AMBIGUUS TILES: ORIGAMI RHOMBIC PYRAMID TILES FOR CREATING DUAL-VIEW TILE MOSAICS

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Abstract

This statement presents a novel expressive medium that the authors call Ambiguus tiles, which construct dual-view tile mosaics. While similar to wall and surface mosaics made with conventional tiles, Ambiguus tiles can be assembled and rearranged to create dual-view tile mosaics in any size and form. Fact vs. Fiction, a letter sculpture composed of 115 Ambiguus tiles, is presented here as an example of the creative possibilities for using Ambiguus tiles as a ready-to-use design material. As seen in Fact vs. Fiction, Ambiguus tiles are particularly effective in communicating social messages.

For 4,000 years, tiles have been used as a decorative material to cover roofs, floors, walls and objects such as tabletops. With infinite creative possibilities, tiles are an expressive medium that is easily accessible (e.g. tile mosaics by Invader [1]). Although tiles are typically square or rectangular, various shapes are available, such as polyhedral tiles, which are used for unique visual and tactile effects [2].

Ambiguus tiles construct tile mosaics that show two entirely different pixel graphics that vary depending upon the angle from which they are viewed. Ambiguus tiles can depict text, patterns or images. The Latin word ambiguus translates as “going two ways” or “hybrid,” descriptors that correspond to the characteristics of Ambiguus tiles. The unique geometric shape of Ambiguus tiles—a rhombic pyramid—enables each tile to show two different squares that are orthogonal to each other. When assembled, the tiles create dual-view mosaics that offer different views from either the right and left or the top and bottom.

This statement aims to explore the creative possibilities of Ambiguus tiles, primarily as a readily accessible, expressive medium to communicate social messages. Based on the ability to compare and contrast two different texts, we developed an example created with Ambiguus tiles, namely, Fact vs. Fiction (Fig. 1). This shows how Ambiguus tiles can convey social messages in addition to fulfilling a decorative purpose.

Related Work

Dual-view or multiview images are not new. Their origin is in tabula scalata, a sixteenth-century optical art technique [3]. Tabula scalata pictures juxtapose two images that are divided into strips and mounted on different sides of a corrugated substrate. Lenticular wall displays, which follow the same principle as tabula scalata, are mainly used in advertisements and public art installations to provide unique visual experiences [4].

Dual-view images are an excellent visual means to contrast two opposites. Showing contrast is a technique often used in public service advertising to steer viewers in a desired direction [5]. Boy, a visual representation of the campaign against child abuse [6], is an example of how dual-view images can be an inspiring medium for communicating social messages. Only when standing on the right can viewers see the smiling face of a little boy; from the left, viewers see the bruised face of the same boy.

However, despite the engaging and eye-catching appearance of dual-view images, there has been no attempt to develop customizable modular units as a ready-to-use design material that can be assembled and rearranged to create dual-view images. We have developed such a tile module that allows anyone to design and construct dual-view images easily.

Ambiguus Tiles

An individual Ambiguus tile module is an origami rhombic pyramid or a hemisected square bipyramid in which the lateral edges and height are the same length (Fig. 2a). Due to its unique geometric shape, the tile shows two different squares depending on the angle from which it is viewed (Fig. 2b). Figure 3 shows three basic tile modules: 00, 01(10), and 11. Here, 0 indicates white and 1 indicates black. Thus, 00 and 11 represent the tiles with two white or black faces, respectively, while
01(10) represents the tile with one white and one black face. The pattern and instructions for making the tiles are provided as online supplemental files along with this article. The patterns are not only ready-to-print but also easily customizable in size and color.

Ambiguus tiles invite people not only to view but also to create dual-view tile mosaics due to their accessibility and customizability. The resulting dual-view images are particularly effective for juxtaposing two opposite concepts, playing with the duality of seemingly black-and-white issues, or provoking viewers to question their perspectives. Beyond being merely decorative, these characteristics enable Ambiguus tiles to be a compelling medium for embodying social messages.

Fact vs. Fiction
To explore the creative possibilities of Ambiguus tiles, we created Fact vs. Fiction, a letter sculpture composed of 115 Ambiguus tiles. The sculpture was developed to emphasize the importance of perspective in discerning facts from fiction on the Internet [7]. Each tile is a physical representation of a pixel, the smallest visible element that humans use in digital communication. The aggregate of tiles represents text in the current online media. When viewers face the sculpture from the front, the image is nonsensical—it is a mixture of fact and fiction (Fig. 1a). However, the word “FACT” appears as black text on a white background when observed from the right side (Fig. 1b). On the opposite side, only the word “FICTION” can be seen in white text on a black background (Fig. 1c). Fact vs. Fiction uses a guided or suggestive type of self-persuasion [8] that approaches an implicit question: Which would you choose, fact or fiction? The sculpture stimulates its viewers to choose “facts” instead of “fake news” by looking from a certain perspective. Fact vs. Fiction was displayed at #SpreadingFacts 2019 [9], a conference for improving science communication to maximize public trust in scientific facts. The sculpture was shown to conference participants for about an hour, and the viewers quickly grasped its concept and engaged in looking around it from various perspectives.

Future Work
The tiles used in the example above are black and white, but it is also possible to produce color-printed tiles with a simple tweak of the provided pattern. We are now working to develop additional examples that can demonstrate the utility of Ambiguus tiles for tangible representations of social messages. Future work also includes an in-person user study to investigate the impact and effectiveness of Ambiguus tiles in communicating social messages.

While the current version of Ambiguus tile is constructed from printed paper, future tile development will explore a wide variety of materials that can expand to use both interior and exterior surfaces. For example, concrete or ceramic Ambiguus tiles will enable building signs that reveal different messages to passersby walking in opposite directions.

Conclusion
We presented Ambiguus tiles, which are modular units for constructing tile mosaics that show two entirely different pixel graphics depending on the viewing angle. We described the design of the tiles and illustrated their creative possibilities in communicating social messages through our Fact vs. Fiction example. As an accessible and customizable medium, Ambiguus tiles are expected to allow people to express their ideas and messages more engagingly and effectively, and provide inspiring and thought-provoking visual and tactile experiences for viewers.

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References and Notes
8. Andrews et al. [5].