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Groundbreaking Discoveries in Science and Technology

A Revolutionary Stadium Show

—

The Conception of U2's 360° World Tour (2009 - 2011)

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1.0 INTRODUCTION

This dissertation is dealing with the actual world tour of the Irish rock group U2 called 360° Tour and its fundamental technical conception which is innovative for the whole event industry and trend-setting for any further mobile productions.

1.1 The Band

U2 is a rock band from Dublin, Ireland. The group consists of the four members *Paul Hewson* (vocals, guitar), most commonly known by his stage name *Bono*, *David Evans* (guitar, vocals, piano), widely known as *The Edge*, *Adam Clayton* (bass guitar) and *Larry Mullen, Jr.* (drums, percussion). In 1976 the band formed at Mount Temple secondary as a school band ^[1] and signed to the label Island Records within four years. They rose to rock super-stardom and had become one of the top international live acts by the mid-1980's ^[2].

Since their first days as a band, the members have deeply cared about drawing attention and addressing issues concerning human rights, disease, social injustice, military conflicts and poverty ^[3].

Over the decades U2 was inducted into the *Rock 'n' Roll Hall of Fame* ^[4], won 22 *Grammy Awards* for their records so far and brought touring and live performances to a new level with innovative concepts ^[5]. The 360° Tour which has started in 2009 is an 18 month world tour and had proved a revolutionary stadium show concept with groundbreaking technical inventions. Beside new aspects of kinetic movement for the event industry most of the components have decorating and functional aspects in the highest definition of modern stage design.

2.0 THE 360° TOUR

In February 2009 the band released *No Line on the Horizon*, their 12th studio album ^[6] and started working on a concept for a 360 degrees stadium show. The following 360° Tour began on June 30, 2009 in Europe, featuring North American stadium dates for the rest of the year as well as for 2011. In 2010 the trek moves to play in Australia and New Zealand after performing additional shows in Europe ^[7]. All in all, U2 plays 92 concerts in 63 towns and 25 countries ^[8].

The basic stage construction is a four-legged supporting rig called “The Claw”. With its excellent lines of sight it affords a concert experience from almost every position in a stadium and uses its capacity to a maximum. For the first time ever a band is playing a world tour with a stage that can be watched in 360 degrees. As enormous and futuristic as it seems, “The Claw” was primarily built to reduce the distance between the band and the audience.

The tickets are scaled so that 85% are sold for less than 95€ and at least 10,000 for 30€ – plus the pre-selling dues in both cases. It is a mutual advance – on the one hand for the audience, on the other hand for the band because due to its capacity concept the *Live Nation Global Touring*-produced tour is destined to become one of the highest-grossing stadium tours in history ^[9]. In 2009, \$311 million (570 million Euros) were earned with the sale of tickets which is about \$10 million revenue for every show. Until summer 2011 the gross income will be about \$750 million ^[10]. Then the tour would advance to the economically most successful major production of all times ^[11].

The production won three *Pollstar Concert Industry Awards* and two *Total Production International Awards* in LA and in London this year ^[12]. Moreover, it awarded the *Billboard Touring Award 2009* in the category *Top Boxscore* for the tour dates at Croke Park in Dublin, Ireland ^[13].

The show at the Rose Bowl near Los Angeles, California was filmed for the concert release *U2 360° at the Rose Bowl* ^[14]. The live stream of the concert on *YouTube* became the most watched live video stream in the history of the website ^[15].

2.1 Conception

“The Claw” is the result of a long time vision of U2, especially of frontman *Bono* who has been looking for a way to play outdoor in the round for years. He had the basic idea while playing with some forks on the dining room table – without any engineering implications in mind.

The achievement was worked out to see if there was a way to create a structure for the public address system and lighting. The renowned stage designer *Mark Fisher* has already worked on sketches for a 360 degree stage during he was designing the last tour of the band and started thinking about the stage as being round rather than a 180-degree area years ago as well. In his conception of the Rolling Stones ‘Bigger Bang’ Tour from 2005 he had already implanted audience sitting on the stage in the back ^[16]. But an outdoor show in an entire circle was not possible at that time. The installation of sound and lighting systems above the stage appeared to be too expensive. Now the technology has become smaller. So he was able to realise the challenging technical innovations together with his team and lighting designer *Willie Williams* who has also been working for the band since many years. Their biggest problem was to compensate a roof in an engineering way. Because you can hang everything from the roof, playing in the round indoors is comparatively easy.

Eventually, *Williams* had the groundbreaking idea in a moment of reverse logic: He realised that instead of trying to make everything smaller, the way it should be done is to make it so big that it just becomes part of the building. *Bono* admitted that there is another paradox in relation to the big stage design – it was created “to make it a small and intimate affair. That’s the magic trick”.

The way of conceiving was completely different to an indoor arena presentation with a center stage. In a way the whole engineering had to be invented and developed to realise this concept and, what is another specific point, to make it tourable.

2.2 Realisation With Technical Innovations

2.2.1 The Basic Construction

The main construction of the stage that is inspired by the LAX Theme Building (airport of Los Angeles) was built by the Belgium company *Stageco*. It was developed to carry the public address system and the lighting system as well as the cone-shaped video screen. The four-legged construction is able to carry about 200 tons. It is about 30 metres high and weighs 190 tons. Despite its size it appears not very massive and more open in comparison to other outdoor stages because of the four arched feet. Right in the middle there is an orange-coloured peak, called “the cigar”. All in all, the stage has a height of 52 metres. The green moulding skin of the steel construction is made of PVC-coated polyester fibre and has a square footage of about 1.500 square metres. It is a very strong woven fabric material that got cut and welded to fabricate the structure. On its surface 36 orange-coloured “polyps” are mounted, creating different light effects during the show.

For logistic reasons, three identic constructions of “The Claw” were built, each is worth about \$25 million. Before the tour the basic construction was built up and down several times on the festival area in Werchter, Belgium. The first step of the build-up is the mounting of four scaffold towers. The top of the stage, an octagonal roof construction is assembled on the ground first and then pulled up on the towers. Step by step, the steel legs get mounted until they finally carry the whole roof construction without any help of the scaffold towers which get disassembled after all.

Mostly there is no maneuvering area for the heavy duty vehicles in stadiums that is able to hold higher point loads, in football stadiums there is even no tartan track that could be used to build up a geotextile for a temporary street. So it is necessary to realise a fast installation of a heavy duty ground floor without a crane or other heavy duty vehicles coming into the stadium. That is why arena panels made of aluminium are used to construct a save base frame to protect the lawn and the underoil heating. The total weight of the stage with all the material is about 600 tons. The four scaffold towers are carrying the whole weight. Even with heavy duty paving tiles a build-up directly on the stadium lawn would be impossible. So the only option is a hanging construction.

2.2.2 The Stage

The real platform where the band is on is absolutely independent from the rest of the gigantic construction. Much of the structure is up high when you are at pitch-level so comparing to other rock and roll productions the stage appears to be very open, obviously without much technology standing on it.

The ellipsoid area is 2.5 metres high and linked with a footbridge ring by two moveable bridges which get moved over the heads of the 3,000 people standing in between in the front of stage-area (FOS) during the show. In the middle of the stage itself there is a rotating section for Larry Mullen Jr. and his drum kit.

Under the stage there is an area of 289 sqm, called the „Underworld“ – including a substage tunnel that the band uses to get on stage. Down there sound technicians prepare e.g. guitars. Moreover, the backing musician *Terry Lawless* has his keyboard position there.

Dimensions (length x breadth x height in metres):

Main Stage: L 22,5 x B 15,5 x H 2,5

Footbridge Ring: L 147,5 x B 2,4 x H 1,3

2.2.3 The Video Screen

The design for the round video system was developed by *Mark Fisher* in association with *Chuck Hoberman* and *Frederic Opsomer*. They wanted to create something expandable and contracting that is minimal when it is in its basic position and able to keep the structure of the transparency with the four legs but becomes a monumental set piece when it gets expanded. The easiest way kinetically would have been a perfectly round cylinder but the finished design is elliptical and saddle-shaped so when it opens it becomes a cone. With the conical screen video artists can create the illusion of content going all the way round.

The whole video system of the 360° Tour is weighing almost 60 tons and is made of more than one million components. Eight hours are necessary to mount the different

elements. The skeletal structure is made of stainless steel and aircraft grade aluminium. The screen itself consists of 888 hexangular LED-elements (light emitting diodes). They are linked with a pantographic running gear mechanism. Thereby, the most different effects are possible, for example the vertical running-in and running-out of the screen (to a maximum of 20.5 metres) and the extending and contracting of the trellis with its single LED-elements. The video screen is made of 500.000 LED-pixel, 320.000 connecting components, 25 km cables and 150.000 other standard elements.

In the first half of the show the screen stays like a static bee hive in its basic position and shows a 360°-mix of bright coloured video content and graphics. At a certain song, the video screen extends and unfolds its whole potential.

A screen in general that can be watched from 360 degrees was technically not possible until very, very recently. Furthermore, a conical, dynamic screen that can move and change its shape has never been built before. This new invention is an essential part of the shows visual excitement. In fact, every arena show has been about showing video content since the LED revolution a decade ago. Traditionally, there is a big art screen and some side screens for IMAG (image magnification) which means that people can see the band on the side screens and the art in the middle. Now, the idea behind it is to reduce it effectively to one screen so that the visitor is not constantly required to look left and right.

Around the main stage, an ingenious camera system is mounted on wheels so that television cameras can go around the stage on a ring on vertical installed tracks. This system allows the cameras to be up at the artists head level or higher and send live footage to the video screen

As always, the band uses video content with political and social background, e.g. a speech of archbishop Desmond Tutu, a message to support the imprisoned civil-rights activist Aung San Suu Kyi and some video art, especially focussing on the Iranian liberation movement to introduce the song "Sunday Bloody Sunday". A highlight of visual experience is a broadcast of Commander Frank DeWinne from the International Space Station ISS, reciting some lyrics from the song "In A Little While" that is played afterwards.

2.2.4 The Lighting System

The whole lighting technology of the 360° Tour consists of 196 so-called “Bad Boy”-light fixtures which are designed especially for big events. Lighting designer *Willie Williams* decided to use them after a test period at the Wembley Stadium in London in 2009 as well as 25 follow spots, 156 colour changing strobes and 47 fog machines.

Within the orange-coloured main pylon there are five xenon ripple projectors, 42 vapour spotlights and 498 DWE PAR-lamps mounted. The pylon itself is 43 metres long and installed nine metres above the ground. At its ends there are two gigantic mirror balls fixed to create some awesome light effects inside the arena. The mirror ball at the bottom descends at a certain point of the show to rotate above the band. The mirror ball on top is the world’s first lightning-conductor mirror ball and does function as a lightning conductor actually. Apparently, for any outdoor steel construction one of the most likely dangers that has to be considered is lightning.

At the interior of each of the four steel feet there are three crew members to operate additional spotlight manually. At the roof of the construction there are eight lighting objects working as search headlight to illuminate the main pylon.

At the exterior of the joists there are 36 orange-coloured plates (“polyps”) that imply eight circulating LED-devices to create special moods of light like the “glowing” of the tensile moulding membrane. Within the arena itself, there are seven more light sources (each consisting of three “Bad Boys”, one follow spot and one Novalight Nova-Flower Effect spot) that are installed at different positions within the tiers to illumine “The Claw” and the audience.

Another striking light effect appears during the first song of the encore. It is sung into a microphone that is implanted into a glowing steering wheel hanging down from the roof of the stage on a steel rope. *Bono* wears a laser-embedded jacket, creating a great effect during he is pulling himself up on the wheel to swing over the stage.

2.2.5 The Sound System

The massive sound system of the 360° Tour was created in a collaboration between *Joe O'Herlihy* (audio producer and mixing engineer of the band since 30 years) and *Clair Brothers*, manufacturer of the loudspeakers. It is deemed to be the most voluminous and extensive speaker system that has ever been used for a major production and its total value is about \$10 million. To switch from 180 degrees to 360 is a gigantic challenge for sound engineers, both in planning and mixing during the show. The whole sound system is completely integrated into the 360° design to satisfy the acoustic requirements from the different positions within the venue. The core of the public address system is a new designed speaker system (Clair i-5™) that is working as a line array system. The entire stage is ringed with bass and full-range speaker systems to accommodate the people that are in the immediate barricade area.

2.2.6 The Logistics

The build-up of the stage construction is very sophisticated. Due to the fact that the schedule is very tight, three basic constructions were built. One is set up for a show, another one gets build up and meanwhile the third one has been rebuilt and gets transported to the next venue. The assembling of the basic construction takes four to five days. The production crew transporting and installing the sound and video system needed about 19 hours at the beginning of the tour to attach it on the general construction, 10 to rebuild it. In the meantime a lot of road work has been done so now only half of the time is needed. Every "Claw" needs about 36 trucks to get transported. The sound, light and video system, existing only once is transported by 50 trucks. Together with merchandise and catering trucks it is a sum of 200 trucks to keep the tour running. That is why the costs for the transport and for the crew are about \$750.000 a day, no matter if the band is playing or not.

In the very beginning, Touring Manager *Jake Berry* did site visits to all of the major stadiums that the band were likely to play to find out about the possibilities of using two 100-ton cranes on the field, due to the fact that it is the first travelling 360 degrees outdoor show worldwide.

3.0 RESULT OF THE THESIS

In conclusion, the most striking and changing advantage behind this conception is the utilisation of unroofed venues. Until now there has always been a part of the stadium that had to be closed because of a stage backdrop or one or more video screens. Now there is more capacity in the indoor standing area and on the grandstands. The whole perspective has changed into a more plastic one, there are completely new possibilities of 3D-visualising, spatial use of LED and so on. The construction is built very high to use effects on top level instead of using the two dimensional back of the stage. A new way is found of working with symmetry and plasticity in outdoor stage designs. Because of the third dimension the audiences visual experience is more punctual and not necessarily focussed on an area any more.

The great achievement behind this engineering is the touring aspect and the reproducibility of it. If a concept is too specific and cannot be realised in several venues because you would overload the roofs, trusses and bottoms then it would not be effective.

The sound is emanating more from a single point than ever, therefore one can reject the view that it has to be always a bad acoustic when a band is playing in a stadium with a roof.

All in all, it is the most expensive production ever and there was a lot of risk in it. But because of excellent work in concepting of new technologies with attention towards the quality aspects it is going to be the most profit-making tour ever. The last ten years outspeed the last decades in the development of groundbreaking ideas in the event business. Therefore, it is necessary to go on in questing, taking risks and investments. Since the record market has collapsed tour productions are more in the focus with the result of being more profitable than ever. They have developed to a serious branch of the economy.

U2's album *No Line On The Horizon* was no groundbreaking record comparing to other ones, so it is obvious that a subsequent tour has no direct reference to it anymore. A tour is a long and complex budgeting process and the aspect of

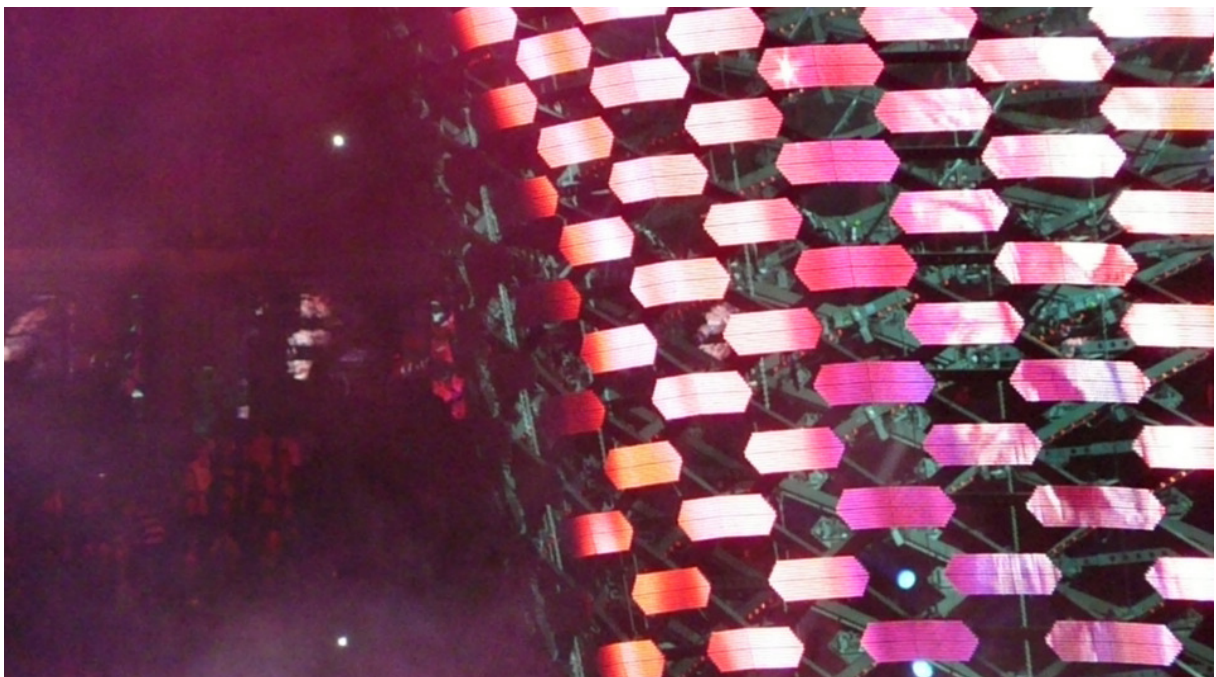
calculating with more seats is also an economic benefit for the audience in the case of ticket prizes. On the other hand, \$750 million profit excupate the design and development of the newest event technology and planning concepts. Every following major production has to focus on the results of the last ones. The consumption of music in general has changed a lot and the industry has not fully adapted to this break. New ideas are needed including the new media as a real chance and not as a menace. The touring business has regarded these signs of the times and acts in every domain: To develop and improve lighting, sound, stage and video designs to satisfy the growing requirement for live music. The music industry with its old structures has problems to solve this changing market with innovative ideas and understanding the fact that “commerce has to be creative” (*Bono*).

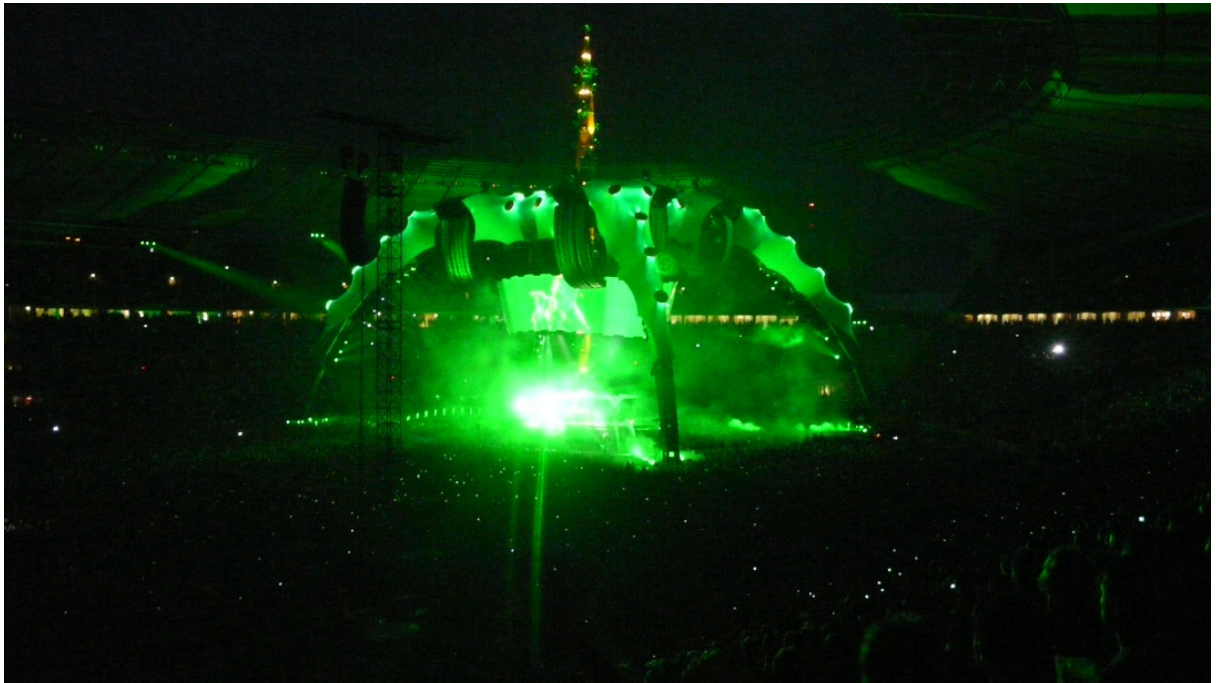
To my mind, this demand is a phenomenon that can be explained in the context of a consumption-orientated throwaway society: A lot of people experience great live shows as a way of being consciously touched by the present. And it can be recognised that serveral entertainment artists get more and more familiar with the way a designed stage works and its chances. U2 as a label that works globally and as a rock band simply consisting of four people making music has been showing these aspects in an impressive way.

A1 Images















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The topics *2.1 Conception* and *2.2 Realisation With Technical Innovations* were partly worked out by analysing the concert, documentary and interview footage “*Squaring the Circle: Creating U2360*” and “*North America, Tour Opening - Chicago*” from the concert release *U2 360° at the Rose Bowl* .

DVD: Live at the Rose Bowl © 2010 Universal-Island Records
Limited under exclusive license to Mercury Records Limited in the UK, Interscope Records in the US and Universal Music Group for the rest of the world.

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A4 Declaration

I declare that this paper is my own work and was written without any other literature than the sources indicated in the list of references respectively the bibliography. Information used from the published or unpublished work of others have been explicitly referred to in the given list of references. This paper has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education.

All pictures were taken by Nico Fusan on July 18, 2009. The author enabled the usage for this thesis.