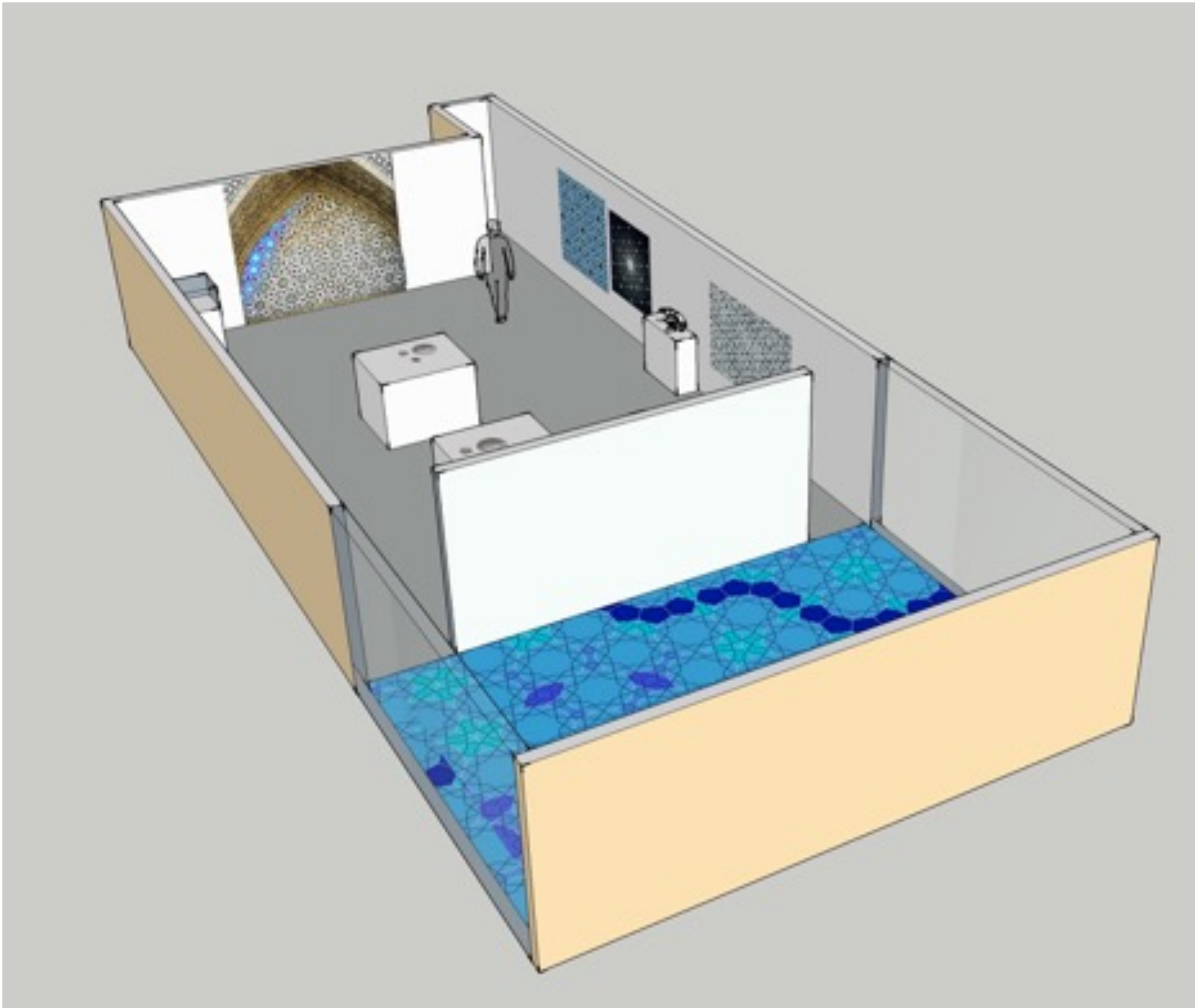
This exhibit bridges the gap between science, engineering and art. These fields of study have entered the popular landscape as vastly dissimilar, but this is simply not true. During the Italian Renaissance in the quattrocento, art and science were studied in conjunction, one enforced the other. As both fields became fragmented and more specialized, the crossover decreased. However there are moments of interdisciplinarity among the fields which present a fascinating view of humanity. The inherent human physiological attraction to symmetry and pattern neatly bridges the gap between seemingly disparate fields of study.

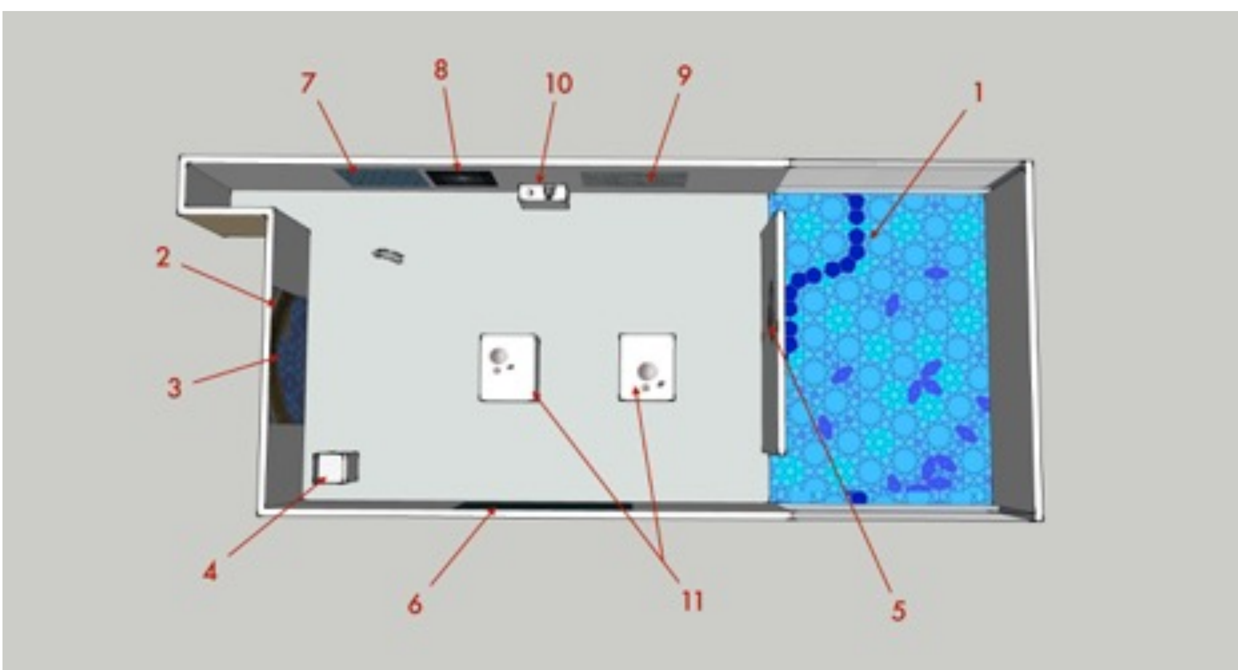
In the 1970s, Roger Penrose developed an algebraic theory of non-periodic tiling. This so called Penrose tiling explored a new form of geometric repetition. The tiling allowed for no translational symmetry thereby requiring the use of a limited arsenal of shapes while maintaining varying and interesting patterns. In early 2007 a new study by a graduate student in the physics department at Harvard likened Medieval Islamic tile patterns to Penrose tiles and the modern study of quasi-crystallography. While on vacation in the middle east, Peter Lu noticed a familiar pattern in the tile work of some ancient Islamic monuments. The pattern reminded him of his research in quasi-crystalline materials.

This close similarity in Penrose's patterns and Islamic art and architecture of 500 years previously, draw attention to the mathematical advances pioneered by the Medieval Islamic Empires. The Islamic girih tile patterns were put to use in about 1200 AD and saw augmented complexity and improvements in the mid 1400s. Girih tiles use five base shapes to create non-repeating designs that nonetheless maintain a continuity and order despite their complex symmetry. This unusual symmetry has gained notoriety in recent years in the synthesis of quasi-symmetric crystals and materials, the discovery of which earned a Nobel Prize in Chemistry in 2011.

The symmetry present in Islamic tiling, Penrose patterns, and quasi-crystals, represent a qualitative description of diffraction patterns. From a mathematical standpoint these physical phenomena can be represented by using Fourier transforms. Fourier transforms decompose a signal into its parts, the most accessible way to think of this is by listening to a single musical note. Though we identify the note as a single distinct sound, it is really a sum of sounds that are combined. When Fourier patterns are visualized, the geometric symmetry can follow the same five fold symmetry as the Penrose and girih tile patterns.

The relevance of quasi-symmetry today exalts the virtues of scientific achievements in the Islamic world. Western science and culture often discounts early eastern discoveries as primitive and misinformed. Discoveries such as the girih tiles are therefore surprising, but more importantly highlight the depth of cross-disciplinary knowledge that is often overlooked. In a world so deeply enthralled in the convenience of technology, it is important to engage our creativity and engage in making connections between even the most far flung subject areas.

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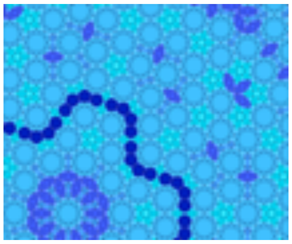
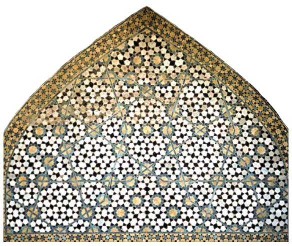
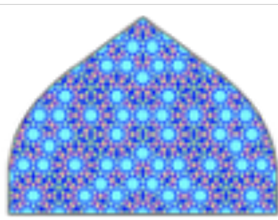
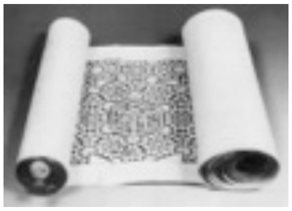
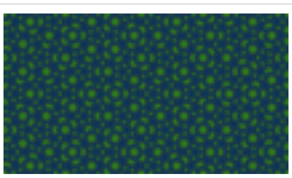
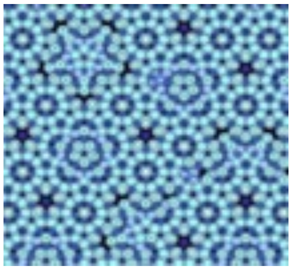
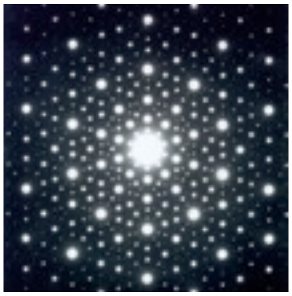
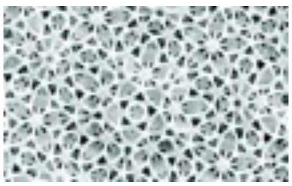
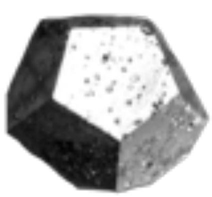
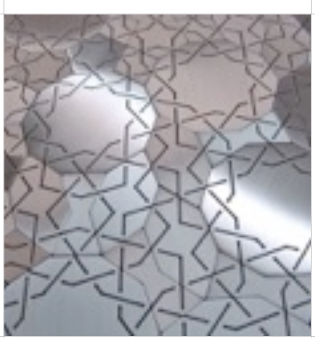
1		Modern reconstruction of a pattern from the Topkapi scroll Tiles, foam? Built in house	—
2		Darb-e Imam 1453 photograph, printed of ceramic tile work 8ft X 9ft Commissioned	Located in one of Iran's most historically significant cities: Isfahan, the Darb-e Imam is a funerary complex with shrines, courtyards, and cemeteries. Initially built in 1453 by Jalal al-Din Safarshah during the reign of the Kara Koyunlu or Black Sheep Turkmen, in the Seljuq period. Built over several stylistic shifts, the courtyards and buildings represent a variety of architectural aesthetics. The tile work shown is taken from the complexes entrance. There are a few instances of the fivefold symmetry throughout the complex, but the iwan (an arched niche often found in Islamic architecture) is the most complete and precisely executed. Particularly peculiar, is the lack of similar mosaics throughout the rest of Isfahan. During the rule of the Safavids, Isfahan became the new capital of their empire. As a result they built a New Isfahan adjacent to the old city. No expense was spared in building the new city, and yet this complicated luxurious symmetry does not appear in any of the later buildings. This would imply that the Topkapi scroll was even more important than previously expected. It could indicate that when the Ottomans appropriated the scroll, the Safavids no longer new how to construct the more complex geometries. This would make the Topkapi scroll's existence even more marvelous, probably prepared by a specifically prolific mathematician and architect.
3		modern reconstruction of the tile work pattern image, projected 8ft X 9ft In house	—

4		Topkapi scroll 15 - 16th century Scroll, ink, parchment 13in X 97ft Topkapi Palace, Istanbul	The Topkapi scroll is presumed to have been prepared by the Timurids in the late 15th, early 16th centuries. It was later pillaged by the ottomans after their war with the Safavids in the 1580s. The scroll was kept in the Ottoman Topkapi Palace in Istanbul, adopting its name. The scroll explores a variety of patterns many of which are overlapped to create more and more complex compositions. The scroll is suspected to have served as a template for architects and artisans as a sort of lexicon of shapes and patterns allowing for accurate replication of the interlacing shapes. Many of the patterns in the scroll can be found in architectural decorations throughout the Islamic Empires. The patterns were given added complexity with extra decorations inlayed within each tile. The sub divisions were constructed with the same pattern with an altered scale factor. The effect of these designs scaled and overlaid can be seen in the Topkapi scroll. The initial constructions may have been made by careful drafting, certain patterns visible in surviving samples of architectural decorations would have been very difficult to draft from scratch. The medieval mathematicians devised a system of tiles in order to simplify the replication of patterns by craftsmen. This tile system allows for the creation of tiling designs that are not centered about a decagon as would be necessary in order to draft the strap-work with no pre- determined tiles. It should be noted that the tiles work together, individually, and anywhere in between. Many examples of Islamic decorations can be mapped with the use of the girih tiles, though not all examples use all five tiles.

5		Samantha Holmes Aperiodic Asymmetry 2014 Aluminum and wood 112 X 38 in Courtesy of the artist	Samantha Holmes holds a Bachelors degree in Visual and Environmental Studies from Harvard University (2007) , and a Masters in fine Art from Accademia di Belle Arti in Ravenna, Italy (2014). A self proclaimed experimental mosaicist, Holmes trained in the Byzantine tradition, all her work is meticulously cut and placed by hand. Additionally she takes great care in choosing the materials with which she works as they are essential to the underlying philosophy of her pieces, for example, both metal and stone represent a perennial quality, but metal has a modern connotation and can therefore speak to modernity in a distinct way. She is based dually in New York and Ravenna, and has shown her work across the globe. Holmes was invited to show in the Palazzo Fortuny for the 2015 Venice Biennale, The Bronx Museum of the Arts, and many more. The Museum of the City of Ravenna also holds some of her work in their permanent collection. Holmes serves as editor to SoloMosaico, the premier international publication on modern mosaics. She has worked repeatedly with symmetry and its disruption, specifically utilizing traditional Islamic patterns. A recent solo show in the United Arab Emirates proves how relevant her take on Islamic mosaics is, as a response to the current international climate. Holmes' work offers an interesting perspective on our conflicting society, modernity versus cultural inheritance. This specific work, Aperiodic Asymmetry, uses the girih tile shapes of medieval Islamic mosaics but places them slightly offset in order to display the way a small shift propagates a crack that disrupts the symmetry.
6		Penrose tile pattern Printed image 12 ft X 7ft Commissioned	In the 1970's Roger Penrose invented a mathematically backed system to successfully continuously tile in fivefold symmetry without gaps or linear translational symmetry.

7		An atomic model of a silver-aluminum quasicrystal. Photo, printed 6' X 5' 4" Courtesy of the US Department of Energy	—
8		Electron diffraction pattern Photo, printed 4' 6" X 4' 6" Courtesy of: Paul Steinhardt, Peter Lu et. al.	(From their paper and supporting work on Natural Quasicrystals)
9		microscopic view of a synthesized quasi-crystalline structures Photo, printed 7' 5" X 4' 7" Courtesy of: Paul Steinhardt	—
10		Quasi crystal sample to be observed under a microscope Acquire, also need a microscope to see the structure	—
11		Girih building tiles Wood Aluminum Acquire	—

Three instances of quasi-symmetry span approximately seven hundred years. In the medieval Islamic empires the pattern was used as a decorative feature of their looming architecture. In the 1970s the west discovered quasi-symmetric tiles, unaware of the precedent set by the Islamic mathematicians. In the 20th and 21st centuries, materials are being constructed in the same quasi-symmetric pattern.

Quasicrystals, Penrose tiling and girih tiles can all be mathematically defined through a simple mathematical formula. This relatively simple expression can be applied to girih tiles of the past and to the future of quasicrystals to uncover cultural heritage and further develop material science.

In particular, quasi-crystalline metals yield strong stable results that sacrifice neither strength nor brittleness. In addition, the quasi-crystalline symmetry makes the surface non-absorbing. These metals are used for everyday objects such as nonstick frying pans and sterile surgical tools. The applications are boundless, recent developments in complex simulations of a new quasi- crystalline structure may lead to a new and more effective camouflage and even the popular idea of invisibility may become a reality.

The parallels between Islamic decorative tiling and modern applied mathematics speaks to a connection between aesthetics and the mathematically elegant that is often overlooked. The assumption is that math and art could not be more dissimilar, when in reality they are intrinsically intertwined. Observing such cross disciplinary and cross cultural links may help unlock some of the mysteries that have long plagued scientists. Seeing a problem from a different angle or approach can foster creativity and innovation.

The incredible girih tiles must be understood as more than purely decorative. This piece of Islamic cultural heritage goes beyond symbolizing the past. The modern and ever developing applications of the same pattern systems dote the architectural decorations with further importance. This realization makes the recent and relentless destruction of many of these Medieval Islamic sites all the more tragic.

Through cultural dissimilarity and political dispute, the middle east has remained misunderstood by the west. Exhibits like Islamic Symmetries strive to shed light on the relevance and importance of preserving cultural heritage from across the globe. The loss of cultural heritage is not a tangible one, and for the most part it makes way for progress, but our society often underestimates the cost. Cultural heritage is one of the many pieces of the puzzle of individual identity. In drawing connections between the past present and future of quasi-symmetry, the exhibit emphasizes the importance of cultural preservation, even from a modernist perspective.

On view are a variety of objects and images to enforce the parallels between Penrose geometry, girih tiles and material structures. The hands on portion of the exhibit engages the audience in a different way, catering towards visitors who learn better through interaction. The synthesis of hands on interaction, text, and visual stimuli work in conjunction with the subject matter to emphasize the importance of approaching a problem from every angle.

Art and science work together if given the right chance.

Gallery 318

552 University Rd
Santa Barbara, CA 93106

Exhibition	Islamic Symmetries		
Dates of Exhibition	October 16, 2016 - November 23, 2016		
Dates of Loan	October 11, 2016 - November 30, 2016		
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Telephone		Email	
Lender’s Name for exhibition label and catalogue			
Artist			
Title			
Date of Work			
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Dimensions			
Insurance Value in USD			
Are photographs available for publicity/catalogue			
May the University reproduce the work			
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