



HUMAN INTERFACE TECHNOLOGIES TEAM



VIRTUAL REALITY - AUGMENTED REALITY - TELEPRESENCE
DEFENCE - HEALTHCARE - HERITAGE - EDUCATION - HUMAN FACTORS



Virtual 1620

MAYFLOWER & BARBICAN



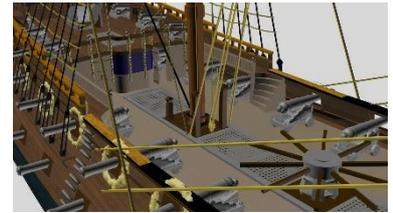
Virtual Mayflower

The *Virtual Mayflower* project came about following a number of presentations and demonstrations by the University of Birmingham's Human Interface Technologies Team of a Virtual Reality (VR) project conducted in 2014 and early 2015. This exercise focused on a 17th century ship, the *Anne*, the wreck of which still exists on Pett Level Beach near Hastings. The *Anne* was a 70-gun third-rate ship of the line, built by Phineas Pett at Chatham Dockyard as part of a late 17th century restoration of King Charles II's Royal Navy, overseen by Samuel Pepys. Launched in 1678, the *Anne* was beached twelve years later during the Battle of Beachy Head and, under the command of John Tyrrell, she was deliberately torched to prevent capture by the French. The wreck is owned by the Nautical Museums Trust (the Shipwreck Museum Hastings) and it is with this Museum that the HIT Team collaborated in an attempt to "resurrect" the *Anne* using VR and Augmented Reality (AR), ultimately superimposing the 3D model of the ship over its real-world wrecksite using drone technologies. The virtual *Anne* was developed at two levels of detail, one to support on-site AR visualisation trials (and subsequent online interactions), and a higher fidelity version for special presentations and events, or in museums.

The original plans drawn up for the *Virtual Mayflower* project were ambitious, and were based on the numerous suggestions for funding opportunities that arose following many meetings held after an original presentation was made to representatives of the Mayflower Trail Towns. In the event, no funding was actually ever made available, so those ambitions had to be scaled back dramatically, whilst still striving to deliver as impressive a demonstration as possible for the 400-year commemorations of September 2020. It was important, however, to uphold the HIT Team's "legacy" ambition, ensuring that the project could be used and developed further for many years after the event.

One very positive early development came about after an invitation was received from Plimoth Plantation (<https://www.plimoth.org/>), to travel to Massachusetts, USA in order to visit the *Mayflower II*. The *Mayflower II* replica was built using traditional shipbuilding techniques in the mid-1950s at Brixham, South Devon, using ship plans held today by the Plimoth Plantation Museum. The *Mayflower II* left Plymouth, UK on 20 April, 1957, captained by Australian-born Alan Villiers, and arrived at Plymouth, Massachusetts on 22 June. Over three days, visits were undertaken to the Ship, the Plantation, the amazing costume repository held by the Plantation and the *Mayflower II*'s shallop (also under renovation at the time). As well as the marvellous Plimoth Plantation personnel, sincere thanks also go to thank the *Mayflower II*'s Captain Whit Perry and his crew for allowing the taking of detailed images, including 360° panoramas, from every location of the ship, including from the main mast crow's nest. These images, plus a later laser scan data of the ship in dry dock during her major refit at Mystic Seaport, were invaluable in the development of the virtual recreation of the *Mayflower*.

The virtual scenes produced subsequent to the Massachusetts visit led to successful early VR and AR demos (including very convincing demos on Plymouth's Barbican and Hoe), some including investigations of avatar representations of the crew and passengers. As part of the virtual human investigations, in June of 2017, the HIT Team was given an opportunity to undertake a truly unique trial of a new piece of motion capture ("MOCAP") technology, the *Perception Neuron*, as its wearer braved the wind and rain to scale the heights of a tall ship moored at London's Canary Wharf. Owned by the Jubilee Sailing Trust, the *Lord Nelson* is one of only two tall ships in the world specially designed to be sailed by a crew with wide range of physical abilities. Despite the appalling weather, the ship's Bosun's Mate managed to complete a 34m climb of the vessel's main mast. The *Perception Neuron* suit recorded her every movement, including a range of actions the crew of the *Mayflower* would have carried out, such as transiting the yard arm and unfurling the lower topsail. She also wore two 360° panoramic cameras, to record activities in detail as she went aloft.



Unfortunately, it was discovered later that the technology was not capable of reproducing quality motion records that would support the production of reliable and stable motion capture files, suitable for avatar movement programming. Although the Perception Neuron “suit” appeared to offer an ideal and relatively non-intrusive technique for recording human motion in unconventional settings, the large amounts of metal present onboard the *Lord Nelson* adversely affected the magnetometer component of the suit, causing drifting calibration issues, noise and, thus, inconsistent and unreliable motion records (such as twisting virtual “bone” elements). Consequently, it was decided that the best approach to generating Pilgrim and *Mayflower* crew and passenger avatars, plus dockside inhabitants in period costumes, would be to seek the help of an experienced game designer. A subject specialist in the field of Games Art at the Royal Leamington Spa College stepped forward to perform that role.

About half way through the 6-7 years that the *Virtual Mayflower* project took to deliver, and following numerous meetings with historians, it was decided that the *Mayflower’s* voyage, although of historical significance, was only part of the story. From an historical perspective, the harbour from which the ship departed on 16 September, 1620, Plymouth’s famous Barbican (Sutton Harbour/Pool at the time) was of equal, if not greater significance from the perspective of historical education. As a result, it was decided that the focus of the work would change, with the aim of developing a 1620s model of the Barbican to complement the existing 3D model of the *Mayflower*.

During the early research into the physical layout of the Barbican in the 1620s, a chance online discovery drew the Team’s attention to what looked like a long forgotten physical model, and one that was decidedly different in a number of respects to the model still held today within Plymouth’s Guildhall. After some further detective work, it was discovered that the name behind this model was Scott Gleed, today the owner of Gleed3D, based in the Scottish Highlands (<https://www.gleed3d.com/>). In the early 2000s he was commissioned to rebuild a scale model of Plymouth’s Barbican that had been left to deteriorate since the 1970s. The impressive result consisted of some 300 individual houses and other buildings, 150 of which contained optical lighting. Many of the ships were animated using a sensor activation system. On show within a “Trail Room” for a year or two in the Barbican, the model was then transferred into storage of sorts, within the studio of the controversial Plymouth artist, the late Robert Lenkiewicz. There it remained for another couple of years gathering dust, until it was transferred by Sutton Harbour, almost *Indiana Jones*-like to a hangar at the currently disused Plymouth Airfield at Roborough. The ravages of time, together with acts of vandalism, struck again, and it was left to decay until 2018, when the HIT Team contacted Sutton Harbour plc for information on the model’s whereabouts and condition. In November of that year, the Team was invited to Sutton Harbour plc’s premises at North Quay House on the Barbican to inspect the model first hand. Sadly, the model and its constituent buildings were in a terrible state of repair and of little use as a reference for the Virtual Barbican project.

Again, given the HIT Team’s limited resources, not all of the Virtual Barbican could be completed in the time available, to the level of detail we all desired. Nevertheless, for the early demonstrations, the Team was able to achieve some of the following:

- Castle Street and steps (today the narrow road that ascends the hill past the Cattewater Harbour Commissioners’ Building and the Barbican Theatre).
- South Quay (today “The Barbican”), from the Mayflower Steps, along Southside, almost to the Plymouth Gin Distillery. However, only a small length of Southside is currently accessible, ending at Smart’s Quay and Jacka Bakery. The South Quay also possesses a virtual cucking stool (later referred to as a ducking stool), used at the time, allegedly, to punish disorderly women (errant wives), and dishonest tradesmen!
- Smart’s Quay, from where the listing form of the abandoned *Speedwell* can be seen.
- New Street, which links to the Castle Street steps and curves around Island House.

400 years to the day the Pilgrims originally departed for the New World (16 September, 2020), and despite the cancellation of the planned *Mayflower* 400 events due to the COVID 19 pandemic, the *Virtual Mayflower* and 1620s Barbican project was successfully demonstrated at the Plymouth Cattewater Commissioners’ Office on the Barbican, just a stone’s throw from the current *Mayflower* Memorial. The enhanced project was also demonstrated the following year (10 and 11 July), yet again despite the second cancellation of planned *Mayflower* 400 events, but this time with an added feature ... smell! With two *ION* olfactory display systems, kindly provided by OVR Technology of Vermont, USA, over 50 Plymothians were invited to attend the *Mayflower* Museum on the Barbican to experience the latest techniques to bring this important historical scene to life.

For further information on this project, including details of the team members, visit:
www.1620Mayflower.co.uk; for news on the HIT Team’s latest projects,
 contact: Prof. Bob Stone - profbobstone@gmail.com

