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Digital painting brings new
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Art in the digital age

Picture this: you're strolling the corridors at the airport, waiting for a flight, when you notice a colorful painting on the wall. But wait, when you look again, the image is different. In fact, it changes before your very eyes. You may think you're losing your mind. But you're not…you are experiencing the new digital art form called 'protoquadro'.

Essentially a digital painting technique, protoquadro is a form of generative art (art created with algorithms using computer or mechanical systems) that can be used in place of traditional paintings. It embodies the dynamic nature of modern life, using the latest technology, yet has an artistic heritage dating back to the Renaissance and beyond.

Protoquadro is the brainchild of two Italian artists: Federico Bonelli and Maurizio Martinucci, who together make up the SUb Multimedia Re_Search Lab. Surprisingly, this revolutionary new art form began with a very commonplace observation – there's nothing good on TV.

In the late 1990s, stylish new flat-screen televisions were appearing on the market. "Italian TV then was terrible, it was a waste of such beautiful TV sets," Bonelli says. "We joked that we should create something more beautiful and meaningful to put on the TVs."

It may have been a joke but it was a good one. The idea led Bonelli and Martinucci to create a whole new approach to art. And although digital art has flourished since the advent of the computer, the ideas behind it aren't new. Much of Renaissance art, including the work of da Vinci and Botticelli, is based on strict rules of composition, often from geometry. Generative art replaces these rules with a complete algorithm that can be applied via a computer or machine.

Dynamic and unique

Inspired by the work and ethos of Italian futurists such as Giacomo Balla and Umberto Boccioni, protoquadro uses modern displays and computing technologies to create dynamic and meaningful art. A protoquadro 'painting' has two key ingredients. First, there is a set of carefully composed and selected photographs. Second, there is a transformation algorithm that selects and combines aspects from the various photos to create an abstract image that changes over time.

Bonelli and Martinucci use algorithms that include feedback, so protoquadros evolve according to the laws of the chaos theory. This means even the artists themselves don't know how the painting will look tomorrow or next week. It also >

Junglescape – interactive digital art on Philips' Shop Window.

means each work is completely unique. Even if you created two protoquadros with the same photo set and algorithm, over time you would have two very different images.

Artistic vision
The image's evolution may be chaotic, but it certainly isn't random. By matching the theme of the basis photos and the theme of the algorithm, Bonelli and Martinucci ensure the evolution of the painting always follows their artistic vision for the piece.

Bonelli likens the process of creating a protoquadro to being a parent. "You try to give your children rules to follow, but when they leave home, you can't control the person they finally become, just as we can't control what the protoquadro ultimately becomes," he explains.

Deeper meaning
For its creators, protoquadro is an attempt to create a new painting technique that fits the 21st century, just as fresco was right for Renaissance architectural painting. However, other observers view protoquadro as a much more ancient artistic endeavor – linking art and the senses.

Kim Veltman, Scientific Director of the Maastricht McLuhan Institute and coordinator of the European Network of Centers of Excellence in Digital Cultural Heritage, explains: "Already in antiquity, there were links between painting and poetry. By the 19th century this evolved into links between painting and music, such as Mussorgsky's *Pictures at an Exhibition*," she says. "These experiments continued in the 20th century with tone painting and colored lasers linked to music. Protoquadro takes these efforts into the digital age and gives deeper meaning to the fashion for cross-media."

A new perspective
In 2004, Bonelli and Martinucci teamed up with Philips Research and the collaboration brought a whole new perspective to protoquadro. Evert van Loenen, who has been involved with a number of 'outside the box' projects at Philips' ExperienceLab facility, says there was interest at first sight: "We saw the demos and thought right away 'We should do something with this.'"

But to bring protoquadro into a more mainstream realm, there were two major questions. Could protoquadros be scaled up to create wall-sized and multi-screen images? And was there a way to make the paintings respond to people's presence?

To explore these questions, the Philips team and SUb Multimedia embarked on joint research projects such as developing a more generic software engine to enable larger, interactive protoquadros. "Our role was, and still is, to challenge and inspire them, as well as to provide enabling technologies like people-proximity sensors for the new interactive protoquadros," Van Loenen explains.

Jungle fun
The result of these projects was the creation of new larger and interactive types of digital paintings known as enhanced protoquadros – the first of which is a piece by photographer Amy Jackson called *Junglescape*. Unveiled in November 2007, it explores biological changes using photos of the Amazon rain forest and an algorithm that activates digital paintbrushes that 'swim' around the images, like fish in a pond.

A multi-screen painting, *Junglescape* was designed for Philips' Intelligent Shop Window at ShopLab on the High Tech Campus in Eindhoven. The window's already built-in sensors allow the painting to respond to its changing environment, even to people. When no one is looking, images evolve slowly. When many people are looking, they evolve more quickly. "*Junglescape* can even tell if there are more people on the left or right, changing faster where more attention is focused," says Van Loenen.

A world of interactive art
So will protoquadros be entertaining us as we walk through the supermarket anytime soon? Small protoquadros would make additions to waiting rooms, lobbies or anywhere else people have to wait without getting bored, says Frank van Tuijl, who also works on the protoquadro project at Philips Research. However, there's still work to be done to make them widely accessible, including further developments in ultra-thin display technologies so that protoquadros can fit into attractive frames as easily as other paintings.

Meanwhile, the large enhanced protoquadros could be the perfect way to create what Bonelli calls "human-scale ambiences": features that bring a more personal, more community-based atmosphere to public spaces such as airports, shopping malls and hospitals.

"We live in a world that can be harsh and tough to deal with," Bonelli concludes. "With protoquadro, we want to make beautiful things that help make the world seem less harsh." ◁

Protoquadro in the lobby of a building.

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All in the details

Protoquadro may be a computer-generated art form, but it is very much a human activity. It starts with an artist and a theme. Next, the artist develops a transformational algorithm that matches that theme.

The very first protoquadro, *Unlikely Canvases*, explored the nature of transformation. Its algorithm was based on the geometric and algebraic structure of the enneagram – a nine-pointed figure supposedly discovered by Sufi mystics and long used as a symbol for spiritual growth.

The artist then creates the basis photo set. Each completed protoquadro uses 20-30 photos – enough for a wide variety of changes while still allowing viewers to recognize details coming back. The photos must have very specific properties that can be described with fractals.

For example, they need a certain kind of scale invariance and a consistent level of sharpness. Therefore, the photographs must reflect the artistic vision of the piece and meet the technical requirements. From a set of a thousand photos, only about a hundred will be suitable for a protoquadro.

Of these, the artist selects 20-30 photos and combines them with the algorithm. Next, it's a case of 'wait and see': watching the painting evolve and adding or taking away photos as the artist feels is necessary. Choosing the photos can take as long as five months, which makes creating a protoquadro almost as labor-intensive as a traditional painting.

Go to www.protoquadro.net to see pictures and videos of protoquadros.