

INTELLIGENT TILES

an innovation in tile technology

by Fiona Bremner

Figure B.

This article is the first in a series that will explore the development of tile technology. Intelligent Tiles as a concept has already become a familiar characterisation and the subject of this article features creations from the Cumulus Design Competition, Italy 2005. The competition involved the efforts of architecture and interior design students and compelled them to explore the fundamental function of ceramic tile surfaces. Products such as Glow Tiles, Propeller Tiles, Magnetic-Wave Tiles and Shadow Tiles are just some of the ideas actualised by the students. This article is an essential reference for any architect or designer interested in keeping up with the rapid developments in the field of ceramic materials.

Consider the functional and aesthetic role of the humble ceramic tile. Ask yourself what the obvious features are. Do you think a ceramic tile is characterised by rigidity, planarity and lucidity? Are ceramic tiles classified by their mere mono-functional characteristics? Ceramic tiles have been utilised throughout the centuries to clad structures of distinction and provide a unique aesthetic. Early archaeological sites in ancient Egypt, Mesopotamia and ancient Greece attest to the beauty

and practicality of tiles as a decorative building material and an adjunct to architecture.

The tile industry, beset with age-old traditions that have dictated the style and application of tile design and function, began to change

rapidly in the 1970's when Monocottura tiles were introduced. The market has broadened, and acceptance of intelligent tiles as a legitimate concept worth producing and marketing is gaining acceptance. Exercises in Architecture - The Cumulus Design Competition is a university training project. Largely funded and supported by the Italian Tile Industry under the trademark



Ceramic Tiles of Italy, it takes an initiative like this to ensure the universal longevity of the tile industry. Similar initiatives are underway in Spain and Japan.

Intelligent tiles are a smart material. Smart behaviour occurs when a material can sense stimulus from its environment and react to it in a useful, reliable, reproducible and usually reversible manner. A very smart material will use its reaction to the external stimulus to initiate an active response. A superior example of this is the Climate Control Tile (Figure A). This concept was researched by Juliet Johnson, of Central Saint

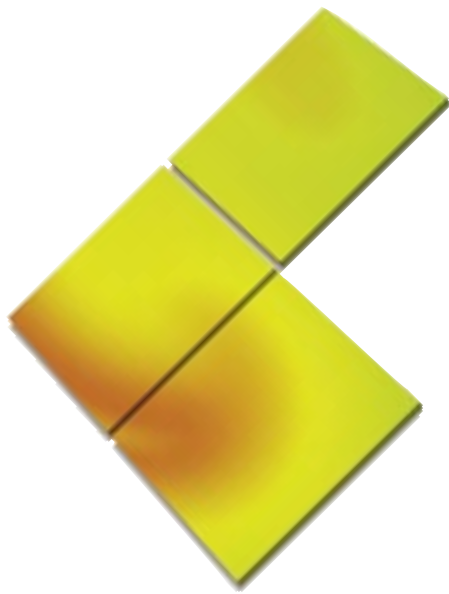


Figure A. Climate control tile.

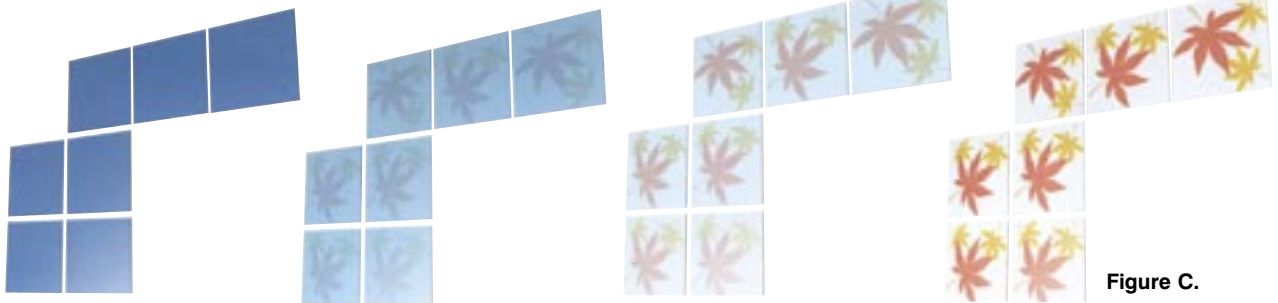
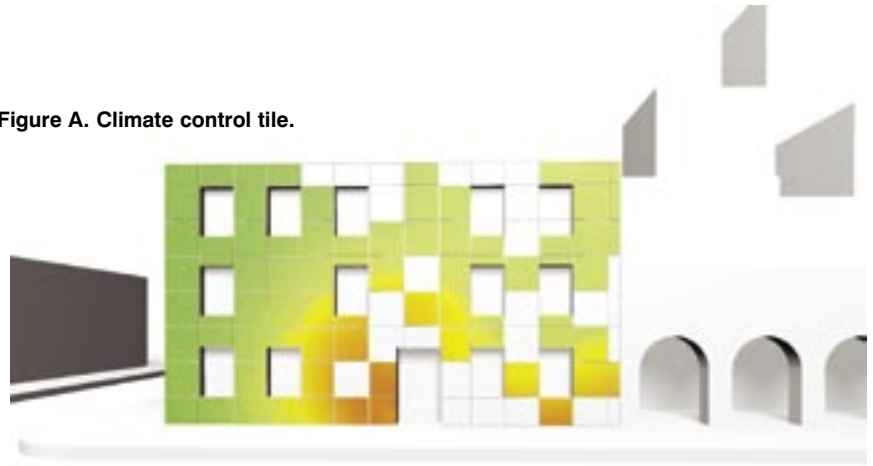


Figure C.

Martins College of Art and Design, London. The Climate Control Tile is receptive to the changing temperature of climate. The fine masonry of the tile contains a microencapsulated phase change material. The intelligence lies in the ability of the material to store a certain amount of heat and expel excess heat when not needed. The tile is a variable-emittance ceramic material with thermochromic ink on the outer surface. It has a smooth surface and changes colour in accordance with colour frequency temperature (blue being the coldest and red being the hottest temperature). In cool climates heat release and further heat loss is prevented because heat emissivity is restricted to the cell size. A remarkable visual outcome is the effect of the changing temperatures as seen on the façade of buildings. The colour of the surface of the tile is a thermo-graphic reflection of the heat held within the building and the heat emitted the outside of the building. The inner climate of the building, ideally controlled by a non-fuel powered technical building application, would correlate with the outside.

Of similar dramatic effect is the Glow Tile (Figure B), which not only addresses innovative use of energy, it also causes a monumental visual impact on its environment. This tile was created by Pacharapong Suntanaphan also from Central Saint Martins College of Art and Design. Pacharapong's tile uses photovoltaic cells, whereby sunlight is converted into electricity thus creating a self-sufficient energy system. Photovoltaic cells or 'solar cells' are usually constructed from silicon alloys and are a stationary non mechanical device. Separating the lights and cells onto different tiles over a vast surface area allows for an increase in the potential to accumulate energy. Eco-friendly and sustainable, power is stored during the day and activated at night by a light sensory unit. With energy use being a topical issue in this age of over-consumption of fossil fuels, solar energy will soon become a sought after commodity; especially now that photovoltaic energy can be a reliably converted cost effective source of electricity.

Keeping to the theme of thermo and photo is another innovative tile that fulfils more of an aesthetic and pictorial role rather than a fully functional role. A concept designed by Patrik Nilsson of Lund University, Sweden, and similar to the technical abilities of the Glow Tile is the Thermo Tile (Figure C). This tile changes its appearance in accordance to changes in temperature and varying levels of light. It all happens on the surface of the tile. The first layer is a thermochromic pigment. The second layer is a photographic emulsion, on which a photograph is projected. This layer can have a photochromatic pigment sprayed directly onto the surface as a pattern. The last layer is a transparent varnish, which protects the other layers from water damage and scratches. Can you imagine the affect of having these tiles on the floor and walls of your bathroom? The room would have a metamorphic and moody atmosphere, providing an optical delight for the senses.

The question is how far can we go? There may be no limitations. If these concepts don't prove viable for mass production and usage, the effort is not a waste of time. Innovations like these lay the foundations for further research and raise the precedent for technical discovery. As stated in the promotional booklet published by Edi Cer "...the educational value that these design schools examined through Cumulus [are] extremely important...it will generate innovative challenges, paradoxical concepts and mental energies that will give the ceramic industry the necessary thrust to open new working hypotheses."^[1] In an attempt to convey the latest innovations to come from the tile industry, Tile Today will re-visit Intelligent Tiles and review more curious innovations in the next issue, including the exciting Highlight series by Saicis, which will appear on the cover. ¹¹

[1] Exercises in Architecture – Cumulus Design Competition, Edi Cer Spa, Italy, 2005.