"Track by Track"

Interactive Music Installation using Manhattan Software.

Part of *Platform to Perform*
BBC Music Day (28/10/18)

BBC MUSIC DAY

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LOCATION   Platform 3, Bristol Temple Meads Station
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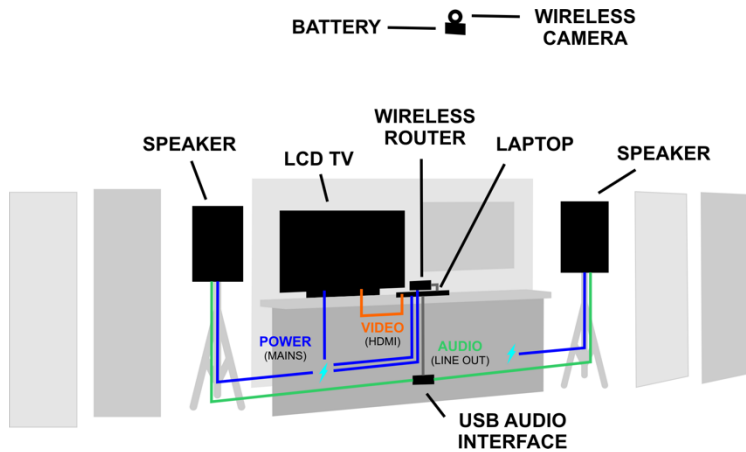**Fig.1** Representative illustration of complete installation.

INSTALLATION OVERVIEW

Track by Track is a live music installation that uses the real-time positions and movement of people on the platform of Bristol Template Meads station to dynamically generate algorithmic music.

A live feed is captured of the platform and sent to the computer, which analyses the footage to establish the position of people (and trains). This data is then used by the Manhattan software (developed by Dr Chris Nash, see p3) to generate live original music that adapts to changes in the crowd size, dispersion, location, etc. The feed and identified objects are displayed on a large TV, along with the process of generating the music.
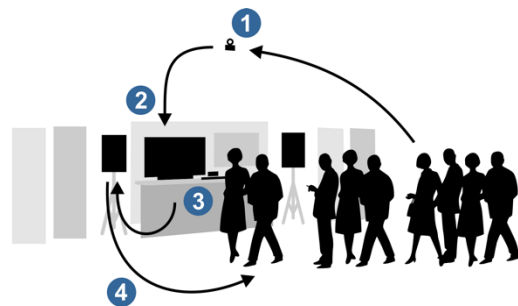
① **CAMERA** captures platform (crowd, trains, etc.).

② **CAMERA** sends live video feed to **LAPTOP** (via private WiFi connection).

③ **LAPTOP** (Manhattan software) analyses feed and generates music, based on scene. Live visual analysis and musical process are shown on **LCD TV.**

④ **LAPTOP** outputs music to **SPEAKERS**, for passengers to hear.

BATTERY — **WIRELESS CAMERA**

SPEAKER **LCD TV** **WIRELESS ROUTER** **LAPTOP** **SPEAKER**

POWER (MAINS) VIDEO (HDMI) AUDIO (LINE OUT)

USB AUDIO INTERFACE

- **2 x SPEAKER** – Active PA
  (line input, mains powered)

- **LCD TV** – 40" Display
  (HDMI input, mains powered)

- **WIRELESS CAMERA + BATTERY**
  (self-powered, wireless IP camera)

- **WIRELESS ROUTER**
  (wired to laptop, mains powered)

- **LAPTOP –** MacBook Pro
  (Manhattan software, mains powered)

- **USB AUDIO INTERFACE**
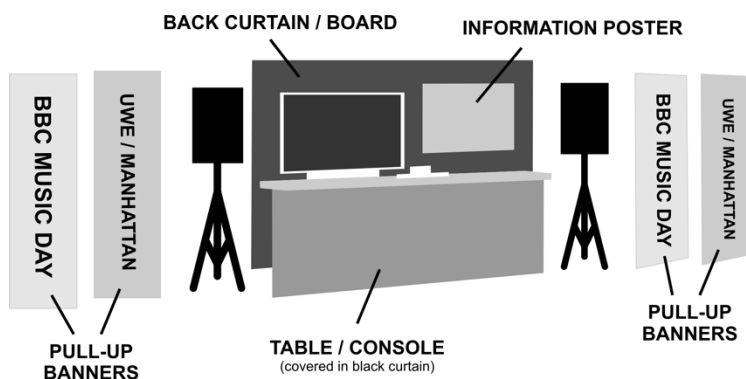 *(wired to laptop, USB power, line out)*

WIRING *Power (blue): Mains power, 230V/50Hz (5 devices/plugs/sockets).*
Audio (green): Line level (unamplified), active PA speakers (Yamaha Stagepas, 400-680W)
Video: (orange): HDMI (digital, DVI-compatible)

TECHNICAL DETAIL

The system is supported using standard computing hardware: a camera, laptop, screen (TV), linked to active PA speakers. The general public only interacts with the system indirectly (through the camera), and do not require proximity. The installation will occupy a depth of approximately 1m from the wall, and all cables will be contained within the installation; hidden and away from any pedestrian routes. No high voltage cables are used (except mains power); the video is digital (HDMI); the audio is line level and amplified within the speaker. The system uses its own self-contained, encrypted 2.4GHz Wi-Fi network (SSID: Manhattan), linking the camera to the computer, via a wireless router. It does not support Internet access.

   The artist / helpers stand in front of the installation, and require only occasional access to the laptop, as the system is autonomous. The external USB Audio Interface provides separate volume control. Optionally (and subject to space), it might be desirable to host a second computer (e.g. an Apple iMac) to demonstrate the Manhattan software to interested members of the public.

   Fittings in the installation include a simple backboard and console table, flanked by PA speakers and freestanding pull-up banners, featuring UWE Bristol, Manhattan, and BBC Music Day branding. The artist and helpers will complete setup of the ground-level equipment and fittings, but station assistance may be required to install the elevated wireless camera, which may require a ladder. The camera position is flexible, and the schematic on Page 1 is only illustrative; it is shown placed on an existing ledge, but could be affixed to other surfaces (walls, window ledges or sills). The dimensions of the combined camera and battery are: 14x7x12cm (weight: < 1Kg).

BACK CURTAIN / BOARD **INFORMATION POSTER**

BBC MUSIC DAY UWE / MANHATTAN BBC MUSIC DAY UWE / MANHATTAN

PULL-UP BANNERS **PULL-UP BANNERS**

TABLE / CONSOLE
(covered in black curtain)

- **2 x BBC MUSIC DAY BANNERS**
  (pull-up, provided by BBC)

- **2 x UWE / MANHATTAN BANNERS**
  (pull-up, provided by UWE Bristol)

- **INFORMATION POSTER**
  *(affixed to backboard, explaining
   the music and Manhattan system)*

- **BACK CURTAIN / BOARD**
  *(black/dark board or curtain,
   provided by UWE Bristol)*

- **TABLE / CONSOLE**
  *(used to support and hide the computer
   hardware, provided by UWE Bristol;
   may include BBC / UWE branding)*

INTERACTIVE MUSIC CONTENT – "Track by Track" (2018)

The system will generate music from the camera footage of the people (and trains) on the platform using a variety of techniques and musical rules. Manhattan (see below) allows the artist both to compose musical elements in advance as well as set the rules for how elements are created or changed in response to the live scene. It supports any genre of music, and is specifically designed to support mainstream popular and classical aesthetics, designed for the general public, rather than just avant-garde or experimental music.

The piece for BBC Music Day 2018 (working title "Track by track") will be designed to complement the ambient sounds and activity of the station. It will notably use voices recorded from the choirs who are performing elsewhere in Bristol on the day, to provide a virtual choir presence, supplemented with suitable orchestral sounds (organ, percussion, strings, brass). The piece is being written in sympathy and awareness of noise (trains, passengers, busy crowds) and the atmosphere of the platform, to provide a pleasant accompanying soundtrack to the bustle of Temple Meads.

A working prototype of the proposed crowd-driven Manhattan-based system was developed to provide a basic demonstration of the technology, a video of which is available from:

http://revisit.info/manhattan/SoundOfTheCrowd.mp4 (streamable video; 1280x800, MP4)
http://revisit.info/manhattan/SoundOfTheCrowd.zip (downloadable video and pdf, 105MB)

This crude demo uses two simple mechanisms to drive the music using the disposition of the crowd: (1) the locations of people are directly translated into the location and pitch of harp notes in the pattern (x~pitch, y~time); and, (2) the overall density of the crowd affects the intensity of the percussion (more people lead to heavier, more complex drums).

The piece being developed for BBC Music Day will employ significantly more sophisticated mechanisms to produce more complex harmonies, textures, and rhythms, but will do so in a way such that the public can appreciate and understand their influence on the piece, aided by visual presentation of the visual detection and music generation process. Moreover, the piece will be designed to vary significantly over time, reacting to different aspects of platform activity, but also providing variety as the day progresses.

MANHATTAN SOFTWARE – Dr Chris Nash (2014-)

Manhattan (pictured below) is a music editor and programming environment, designed as a digital platform for creativity and learning in both composition and coding. It is used to teach programming in the context of music, where code is injected into a short pattern of music and used to generate and modify it over time. This simple mechanism exploits patterns found in all music, and can be used to model pieces in any genre, from popular to classical, Blue Monday to Beethoven's Seventh. As a programming tool, Manhattan is similar to the spreadsheet, supporting easy editing of data but also a flexible formula-based code language behind. It is used by students on UWE Bristol's music technology programmes, to develop computational thinking skills, and part of the university's initiative to support digital literacy learning, and widen participation in coding.

Manhattan has been designed in consultation with composers, as a tool for artistic expression that offers a new perspective of music, combining traditional approaches with code fragments to produce new algorithmic, reactive, and dynamic pieces, as well as more traditional works.

The first piece, a piano duet for human and computer, *Manhattan Circus* (with Maxwell Davies and Chris Nash), premiered in St. David's Hall, Cardiff, in 2017. Other pieces and collaborations with international composers are also currently in development.
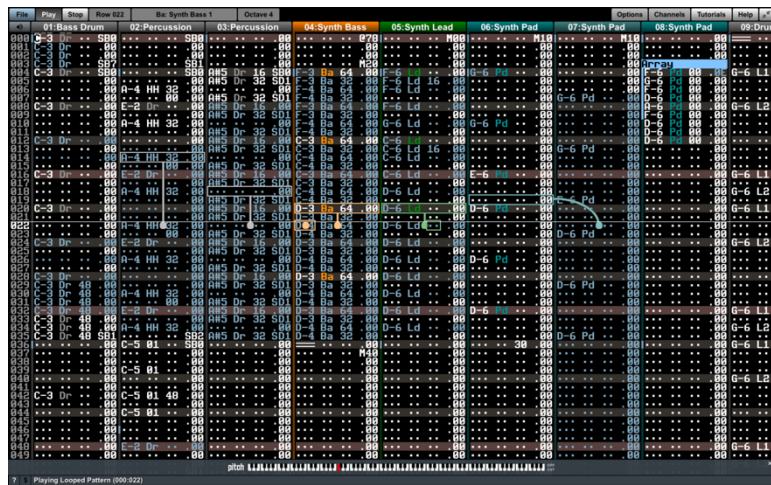
The current version of the software is available for free, from http://revisit.info/trinity, for Mac and PC. Artists and users are encouraged to contact the project and provide feedback on the environment, to support its further use and development. The project is interested in new collaborations in any genre or setting.