OK, Glass?
Ionica Smeets & Hanna Schraffenberger

Tactile Augmented Reality
Maarten H. Lamers

Visualizing bullets inside of trees
Wim van Eck
AR[t]
Magazine about Augmented Reality, art and technology

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AUGMENTED MEMORY (2012), TAMÁS SZVET, ARTICLE ON PAGE 50
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For this fourth issue of AR[t] we received an impressive number of proposals — it was really difficult to choose among so many good topics and articles.

Ultimately, we decided once more to offer a wide-ranging variety of topics. Their common denominator, however, is one idea in particular: the love to experiment with new techniques in a playful, yet at the same time meaningful way. The focus and emphasis might be different for each of our authors — whether scientific in the technical sense or in the social sense or just purely artistic. We hope and expect that their experiments, projects, products and results are inspiring for a bustling community such as ours.

In random order I would like to give you a quick impression of the articles you will find in this issue.

Wim van Eck continues his AR tutorials in the series ‘How did we do it’, giving an insight into how the AR Lab develops its applications. Meredith Drum tells us about AR projects that make critical statements about social, cultural and political phenomena that relate to a physical location. Robert Prevel guides us through all kinds of hurdles one can come face-to-face with when coding high-tech AR programmes. Ferry Piekart and Lex van der Stuijs shine a light on their project ‘Museum op de Markt’ from a historical as well as technical perspective. In the article Joanna Coelho wrote, we look back and forth to James Bond and his futuristic gadgets. Hanna Schraffenberger interviewed Michiel Helvensteijn about his audio augmented reality platform Talescape. Tim Zaman, Joris Dik and Pieter Jonker present their recent experiments and spectacular results in 3D scanning and printing masterworks by Rembrandt and Van Gogh. Alison Bennett might send shivers down your spine with her article on shifting skin. Vladimir Geroimenko discusses the possibility of selling augmented reality art and puts forward some solutions. Maarten Lamers focuses on an AR work that engages not just our visual sense but also our tactile sense. Oliver Percival continues the AR science fiction story set out in issue 3. Ionica Smeets and Hanna Schraffenberger go head-to-head on Google Glass: guess who is in favour? Barbara Asselbergs describes a social experiment with augmented reality. My article ‘Trying VR!’ describes the various applications of Virtual Reality. The first article describes the healthy and mature relationship between augmented reality and cultural heritage and we conclude with our AR[t] Pick: Quadratura by visual artist Pablo Valbuena.

Above all I wish to thank the authors for their contributions, and a very special thank you goes out to Esme Vahrmeijer, Hanna Schraffenberger and Mariana Kniveton: They did it again, a beautiful volume of AR[t] now lies before you.

Yolande Kolstee, Head of AR Lab
AR AND CULTURAL HERITAGE: A HEALTHY AND MATURE RELATIONSHIP

YOLANDE KOLSTEE

Nowadays, at almost every conference on cultural heritage the topic of adding digital information to artefacts (paintings, sculptures, curtains, tapestry) is discussed. Alongside of that development, many cities now have AR city or landscape tours to inform the public about their history.

These developments stem from the late nineteen-nineties: ‘Application of IT in museum and cultural heritage institutions was first discussed in the International Conferences on Hypermedia and Interactivity in Museums (ICHIM) which started in 1991. Then in 1997, the annual conference of Museums and the Web was established which was dedicated for this purpose.’

Historical cultural heritage sites are supplemented with original floor plans, pictures, and ‘artist’ impressions when there are no other images available. In the AR Lab we work on projects in the cultural sector, mostly museums, but not restricted to that, to enhance the public’s interest in the artworks that are, or sometimes, are not, on show. We strongly believe that by enabling the public to interact, in one way or another, with the artworks, the appreciation for these artworks will grow and intensify. Maybe these projects even contribute to a larger cultural awareness.

In The Netherlands, we have completed several projects for both the Van Gogh Museum in Amsterdam as well Museum Boijmans van Beuningen in Rotterdam, not to mention the work we did for Museum Escher in the Palace in The Hague, Museum Catharijneconvent in Utrecht and the Kröller-Müller Museum in Otterlo. And there is more to come. In this article we want to emphasize the benefits of AR in the field of cultural heritage and we will also consider some of the benefits of using AR in cultural tourism.

CHICHEN ITZA: THE STEPPED PYRAMID OF KUKULKAN. THIS WAS ONE OF THE LARGEST, PROBABLY ALSO MYTHICAL, MAYA CITIES (600-1000). THIS SACRED SITE WAS ONE OF THE GREATEST MAYAN CENTRES OF THE YUCATAN PENINSULA. IMAGE COURTESY OF CYARK.
Cultural heritage

The meaning of the term ‘cultural heritage’ has changed considerably in recent decades, partially owing to the instruments developed by UNESCO: United Nations Educational, Scientific and Cultural Organization. Cultural heritage does not end at monuments and collections of objects. It also includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts. The term that covers this type of heritage is “intangible cultural heritage”, in this article, however, we will concentrate on tangible cultural heritage.

UNESCO upholds strict guidelines to protect culture and cultural objects, buildings and archaeological sites in their cultural heritage programme (as well as programmes for ‘Natural Heritage’). UNESCO also emphasizes creativity:

‘In today’s interconnected world, culture’s power to transform societies is clear. Its diverse manifestations - from our cherished historic monuments and museums to traditional practices and contemporary art forms - enrich our everyday lives in countless ways. Heritage constitutes a source of identity and cohesion for communities disrupted by bewildering change and economic instability. Creativity contributes to building open, inclusive and prosperous knowledge societies.’

Cultural tourism

Since the economic might of the tourist industry has proved itself — now regarded as the biggest in the world, ahead of the automobile and chemical industries — careful attention should be paid to this many-sided phenomenon with its global repercussions. For ‘cultural tourism’ there are special arrangements, conventions, among others, to prevent unlawful traffic of cultural property and to protect cultural property in the event of armed conflict.

AR benefits in the domain of cultural heritage

Non-invasive

AR is a non-invasive technique, this means an object or site will not be touched or corrupted, whilst enabling visitors to engage with artefacts, using devices that are in no way physically connected to them. The article “Augmented Perception of the Past: The Case of the Telamon from the Greek Theater of Syracuse” describes “a system of real-time interaction with ancient artifacts digitally restored in a virtual environment in which the perception of reality is augmented, through the provision of the visual data missing in the current conditions of the artifacts themselves. The application of this system will be through common mobile devices, like the Apple iPhone”.

Not sacrilegious

Besides the non-invasive character of AR, there is also another important aspect to consider: the sanctity or holiness of artefacts (as perceived by believers) makes it impossible to touch and manipulate the objects. But in AR, this is possible in virtual space.

No touch needed for manipulation

In the case of non-holy objects, the delicacy of artefacts might cause a strict do-not-touch policy. With AR, however, one can see, in real-time, the back of a priceless painting projected upon its surface, as the AR Lab did with six paintings by Van Gogh and one painting by Govert Flinck, (one of Rembrandt’s students) which is impossible without AR.

These characteristics also aid archaeologists and researchers to study archaeological artefacts and artworks without compromising the real artefact/artwork.

See (impressions of) no longer existing sites

Rohzen Mohammed-Amin notes another reason to use AR: with AR we can show objects or sites that no longer exist. Sometimes this is due to natural disasters such as earthquakes in 2010 and 2011, as happened in Christchurch, New Zealand, in which case there are countless photographs and other ‘souvenirs’ that can help to revive the demolished city in AR. By working closely with the CityViewAR project team at HiLabNZ, Mohammed-Amin observed how AR can create views for the people of Christchurch who had to say goodbye to landmark buildings of their city.

Artists’ impressions of antique sites, which are made as an interpretation of the former state of the site, can also be shown. A well-known example is the Archeo guide. For example, in Rome, where due to historic changes over the past centuries, ruins are in the centre of the city; with AR it is possible to give an impression of how these ruins once were buildings. This is also the case of the more than 7000 year old (built 5000 BC) historic site of Arbel (also called Erbil or Arbel citadel), located in the heart of the modern city of Arbel in the Kurdistan Region of Iraq.

Augmenting with which information format?

Various formats of information can be superimposed on the site or the object. This includes 2D images and 3D models, as well as written texts, sound and music.

CT scans

To add information to an object or site, in most cases, a 3D model is needed. Already in 2008, the AR Lab was able to use the bio-medical equipment of a hospital (Erasmus Medical Centre in Rotterdam), specifically their CT scanner to make 3D models from Medieval earthenware. These models were used for the exhibition ‘Sgraffito in 3D’ at Museum Boijmans Van Beuningen in which bowls from the preIndustrial era were on show. The CT scan images (models), however, had to be adjusted and coloured-in to make them appropriate for the augmented reality interactions.

Also the porcelain teacups of the ‘Smart Replica’s project, which we described in previous issues of AR[10], were put through a CT scanner. In cases where an artefact or site still exists, scanning is done more often than 3D modelling. When the site or artefact no longer exists, 3D modelling artists make their version based on texts or other images.

More scanning — less modelling
Preventive scanning

Looking at the future, we now see a remarkable change that includes preventive scanning. The American non-profit CyArk ([www.cyark.org](http://www.cyark.org)) is scanning world heritage sites to create a kind of back-up which may be needed should they suffer extreme demolition due to war or natural hazards.

The 3D scanning of paintings from Van Gogh and Rembrandt is an example of a new application in the domain of restoration and preservation of cultural heritage.

3D scanning of paintings

Due to the innovative work done by professor Pieter Jonker from the vision-based robotics group at the TU-Delft, and notably his PhD student Tim Zaman, high resolution 3D scanning techniques have improved. His work on simultaneously topographic and colour scanning for Art and Archaeology was presented at the Technart14 conference at the Rijksmuseum in Amsterdam. In close collaboration with professor Joris Dik, a new scanning technique was developed that scans the surface of paintings in three dimensions, (x, y, z) with a resolution of ten micron. Aside from digitization for monitoring paintings in 3D over time, digital image processing for art historians and material scientists, as well as 3D printing of paintings are goals of this scanning technique project. The 3D printing of the paintings was achieved by professor Jo Geraedts from Océ / TU-Deft and his team. They attracted national and international attention with their 3D print of The Jewish Bride and Self-portrait by Rembrandt and flowers by Van Gogh. These 3D printed paintings were on show during the conference. These scans or models, are now used for 3D printing, but they might be used for any AR system, due to their high accuracy. (More information on this project on page 56.)

The 3D scanning of paintings from Van Gogh and Rembrandt is an example of a new application in the domain of restoration and preservation of cultural heritage.

AR meets various needs

To sum up the important role AR fulfils in the domain of cultural heritage (by 3D scanning, 3D modelling made by artists, or a combination of both) we come to the following list:

- Enriching
- Engaging
- Entertaining
- Referencing
- Recreation
- Education
- Scientific Research
- Restoration
- (Future) Preservation

In this list we didn’t mention the role that AR has on other domains, for instance in medical or army applications as well as its role in customizing production.

A critical note

As a technology for merging real and virtual worlds together, AR enables us to insert and link virtual objects and entities to physical objects or in spaces. This characteristic promises a state-of-the-art way to experience historical sites and museums by using personalized devices like smartphones and tablets, see note 11.

Tillon, Marchal & Houlier15, state “[n]evertheless, if reality is not incorporated into the augmented guide, the visitors express their lack of interest. For example, it is the case when they could not link the clues presented in Augmented Reality and the real work of art with the naked eye. So, the same crucial question remains concerning analytical activity: how can we integrate reality and prevent the visitor from straying away from it?”

In that respect, Hanna Schraffenberger and Edwin van der Heide16 discuss the status of adding information. They state that, “in Augmented Reality (AR), virtual and real content coexist in the same physical environment. However, in order to create AR, solely adding virtual content to a real space does not suffice.” In their paper, they argue that “an augmentation adds and relates something virtual to something real.” When cultural heritage is augmented, we find such relationships between the virtual and the real. Here, often, the virtual informs us about the real. Also common are temporal relationships between the virtual and the real, e.g., images of the past are superimposed on the spots where they were taken.

Conservation of AR installations and born digital art

The Dutch institute for Digital Cultural Heritage17 (DEN) takes part in European programmes like ENUMERATE20. ENUMERATE is an EC-funded project, led by Collections Trust in the UK. The primary objective of ENUMERATE is to create a reliable baseline of statistical data about digitization, digital preservation and online access to cultural heritage in Europe. ENUMERATE builds on the results of the NUMERIC project (2007-2009). This was a ground-breaking initiative to create a framework for gathering statistical data on digital cultural heritage.

At the AR Lab we have already seen, in the seven years of our existence, changes in software and equipment, which makes it extremely difficult to use our earlier models on new equipment. In The Netherlands, four organisations concern themselves with digital born art and digital preservation, forming the Digital Art Force (DAF) which held their conference in June this year18. Preservation of AR installations and born-digital art will be a new challenge to take into account.

Acknowledgment

I would like to thank Rozhen Mohammed-Amin for her help.
References and notes


2. According to Silvia Filippini-Fantoni and Jonathan P. Bowen, preliminary data from a study by Anne Manning and Glenda Sims confirms that “visitors using multimedia tours have more extensive learning experiences, demonstrate a deeper level of understanding and critical thinking, make more connections to their own history and background, and engage in greater personal learning” In: Silvia Filippini-Fantoni and Jonathan P. Bowen, Mobile multimedia: Reflections from ten years of practice. In L. Tallon, & K. Walker, editors, Digital technologies and the museum experience: Handheld guides and other media. AltaMira Press, Lanham, 2008.


5. The 1972 Convention of UNESCO, concerning the Protection of the World Cultural and Natural Heritage, recognizes that certain places on Earth are of "outstanding universal value" and should form part of the common heritage of humankind. http://whc.unesco.org/en/convention/


As new augmented reality software has made production more accessible, there has been a surge of mobile AR projects produced by artists interested in place and situation. A notable subset use the virtual to make critical statements about social, cultural and political phenomena tied to, or associated with, a physical location. As new forms of public art, the works engage aspects of a participant’s experience of place generally negated by mobile devices. Exploring the physical setting, the built and natural environment, as well as the events and functions centered there, is often a main goal. The virtual forms point back to the material. Participants are not only asked to actively attend to the spatial and the corporal, they are also invited to consider and enter critical discourse on the history and future of unique spaces — how they are used and might be used.

Telesthesia, to perceive things at a distance without use of known bodily sense organs, is a favorite theme for media scholar McKenzie Wark. In a post-capitalist age, according to Wark, we have
entered the era of the vector. Our commodity economy has moved beyond manufacturing and centers on controlling information flow experienced telesthetically by the consumer. [1]

By re-engaging the body, place-based somatic AR may release users, however temporarily, from immaterial vectors that push consumer culture. Often, in these artist-produced projects, a dynamic range of movements is necessary to activate the virtual. There are many precedents for this approach to participation; though they deserve longer consideration, I will introduce a few.

Jeffrey Shaw’s influential installation, The Golden Calf (1994), instigates a dynamic conversation between the corporal and the simulated. A potential viewer finds a wired, hand-held device (roughly the size of an iPad) sitting on an empty pedestal. Those brave enough to overcome the fear of interacting with the work in a gallery or museum are rewarded with an experience of the virtual 3D idol. And then the full splendor of the calf as apparition is discovered only as the viewer moves her body, twisting and turning the device. Shaw refers to this requirement as a “specifically physical process of disclosure.” [2] The somatically disclosed seems to be an institutional critique.

Rebecca Allen’s Coexistence (2001) offers a unique biometric interface in which a participant’s breath triggers interaction with virtual elements, and with another person across the room. The interface provides both visual and haptic feedback; the hand-held device vibrates when the other player blows into the sensor. Breathing and touching are distinctly sensual states. Allen’s piece sets up a close encounter with another player, but also an intimate exchange with the computing device and the space of the installation.

To experience Teri Rueb’s Drift (2004), a location specific sound walk set along an expanse of tidal flats in northern Germany, participants wear headphones attached to a mobile sound and GPS unit. The piece invites them to find and follow circles of sound drifting across the beach — movements patterned on the tides and the shifting satellites overhead. The shore itself becomes an interface. Within a sound circle, listeners hear recordings of literature and poetry (Dante, Joyce, Woolf, Mann) on the experience of being lost, of drifting. Rueb is invoking psychogeography, non-utilitarian walking as a refutation of hegemonic economic engines.

Rueb has continued to produce seminal GPS sound walks. No Places With Names (2012), made in collaboration with Larry Phan, with contributions from Carmelita Topaha, takes visitors on a walk through the high desert surrounding the Institute for American Indian Art in Santa Fe, New Mexico. The artists interviewed a range of locals about their experience of Southwestern landscapes, and engaged them in conversations about the history of the work “wilderness.” The resulting sound narratives were programmed to different coordinates along the walk’s trajectory; the recordings are triggered when the participant, wearing headphones and a mobile device, enters each spot. No Places With Names is an inquiry into how language, native and imported, represents, limits and shapes our relationship to cultural and physical landscapes.

Border Memorial (2010-ongoing), by John Craig Freeman and Mark Skwarek, provides an interesting twist on this dialogue between the physical and virtual. The artists have located virtual memorials at spots along the U.S./Mexico border where human remains have been found. It is highly probable that these are the remains of people attempting to illegally cross into the U.S. Many of the sites are too remote for cell service. Though they cannot be detected by anyone on the ground, the virtual shrines are physically tied to and, you could argue, present within this contested border space; the shrines instantiate a compassionate perspective on human rights in regard to immigration.

My own collaborative AR work, Oyster City (2012-ongoing), is a game and walking tour of New York City that I am producing with Rachel Stevens and Phoenix Toews. Oyster City invites participants to explore ecological and social histories within the context of the long relationship between oysters and humans across this land and waterscape. The piece also invites speculation regarding the benefits of bioremediation, in the form of oyster reefs, as smart city planning with serious potential to mitigate current and future problems, especially flooding. These elements of social documentary unfold as locative media available only when participants move their bodies and engage their senses in exploring the often-neglected urban water’s edge.

Emerging place-based, somatic AR projects with a critical focus have the capacity to activate physical sites as places of social engagement in the public sphere. Somewhat paradoxically, the same mobile devices that normally remove us from our environment and our immediate community can be used to connect us somatically with sites and encourage dialogue with the lives, human and non-human, occupying these places with us.

References


2. This quote was extracted from text on the page devoted to The Golden Calf, on Jeffrey Shaw’s website: http://www.jeffrey-shaw.net/html_main/frameset-works.php
Museum op de Markt: history conserved

How can you breathe life into the past when much of it has been lost? The city of Spijkenisse wanted to revive part of its history based on the collective memory of local people. A 3D museum in Augmented Reality seemed to be the method to glue all the scraps of memory together and reconstruct what was once there.

FERRY PIEKART

Spijkenisse used to be a small country town, isolated on the island of Putten. Although close to Rotterdam, it was separated from the big city by water. For a long time, the town had only a couple of thousand inhabitants — until the government decided to make it an urban development center. Access was improved and a large part of the old center was demolished during the 1960s to make way for new homes: 16,000 houses were built in the 1970s alone. Since then, Spijkenisse has grown continuously. With that growth, much of its identity has been lost.

The older inhabitants of Spijkenisse regret this still and the municipality saw the redevelopment of the old market square as a chance to do something about this. The square holds one of the few reminders of the town’s past: the church. Surrounded by new buildings (including the impressive Boekenberg library designed by Winy Maas), the old church exudes nostalgia. There used to be some small houses and even a farm on the site of today’s market square and the municipality decided to mark their outlines in the paving.

AR based on outlines

Twinkls’ AR builders heard about this project and a new idea was born: if the outlines of these old buildings are visible in the pavement — like an old street map — why not virtually recreate them on top?

The municipality of Spijkenisse jumped at this unique idea. The aim of the project was simple: using a special app (available on both iOS and Android devices), people walking around the square with a smartphone or tablet could see the buildings that had been demolished in the 1960s exactly on top of the outlines laid out in the pavement. And as well as looking at them, you can also hear the stories of the people who used to live there. They decided to call it a ‘museum’; a museum in AR.

The museum would be visible through the screens of smartphones and tablets. Visitors to the virtual museum would be able to walk around the square with their own devices and see an augmentation of the long-gone buildings from different angles.

An AR telescope has been positioned in a corner of the market square so that people without access to these devices can also enjoy the experience. The telescope can be turned and aimed at any part of the square and it shows the same augmentation, but from only one viewpoint. The telescope is easily accessible and does not require downloading the app. At the same time, its draws attention to the experience (which otherwise cannot be seen).

The whole assignment was a challenge. Twinkls had been involved with the revolutionary UAR (Urban Augmented Reality) app for the Netherlands Architecture Institute in Rotterdam, which shows 3D images of buildings in the city based on GPS positioning within a Layar engine. However, it turned out to be very difficult to position buildings precisely at the required location within a margin of only a few meters. In the Museum op de Markt app though, the buildings had to be positioned with an accuracy of only a few centimeters. This was a definite requirement from the start because seeing a building next to its foundations does not make sense.

The makers of Museum op de Markt were overwhelmed by the photo material they received from the municipality and the people of Spijkenisse. Shoeboxes full of black-and-white pictures were emptied out on the table. The issue quickly became apparent; at a time when photography was expensive and film was used sparingly, people did not just take snaps. Every photo had to be a beautiful picture, and there was nothing more beautiful in the town than the church. As a result, there were boxes full of photos of the church — the one building that had not been demolished — taken from all different angles.

What it used to look like

The article on the next pages explains more about the technology that was eventually used to pull off this difficult feat. Another major challenge was the reference material. The 3D generation of the old square had to be based on old photos, but at the time they were taken, no-one could have dreamt that these photos would be used to generate 3D models.
The church is a large building. You have to stand back when you take a photo of it and so, luckily, the photos showed some parts of the surrounding houses. Nevertheless, this resulted in a one-sided view: the only images the 3D builders had available had been taken looking towards the church. It was very hard to find the other side of the houses seen from the church. And there was no information at all about the colors in the buildings—all the photos were black-and-white. This left the makers with no option other than to make an ‘educated guess’ based on the available material. Colors were worked out from the black-and-white images and missing parts of buildings were made up using the sides of other buildings as a basis, assuming they would have been to some extent similar.

Community

It turned out that the municipality did not have enough data of its own to regenerate this old part of the town in 3D and a call had to be made on the collective memory. A banner was set up in the market asking people to share their memories. The phone kept ringing for days.

The memories were written down to be used in the stories that are now part of the Museum op de Markt. Old photo albums were examined, looking for any photos with a different perspective. In fact, this process is still not finished. The 3D representations still include some assumptions. Some people laugh when they see the 3D buildings, because the bricks are ‘too red’ or they see a water tank where there had never been one.

From a simple idea of ‘conserving history’, Museum op de Markt has become a crowdsourcing project. AR has become a tool to bring the different pieces of the story together and to make it visible in a single view. A tool that is accessible, so that everybody can respond to it.

Thoughts are now being given to whether Museum op de Markt can be linked to an online system where people can upload their own images and memories. Thanks to AR, something is growing in Spijkenisse that was not there before: a well-documented past.

Ferry Piekart

Ferry Piekart (1974) studied Journalism and Cultural Anthropology, and then went on to become an expert in storytelling. Ferry has been working for museums, television companies and (educational) publishers. At the Netherlands Architecture Institute, he developed the app ‘uAR’ (Urban Augmented Reality). In 2010, uAR was the first mobile application to use 3D models on a large scale, within the Layar engine. The app was showing a collection of non-existing buildings from the past and the future, within the city, on the exact place they were designed for. Ferry initiated the project, and was focussed on ways to integrate AR in storytelling, in order to make the technology relevant for users. In 2012, Ferry was a keynote speaker at MuseumNext in Barcelona, telling about ways to make AR a relevant technology instead of a trendy gimmick. Twnkls and Ferry collaborated on several projects, ‘Museum op de Markt’ being one of them.
The use of Ultra Wide Band tracking or Differential GPS to get the required accuracy was not an option since the app needs to run on a standard mobile device, and so we invented a new method called TileFusion. This is a novel combination of Natural Feature Tracking and sensor tracking: there are eight special tiles laid into the pavement of the square, each shows a nice historic picture and they are used to determine the visitor’s location as follows. We have embedded the tracking signature of these images in the app, along with their exact location and orientation, which were determined beforehand. When the visitor picks out a tile with the device, the software computes the absolute location and orientation of the device, in world-space. Of course, the augmentations are around the visitor, not on the ground, so when the device is tilted upward to look around, the sensors take over the tracking.

Since the output from the magnetometer in smartphones and tablets is consistently unreliable, we chose not to use it at all and instead relied on a sensor fusion of the accelerometer and gyroscope for the tracking. The CoreMotion implementation was used for Apple devices; for Android, we created our own implementation of this algorithm. A downside of this method is that only relatively high-end Android devices can download and use the app because a gyroscope is not embedded as standard on that platform, whereas all recent Apple devices (starting with the iPhone 4) have one.

A limitation

Using TileFusion, we have created the first large-scale outdoor AR experience with pretty good tracking accuracy that can run on consumer hardware.
SHIFTING SKIN

ALISON BENNETT

Skin extends beyond the ‘body proper’ giving us pause. Resting at the edge of our skins we cannot help but wonder what holds us together. … Skin, our largest organ, doubles upon itself, duplicitous, touching itself as other. … The body – even the technological body – is concerned with skin, be it skin colour or the surface of the screen, threatening to transform place into dermographics. Skinscapes abound. (Manning 136).

Cyberspace is colonizing what we used to think of as the real world … I think that our grandchildren will probably regard the distinction we make between what we call the real world and what they think of as simply the world as the quaintest and most incomprehensible thing about us. (Gibson, as quoted to Ward)
It was an unusual exhibition opening. There was quite a bit of inappropriate squealing. Some people were rolling about on the floor, holding out iPads and smart phones as they traced the shape of the 3D virtual objects that had sprung out of the prints on the gallery wall. Some attempted to get underneath the work, to see behind the virtual topography into the space between the digital object and the physical print. Visitors paced back and forth, engaged in a dance with the work and the limits of the interface. It was as if they were completing a dialogue by performing an act of revelation that mirrored many of the processes used to create the work.

The exhibition Alison Bennett: Shifting Skin at Deakin University Art Gallery consisted of ten large prints showing detailed close-up images of skin marked by tattoos. Working with representations of human skin captured with a re-purposed flatbed scanner, I sought to complicate the encounter with photographic surface with an overlay of augmented reality. The print image was not simply translated back into a limb or torso but wrapped around a landscape of peaks and valleys describing the tonal scale within the surface of the subject, the terrain of scars, tattoos, skin-tone and texture.

The overlay of augmented reality and fine art print was a gesture towards the collapsing boundaries between the material and virtual. The seed print was a gesture towards the collapsing boundaries between the material and virtual. "The algorithmic turn considered how image applications such as Photosynth and augmented reality point to potential "fractures" in the "representation order" (20), the schema and conventions by which we construct and interpret images. The "algorithmic construction of the image" (19) allows for a reconsideration, a retesting, of the limits and potentials imposed by the framing technology. He appears to position Photosynth and augmented reality within the family of technologies that mediate photographic desires, the impulse for the mediated image.

Watching visitors to the Shifting Skin exhibition as they contorted and danced in an arc before the exhibition prints highlighted the implications of augmented reality for the embodied viewer. Indeed, the issue was succinctly encapsulated by sociologist Nathan Jurgenson in 2011 when he coined the phrase “digital dualism” as “the belief that the on and offline are largely separate and distinct realities. Digital dualists view digital content as part of a “virtual” world separate from a “real” world found in physical space.” (Janssen) At the 2013 ISEA conference in Sydney, I was struck by how often delegates struggled to articulate the dynamic between the so-called ‘real’ and ‘virtual’.

This was no passive reception of an image on a screen. The mobile tablet became a portal to an alternative view of the image in space, one that could engage the entire body of the viewer. I was reminded of Arthur C. Clarke’s 1973 third law of prediction, that “any sufficiently advanced technology is indistinguishable from magic” or, if you prefer, Gregory Benford’s 1997 corollary that “technology does not appear magical is insufficiently advanced”. Whilst exhibition visitors experienced an encounter in the realm of magic, in retrospect the individual steps to create this effect were simple. Granted, at the time of making they did not appear obvious. It was not clear which platform, techniques, software and content was needed to resolve the impulse to make this kind of work.

The original images were captured using a repurposed flatbed scanner that was held directly against the skin, like a contact print. As the head of the scanner travelled below the glass of the scanner bed, I maneuvered the device around the contours of the subject’s body. The scanner has a built in light source that travels with the sensor head of the scanner that creates a uniform lighting environment without contours defined by shadows. The results are disorientating, as if the surface of the body has been unwrapped and flattened, a surface devoid of light chiaroscuro. The details of the surface of the skin are captured in forensic detail, something disembodied yet incredibly intimate. What is more, the scanner was not designed to be moved and tilted in this way. The gears and cogs slipped, creating beautiful glitches and ripples in the surface of the image.

These images then processed in two directions. Working with master printer Warren Fithie, the 2D images translated into large-scale prints on a
fine art matt paper, Hahnemuhle Photorag, using pigment inks from the Epson 9900. Even without the augmented reality component, the images are strong enough to stand alone. The prints are high quality art objects in and of themselves.

Another version of the images were translated from 2D plane to 3D form via a modified depth-map in Photoshop and Maya. My intention in developing this aspect of the work was to create a topology of the 3D object that would directly correlate to the light and dark elements within the image. This created an alternative view of the image data – an inversion of the surface data into representation as depth.

Finally, the 3D virtual objects were hosted by the augmented reality application Aurasma. Visitors to the gallery could either download the Aurasma app or borrow an iPad from the gallery. When the app recognised an image, it downloaded the associated 3D file and positioned it over the image. Whilst each step in the process is simple, the visitor experienced the illusion of seeing a 2D print transform into a 3D form. The mobile screen appearing to reveal something that was otherwise invisible. The overlay of augmented reality over the 2D image created an illusion that the 3D content rose out of the physical print, that the screen was revealing something that was directly latent in the physical print itself.

Which brings me back to skin and tattoos. Whilst, the individual technologies utilised were not difficult, the combination was effective at creating the illusion of technological magic. Similarly, the consideration of skin and tattoos via augmented reality appears to have been a particularly potent combination. The artwork generated quite a bit of viral internet attention internationally, stemming from a retweet by William Gibson and a video report by Mashable.com.

The intention behind combining this content with this presentation (images of skin with tattoos as prints overlaid with 3D augmented reality) was a desire to maintain a visceral link to embodiment throughout the encounter with the transformed digital image. Furthermore, skin embodies many of the paradoxes of materiality and immaterial embodiment within digital culture. There is an emerging cultural tendency to confabulate the biological metaphor of skin with the surface of digital media, and the metaphors of the digital interface with biological skin. Indeed, as the cultural conception of digital duality collapses, the distinction between the physical and virtual, the space between biological and technological skin converges and skinscapes abound.

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Alison Bennett is an artist and PhD researcher based in the Motion Lab at Deakin University, Melbourne, Australia. Previous solo exhibitions by Alison Bennett include ‘Shifting Skin; transforming fabric’, a moving image projection work commissioned by White Street Project with the support of Frankston Arts Centre and Arts Victoria in 2013; ‘Cavity’, also supported by Arts Victoria, which toured to a number of regional galleries 2009-2010 and was discussed by Robert Nelson in The Age 22 July 2009; the ‘to occupy’ series exhibited at the Vivid National Photography Festival in Canberra August 2008, featured in the November 2008 issue of Indesign magazine and reviewed in Issue 2.2 of Un magazine; ‘Verticalism: gothic ceilings’ reviewed in issue#24 of Artichoke magazine; ‘In Ruins’ exhibited at Platform2 featured on the cover of Arena magazine #78 and ANThesis journal #17; ‘Woolsheds and Shearers’ Quarters’ reviewed by Phillip Drew in Indesign #24; and ‘Inside Hill End’ reviewed by Charles Rice in Architecture Australia July 2004. Robert Nelson, reviewing ‘Making Hay’ in The Age 15 Nov 2006, compared her work to that of Walker Evans. She curated the group exhibition ‘Frames of Reference’ for Bathurst Regional Art Gallery 2005 and has works in the collections of Deakin University, the National Museum of Australia, the Historic Houses Trust of NSW and the City of Geelong.

Alison Bennett: Shifting Skin was an exhibition at Deakin University Art Gallery 24 July - 31 August 2013 and will tour to other venues in the near future.

Video documentation, exhibition catalogue, images and instructions for accessing the augmented reality content may be found at www.alisonbennett.com.au
Imagine picking up a box, shaking it about, and feeling smaller items inside the box being knocked about. Not difficult to imagine, right? Now imagine that the box is both fully transparent and empty, but still you perfectly feel its virtual content knocking around when you shake it. An example of tactile augmented reality.

A roughly 6 x 6 x 6 cm transparent plastic cube was fitted with two small contraptions on opposing sides, through which the thumb and index finger of one hand were slid. Holding the cube in this manner, I viewed a very basic animation on a monitor, which showed a simulated cube with one tiny ball inside it. When physically shaking the cube in my hand, the visualized cube would move correspondingly and the ball would bounce around in it, according to a basic physics simulation.

But I could also feel the tiny ball hitting the sides of the cube I was holding! Whenever the virtual ball bounced off an inner surface, I would not only see it on the monitor, but felt its impact with my fingers. Even when I closed my eyes... The virtual ball was physically present through my sense of touch, and I could interact with it by shaking or tilting the cube I was holding: tactile augmented reality.

The demo would even fill the complete cube with many virtual balls, and let me shake them about and spill them over the cube’s upper edges.

The simulation of many balls hitting the cube’s inner surfaces would perfectly match the tactile sensation.

In short, it works by deforming the finger pads with which I held the cube. By simply pushing my fingers slightly against or along the surface of the object, my brain was tricked into sensing impact and even changing mass of the object. Quite impressive.

For me, this project illustrates two major points in augmented reality research: (1) augmented reality could greatly benefit from including the non-visual senses, and (2) never underestimate the importance of student projects. I can’t wait for students to throw aside Google Glass, and develop their improved tactile version of Google Glove.
The Citadel of Learning

Within a defunct building opposite the old Chesh-ire Cheese pub, a stones-throw from London’s famous Fleet Street now hosts a groundbreaking new venture and an incredibly unique device called the STAARL (Super Technically Advanced and Rather Large) computer. It’s an awe-inspiring, liquid cooled device of unrivaled complexity. Using actuators and sensors to create an immersive graphical experience for the end user, the computer stores extraordinary cutting-edge Augmented Reality programs which people can call upon. Using complementary AR glasses, users can learn from the history of famous sporting grounds to buildings of art and theatres as if they were actually there.

A Glitch in STAARL

Today was an extraordinary day for St. Leonard’s college. Seventeen finance students and their tutor were eagerly waiting in a cordoned off section of a modern banking hall. Around their necks hung a razor-thin pair of prototyped Augmented Reality glasses named GG416. Today they were part of a chosen group to learn and see in stunning detail the intricate workings and daily life as it once was in one of the oldest banks in the world. The very banking hall in which they now stood once accommodated Child’s Bank, situated at 1 Fleet Street London, which began trading in 1671.

‘Now everyone.’ The organiser explained. ‘Please put on your glasses which will lock securely around your heads. You will be unable to easily remove these until the program has finished. You are about to have a very rare history lesson. The Augmented Reality simulation you are about to

OLIVER PERCIVALL

see shows techniques and terminology which are now completely outdated within the banking world. You should however find it an extremely interesting and educational experience.'

The students put on their glasses, which locked into place; and the banking hall appeared to suddenly darken. Using an immersive computer generated environment the students were instantly transported to the gloomy halls of the ancient Banking house. Huge gargoyle statues stared down from the yellowing walls as if to oversee proceedings. Money and gold was carted up and down the shadowy hall and bank notes were being shuffled over by the practiced thumbs of clerks behind desks. Grain merchants and numerous traders formed queues clutching their silver and gold. Streaks of bright morning sunlight shone through the huge windows.

Within their immediate field of view, a computer generated moustached man dressed in old-fashioned business attire appeared in front of a cashier desk and began to address the audience. ‘Goldsmiths were the first type of bankers. Gold was heavy and cumbersome so they offered the depositors a receipt instead of the gold which became the first type of bank notes.’

The program stuttered then paused unexpectedly. Unbeknown to the class a message flashed across the screen of the STAARL computer. Due to sudden and unexpected circumstances something illegal has occurred. This computer or any programs running on it may not function as expected. A random program will run in place of the current program if the problem persists.

The Augmented Reality simulation juddered for a few seconds and the organizer began to look nervous. It then resumed as the moustached man continued his speech. “The complex business of the check is a bill of exchange from recognized institutions which in turn is transferred to... the Android open source architecture.” An enormous Gingerbread man stomped through the banking hall. Some of the students sniggered. The tutor peered over his glasses to one of the organizers. A rotund man dressed in a starched white shirt and braces clutched a bag of gold as he spoke to a banking clerk. The eyes of one of the gargoyles above him began to glow an evil green. He looked up in terror as a bright green laser beam bore down and burned the bottom of his bag spilling its contents over the floor.

‘Banking is the safest and most conventional institution known to exist.’ The moustached man continued to explain looking around anxiously. ‘The importance of these transactions that take place every day in this very banking hall are probably as significant as... mankind’s thirst for ever more powerful smartphones which have left the world a scorched battleground, blistered and scarred from the mighty Androids that stalk the earth. You humans live in a world overrun with devices of unprecedented size and capability.’ A booming multi-pitched robotic voice finished.

Laser beams thunder down and explode all around the banking hall as customers dive for cover. The students jump back as the awful realisation of towering green Androids appear around them. They march relentlessly forward, their cold eyes hell-bent on vaporizing all that stands in front of them. Terror fills the eyes of the students as they bash into each other while grappling in vain to remove their headsets. ‘Our architecture will soon incorporate this domain.’ An unemotional computerized voice says. Huge chunks of wall are blasted from the hall flooding sections with brilliant sunlight. The students cover their eyes from the searing light.

The STAARL computer displayed another message Initiate rollout of the program One day we will all live within the Android operating system YIN...

The event supervisor asks the students to remove their glasses. ‘I’m sorry.’ The supervisor says. ‘Looks like we may have ourselves a virus. This lesson has now finished.’
RADICAL TRANSPARENCY: AND HOW TO DESIGN THIS?
BARBARA M. ASSELBERGS

AN APPARENTLY HARMLESS APP TO GAUGE STUDENTS’ OPINIONS OF THEIR LECTURERS, DESIGNED BY DESIGNARBEID, WAS MET WITH FIERCE OPPOSITION FROM THE ART ACADEMY WHERE IT WAS PRESENTED. THE PROJECT DEMONSTRATES THAT THE INFLUENCE OF TECHNOLOGY ON (FUTURE) SOCIAL RELATIONSHIPS HAS MANY COMPLEX FACETS TO CONSIDER. DESIGNERS, ARTISTS AND ARCHITECTS INCREASINGLY QUESTION THE CIVIL, SOCIAL AND CULTURAL ASPECTS OF AVAILABLE DIGITAL DATA AND ITS USAGE. DESIGNARBEID’S CO-OWNER BARBARA ASSELBERGS REFLECTS ON THE RADICAL TRANSPARENCY IN EVERYDAY LIFE AND HOW THIS AFFECTS DESIGN PRACTICE.

An invisible network of wireless, traceable chips, sensors, scanners and cameras is evolving around us at an exponential rate. The quality and quantity of the data collected with this network is increasing at an equally fast pace. Newly emerging networks collect so-called ‘big data’ and convert it into meaningful information. These networks are able to make connections between all kinds of physical indicators (people’s facial expressions, body temperature and heart rate) and lifestyle choices (people’s social activities and consumer behaviour). The models derived from these data cannot only predict people’s behaviour, but can also interpret it. However, this often involves confidential information.

Processing all of this data can have a great impact on cities – and the behaviour of its residents. In the future these data sets from individuals could be analysed to predict the likelihood of them committing a criminal offence in the months ahead. This information can be collected without the need for specialist knowledge or any kind of explicit consent from the public. Is it, then, in any way desirable that everyone knows exactly what you think of your neighbour, your employer or, in the case of this project, your lecturer?

In March 2013 DesignArbeid presented ‘Students Open Up’, an application that allows students to share their opinions about the performance of their lecturers and the quality of general facilities like the cafeteria, the library and the work spaces. To reflect on the public nature of the data and the inability of individuals to remain anonymous, the students had to use their own name when providing feedback via the app. The data set was displayed in a graphical form in a physical location in the college rather than assigned to the individual lecturers. Responses included: ‘Cool projects’, ‘often nice guest lecturers’, ‘sometimes varying feedback’ and ‘breaks take too long’. More than 60 third-year students gave their lecturers a ‘good’, ‘satisfactory’, ‘moderate’ or ‘insufficient’ score and were able to add a brief explanation.

All ratings were linked to the physical location of the relevant lecturer’s class. This was done not only to map the individual qualities of the lecturers, but primarily to make all the members of the college aware of the implications of this information being made public. In the preparation stage for the intervention, in which students from the Fashion Design, Graphic Design, Illustration and Spatial Design departments submitted data via the app, head-lecturers and students responded positively to the initiative. (Students from the Photography Department declined to participate owing to concerns that it may have negative repercussions for their lecturers).

The app is a useful tool in collecting and assessing current students’ opinions on the quality of the education provided by the institution. However, of more interest is that sharing these opinions allows prospective students to draw on the previous experiences of the existing student body to make more informed decisions regarding their future. DesignArbeid extended the project to the academy’s Open Day which took place in March.
2013, to investigate this aspect further. During the open day a team of designers and artists at the entrance of the college introduced the visitors to the “Students Open Up” AR app on dedicated iPads. Of the visitors the young prospective students rather than their parents were comfortable installing the app on their phones and proceeding to the introduction to the college. On their way out they were questioned about the impact of the data from the app presented to them throughout the college and their opinions of the open day overall.

This response is remarkable given that these sorts of experiments belong in an environment such as an art academy where creativity and free-thinking experiments are a cornerstone of its mission. Indeed creative institutions should embrace these kinds of initiatives and be keen to identify themselves with them. The shock to the college authorities came from the app creating an alternative perspective. By observing the academy from the inside-out, through the eyes of the students, the official publicity policy of the college was reduced to just one of the flows of information the public could choose to access. The information available to the students then becomes more complex as it can no longer be presented as an unambiguous and unified narrative.

When using the app to fill in their opinions, existing students indicated that they were fully aware of the consequences of the intervention, and the responsibility it entailed. Thus, the communication department should not have reacted solely with the interests of the institute itself in mind, but should have taken a stance regarding the vulnerability of its lecturers and staff.

A lively debate about privacy and the ethical impact surrounding the use of data is taking place globally. What does this radical transparency mean for individual social interactions and the design of new interaction models? In today’s world it is no longer an option to be “for” or “against” transparency and openness. It is simply a reality in today’s world. The question is “how do we want to engage with it?”. It is important to investigate the relationship between “transparency” and “confidentiality”, and from the results of this research, develop new strategies and, perhaps even, new social structures. The challenge for designers and artists is to visualise this relationship and generate meaningful discussions in order to create solutions to the problems raised.

The app “Students Open Up” was developed by DesignArbeid in collaboration with AugmentNL.

“Thus the communication department should not have reacted solely with the interests of the institute itself in mind, but should have taken a stance regarding the vulnerability of its lecturers and staff.”

Could the information from current students possibly influence prospective students’ choice of study programme? The responses to the first Facebook posts about the open day were positive. The prospective students liked the idea, and on the day itself also provided more detailed feedback. Some commented “I already made my choice, I came for the college and not for the lecturers”. Other students said they would be directly influenced by negative comments from students about their lecturers.

While the event was progressing, a representative from the communication department unexpectedly stepped in. She had been unaware of the full nature of the intervention and demanded DesignArbeid to put a halt to it immediately. Furthermore, she requested that they refrain from publicising the project. The reason given for this strong response was the inability of the college to control and manage the app or the information gathered. Alongside the regulated information provided by the art academy, visitors would have access to an alternative, unedited narrative, based on the opinion of current students.

DesignArbeid is run by designers Ruben Abels and Barbara Asselbergs. It is a studio in Amsterdam that focuses on social issues. One of its primary objectives is to consider the maintenance and improvement of living conditions within our cities. In particular, to identify the concrete steps we can take as individuals to influence our surroundings and what kind of contribution new media and technology can make in this respect. DesignArbeid attempts to stimulate ‘design thinking’ in neighbourhoods and communities. The resident’s quality of life always comes first in each of the projects undertaken.

DesignArbeid developed the AR intervention ‘Politics in the street’ in 2012 where they confronted visitors of the Rembrandtplein (in Amsterdam) with the voting behaviour of other visitors to the same square (see www.designarbeid.nl/#/politiek-op-straat-).

In 2012 DesignArbeid developed the AR app ‘Open lectures’ where visitors to the lecture series ‘Summit of New Thinking’ (Berlin 2012) were able to vote on the speakers in real time (see www.designarbeid.nl/#/voting-for-lectures).
Ionica Smeets is a science journalist, mathematician and television presenter. Ionica obtained her doctorate in mathematics with a dissertation on continued fraction algorithms from Leiden University. As a journalist and a presenter, she is interested in the role mathematics plays in everyday life. She writes columns for the Dutch newspaper “de Volkskrant” and has published the book “Ik was altijd heel slecht in wiskunde” (I was always bad at maths) with Jeanine Daems. Besides writing, Ionica has published short videos about science for the website wetenschap101.nl. In her recent television programme “Eureka”, Ionica Smeets and co-host Sofie van den Enk try to find mathematical answers to questions such as how to win the lottery and how to find the ideal partner.

OK, GLASS?

GLASS
HALF FULL
VERSUS
GLASS
HALF EMPTY
OK, GLASS?

GOOGLE GLASS? YES PLEASE!

BY IONICA SMEETS

When I hear the arguments against Google glass, I am reminded of my best friend’s reaction when I told him I planned to buy an iPhone, sometime in 2008. He was appalled. “You will read your email everywhere! What will happen if we are at a party and you get an important email from work. Would you leave the party?” I honestly answered that I thought I might, if there was a serious problem. He decided that he would never, ever buy a smartphone. And he questioned my sanity.

Of course, by now he is on his second iPhone as well. And I believe that many of the people who are now railing against Google Glass will turn around at some point. For now, it is very hard to predict how we will use these types of technologies in the future. After all, when the first mobile phones came, nobody dreamt about WhatsApp, never mind Angry Birds.

So probably, in a few years, everyone will be using Google Glass (or one of its competitors) in ways we cannot even imagine now. I have some rather trivial reasons for wanting a Glass now, but I am mainly excited about the new possibilities I will discover once I have one.

One of the things I already look forward to is navigating around the city with more ease. I am probably the person with the worst sense of direction in the world. After living in Leiden for seven years, I still get lost sometimes when I bike to friends at the other side of the city. So having an interactive map on my smartphone improved my life a lot, but having a map projected on glass would be even better. Because now I quite often go to meetings on a rented public transport bike (another thing I did not imagine using before it existed, but something I would miss so much if it wasn’t available anymore) and ride with my phone in hand to navigate. I still get lost at least twice a week. Having the instructions, well, in front of my face, will make my life easier.

Another reason I would love to have a Glass is for skyping. Currently, when I want to show my family abroad my lovely two-year-old son, I have to run around with my laptop with its built-in webcam. Toddlers are not so great at sitting still in front of a computer. Just following him around with my eyes will be much easier. And of course, taking pictures in the blink of an eye will also be nice when I am playing with him.

What’s more: my lousy facial recognition skills could also use some algorithmic improvement.

GEEGEE!
OR WHY I PREFER RUBBING GLASS OVER WEARING IT.

BY HANNA SCHRAFFENBERGER

“When’s my Geegee?” — I can’t find anything without my Geegee!” I sound like my mother when she can’t find her glasses. However, unlike her, I’m not shortsighted. I’m envisioning my life as a Google Glass addict. I picture a world in which my hands search the bedside table for my Glass first thing in the morning and put them down just after turning off the light at night. A world in which my little black ‘Geegee’ knows where it has last seen my keys, displays what I have to buy in the supermarket and remembers the names of those friends who use fake names on Facebook. Although the highly anticipated device will probably hit the consumer market soon, this future vision remains very unlikely – at least for me.

It’s not that I don’t like technology – being connected, liking stuff, sharing what I see, reading my emails while shopping for groceries and buying overly expensive gadgets. Like many, I’m addicted to my phone and I can’t wait to sync it with my future iWatch. Also, I enjoy reading the newspaper on my tablet while having breakfast. And I love my Macbook. So much so, that I spend about eight hours a day in front of it. But the fact that I’m a screen addict doesn’t mean that Google Glass will be a good fit for me. The opposite is the case: I don’t see the point in staring at a screen through yet another screen. What will Google Glass possibly display that my phone, tablet, laptop and smartwatch won’t display even better? Emails? Pictures? Articles? The newspaper?

“But it will replace your phone” – the proponents might object. Well, it can’t. Glass needs your phone to receive calls and messages. In fact, Glass might even motivate you to take out your phone. If you receive a private text message, would you like to type one back – or speak out the response for everyone to hear? I agree, phones don’t necessarily make us act social. Zero eye contact. But I prefer to disappear into my phone over acting like an undercover zombie who stares ahead while secretly reading the news. More importantly, I like to be in charge of my attention. It is difficult enough to ignore a message, postpone Facebook prompts and to stay focused when the phone is buzzing in my pocket. How will I be able to ignore the pop-ups and temptations floating right in front of my eye? I guess information is like food to me. While some like to be fed, I prefer to be in charge of what, how much and when I eat. And by the way, I am sure, receiving...
I would love to get some hints from Glass when I meet an acquaintance and cannot remember his name and have no clue why he is talking about Peru. Did he live there? Is his wife from Peru? Help me out here Glass! Will this make social interactions less valuable? I don’t think so. Does setting automatic birthday reminders make the card you send less valuable?

It is all about how you use the technology; with smartphones it took a while to find a new equilibrium between being connected and being polite. But in the end, I never had to leave a party because of an urgent work email, simply because I try not to read my email when I am with company. I am confident that we will also find a way to use Glass, without ruining our entire social lives.

Some people will just be annoying and use their Glass to check Facebook during a dinner party. But they are probably the same people who, now, always have their smartphone on (with the most obnoxious ringtone possible). But I bet that these kind of persons were already a pain in the neck in the fifties when they monopolized the jukebox in their diner.

So, Google Glass, will I wear you 24 hours a day? No way. Would I like a pair? Yes please!

Considering that I won’t wear Glass in front of the computer screen, on my way to work, when getting lost, when talking to strangers and while having breakfast, a question arises: when would I wear it? Google’s demo videos provide the answer. I wouldn’t mind wearing Glass in order to record a video when riding in a hot air balloon, jumping out of a plane, sculpting ice or when Skyping with my boyfriend from the highest building in town. It’s just that these kind of things happen so rarely in my life that it is not quite worth buying the device.

I don’t want to bore you with technical arguments, like the low screen resolution. I don’t want to make up psychological assumptions, e.g., that people like to touch stuff — even if it’s only words on a screen. I don’t want to be too negative. It is a new device — I haven’t even tried it yet — it deserves a chance. So what would make me want to wear Glass? Personally, I would wear Glass for the same reason that I would wear glasses. I’ll wear them to be able to read things that I otherwise can’t, I’ll wear them in order to perceive more about the world around me. In my opinion, traffic-directions, weather predictions and superimposing names just doesn’t cut it. My advice: if Geegee wants to succeed, it should not rely on the hardware itself. I think the best way to convince me and fellow skeptics is by creating content that is worth seeing with Glass. But even if that happens, I’m not sure whether I’d wear it. I’m afraid, I’d prefer to get lenses instead.
Allow me to pose a question. Put aside the artistic values of augmented reality in today’s society, and look at augmented reality from a purely technical perspective. When developing our augmented reality applications, how can we ensure that we achieve accurate, reliable results? There are two fundamental problems we have to solve: accurately tracking the pose of the user’s viewpoint (in order to adapt the relative pose of our virtual content), and finding a suitable way of delivering our augmented experience to the user via some appropriate display technology.

In issue 1 of AR[t] we discussed some methods that allow us to place virtual objects into our perspective of the real world. These methods include the use of fiducial markers or natural features to track the user’s viewpoint. Natural features offer many advantages over fiducial markers; far more landmarks are visible in the scene, not all of these landmarks need to be visible at once, and our working environment has the ability to grow. The disadvantage of using natural features instead of fiducial markers is that we lose our known measurement. Without some known measurement, we can only determine the relative distance between features, not the absolute distance. Given that we want to remain working in an unprepared and unknown environment, we need to find a way to reintroduce our known measurement.

Nature offers a solution to this problem. Humans have many different visual systems for depth perception, one of which is stereopsis. Stereopsis works on the principle that two eyes are better than one. By looking at an object from two different viewpoints at the same time, our brains are able to triangulate the 3D position of that object, based on the difference of its location in the two images received and the existing knowledge of the distance between our eyes. Stereo vision in computing uses the same principle. By setting up two cameras in such a way that we know the absolute difference in pose between the two cameras, and by knowing the relationship between the images captured by the cameras and the real world, we can determine the absolute position of our identified features.

In order to determine the relationship between the captured images and the real world, camera calibration has to be performed. Camera calibration is typically done by taking still images of a scene, containing a pattern of known size, from multiple viewpoints. Using computer vision techniques, we can then determine the relationship between the image obtained from a camera and the real world. This relationship can then be used to determine where a 3D point in front of the cameras in the real world would appear on both images. The challenge with a stereo camera setup then, is to successfully match the same features in both images. Assuming that we have successfully matched a feature in both images, we can then use simple triangulation to determine the 3D position of that feature in the real world.

In issue 2 of AR[t], the AR Lab in co-operation with the Delft Bio-robotics Lab of the Delft University of Technology, introduced Marty — the new affordable AR headset. Marty takes full advantage of the stereo camera setup discussed. This allows us to create augmented reality applications, using natural features for tracking the user’s head pose, and to create a correctly scaled map of our observed environment. Marty has two displays — one in front of each eye. By making use of stereopsis we can present the user with a 3D representation of the real world augmented with our content.

All visual augmented reality applications require methods for image acquisition, pose estimation, and some display technology. The problem with most existing solutions is that they are often made available as packages, in which each of these components is tightly coupled together. It is often difficult to, for example, take the image acquisition and pose estimation components of one solution and to combine them with a different display technology than the one provided, without having to delve deep into the source code. Whereas most solutions contain support for displaying customised augmented content, the same flexibility has not been adopted for changing the system components themselves.

In order to deal with these challenges, we at TU Delft have developed a more modular approach to augmented reality system design. Each component of our system has its own module, with explicit inputs and outputs. By having modules that focus on specific tasks, and well defined inputs and outputs, we can easily exchange any component in our system with another that has the same inputs and outputs. For example, should we wish to use a different camera tracking technology, we merely remove the existing tracking module from our system and replace it with another, making sure that the inputs and outputs of the modules are reconnected. In this case, the inputs to our tracking module are the images acquired by the cameras, and the output a 6D pose (position and rotation) of the camera. The advantage of having an interchangeable modular system design is that should a new camera tracking or display technology become available, we can easily adapt our existing system to incorporate it. In this way, we can create tailor-made solutions for many different augmented reality applications.

In addition to augmented reality hardware and system design, our current research at TU Delft is focused on how to extract more information from the images captured by our stereo camera setup, in order to improve our understanding of our working environment. This provides two benefits to our augmented reality system; we can improve the virtual model of our environment and thus adapt our virtual content to better suit the real world, and we can use our improved virtual model of our environment to better track the pose of the user’s viewpoint. This is in fact a cyclic process. The more accurate our estimate of the user’s pose, the better we can model our environment. The better our model of the environment, the more accurately we can estimate the user’s pose. To this end, work is on-going into methods of modelling our environment, and how this information can be used for a more reliable and interactive augmented reality. So how do we best extract more information about our environment? I guess it’s a question of pose.
AUGMENTED MEMORY IN AN ARTIST’S ATELIER

AR INSTALLATION, PARTHENON-FRIEZE HALL BUDAPEST [2012]
Time and memory became the main topics of an experiment based on Augmented Reality. The installation was part of a PhD research project into the artistic usage and possibilities of immersive and augmented virtual reality. Using AR, the past and the present placed together, and time passed became visible.

Would it be possible to recall a place with interactive technology? Could virtual systems take us somewhere else in time? Alongside these questions, the main idea was to show the layers of time in connection with technology. Furthermore, the experience intended to investigate the possibilities to observe a space in relation to time and history.

The inspiration came from a specific space, an exhibition hall in Budapest called the Parthenon-Frieze Hall. At the beginning of the twentieth century the room was the atelier of artist Alajos Stróbl (1856–1926), who was one of the initiators of fine art education in Hungary. The atrium used to be nicely decorated with a fountain, a gold fish pool, palm trees, Persian carpets and the stucco walls were painted the color of Pompeii red. The history of the hall is well known, but the interior changed over the time until it was transformed into a white cube space; only the frieze shows some of the richness of the previous periods. The reconstruction of this interior was the main goal of the project.

Archive photographs of the building were found in the collection of the owner’s grandchildren, and several articles helped to imagine and recall the decoration. The pictures were taken at the beginning of the last century. Most of them were made by the artist’s wife, Alajosné Stróbl (Louise). Taking photographs then required longer exposure time and wider aperture, so she needed a camera stand. Considering the structure of the room, and the equipment needed, there was only a limited space for a tripod. There was one specific area where several pictures were taken. It was a spot close to the sculptor’s table. It is just a speculation, but that table could have served as a base for the camera to sit on. No matter if this is true or not, the fact that these pictures were almost taken from the same position, allows us to look around, like in a panoramic picture. Only an interface is needed to visualize this.

From the technological side, AR seemed to be the best solution for projecting the images in their original positions. Luckily the relief running around the wall served as a perfect pattern showing the appropriate size and the actual positions of the captures. After linking the photos to the AR markers, they just needed to find their original position in the space. Supervisor of the project, Dr. Zoltán Szegedy-Maszák, head of the Doctoral School, offered his assistance to develop the idea. Since he had made several AR based artworks in the early on in the development of Augmented Reality, he helped to modify his own software for the new parameters.

When visitors entered the space, they saw the empty walls with AR markers placed around as well as the monitor on the top of the sculptor table. The classical interior with the geometrical black and white AR markers strongly contrasted each other. This particular exhibition place is known for showing more ‘classical’ media, in that sense, high-tech equipment on the top of a sculptor table can be also considered as a different statement. The copy of the master’s table served as a tripod. A monitor with a webcam on its back was visualized the AR experiments, while a small laptop with the software was hidden inside the table. The camera and the tripod handle invited the visitors to move the screen; when the camera captured the AR markers, the images appeared. Pictures with different transparency sometimes make the past, or the present more visible. The physical space was filled with digital information and on the screen they became one. Moving the screen around the space enabled visitors to observe the room in different periods of time, and turning the monitor 360° around, made it possible to experience the reconstruction of the whole space.

The reaction of the audience varied. Some visitors even asked to develop the work in a way that they can walk in the picture while they also can see the image. They wanted to be inside the screen, what really is a step to consider next.

While we augment the space, the project proved that if the supplements have something to do with the real space, if the two have a strong tie, we might believe that they are one. Archive pictures can give us information from previous times, but if we can interact with them, or step inside them, maybe it will lead us toward a new kind of relation with time.

**Acknowledgement**

The installation was supported by the EU as part of the TÁMOP project. The work could not have come into existence without the help of the supervisor Dr. habil DLA Zoltán Szegedy-Maszák. Thanks goes out to the Stróbl family’s generosity for sharing their archive. The project leader is also really grateful and would like to thank to the AR Lab for their support, especially to Wim van Eck for the technical advice, and Yolande Kolstee for the individual assistance.

**Links:**

- Video presentation of this project: [www.youtube.com/user/szvet](http://www.youtube.com/user/szvet)
- The article is a part of a PhD research of Tamás Szvet. More information on the website: [www.szvet.blogspot.com](http://www.szvet.blogspot.com)
- Supervisor of the project Dr. habil DLA Zoltán Szegedy-Maszák: [www.sznm.hu](http://www.sznm.hu)
Tamás Szvet is an artist and a PhD student at the Hungarian University of Fine Arts Doctoral School Budapest. After he graduated from the same university in 2007, he started an artistic research project in 2009 and carried on his work at the Department of Media Studies at the University of Amsterdam, and at the Gerrit Rietveld Academy, also based in Amsterdam, in 2011.

Szvet always starts with a conceptual question. The convergence of science and art is a central focus in his work. He plays with technological invention in order to convey his fascination with fields of energy and our place in the world, through levitation, illusion, reality and non-reality and where the thin veil between these lie.

His working process employs a wide range of techniques. He places great emphasis on the interaction of the artwork and the viewer. His works call for viewers' participation. Lengthy art historical and scientific researches precede the creating activity, so research becomes a basic act in his work.

Szvet’s work has been exhibited in numerous international venues and he has participated in artist residencies in Germany, Italy, Czech Republic, Finland, France and in South Korea. He won the Talentum Prize — founded by the Hungarian Academy of Science — in 2010.
Making Cultural Heritage accessible to the public is an important mission of museums, libraries and archives. To facilitate this, they often digitize it to remediate it and put it on the Internet. Doing this has several advantages. Besides making the content accessible, it will build a database that can be easily accessed. These digital files can be used as a preservation method, relevant for items that are slowly degrading. Digital collections often make the actual physical collection less relevant, meaning less work for librarians, less need for the study-hall, and the items are not handled physically, improving their health. Moreover, digitization facilitates conservation, art history studies, restoration and exploitation for publicity or monetary profit.

The digital representation of the material is often a — very high resolution — RGB image with some metadata. For items of high cultural value, such as paintings of Rembrandt and van Gogh, great care is taken and they are frequently analysed with various imaging techniques and methods that can provide new insights. Methods range from infrared (IR) photography to TeraHertz imaging or X-ray fluorescence (XRF) spectroscopy. From frequent use of raking light images and surface normal maps it is apparent that there is a great interest in the capture of the surface topology too.

Paintings are 2D projections of a 3D world carefully considered by the artist. Painters like Rembrandt and later van Gogh — apart from using cues such as depth from luminance and shape from shading — more and more used paint in 3D as a medium to give form to the local 3D shape of objects in their paintings.

Up until recently, retrieving this extra dimension had a limited use, such as topographic analysis for the detection of local surface defects for restoration purposes. Because of the current developments in AR, consumer 3D screens and 3D printers, the relevance of 3D scanning and publishing is increasing. To our knowledge, no art reproductions have ever been made that are both in full colour and printed accurately to scale in all three
New developments in high resolution 3D printing make such reproductions possible, and sparked our initiative to develop a high resolution 3D scanner with the following requirements:

- Non-invasive, portable and low cost
- Size (XY): 2 x 2 m, Depth (Z): 2 cm
- Resolution: 50 μm/pixel; the resolving power of the human eye at 75 cm
- Color Accuracy: ΔE conform to the Technical Guidelines for Digitizing Cultural Heritage Materials, FADGI

After careful analysis we came up with a principle solution based on a combination of stereo vision and fringe projection. Stereo vision is a passive method with excellent color reproduction and has a good absolute triangulation, however it requires images with much saliency; i.e. it fails on surfaces without texture. To overcome this, we used a projector to project fringe patterns on the painting. Triangulation using fringe project-ed patterns is a relative triangulation method, it requires no saliency in the image as texture is actively projected, it has phase unwrapping problems, but these can be solved. Both methods can be combined to obtain all advantages and no disadvantages. The stereo matching is first performed on salient points in the image only. Then these points are used to anchor the relative matches of the fringes triangulation, making all matched pixels in the image absolute 3D points.

Finally all points are fused with points obtained from dense stereo matching, providing for each pixel in the image both depth and color. See figure 1.

Figure 2 shows the actual set-up with crossed polarization filters on an Optoma PK301 pico projector and (Scheimpflug) lenses on the Nikon D800E (40 megapixel) cameras. The triggers to the camera and whether the cameras have actually triggered can be sensed through the connection of a synchronization (or flash-) cable between the devices.

The linear translation axis is used to scan with a 17x10 cm 40 megapixel window over the painting. The vertical translation is done manually. One capture takes 2 minutes and processing takes 10 minutes per capture. The final resolution realized is 50x50x10 μm/pixel (x, y, z). All captures are 3D stitched to form the final data-set of the image. The controller of the system uses a USB connection to a host-computer and is based on an Atmel chip flashed with the Arduino bootloader allowing programming in C++. The micro-stepping of the linear translation axis is performed with an Allergo A4988 chip, while manual adjustment of the axis is possible with a joystick. End-stops are realised with Hall sensors. The mems device MPU-6050 is used to measure 6DOF motions; high motion amplitudes postpone the capture of images.

The limitations of the system lay in the non-neutral illuminant (RGB-LEDs), a non-consistent illumination when working in a not fully conditioned environment of a museum and the angle of incidence is not known.

We scanned the following paintings:

- Self-Portrait, Rembrandt (1669), Mauritshuis
- Flowers in a Blue Vase, Van Gogh (1887), Kröller Müller Museum
- Jewish Bride, Rembrandt (c. 1667), Rijksmuseum

Rembrandt’s Jewish Bride is a painting of 160 x 120 cm. It was acquired in 24 shots with in total 6000 photos, which has taken 4 days. The processing time for triangulation and 3D stitching on a quad core PC has taken 2 weeks.

We discovered that due to illumination issues, we had to scan the images in High Dynamic Range and account for background lighting fluctuations. We successfully printed the 3D pictures on the 3D printers of OCE (a Canon company) in Venlo (NL) by intervention of Prof. Jo Geraedts or the TU-Delft, Faculty of Industrial Design.
Although developments of new technologies are impressive to most of us nowadays, to the lovers of science fiction, they are certainly not big news. It is very common to see fictional characters using the most exotic devices when it comes to futuristic movies.

But what if we consider that many of these devices already exist and that they are available for consumers? For example, a few of the gadgets shown in early action movies are now readily accessible. So let’s take a trip through time and see how many of these utilities we can find in our pockets or even inside our mobile phones.

There’s a big list of characters we could talk about, but for the sake of concision I will take a quick look at James Bond’s gadgets and hopefully, after reading this article, you’ll find that you have lot more in common with 007 than you thought.

In 1963 our dearest secret agent already showed us an interesting example of the huge gap between the devices of today and the expectations we had towards technology a few decades ago.

It is in the movie From Russia With Love that Bond hides a reel-to-reel tape recorder inside a photo camera that would serve to secretly interrogate Tatiana Romanova, a cipher clerk from the former Soviet Union. The curious thing about this example is that, today, it seems very unlikely, since we have all of Bond’s gadgets in one. Still in the same movie, something that seemed quite impossible for the 60’s appeared as an important tool for the character: a pager. With this device Bond could receive requests from MI6 in case of emergencies. It’s funny to see how we take that for granted nowadays.

Almost ten years later in Diamonds are Forever — which was partly filmed in the city of Amsterdam — we can already see the evolution of the gadgets that vary from a fake fingerprint membrane to a slot machine ring that is designed to guarantee a jackpot at any slot machine. However, the gadget we are going to review from this movie is more related to audio. The so-called “voice changer” was the size of a typewriter and functioned as an audio filter that processes the user’s voice. You can already imagine that Bond could use this device to mimic someone else’s voice in order to deceive his enemies. This exquisite piece of equipment can now be easily substituted by any audio editor, not to mention the extra features that we have readily available at the click of a mouse.

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Last but not least, the TV Watch showcased in Octopussy (1983) that appears as a device that Bond uses not only for spying business but also for fun. What is interesting about this gadget is that is was actually produced and commercialized by Seiko, although it was only available with a black and white display.

There are still many more of 007’s movies and gadgets to explore, however what is noteworthy in this discussion is that the more recent they are, the smaller the gap between fictional and real devices is. Considering this technological evolution throughout the years, an interesting question to ask ourselves would be: Will we ever reaching a point where all our ideas can be materialized into viable creations?
Talescape
Michiel and the tale of an it-can-be-everything-you-want-it-to-be locative media API
Hanna Schraffenberger
“He’s a social nerd” — that’s what I thought when I first met Michiel at a faculty dinner two years ago. Michiel is one of those PhD students whose work is so unrelated to what I do, that it is difficult to find common ground. At the same time, he is so social, that you’d easily talk to him nonetheless. When we ran into each other at lunch, we used to practice our small talk skills and discuss bad weather, new gadgets and canteen food. However, this has changed a while ago. While continuing his PhD by day, Michiel has been working in my field of expertise at night. His latest project, Talescape, is what he calls a “locative media platform”. The first idea he is deploying on the platform is what I’d call an “Audio Augmented Reality Application”. While we have lunch, he tells me more about his new endeavors.

“Talescape is a service, a platform, an API (Application Programming Interface) that allows you to develop anything that connects audio to certain locations.” Although this sounds rather abstract, Michiel has plenty of concrete ideas for services that could be created with the API. “With Talescape, you can develop anything ranging from audio-based city guides for tourists, way-finding services, silent disco’s on the beach, real world adventure games to location-based advertisement and experimental audio walks.” As diverse as this might sound, it basically comes down to a person moving through space with their mobile phone in their pocket and their earplugs in their ears. Depending on their current position (mostly GPS coordinates received by their phone), they hear different audio content.

Actually, the platform is intended to be so flexible that it is more easily described by what it can not do: “Talescape can be anything you want it to be. For example, while we’re currently focusing on audio, the platform will not be limited to it. You could use it to send yourself reminders to buy groceries when you are near the supermarket, or update your Facebook status automatically when you arrive at work. The only thing it probably shouldn’t be used for is security and authentication. Having your home’s door unlock automatically when Talescape thinks you’ve arrived is not the best idea. Nor can a Talescape application prove that someone is really where they claim to be, because the GPS data from a smartphone can be faked, if you have the know-how. Other than that, the sky’s the limit. It is also flexible in terms of hardware: It runs in the browser of any modern smartphone or tablet. And when Google thinks our little country is ready for Glass, it will run on that too.”

Something else that makes Talescape special is that the end-users (those who walk the streets with their phone) can not only receive location-based content but also create and upload their own content. “One application we are focusing on is storytelling. Imagine walking the streets and being reminded of a story about your surroundings. How great would it be if you could simply use your phone to record the story and share it at that particular spot? Our plan is to make this possible. Once the story is shared, other users who walk through the area can listen to it, rate it up or down and even record their own response. Of course, this is not a substitute for the experience of walking around with a local expert and hearing the story of your surroundings firsthand, but we believe it is the next best thing.”

Interestingly, it is this storytelling idea that initiated the Talescape project in the first place. “I wouldn’t be working on Talescape if it wasn’t for the Startup Weekend in Enschede. When I arrived there, I was expecting dual screens and quad-core computers, ready for long-night coding sessions.” Instead, Michiel was surprised to find a much more business-oriented event where participants pitched their ideas and developed concepts rather
TALEScape allows you to find and track nearby audio sources on a map.

Since the event, the storytelling project has grown into a general-purpose locative media API. The team-size, however, has shrunk. By now, only three of the original members are still on board. “My team members have expertise in finance and business, and I’m the developer. We still believe in the original idea. But we were faced with a chicken-and-egg problem: People will, understandably, only want to share their experiences on a platform that already has people listening, and potential listeners will only go where there are already stories to be heard. That’s why we decided to start out with an application that provides interesting content right away.”

For Michiel, working on the Dam Square Experience is a rewarding first project. “By creating the application, we learn a lot about our platform. One of the biggest challenges with creating actual applications is acquiring high quality content. Fortunately, Professor Dr. Karin Bijsterveld and the “Soundscapes of the Urban Past” group of Maastricht University have conducted research into how cities sounded in the past and Arno Rut Traa made all those great recordings of authentic carts, cars and carriages that are exhibited in the Amsterdam museum. All that’s left for us to do is to place the sounds back in the city. And with Talescape, that’s the easy part.”

“With the Dam Square Experience, we place the sounds of Amsterdam’s past back into the city it is now.”

As it turns out, this first application, ‘The Dam Square Experience’, is already well on its way. The Dam Square Experience will be an interactive scenario that allows users to experience how Amsterdam’s largest square, the Dam, sounded around the years 1895 and 1935. Currently, these sounds can be heard as part of the exhibition ‘The Sound of Amsterdam’ in the Amsterdam Museum. In contrast, ‘The Dam Square Experience’ will allow its users to experience the recordings of authentic historical objects while actually being there. “These ‘virtual audio sources’ will move around realistically and get gradually louder as you move in closer. It will be as if you’re really there... eh... then.”

It won’t be long until everyone with a smartphone and an Internet connection can run the the Dam Square Experience on his or her phone and experience the city’s sonic past. Michiel is looking forward to this moment. “Of course, I want to try it out myself. Walking through Amsterdam and hearing history take place around me must be great. But for the team and me there’s more on the line. Once the Dam Square Experience is launched, we will know more about the potential of our platform. Right now, all I can tell you is that the code will work. But I can’t be sure if people will like it. The Dam Square Experience is also an opportunity to show potential developers what is possible with Talescape. We hope our locative media concept will catch on.”

I don’t know if Talescape will succeed either. I don’t dare to make a guess. What I do know is that Michiel’s enthusiasm is contagious. Personally, I can’t wait to use Talescape to create my own spatial mixtapes that keep me company when I’m out for a run and to search for hidden messages when going for a walk. Maybe I’ll even upload the recording of this interview to the space where it took place. Then you’ll be able to listen to it, like it or dislike it and record your own opinion when you visit us at work.

Does the team behind Talescape expect it to become a huge success? “We certainly have faith in the concept, and believe it could speak to many people – both literally and figuratively. The API will be open source, and anyone will be able to run the Dam Square Experience for free. Of course, success or failure is not based solely on quality, but also on marketing, timing and competition. And those are tricky. We all have our other jobs and have only been able to work on the project in our free time. But this has changed recently. I’m now spending three months developing Talescape fulltime with the support of the CWI - in early 2014 Talescape will go public, and then we’ll see.”

“I work on Talescape. Who knows? It may bring me just a bit closer to both of my goals!”

As of writing this, I’m close to getting my PhD in Theoretical Computer Science. But theoretical though my work may be, I’m always happiest when I can apply theory to practice. It’s my dream to create something so useful – so awesome – that everyone will want to use it.

While I generally enjoy my work, I always regret that it confines me to a desk, staring at a computer monitor. If I were ever to find a way of writing code (and articles) while walking outside breathing fresh air, I’d jump on it. I have a feeling augmented reality will have a lot to do with an invention like that.

I’m fortunate to have the opportunity to work on Talescape. Who knows? It may bring me just a bit closer to both of my goals!

INFO:

Talescape is developed by Michiel Helvensteijn, Marcel Jordaan and John Mulder.
The development of Talescape is supported by ‘CWI in bedrijf’. Talescape is based on ‘Moving Story’ – an idea developed during Startup Weekend Enschede by Lissa Kooijman, Michiel Helvensteijn, John Mulder, Josbert van de Zande, Marcel Jordaan, Chris Knuever, Manthos Petropoulos and Valentina Rao during 15-17 March 2013.
The Dam Square Experience will be accessible to the public before the end of the year, and will be demonstrated during CWI In Bedrijf.
Visit Talescape online: www.talescape.net
Augmented Reality Paintings:

BY VLADIMIR GEROMENKO

AR Art for Sale?

“IF IT SELLS, IT’S ART.”
FRANK LLOYD WRIGHT

The saleability of an Augmented Reality artwork might just prove to be a tipping point to root AR as a medium in which it is possible to make art. This, for example, was clearly stated by Lanfranco Aceti in his Editorial to the LEA double issue on Augmented Reality Art: “Problems though remain for the continued success of augmented reality interventions. Future challenges are in the materialization of the artworks for sale, to name an important one. Unfortunately, unless the relationship between collectors and the ‘object’ collected changes in favor of immaterial objects, the problem to overcome for artists that use augmented reality intervention is how and in what modalities to link the AR installations with the process of production of an object to be sold” (Aceti, 2013).

Although the problem is common for AR Art in general (because of non-material nature of its augmentation of objects), there are different types of AR artworks (see, for example, Geromenko, 2012 and Geromenko, 2013) that may differ in terms of their commercial potential. This article will consider just one particular form of AR art that, in my opinion, has one of the best chances to become saleable.

This form can be called “Augmented Reality Paintings”, because it is AR in its very essence and also because the use of the proposed term is consistent with that for books that are called “Augmented Reality Books” (see Amazon, 2013a). An Augmented Reality Painting comprises two parts: a physical painting (such as an art print, or an oil or acrylic paint painting) and a digital AR component that is integrated with the material painting in such a way that by experiencing both parts at the same time, with an AR-enabled device, makes the entire painting complete and meaningful.

To test this concept of an AR Painting, six experimental artworks were created. They were also intended to explore and exhibit some possible diversity of this novel type of painting in terms of both its content and form. As a result, paintings 1 to 4 used flat images with transparent backgrounds as their augmentations, which were visible using the Layar application. Paintings 5 and 6 were augmented with 3D objects, floated in the air in front of them, that could be experienced with the Junai AR browser. In both cases, visitors just had to scan the physical part of a painting with their iPhone, iPad or Android smartphone in order to see the entire artwork.

These six Augmented Reality Paintings constituted a solo exhibition “Hidden Realities” that took place in the Scott Building’s Foyer Space at Plymouth University (UK) from 8 to 19 April 2013. All the paintings were gallery-quality framed A3+ art prints of original digital paintings, produced by the author. The following labels, placed on the wall near the paintings, included the title of a painting and a concise description of its main idea:

Painting 1: “What Lies Underneath?” An Impressionist-style digital photo painting of the Link Café at the Eden Project, Cornwall. This artwork is a tribute to the Black and White Photography that was an historic starting point for today’s Digital Photo Painting.

Painting 2: “The Half Kiss.” A digital photo painting that brings up a question “Who is that girl kissing?” Augmented Reality provides the answer.

Painting 3: “This is not a Phone.” A digital photo painting with a reference to René Magritte’s “This is not a Pipe”. Is the iPhone really a phone or is it something else? Look at the painting through the AR browser of your smart phone.

Painting 4: “Augmented Quote.” A digital photo painting that shows only the first part of a quotation. An Augmented Reality feature completes the quote, makes it funny and adds the name of the author.

Painting 5: “Four Keywords Lost in Augmented Reality.” A digital photo painting based on a constructed virtual environment. Where is the fourth key? Only your AR browser can find it.

Painting 6: “The Hand of Moscow.” A digital photo painting of Moscow’s Red Square with a humorous AR parody on an infamous cold war cliché. Beware the Invisible hand!
to be on permanent display. Its AR component may complete the painting in several ways (e.g. visually, conceptually or, perhaps even auditorily), but this is not a prerequisite (when someone is viewing the painting through an AR-enabled device).

In response to the question “What would make a good AR painting per se?”, the closest answer would be “Integration, integration, integration!” Creative integration of physical and digital components is paramount to produce “a complete picture” - AR paintings are about the integration of physical and digital worlds to produce a coherent whole. Consequently, painting, constructing and putting together AR artworks is a new and exciting area of creative practice.

The physical part of an AR artwork can, in principle, be a painting of any kind and made with any sort of technique, ranging from a specifically produced piece to an existing masterpiece, such as a Van Gogh. It’s worth mentioning, for example, a research project in which visual AR-based information (e.g. the X-ray capture and the back of the painting) can be digitally overlaid onto the original of such a masterpiece (Van Eck & Kolstee, 2012).

Whilst, having a deep respect for oil, acrylic and other traditional styles painting, digital painting, and particularly Digital Photo Painting (Geroimenko, 2011), can be considered most suited for the implementation of painted AR artworks. Digital paintings can easily be crafted and painted in such a way as to allow the best possible integration between their immediately visible components and their hidden augmentations, since both components are digital. The material part can then be exhibited and/or sold as a printed artwork.

The sale of Augmented Reality Paintings can encounter particular difficulties, some of which are rather obvious and can be named a priori:

The key technical issue is the availability of a painting’s AR component: the server can be unavailable for a while or shut down for good, a new version of the AR browser may have a compatibility issue with older content, and so on. However, an AR painter or seller needs to be able, somehow, to provide (despite all possible and unpredictable technical glitches) a warranty that an AR painting will be “functional” for a certain period of time. The main creative problem can be the artistic merit of the physical component of an AR painting, as was discussed above. In other words, a limited edition print, hanging on a wall, should also be able to stand on its own. The AR component is intended to enhance its aesthetic, conceptual, visual value, amongst others. Furthermore, it presents “the hidden meaning of a painting” in a completely new way by “materialising” its concealed AR parts (i.e. shows it in a literal sense).

As of today, the major problem could, however, be the novelty of Augmented Reality Paintings. It will obviously take some time before the current level of knowledge about this new type of artwork develops significantly to affect art buyers’ behaviour. At the moment, we are in a paradoxical situation; on the one hand, to become a popular form of art, AR painting should be represented in the art market; on the other hand, to become a highly saleable art form, the acceptance and understanding of Augmented Reality Painting should be expanded.

Thus, Augmented Reality Painting, combining Digital Painting and AR technology with gallery-quality limited edition prints, provides quite realistic opportunities to break into the art market. Rephrasing Frank Lloyd Wright’s humorous epigraph to this article, one can add the following about the emerging Augmented Reality Art: “As soon as it is on sale, it will be closer to universal recognition of AR art as a new form of art.” Augmented Reality Paintings should, and hopefully will, find their way to private collections around the world.

References

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- Amazon (2013b) Search for: Augmented Reality Paintings. [online] Available at: http://www.amazon.co.uk

Vladimir Geroimenko

Vladimir Geroimenko was born in the Vitebsk Region of Belarus, the legendary birthplace of Mark Chagall. He has awarded a PhD degree in the Philosophy and Methodology of Science and a higher Doctor of Sciences degree from the Belarusian State University. He has lived and worked in Belarus, Russia, Ukraine, Germany, Sweden and, since 1998, in England. He is Associate Professor (Reader) in Multimedia and Web Technology in the School of Art and Media, Plymouth University, UK. His University Staff Pages are at www.plymouth.ac.uk/staff/vgeroimenko

Vladimir has published 13 books, including some on the nature of creativity and the use of visualisation. His current research focuses on cultural, technological and artistic aspects of augmented reality, augmented reality art, and digital photo painting. He is currently editing a pioneering book titled “Augmented Reality Art: From an Emerging Technology to a Novel Creative Medium” scheduled for publication by Springer in 2014.

Vladimir has been involved with digital painting since 1995. His artworks are mostly digital paintings, presented as limited edition art prints, but also include some acrylic, canvas and rock paintings. They are in private collections in several countries. His Online Art Gallery is at www.geroimenko.com
Trying VR!

ALTHOUGH WE ARE AN AUGMENTED REALITY LAB, WE ARE ALSO VERY INTERESTED IN WORKING WITH VR EQUIPMENT. FROM 2008 TILL 2011 WE EVEN USED A HACKED VR HEADSET AND TURNED IT INTO AN AR HEADSET, BY ADDING AN EXTRA CAMERA ON TOP AND AN INERTIA METER. THIS VR HEADSET, THE VISETTE, HAS BEEN MANUFACTURED BY CYBERMIND AND TOGETHER WITH CYBERMIND WE MADE A MORE INTEGRATED AR HEADSET, GEORGE, WHICH IS ALSO BASED ON THEIR VR HEADSET.

Virtual Reality Systems

We consider a virtual reality system to be a system in which we can alter or mimic the real life environment by excluding direct visual clues of the real world and to replace them by digital imagery. Besides replacing what one sees with virtual images, most VR systems also add sound as extra sensory information to strengthen the immersive experience; some setups even use haptic stimuli or tactile information. For example, a real chair might move when a person is sitting on a moving chair in his virtual world; in a virtual airplane or in a digital rollercoaster. This is also known as force feedback.

Saying that wearing a VR headset is nothing more than wearing a monitor on your head might be a bit rude, however, at AWE 2013 I saw some really cheap and nerdy systems that only use the screen of a mobile phone to display the virtual environment wrapped in plastic foam with.

Medical and psychological applications

The repeatability and the general control over external conditions, make VR very suitable for psychological experiments. A virtual reality experimental setup is stable and can be used as many times as needed. Researchers can monitor all kinds of bodily functions, physiological parameters like heartbeat, blood pressure, temperature, breathing frequency and depth.

In the research domains of psychology and medicine, various experiments and clinical trials have been executed, with a strong focus on pain reduction by distraction. In Delft we recently visited the start-up Company CleVR, that uses a Visette to reduce fear of flying. Alongside of this, they made a virtual environment in which people with certain degree of autistic behaviour, can learn to be more sensitive in recognizing the emotional state of people they meet. The acronym VRET: virtual reality exposure therapy, is often used to indicate therapies aiming to reduce a variety of phobias with virtual reality.

Gaming

With the Oculus Rift, a new era for gaming seems to dawn: it is a very affordable headset – especially in comparison with the Cybermind system mentioned before - and it has an attractive design and a comfortable weight. Since its launch, the market for VR seems to have expanded dramatically. This incites other (start-up) companies to launch their own VR headset soon.

Sony will release their VR goggles in 2014. The next chapter in their next-gen technology strategy might come in the form of a custom virtual reality headset for the PlayStation 4. And a new kid in town, castAR, is trying to raise money via Kickstarter, to bring out its own VR and AR headset. Their “projected augmented reality system” works with a combination of heavily kitted out glasses, a motion-sensing “Magic Wand,” and an RFID Tracking Grid. As is mentioned on their website this is the creation of Jeri Ellsworth and Rick Johnson, a pair of ex-Valve employees. They continue: The castAR glasses are quite a bit more complicated than Oculus Rift. The glasses themselves are fitted with two micro-projectors, one for each eye, and make use of active shutter technology to limit what each eye can see. Between the two lenses is a camera that enables head-tracking, using infrared ID markers placed on an included reflective surface. This is where the castAR’s holographic projections appear. Then there’s the Magic Wand, a Wii Remote-like device fitted with buttons and a trigger, an analog stick, and motion-tracking tech.

VR and art

A year ago, Martin Sjardijn, an artist and lecturer at the Royal Academy of Art, made a VR installation, in which one could see the universe, complete with celestial spheres. He used the Cybermind Visette and made a safety gate in order to prevent visitors from getting lost in reality and experience a sense of falling. To engage those visitors not wearing the headset, they could see the VR images on a monitor.

At the Royal Academy there was one student, Mendel Agterberg, who graduated with an Oculus Rift setup. With the help of the VR headset one could experience his architectural installation. His work Space/Another Space is an interactive experience with a strong focus on the narrative side of gaming. Immersed in different worlds, it utilises these realities to ask its main question: Where is the place you call home?

In the AR Lab we are planning a novel application of VR in mid-December, which allows users to re-experience an opera at home. We will discuss the outcome of this project in the next issue of Art.
To be able to develop and test the application, we needed easy access to an actual tree with bullets inside of it. The trees around the museum were too far off from electrical outlets, and none of these trees were scheduled to be felt. As an alternative we decided to ask Dutch rifle club “Defensie Schietvereniging” to fire multiple rounds at a more manageable piece of tree trunk (image 2). They were so kind to even arrange genuine World War II weapons and ammunition, and after spending a morning at their shooting range, we had a perfect sample to experiment with.

FINDING A TREE TO EXPERIMENT WITH

To be able to develop and test the application, we needed easy access to an actual tree with bullets inside of it. The trees around the museum were too far off from electrical outlets, and none of these trees were scheduled to be felt. As an alternative we decided to ask Dutch rifle club “Defensie Schietvereniging” to fire multiple rounds at a more manageable piece of tree trunk (image 2). They were so kind to even arrange genuine World War II weapons and ammunition, and after spending a morning at their shooting range, we had a perfect sample to experiment with.

Eventually we would need to scan the trees in the forest, so we decided to look for a portable X-ray scanner. We got help from Dutch veterinarian “Mijn Paardenarts” who normally utilizes a portable X-ray scanner to examine horses on location. They were intrigued by our project and lightheartedly remarked it was a welcome change to scan something for once which was not able to kick them. They brought their equipment to the Royal Academy of Art in The Hague and we scanned the tree trunk in one of the classrooms (image 3).

We expected the scans to merely indicate the bullets as white marks on a black background, but to our surprise the scans were more detailed than we anticipated. You can clearly see the shape of the bullets, and even the year rings of the tree are visible (image 4). This was an unexpected but most pleasant surprise.
3D-SCANNING THE TREE

Our goal was to create a virtual hole in the tree through which you could see the bullets. We did this by creating a digital copy of the tree with a hole, virtually overlaying it onto the real tree, and only render the hole and its insides over the surface of the real tree. To create the 3D-scan we used the free software 123D Catch [2] which is available for iOS and Windows, and photographed the tree-trunk from multiple angles using an iPad. 123D Catch uses these photographs to generate a 3D model of a surprisingly good quality. The 3D model itself is already quite detailed, but the overlaid photographs (textures) give the illusion of even more detail (image 5). Not bad for a free app.

For our purpose the model actually had too much detail, which might slow down the application. Using the program 3D-Coat [3] we reduced the amount of detail (polygons) and created a cleaner distribution (topology) of these polygons (image 6).

A special material (RenderOcclusionLayer) will render the model itself invisible, except for the hole and the inside of the model. When this virtual hole is overlaid on top of the real tree you get the impression you can look inside of it (image 8).

To be able to position the hole precisely onto the real tree, we need an augmented reality marker. It would be possible to use a part of the tree's surface as a marker, but since we need to inform the public about the project with a sign on the tree in the first place, we chose to track this sign. Using a sign as an augmented reality marker offers better tracking quality, since it can be designed with the requirements of the software in mind. Image 9 shows the final result.

We expect to present the final version of this project at Airborne Museum Hartenstein in 2014 during the 70th remembrance year of the Battle of Arnhem. In case you have any questions you can contact me via w.vaneck@kabk.nl.

AUGMENTING THE TREE

We chose Qualcomm's Vuforia [4] augmented reality software to augment our tree, in combination with the Unity game engine. Vuforia actually has a demo which demonstrates how you can look ‘inside’ of an object, it is named ‘Occlusion Management’ and can be found on the ‘samples’ page [5]. When using this example you will need to replace their 3D model of a box with your own model, in our case the tree's scan. An ‘alpha channel’, a greyscale image which indicates which parts of your model are transparent, will create the hole in the model (image 7). White is visible, black is transparent and greyscale values are semitransparent.

REFERENCES

3. 3D-Coat, http://3d-coat.com
**QUADRATURA**

Quadratura was the technique used in the baroque to extended architecture through trompe l'œil and perspective constructions generated with paint or sculpture. This immersive, site-specific installation follows the same principles but manipulating space by means of projected light. The main axis of the room is extended and the limits of the physical space dissolved.

This project has been possible thanks to the support of Matadero Madrid and Laboral Centro de Arte.

Video link: [http://player.vimeo.com/video/18371932](http://player.vimeo.com/video/18371932)

**PABLO VALBUENA**

Pablo Valbuena develops artistic projects and research focused on space, time and perception.

Some key elements of this exploration are the overlap of the real and the virtual, the generation of mental spaces by the observer, the dissolution of the boundaries between reality and perception, the links between space and time, the experience as object of the work and the use of light as prime matter. These ideas are materialized as site-specific, ephemeral interventions that transform space with perceptual tools rather than physical ones.

The resulting works have been presented internationally in a wide range of contexts as site-specific commissions, museum and gallery exhibitions and large-scale urban interventions, always formulated as a direct response to the perceptual qualities, physical conditions and surrounding influences of a certain location or space.

More info at [www.pablovalbuena.com](http://www.pablovalbuena.com)