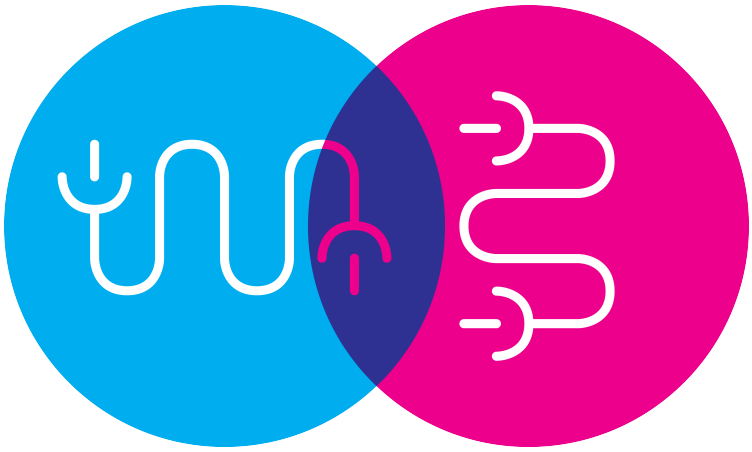


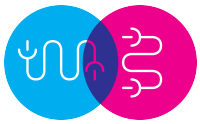
Project Acronym:	**MusicBricks**
Project Full Title:	**Musical Building Blocks for Digital Makers and Content Creators**
Grant Agreement:	**N°644871**
Project Duration:	**18 months (Jan. 2015 - Dec. 2016)**

D6.3 Final Results from the Industry Testbed

Deliverable Status:	**Final**
File Name:	**MusicBricks_D6.3**.pdf
Due Date:	**Mar 2016 (M15)**
Submission Date:	**Mar 2016 (M15)**
Dissemination Level:	**Public**
Task Leader:	**TU WIEN**

Authors: Thomas Lidy (TU WIEN), Alexander Schindler (TU WIEN), Michela Magas (Stromatolite), Steffen Holly (Fraunhofer), Marta Arniani (Sigma Orionis)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n°644871



The MusicBricks project consortium is composed of:

SO	Sigma Orionis	France
STROMATOLITE	Stromatolite Ltd	United Kingdom
IRCAM	Institut de Recherche et de Coordination Acoustique Musique	France
UPF	Universitat Pompeu Fabra	Spain
Fraunhofer	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung E.V	Germany
TU WIEN	Technische Universitaet Wien	Austria

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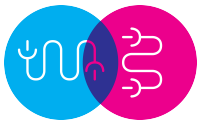

Revision Control

Version	Author	Date	Status
0.1	Thomas Lidy (TU WIEN)	March 3, 2016	Initial Draft / Framework
0.2	Thomas Lidy (TU WIEN)	March 8, 2016	Achievements and Results
0.3	Alexander Schindler (TU WIEN)	March 9, 2016	Achievements and Results
0.4	Thomas Lidy (TU WIEN)	March 9, 2016	Feedback on Tools and Incubation
0.5	Thomas Lidy (TU WIEN)	March 18th, 2016	Executive Summary, Conclusions
0.6	Michela Magas (Stromatolite)	March 18th, 2016	Review
0.7	Steffen Holly (Fraunhofer)	March 22, 2016	Review
0.8	Marta Arniani (Sigma)	March 24, 2016	Review
0.9	Thomas Lidy (TU WIEN)	March 25, 2016	Final Editing
1.0	Marta Arniani (Sigma)	March 25, 2016	Final Draft reviewed and submission to the EC

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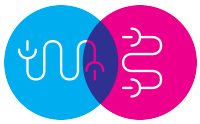

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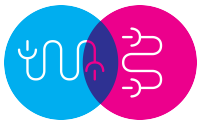

1. Executive Summary

The present document is a deliverable of the #MusicBricks project, funded by the European Commission's Directorate-General for Communications Networks, Content & Technology (DG CONNECT), under its Horizon 2020 research and innovation programme.

After hosting four Creative Testbed events (WP5), the best hacker ideas were selected to be taken into the Industry Testbed programme of #MusicBricks: an incubation program to foster the projects development towards market-ready prototypes. This incubation program has given the people and projects the unique opportunity to develop their initial idea towards a sustainable prototype to be presented in industry environments (startup events, investors, trade shows etc.).

At the same time, the incubatees in the #MusicBricks Industry Testbed provided invaluable feedback to the authors of the #MusicBricks tools, firstly, in terms of stability, reliability and usability, secondly, in terms of performance, integrability and applicability together with other tools from MusicBricks as well as third party software and hardware - important factors for deploying a product on the market.

In the deliverable 6.1 we have presented the projects' ideas and roadmaps for the incubation period carried out in the MusicBricks Industry Testbed. **In this deliverable we outline the achievements and results from the Industry Testbed, alongside the key outcomes.** It also includes feedback both on the #MusicBricks tools that were at the center of development in the incubation phase as well as the incubation process itself.

All of the 11 projects fulfilled their goals for the incubation roadmap in the Industry Testbed and are eligible to **move forward to the Market Testbed** in WP7. Several of the projects made progress far beyond the state of a "hacker prototype". **One new startup was founded** among our incubated teams, **3 further teams incorporated their new prototype into their prior startups, one new art collective** was formed. One incubated project has **filed a patent** for their new innovative idea, several of them already presented on stage on major international events, and **one has been nominated for the Prix Ars Electronica 2016**.

There was **overwhelming positive feedback** about the incubation process and mentoring, where the incubatees said they both learned a lot and progressed a lot in this incubation. **Feedback on the #MusicBricks tools** was also **vastly positive**, with **some demanding feedback** for more real-time capabilities, additional analysis and input/output features. For maximum flexibility, there was the **desire for open-source tools** in order to be able to do any kind of change and adjustment to the original tool. On the other hand incubatees stated they like to work with preconfigured tools that work out of the box.

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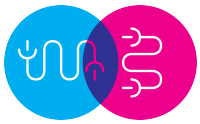

2. Industry Testbed: Incubated Projects and Outcomes

As an outcome of the Creative Testbeds in WP5, **11 projects** were awarded at the four Creative Testbed events (refer to deliverables D5.4 and D6.1), and nominated to be **taken forward to the #MusicBricks Industry Testbed**. The Industry Testbed was carried out between **June 2015** and **February 2016** and was offering an **intensive incubation programme** that supported the projects with:

- advice on realization of their ideas
- assistance with the MusicBricks tools
- financial support (for material, travel, additional resources)
- business planning in thinking towards the market
- advices and connections for partnerships and technologies

The duration of the incubation was approximately 3-5 months per incubated project.

The following table lists the projects, the number of team members and their home country, the Creative Testbed event where it was nominated from, and the mentors from within #MusicBricks that accompanied them during the Industry Testbed.

MusicBricks: Projects Incubated in Industry Testbed

Incubated Project	Nominated from Creative Testbed	# of Incu-batees	Country of Origin	Incubation Period	Incubation Contractor	#MusicBricks Tools Used	Mentors
Airstrument	#MTF Scandi	3	Israel	June - Dec 2015	Sigma Orionis	IRCAM R-IoT, Fraunhofer Melody extraction	IRCAM, TUW, Fraunhofer, Stromatolite, SigmaOrionis
Interactive Cube	#MTF Scandi	2	UK, Sweden	June '15 - Feb '16	Stromatolite	IRCAM R-IoT	IRCAM, Stromatolite, Joshua Saunders (Warner Music)
Dolphin	#MTF Scandi	1	Sweden	June - Dec 2015	Stromatolite	IRCAM R-IoT	IRCAM, Stromatolite, external partner incubator: Umenova eXpression, Umeå
FindingSomEthing BondingSounding	#MTF Scandi	3	Portugal, Hungary	June - Oct 2015	Stromatolite	IRCAM R-IoT, UPF Essentia	IRCAM, Stromatolite, UPF, SigmaOrionis
Hi Note	#MHD Barcelona	2	UK, Spain	July - Dec 2015	Stromatolite	IRCAM R-IoT	IRCAM, Stromatolite
The Snitch (ear	#MHD	4	Spain	July - Nov	Stromatolite	UPF Essentia	UPF, TUW

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we go)	Barcelona			2015			
Sound in Translation	#MHD Barcelona	3	Germany, Spain	July - Nov 2015	UPF	TU Wien RhythmTimbre, Fraunhofer Transcriber	TUW, Fraunhofer, UPF, Stromatolite
Enboard	#MHD Barcelona	2	Spain/Colombia	July - Nov 2015	UPF	IRCAM R-IoT	TUW, UPF, IRCAM, Stromatolite
GIRD - Interactive Remix Dance Floor	#MTF Central	2	Austria/Australia	Nov '15 - Feb '16	Stromatolite	IRCAM R-IoT, UPF Essentia	IRCAM, Stromatolite, TUW
Manuphonia	#MTF Central	6	Slovenia, Bulgaria, Germany	Nov '15 - Feb '16	Stromatolite	IRCAM R-IoT	IRCAM, Stromatolite
Light Beat	#MHD Vienna	2	Austria	Nov '15 - Feb '16	UPF	Fraunhofer Transcriber, Essentia/AcousticBrainz	Fraunhofer, TUW, UPF, Stromatolite

The results after this in-depth incubation and mentoring period have been demonstrated to the #MusicBricks consortium either via a live demo, Skype demo or video. **All projects produced a video** about the prototype that resulted from the incubation. In addition, a feedback report was submitted by each of them, including a summary of their achievements and feedback about their experience with the incubation programme as well as the #MusicBricks set of tools.

In the following subsections, we present each of the incubated projects with a brief description, the team members, the #MusicBricks they used to realize their goals and a **description of the results** after the Industry Testbed incubation programme, alongside with the **key outcome** and the links to the final video presentations.

2.1 Dolphin

Team: Rojan Gharibpour (Sweden)

#MusicBricks used: R-IoT gesture sensors

Dolphin is about generation and playing of sounds and music in relation to head movements and head gestures. It is like a menu structure (e.g. comparable to a mobile phone's voice box) which can be navigated completely hands-free through head movement and nodding gestures. This is achieved by mounting a #MusicBricks R-IoT gesture sensor on a headset.

The Dolphin platform is a framework created by its author, Rojan Gharibpour, and adapted from some of the available open source libraries, and comprises a set of tools and libraries, which can load and run special applications written for Dolphin.

The framework provides the application with input data from the sensor like current sensor orientation and/or produces 3D sounds to be played on behalf of the currently running application for spatial location and

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direction of sound sources. It can be used to navigate in menu structures or virtual worlds. Of course it has also applications in Augmented Reality and is therefore applicable to a wide range of industries.

The code is written in C# and running on a Unix based system. In the particular setup it is running on a Raspberry Pi as the hardware to enable a portable setup with only micro-boards involved.

Achievements and Results

During these 3 months, Rojan implemented all the features that were planned in the beginning and even way more than that. The original idea of controlling sounds by head movements matured and grew into a completely new direction: The application in a variety of industry sectors, where it can help to navigate or assist production processes. The Dolphin framework now is also able to register some gestures, thanks to Machine Learning techniques that were being integrated during incubation.

Out of this incubation idea, a new startup was founded, which already is in concrete talks with major industry players to utilize the upcoming product, which helps further refine it for the market. Before getting in touch with industry players, a patent was filed for this novel idea of navigation in industry environments. For that reason, public presentation of the core idea is currently under non-disclosure, and the publication of the final video was held back.

Dolphin is considered the ideal case of an incubation: In only 3 months the idea went from its inception at a hackathon to maturity and demonstrability for industry, while incorporating a startup and filing a patent. Knowledge transfer from partners to the incubatee was very intensive and the learning curve for the incubatee very fast, resulting in exceptionally fast track to innovation. Aside from great interest from gaming communities, the idea has remarkably resonated outside of the creative industries with current talks involving forestry and agriculture.

Key Outcome:

- mature prototype finished
- startup founded
- patent filed
- entered talks with industry players

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Videos:

- #MTFScandi presentation: https://www.youtube.com/watch?v=Npj7uf-1Q_o
- Final prototype under non-disclosure due to patent filing

2.2 Interactive Cube

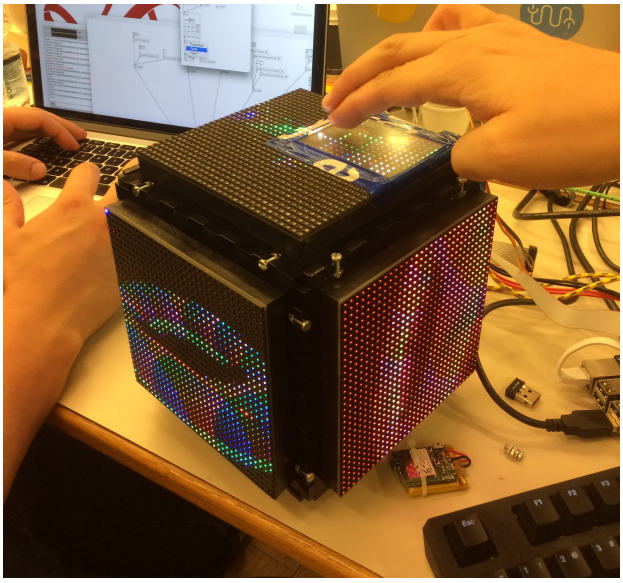
Team: Balandino Didonato (UK), Per-Olov Jernberg (Sweden)

#MusicBricks used: R-IoT gesture sensors

The Interactive Cube was awarded at the #MTFScandi hackathon and is an interactive cube display for manipulating audio. The Interactive Cube was originally composed of 5 LED displays, which show the projection of a sphere on each side of the cube. The position of the sphere within the cube was determined by the orientation of the cube.

The LEDs were later replaced by 5 retro-illuminated pads in the course of incubation.

The cube's orientation is tracked using the R-IoT device. The orientation also defines the mix of five audio loops. Moreover, the movement of the cube drives a stereo panning effect. The colour and size of the sphere, as well as the VU audio meters, are regulated by the audio signal.



Achievements and Results

The two team members created a gestural controller inside a cube to manipulate audio and video feedback. The cube device was made of LED displays. A R-IoT sensor was put inside the cube in order to map the cube's orientation and movements into parameters for controlling the audio signal processing of 5 audio files.

This first prototype was created using Open Hardware and Software (Node JS and Pure Data).

In the following months, despite difficulties due to the distance between the two team members, they kept working on the Interactive Cube and before the Interactive Cube completion they showcased the work in progress version at #MTFCentral (see video link below).

A discussion with a potential hardware manufacturer led to the redesign of the cube to use 6 retro-illuminated pads with buttons instead of the 5 LED displays.

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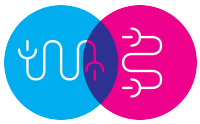

The Interactive Cube has been already reviewed positively by Josh Saunders (Warner Music UK) and Jon Eades (Abbey Road Studios). The former has seen the Interactive Cube under the artistic light and its usability in artistic practice. The latter instead looked at modalities to launch the Interactive Cube on the market through Abbey Road channels, such as Abbey Road Red Incubation program (http://www.abbeyroad.com/abbeyroadred).

The Interactive Cube team followed their Open Hardware and Software spirit and published the code on GitHub. Together with the proposed hardware, it can be utilized as a DIY-kit, however, the Interactive Cube team is also open to any artistic collaboration and to launch the device on the market.

It can be sold in different formats:

- DIY kit: All info to realise a cube by oneself are published through GitHub (see below)
- Starter kit: the customer may order all parts and instructions to realise it
- Finished product: the customer can buy the cube ready to use

Before the launch to the market, there are still some things to be clarified on the design and realization side including a deeper research concerning cheaper hardware which can be implemented to lower down production costs.

Key Outcome:

- prototype created, published as a DIY kit
- reviewed by Warner UK (for artistic use) and Abbey Road (incubation program)
- talks with hardware manufacturer initiated
- Facebook page: https://www.facebook.com/Interactive-Cube-626854824083736/?ref=hl
- GitHub repository: https://github.com/interactiveBrick/Interactive-Cube

Videos:

- #MTFScandi presentation: https://youtu.be/8a17_66Da7w?t=6h37m59s
- #MTFScandi awards: https://youtu.be/HwC11hLbe0E?t=2h28m43s
- #MTFCentral presentation: https://www.youtube.com/watch?v=Kx1sFe0oGT0
- Final video: https://vimeo.com/157064325

2.3 FindingSomething_BondingSounding

Team: Francisco Teixeira (Portugal), Horacio Tome-Marques (Portugal), Fanni Fazakas (Hungary)

#MusicBricks used: R-IoT gesture sensors, Onset Description

FindingSomething_BondingSounding is an audiovisual performance involving movement sensors and neuro-feedback from brainwave sensors (brain-computer-interfaces).

FindingSomething_BondingSounding represents the duality between the mind and the body. There is constant fight between the mental & the physical fulfillment to achieve an enlightenment state of being. As Napoleon said: "There are only two forces in the world, the sword and the spirit. In the long run the sword will always be conquered by the spirit."

What mediates this fight in this performance is the sound. The mind controls audio and video samples organized in a mental playlist according to it´s activation or relaxation and the body controls the effects according to its position, acceleration and angle. It is to see who wins this fight ...

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Achievements and Results

The result of transforming **#FindindSomethingBondingSounding** from an art performance to something sustainable and marketable is an application made for audio-visual artists who want to bridge their brains and their gestures in a live performance. With this application the brain can act as an audiovisual sampling system and the body movements (gestures) as an effects modulator. The mind controls audio and video samples organized in a playlist according to a mental activation or relaxation neurofeedback paradigm — representing, broadly, states of mind in 7 steps, from low arousal to high arousal — and the body (e.g., arms) controls the effects according to the position, acceleration and angle.

These are the achievements carried out in order to move from a performance to an application during the incubation process:

- developed a Max7 *patch* that receives raw data from the Emotiv Epoc Headset, via HoMy_EmoRAW as a stream of floating numbers that is decomposed in outlets representing the 14 channels of the Emotiv Headset
- implemented on the same *patch* a filtering schema based on neurofeedback paradigms, using the MnM/FTM filters, to filter the data in two main frequency bands (Alpha & Beta) and distributed this filtering by using the Beta band on 8 frontal electrodes and the Alpha band on 6 posterior electrodes. Having the power spectrum of these 2 main bands the sensibility of each MnM/FTM filters according to the person that was going to use the headset was calibrated
- at the output, this patch sends triggers to *Live* according to the set of electrodes that have more power, according to the spectrum power. The Live set was implemented with the capability to control (via outside triggers) 7 audio *sub-narratives* (channels and layers), corresponding to the 7 stages that constitute the all narrative, correlated to the mind states.
- on the other hand, Live sends triggers at each audio channel key start to a Max7 jitter patch that was implemented with the capability to control 7 video *sub-narratives* (corresponding to the 7 visual sequences that constitute the all narrative and correlate to the mind states).
- the all set uses a private network based on 8 port router and 3 TP-Link Wireless Routers (APs), (used by the R-IoT sensors) and fixed IP addresses, as means to make the flow of information as robust as possible.

The team was able to take the project to a level that fulfills some of the starting ideas and aims, not only in technical aspects but also artistic. Emotiv Epoc triggers the audio on Live and video on Max7 (jitter) correctly and the R-IoT sensors modulate audio on Live and video on Max7 (jitter) correctly. The audio and the video samples synchronize effectively; even when being triggered by a rather complex set interlinked *patches*,

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applications and communications system. The filtering prototype seems to respond correctly up to a certain level. These aspects allow controlling more effectively the narrative, which is a crucial part of the project.

Some aspects remain to be addressed and made more effective, namely e.g., the brain data filtering system, the complexity of all set, or the stage setup-time the project needs to allow public presentation. The team formed a collective to further develop on the project.

The project has received Jury Nomination for the 2016 Ars Electronica Interaction+ Prize, which is the highest level artistic recognition in this field.

Key Outcome:

- project now integrated in company MuArts
- **#WhiteMatter** founded as a collective formed by the MuArts (Francisco Marques Teixeira & Horácio Tomé-Marques) and RUMEX (Fanni Fazakas)
- project transformed an initial arts performance into an application that can be used by other artists
- Jury Nomination for the 2016 Ars Electronica Interaction + Prize
- will continue to work to make the setup easier for artists

Videos:

- #MTFScandi presentation: https://www.youtube.com/watch?v=VHTdN9iF5Ag
- #MTFCentral presentation: https://youtu.be/yT27T9k2ZcM
- Final Video: https://vimeo.com/158842292

2.4 Airstrument

Team: Ariel Angel (Israel), Matan Berkowitz (Israel), Rani Dar (Israel)

#MusicBricks used: R-IoT gesture sensors, MusicBricks Transcriber (MelodyExtraction), initially also RhythmTimbre

Airstrument is a gesture-driven instrument that solely works “in the air” through a wristband with motion and gesture sensors. It allows non--musicians and musicians alike to jam along to their favorite tracks using hand gestures and movements.

The software flow allows the user to ‘upload’ a song / audio file, process it using the MusicBricks tools (detect chords, progression, scale, scale shifts) and play along always in tune with the harmony, rhythm and melody of the original piece.

The prototype is designed as two colorful wristbands, one for each arm, which use the #MusicBricks R-IoT sensor to track movements and also comprises a new, intuitive musical UX.
It is planned to turn the prototype into a consumer product.

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Achievements and Results

The outcome of Airstrument can be described as an intuitive, motion based, wearable instrument that holds accessibility at its core and features the ability to jam along with existing music. The team - though experiencing some communication difficulties due to living in 3 different time zones - worked hard on the software and the hardware side. They created an analysis software part and several design prototypes for the wristband to play the Airstrument, one of which was chosen as the final prototype for the time being.

The outcome is very much aligned with the vision that the team had at the time of the Creative Testbed. It is certainly a reasonable result in the viewpoint of a proof of concept. Going further along the commercial road however, there is still a lot left to do to realize the full vision of the
Airstrument as a consumer product.

It is planned to expand the hardware capabilities with more sensors and components, building a standalone application that covers 3 different modes (educational, freeplay, jam along), and creating a unique design with a particular look & feel. One of the team members (Rani) left the project after the incubation stage, and while Ariel is focusing on deeper research and software analysis models, Matan is outlining the business model and marketing strategy.

Key Outcome:

- solid prototype to play an instrument “in the air”
- design mockups for the wristband case + realization of the prototypical case
- promo video created
- started on business model and marketing plan

Videos:

- #MTFScandi presentation: https://www.youtube.com/watch?v=_zYtSA8Iv04
- Final Video: https://www.youtube.com/watch?v=0Ray02ILJfY&feature=youtu.be

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2.5 The Snitch

Team: Cárthach Ó Nuanáin, Ángel Faraldo, Martin Hermant, Daniel Gómez (Spain)

#MusicBricks used: Essentia

The Snitch (formerly “Bionic ear”, “The Eear” or “ear we go”) was created to help musicians get in tune with an existing musical ambience.

A producer wants to jam along with (a) a performer who is playing a guitar, keyboard or other chordal -based instrument and (b) a digital artist who wants to create real-time mapped graphics for the performance. The producer pulls out his phone and places it near the guitarist. The Snitch starts analysing the music and estimates the chord as well as other useful features such as the spectral profile. In the producer’s Digital Audio Workstation, an application (i.e. a sampler) is ready to play pre-analyzed snippets of music so the performer is in time and in tune with the performance. On the other hand, the digital artist also receives the analyzed musical information and uses it as real time data to animate the visuals.

The Snitch is realized as a mobile app running a stripped down version of Essentia (or #MusicBricks Transcriber) capable of operating on Android and iOS tablets and smartphones. It will capture features such as key, tempo, MFCC and other spectral features to be then transferred to a computer via OSC messages through a Wi-Fi network to realize the use cases.

Achievements and Results

The Snitch team has developed a smartphone application that listens to incoming audio and estimates the chord/key of the audio.

There are two modes of operation:

(a) continuous mode, in which the system estimates in short windows of time the chord that is sounding (although limited to major and minor chords only); and

(b) a manual mode, which estimates the most salient tonality over a time window selected by the user, which can be associated with the key of the musical fragment.

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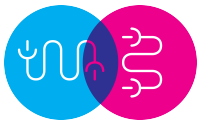

Furthermore the app is able to obtain additional information about the loudness and noisiness of the signal. All this information is sent over OSC, so it could be used to influence other musical processes or digital instruments (for example, loading a bank of samples in the key somebody is playing in).

The prototype realized in the incubation process follows closely what was outlined immediately after the Creative Testbed hackathon. It is a great achievement that the team was able to fulfil these aims in the incubation time provided. Moreover, this is an app ready to be put into the App Stores and to be used by users interested in playing in tune with the background.

Implementing new features, improving support and collaborating with the open source community are next stages. Evaluating the tools in more practical and musical scenarios such as concerts and installations would be beneficial.

Key Outcome:

- fully functional Android app
- reliable recognition from chord or key from environment
- stable connector to Audio workstation on desktop
- communication over standard OSC protocol with a multitude of digital instruments
- positioning as an open source project (Code published on GitHub)
- presentation at International Society of Music Information Retrieval Conference

Videos:

- #MHD Barcelona presentation: https://www.youtube.com/watch?v=sWerNCeb7JE&t=1h2m36s
- #MTF Central presentation: https://www.youtube.com/watch?v=9cPuopxrG3o
- Final Video: https://www.youtube.com/watch?v=PZ4thrFiCss&feature=youtu.be

2.6 Sound in Translation

Team: Timothy Schmele (Germany), Juan José Bosch (Spain), Andrés Bucci (Spain)

#MusicBricks used: RhythmTimbre, Transcriber

The main idea for this project is to support musicians in the creative process when performing or composing using loops. More specifically, the prototype creates musical loops from the user's musical collection which have certain rhythmic similarity compared to an input audio.

Sound in Translation thus enhances musical creativity by reducing the time it takes someone to browse through his/her data collection and create loops that fit the initial musical idea.

The main context of use is within a live performance, but can also be useful for the generation of ideas for composers at the studio. By analyzing the music collection, the system is able to present usable and similar loops that are arranged in a (e.g. 8x8) button grid, using automatically computed musical information.

The MusicBricks project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n°644871

Achievements and Results

The Sound in Translation team has built a tool that creates music loops from a user's music collection, which fit an initial musical idea. The intended context of use is within a live performance, but can also be useful for the generation of ideas for composers at the studio. Loops are arranged in a grid of buttons using automatically computed musical information. The tool also helps the musician by providing visual feedback on the process, either at the computer or the controller used, if the controller supports it.

Some of the tasks that they performed are:

- improve the song retrieval process (e.g. considering/filter previously retrieved songs, improving the similarity search with more features, and using normalisation)
- improve the identification of the most suitable part from the retrieved song, using automatically computed musical information.
- time-warp the retrieved loop to properly match the buttons on the control pad
- improve stability of client and server (e.g. handling of audio i/o)
- test scalability of the prototype to larger collections of data
- tested stability of prototype
- allow the use on Bhoreal and other controller types (Launchpad)
- Promo video

The outcome is in line with the objectives and the prototype is a very promising first version. It is planned to be further refined, e.g. for a better loop retrieval and developing a Max4live plugin, to be able to integrate the tool in MAX.

Sound in Translation was already shown (besides the demos at #MHD Barcelona and #MTFCentral) in live performances at the Algorave in London and at the Barcelona Loves Entrepreneurs (BLE) event. It will also be shown at #MTFBerlin to gather feedback for further refinement.

Key Outcome:

- solid prototype of controller for interactive loop retrieval

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- extension from initial limited controller board to larger range of possible controllers
- convincing demo, already shown in live performances on stage at several events
- Facebook page: https://www.facebook.com/soundintranslation/
- Barcelona Loves Entrepreneurs Listing: http://www.barcelonalovesentrepreneurs.com/2016/03/01/quieres-emprender-en-el-mundo-de-la-musica-apuntate-al-proximo-ble-music/

Videos:

- #MHD Barcelona presentation: https://www.youtube.com/watch?v=sWerNCeb7JE&t=6m8s
- #MTFCentral presentation: https://youtu.be/CjJeguYQ42s
- Final Video: https://youtu.be/Swc_puFfgB8

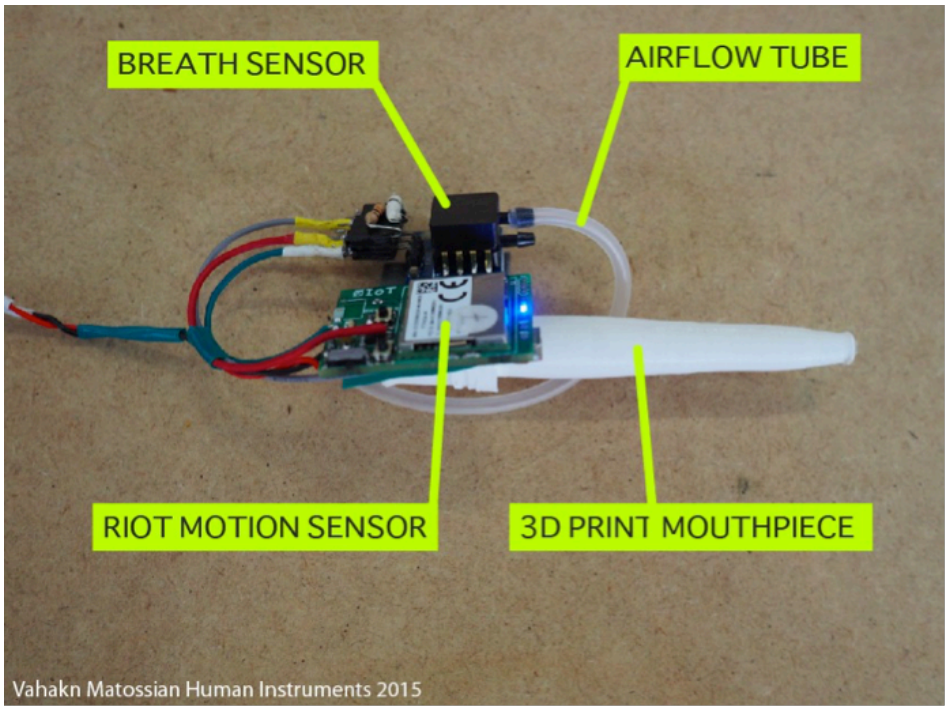
2.7 Hi Note

Team: Vahakn Matossian (UK), Rolf Gehlhaar (UK), Pere Calopa Piedra (Spain)

#MusicBricks used: R-IoT

Hi Note is a hands free wireless accessible musical instrument that uses breath control, head movements and other gestures to control music via a MIDI interface.

The project aim was to design and develop a device allowing the chance of a profession in music to someone who can't access tools that fit the user's physical ability.



Achievements and Results

Pere Calopa and Vahakn Matossian built the new hardware device Hi Note, with the guidance of the eminent composer Rolf Gehlhaar. It is a wireless hands free music controller instrument with accessibility in mind.

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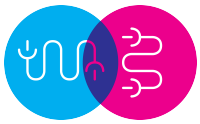

They wrote and developed custom software to receive movement data of a player's head and then further software to convert that precise movement to playable musical notes via breath pressure.

The team faced some technical obstacles along the way, most of which could be resolved, some of which needed some design changes.

Plans for further development are to create haptic feedback alongside the visual feedback (was not yet possible due to time constraints). A learning from the incubation is that it seemed more effective to improve the existing functionality than to create potential further issues with new functionality.

The team has been working with the members of the British Paraorchestra to test and gain user feedback on the tools. The prototype video shows a test conducted with a paraplegic performer, who was able to express himself musically with a wide range of rhythms and sounds, creating complex compositions.

Both the team as well as the #MusicBricks consortium are happy with the outcome. It will receive great visibility in a demonstration to be performed together with the Para Orchestra at #MTFBerlin in 2016.

The project has received a Jury Nomination for the prestigious 2016 Ars Electronica STARTS (Science Technology and the Arts) Prize.

Key Outcome:

- a wireless hands free music controller instrument with accessibility in mind.
- it brings the company Human Instruments (founded 2013) to the next level
- tested in real-world environment
- Jury Nomination for the prestigious 2016 Ars Electronica STARTS (Science Technology and the Arts) Prize
- performance with Para Orchestra planned for #MTFBerlin in 2016

Videos:

- #MHD Barcelona presentation: https://www.youtube.com/watch?v=sWerNCeb7JE&t=1h21m13s
- Final Video: https://vimeo.com/153036940 , https://youtu.be/uA71d3iNoKA

2.8 Enboard

Team: Juan Felipe Gómez (Spain/Colombia), Steven Bolaños (Spain/Colombia)

#MusicBricks used: R-IoT

Enboard is an audiovisual project, a meeting point of the team's admiration towards art, music, technology and skateboarding, elements which have met in the past and that once again collide in a project that seeks to explore, create and experiment.

Similar to dancing, skateboarding has specific physical expressions, in various aspects, ranging from its sonority to its corporal output, which with the right tools can be mapped and used to generate a unique audio-visual live experience.

Enboard aims at achieving this, using a R-IoT sensor to map different skateboarding states, as well as a microphone to input live skating sounds, which could be potentially used as live sound assets and to create compelling visuals out of the movements of the skateboarder.

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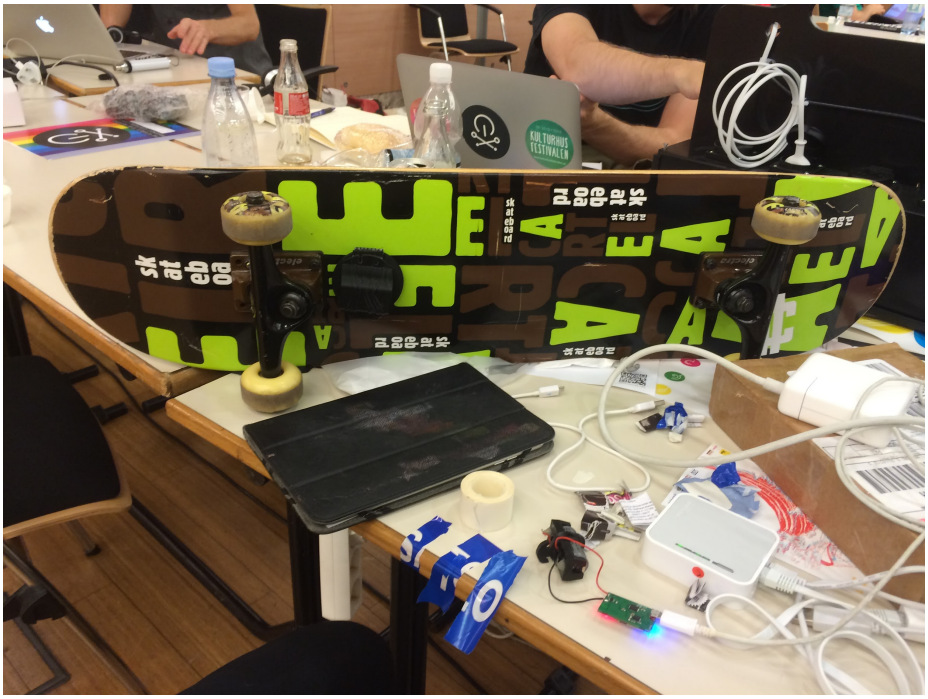

Achievements and Results

The Enboard team used the first three months of incubation to develop a first technical and conceptual approach. The intermediate presentation at #MTF Central still had some technical difficulties both in the physical setup and in the audio-visual processing.

The team reacted to it, changing entirely the setup of the contact microphone on the board. However, also the new setup experienced some difficulties, because a rather large transmitter was needed, and the skateboarder is touching the board anywhere on the surface for different tricks, making the placement of the transmitter very difficult.

Also with elaborating the sound and the visual aspect, the team had some technical complications, but they improved towards the end of the incubation. The team said, these taught them a lot and paved the way to go, but they would have liked to experiment more with the soundscapes, and they hada lot of physical problems.

All in all this can be seen as a very rough prototype of the original idea, however with both further thoughts and efforts to be put into the project.

The #MusicBricks consortium believes that this idea of combining Skateboard tricks with audio-visual outputs (e.g. in form of an app) has very great potential, but it needs to be taken to the next level, with fresh inputs. The goal is to add more people to the project team and pitch it at the upcoming #MTF Berlin event for further creative exploration.

Key Outcome:

- rough prototype of skateboard recording sounds and creating audio-visual output
- ideas on how to largely extend this idea and project
- Website: http://mudcircles.com/enboard-project/

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Videos:

- #MHD Barcelona presentation: https://www.youtube.com/watch?v=sWerNCeb7JE&t=30m57s
- #MTF Central presentation: https://www.youtube.com/watch?v=2lAj6aKUAIc
- Final Video: https://vimeo.com/153921070

2.9 GIRD - Gesture-based Interactive Remix Dance Floor

Team: Tracy Redhead (Austria / Australia), Jonathan Rutherford (Austria / Australia)

#MusicBricks used: R-IoT, Essentia~RT code (from The Snitch)

A gesture based interactive dance floor experience that allows a performer or audience members to interact with music in an immersive environment.

The lighting in the environment plays a vital role. Using individually programmable LED “neo pixels”, the project creates individual lighting fixtures. Each fixture will be a standalone hardware device driven by PD on a Raspberry Pi and enabled via wireless signal or its internal microphone. The fixture will have several modes for 1) an emotional atmospheric interpretation of the music using #MusicBricks software 2) gesturally controlled mode lighting using the #R-IoT board and 3) interaction feedback to guide the user based on the music being interacted with.

An individual or group can interact with this environment using a #MusicBricks gesture sensor within a wearable bracelet or object. Based on individual’s movements they are able to manipulate stems or trigger loops and samples in order to remix, recontextualise and compose music.

Achievements and Results

During the incubation, the GIRD team acquired relevant knowledge and skills such as in managing wireless network infrastructures with OpenWRT[1], audio programming and processing with Quartz Composer[2], and

[1] https://openwrt.org/

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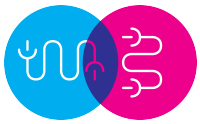

the integration of the applied heterogeneous systems into a package to create the lighting effects. Skills in using Max 7 and Max for Live were acquired to integrate the patches provided by IRCAM for the riot sensors. These were used to design dance and gesture interactions that could work with interactive music elements. Two Max for Live patches were created to control the lights and enable composers and producers to experiment with creating interactive mixes and dynamic tracks.

The prototype or proof of concept showed the potential of how this glove could be used by audiences to experience music in a new way. It also provides tools for musicians and producers to produce music that audiences can explore and remix through dancing.

Although intended, the GIRD team was not able to develop a method to produce emotional interpretations of the music for the creation of lighting effects. They have however created a number of modes of mood lighting. Jonathan is currently working on new approaches to program the lights in order to provide interaction feedback for audiences using the remix and exploration modes.

Further attempts focus on acquiring knowledge in machine learning to attain more complex analysis results and thus to create interesting dance moves and gestures beyond those offered in the IRCAM Max patches.

The team aims at integrating this in time for #MTFBerlin so the system provides a better user experience when presented in a large-scale scenario for the first time.

There have been several thoughts on how to market this idea and move forward towards a product. Given the impressive glove-based projects available like Mimu and Remidi aimed at artists and performers, the GIRD may well move forward focused on the consumer market, inviting audiences to experience music in a different way with their bodies. On the other hand, if the machine learning based system is successful, even further possibilities are envisioned for the GIRD, e.g. as a multiplayer gaming experience, an instrument free orchestra, a mass participation interaction, and more.

Key Outcome:

- glove-based interactive system to control sound and lights
- integration with Max for Live to address artistic environments
- presentation at Music Interaction Design (MiXD) Symposium in Birmingham
- extension to self-learning gesture system
- plans to productize in consumer market and extend possibly to gaming and mass audience participation
- convincing video and demo prepared for #MTF Berlin

Videos:

- #MTFCentral: https://youtu.be/FFSrgmT6n-k
- Final Video: https://youtu.be/ns24sgQfXYw

2.10 Manuphonia

Team: Maya Lekova (Bulgaria), Terhi Marttila (Germany / Finland), Kristjan Sešek, Rok Milošič, Adrijana Bundalo, Ernest Beličič (all from Slovenia)

#MusicBricks used: R-IoT

Manuphonia uses the R-IoT sensor module to recognize different gestures and make sound based on it.

[2] http://quartzcomposer.com/

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The core idea of this project is to make music by using gestures. It is intended to fill the gap between performer's movements and the soundscape. The idea comes from the observation that humans can both react to sound and shape it at the same time, much as like when playing an instrument. To free people from the need to own a physical instrument to play music, Manuphonia are developing a product which combines hardware sensors, machine learning techniques and software that maps sounds to gestures.

An Android application implements a library for effective gesture recognition combined with samples for different instruments and a library of predefined sounds. The user will have the ability to record custom gestures and bind them to existing samples for each connected sensor.

The target users are:

• professionals that will use the product as part of their performance
• non-professionals that will use the product in their free time.

Achievements and Results

During the incubation a Python application was developed that connects to the R-IoT sensor and uses a library of predefined sound samples and a library for gesture recognition. Python was initially chosen, due to its ease in debugging and visualizing data. The prototypical implementation was succeeded by the development of an Android application that uses the same libraries. This final application allows users to record their own gestures, bind these gestures to predefined samples and to create music.

The team further created a simple 3D printed encasing for the sensor that can be worn on arbitrary body parts.

During the testing phase, the team observed that simply playing predefined sounds with a single sensor does not keep users engaged. As a consequence, the application was adapted to also play background music during the playing phase.

Limitations with the gesture recognition are still observed. For example, the gesture recognition library currently doesn't distinguish between two recorded gestures, where the first one is the same as the beginning of the second one. To cover this case is part of future development.

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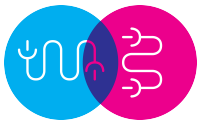

The successful completion of the prototype has been in part due to the team being proactive and arranging to meet and work together, despite being located in Finland, Germany, Slovenia and Bulgaria.

Key Outcome:

- Android application allowing users to record their own gestures, to bind these gestures to predefined samples and to create music.
- 3D printed encasing for the sensor that can be worn on arbitrary body parts
- product-wise very far, needs some polishing and minor improvement only
- accepted and demoed at the Munich Maker Fest

Videos:

- #MTFCentral presentation: https://www.youtube.com/watch?v=H-wyfofFOB4
- Final Video: https://www.youtube.com/watch?v=9NK9GF11S80

2.11 LightBeat

Team: Stefan Salcher, Adrian Jandl (Austria)

#MusicBricks used: originally MusicBricks Transcriber, adapted to use online APIs, indirectly Essentia through AcousticBrainz

LightBeat is a platform for a universal music visualization solution in the spirit of MusicBricks. It originated in the idea of Collaborative Playlisting in a bar or at a party at home. The LightBeat idea adds adds an immersive light environment by analyzing the sound for beats. By incorporating music analysis technology, pre-analyzed music is visualized on a range of connected devices.

In its initial version it was built using the #MusicBricks Transcriber by Fraunhofer combined with the Philips Hue wireless LED light system. For a larger catalogue of audio, online APIs with pre-annotated metadata derived from the audio are also incorporated.

The goal is to build a device agnostic light control platform and a consumer friendly interface so that any home user can use it with a large range of light systems. This is accomplished by establishing a virtual interface for sound visualization to allow the connection of different types of hardware both professional and consumer level.

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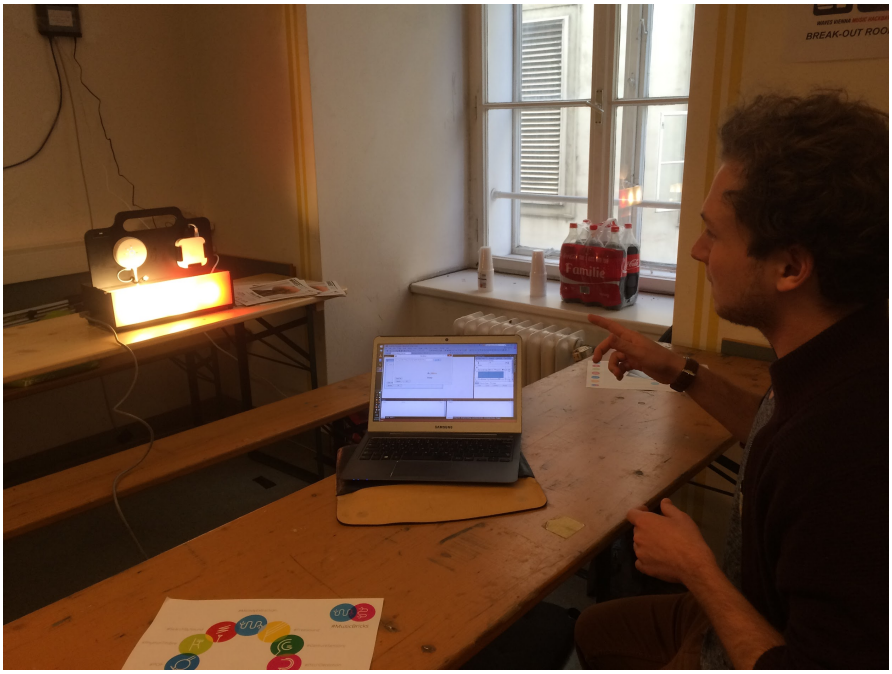

Achievements and Results

LightBeat finally decided to use the music analytics data from AcousticBrainz, which extracts descriptors using the Essentia DB #MusicBrick, and Echonest to gather the information necessary to generate light patterns. This eliminates the need for extensive computational analysis on the listening-device and direct access to the music data itself isn't necessary anymore. With this new approach the possible areas of application now greatly opened up, in particular also to mobile devices. This allows the technology to be suitable for a much larger audience than foreseen in the original concept.

The team realized the new concept as an Android application, as Android currently is the most prominent mobile operating system, in Europe and worldwide. They developed an interface language (LightBeat Action Script), to translate between the specific data sources (and be open for additional ones in the future) and the light interface. This is in line with the vision to become a platform and allows to easily implement new data sources but also different visualization hardware.

The now finished prototype app proves the effectiveness of the chosen approach.

From a market viewpoint, the LightBeat technology could find best use in enriching the possibilities of existing streaming applications. A limitation still remaining is the dependence on the streaming provider, used for music playback. A commercial application for LightBeat therefore relies on the cooperation with such a provider. On the side of the music analytics information, this problem was solved by incorporating the open source project AcousticBrainz and even allowing for the fast implementation of further sources.

The LightBeat team are also founders of music startup "Phono Music" and plan to integrate the LightBeat app next to its already available app "Phono Music" (an app for collaborative playlisting in bars and at parties). It will certainly strengthen the visibility and uptake of the LightBeat solution and pave its way towards commercialization (once the limitations of commercialization through third party APIs are solved).

Key Outcome:

- Android app created
- uses two online APIs (Echonest and MusicBrainz) for beat detection + light visualization

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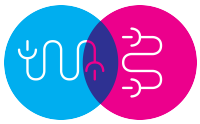

- created platform to extend easily to further music APIs and/or light devices
- part of startup company Phono music
- will integrate LightBeat into their Phono music collaborative playlisting app (planned for #MTFBerlin)
- plans for commercialization outlined

Videos:

- #MTFCentral Presentation: https://youtu.be/Z-5pI_m-FBo
- Final Video: https://youtu.be/Ud8uZDAcFLI

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3. Feedback from the Industry Testbed

As the #MusicBricks team was in continuous contact with the incubated project teams in the Industry Testbed, a lot of **feedback** was collected already **continuously during the incubation** on the communication tools, such as Slack, Skype, eMail, and also in face to face discussions. This covers both feedback on the tools that were provided by #MusicBricks to build upon and realize the incubatees' ideas, but also feedback on the process of the incubation itself.

3.1 Feedback from the Incubation Process

The aim of the #MusicBricks methodology, comprising of three phases: Creative Testbed - Industry Testbed - Market Testbed, was to have a continuous feedback loop between tool providers and the developers, to enable developers to generate ideas, which were then incubated and mentored, and to gather knowledge and feedback from productisation of tools, which in turn could lead to an improvement of the tools themselves. A lot of feedback and knowledge was also gathered about the processes and methodologies involved, and from the incubatees' personal experiences:

- How did you experience this incubation?
- What did this process do for you?
- How did it help you (people, funds, expertise, know-how, …)?
- Did you learn about new tools and methods?
- Did it help you to progress towards a product?

In the following we quote the feedback that we received about the incubation process. Most of it is provided *verbatim*, indicated in *italic* font.

Dolphin

I learnt a lot during this process and also realized that there is still much much more left to learn. Not only I learnt about new tools and concept, also I implemented these concepts and tools in my own framework.

I met very nice and knowledgeable people who helped me a lot with my project. Specially Cyril who was a great teacher to me during these 3 months.

The time frame was a little too tight for me regarding that I had a lot planned for implementing and I even went further than the plans.

The funding was very helpful for covering the costs.

Interactive Cube

Thanks to MusicBricks, we both gained a wide knowledge concerning all MusicBricks tools, IoT technologies, interaction design, and audio processing all using open hardware and software.

In addition to increase our knowledge, we definitely improved many skills like working in a team, management of a long distance professional relationship.

Last but not least for importance, thanks to #MusicBricks, our CV and professional profile has made a step forward within the music industry. In fact, the Interactive Cube gave Balandino the opportunity to be interviewed by Josh Saunders at Warner Music UK and Jon Eades at Abbey Road Studios.

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The #MusicBricks incubation program gave Balandino and Per-Olov the possibility of two great experiences MTFScandi and MTFCentral, where they have shared ideas, questions, issues, solutions, and built up a wide network with the Music Hacker community.

FindingSomething_BondingSounding

Thank you very much for all the support. For all the help #MusicBricks, Music Tech Fest, Stromatolite and SigmaOrionis gave us so this project could have wings and fly as we never thought it could. Thank you also for all the networking you all allowed us to have so our baby could in the future became a smart and funny adolescent :)

Regarding our opinion about the programme and how did it helped us: we firmly believe that this programme is one of the kind, the "bricks" concept is amazing, it allows a modular kind of thinking in building music technology and applications. It was also amazing to be able to work closed related with institutes like the IRCAM as if we didn't be working inserted in the #MusicBricks programme it would had been way more difficult.

Regarding the funds I just think (and I'm talking / representing the all group) they came a little bit late so I had to advance a quite big amount of money. It was ok but I believe that with some groups that did not have this amount available right away could had been a problem.

Airstrument

Team Member 1:

Honestly, my personal experience of the incubation period was not a smooth sail. Since day 1, Airstrument's biggest challenge has been the human factor. The relationships, politics and personal issues of the people involved were almost always at the forefront of the discussion, often requiring more energy than the actual work. Geographically we were all over the place, as well, which didn't help make the communication easier.

Starting as 3 team members then becoming 2, we tried to add some 'new blood' in a quest for a dream team that will work both effectively and in harmony. While these changes did help get us back on track, bringing renewed excitement, energy and ambition to the game, they gradually created new issues around questions of equity, roles, contracts etc.

I take responsibility for allowing this situation to arise, and not being clear and lucid enough in some of my decision making. I now see this as a direct result of inexperience, as I've never managed a team for this long and in this manner before, and find that the incubation allowed me to learn these important lessons 'the hard way' yet in a much safer, lower-risk environment than the traditional startup route entails.

As someone who already has experience with creating music tech prototypes, interactive installations and performances, the incubation allowed me to go deeper down the rabbit hole and explore the next stages of the product development process. It was a fascinating, fun, wild ride - and one that I will be much wiser going into the next time around, thanks to the #MusicBricks experience.

The time frame was flexible enough to allow this project's somewhat chaotic narrative to unfold, which I don't take for granted. Funds were a great boost yet also very limited, and I chose to use them primarily for the industrial design & UI, aspects, where I felt our (changing) team members all lacked a professional touch. Since 2 thirds of the budget was not paid upfront, I had to put on hold some of the more exciting work we started doing with these designers, and plan to 'unfreeze' it when I can pay them.

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It was awesome having a group of tech ninjas to consult with from the #MusicBricks team, and 'exclusive' technology to build on. I personally felt supported by Michela Magas as a business & leadership mentor, for her advice is always very insightful and helpful. It could have been even better if we had a regular Skype meeting once every 2 weeks or so, especially during the periods when Airstrument required a lot of management & maintenance.

All in all the incubation definitely helped me progress towards a product, as well as learn more about what that really means, and I'm grateful for both.

Looking forward, […] & I plan to continue on separate paths: He wants to focus more on independent development and the technology behind #MusicBricks (as far as I can tell), while I'm interested in bringing my ideas, visions and prototypes to life as real products.

Team Member 2:

The project was like a rollercoaster for me. The crux of this rollercoaster however, was not a creative app development but an ongoing debate about sharing the responsibilities and the company (which does not [yet] exist) .

Anyhow, I mean to say, I've learned a lot about cooperating with people, and how to stay true to my ideas and my ideals whilst working and not to compromise personal and professional integrity out of fear. Because that only paralyses me. So , in that sense, it did help me to evolve towards professional maturity and understanding my place in projects of various kinds.

Technically, it was insightful and useful to see the various MusicBricks tools that were released. [...] I've learned of new methods and tools, and have earned a better understanding (from the inside look) into making devices, data processing API's and more.

I can't say I'm closer to a market-ready-product after this incubation, but I think my thinking has definitely matured in many ways.

Technically, I know better how to incorporate libraries and use them, and also how to mix programming languages if necessary to achieve a result. I think I understand the bridge from math to API better and in general what's required of a product. Also, seeing the other MusicBricks teams and their development has been insightful to this end.

The beginning of the incubation (i.e. winning the incubation) was very motivating for me, and has given me confirmation that creativity and ideas are worth fighting for.

Lastly, the network of people I've met is probably the highest and most useful reward. I'm just sorry I haven't used it more…

The Snitch

We feel happy that we were able to achieve these aims in the incubation time provided with the help of the MusicBricks programme.

It was an interesting project. We were able to put the effort into making it a real-live application, which otherwise would have been highly unlikely. We learnt about the different stages of product design, and finally decided to offer it as a free app plus open source code on Github.

The timeframe was perfect for the scope of the project, there were frequent check ins with the MusicBricks team and the Music Tech Fest in Slovenia was a nice incentive to stick to schedules and deliver prototypes.

One criticism perhaps was the difficulty in getting access to funds in a timely manner, which was down to many factors of bureaucracy and red tape on both sides ... Maybe for future incubations this could be made smoother.

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Sound in Translation

The incubation was a really good experience. It helped to give us time and motivation to push the prototype further. Without it, we would not be as close to a product as we are now.

Timeframe was ok, and quite flexible. Tom Lidy helped us during the incubation as well, and we got some expertise out of this.

We learned about Rhythm Pattern music feature extraction, and also we could try state-of-the-art technology for music transcription.

Hi Note

The incubation funds and support allowed us to meet in Barcelona and UK to continue development together. The affiliation with MTF brings about an aim to excel, to make sure future demos are compelling for other people to be inspired, and also to bring a level of professionalism to the project. Affiliations with well regarded organizations helps the project grow.

The expertise from IRCAM was very useful and would have been impossible without.

The time frame suited us very well. We used new tools and as a team showed each other methods that were new.

We are definitely many steps closer to a product.

With further proper funding we could develop a much more robust device.

Enboard

We felt encouraged. These kind of scenarios for us back here in Colombia are actually very hard to find, much less the infrastructure of people, tools, and possibilities.

Nonetheless we felt the timeframe a bit tight, mainly because we had to juggle with other things like work and studies. We also found ourselves having some problems meeting in person with someone that could help us solve some issues. Our project was not intended exactly as a product, but more of a performance. The tools provided helped us achieve this and the sense of a timeline always helps.

GIRD - Gesture-based Interactive Remix Dance Floor

We are so happy to have been given this opportunity. It has been a rewarding and challenging process. It pushed us to work hard and has inspired a new area of focus in our research.

Over the past 3 months we have had a steep learning curve. Jonathan developed skills in networking to setup the wireless network infrastructure supporting the project using OpenWRT. He also learned to program in Processing and Quartz Composer, and to integrate the two softwares into a package to create the lighting effects. Tracy learnt Max 7 and Max for Live. She worked with the patches provided by IRCAM for the R-IoT to design dance and gesture interactions that could work with interactive music elements. Together they have built two Max for Live patches that control the lights and enable composers and producers to experiment with creating interactive mixes and dynamic tracks.

Given the steep learning curve of the project we feel we were not able to take full advantage of the software provided by #MusicBricks and hope we can still incorporate it into the project in the future. It took quite some time to work out how to use the data and discover that machine learning is the potential way forward for us at this time.

We have learnt so many new tools and software, Max 7, Max for Live, Processing, Quartz Composer, OpenWRT, 3D printing, Wekinator. Tracy has also developed lots of ideas for dynamic and interactive music production.

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Manuphonia

We learned a lot about machine learning and receiving data from a physical device. We mostly used the technical expertise from the R-IoT team.

Besides the technical knowledge, we have gained an insight on how to manage ourselves as a team and what are the basic steps that need to be taken in order to successfully complete a project. Because we are living in different countries, we have also realized the importance of face to face communication. Luckily a few of us were able to meet at the Munich Maker Fest half time through our incubation.

The funds we have received helped us print 3D encasings for the sensor, however so far they were mostly spent on traveling to Munich.

The timeframe for the incubation was sufficient. We have realized the challenges we had to overcome and set ourselves goals that could be achieved in this short period.

LightBeat

LightBeat started out as a vision of combining light and music. And we are happy to say, that now, after three very exciting and interesting months, we have fulfilled that vision. With feedback from our #MusicBricks mentors and experts, we adapted the initial concept to better fit the changing consumer requirements.

The #MusicBricks incubation was a main factor in the success of the project. In identifying the disadvantages of the original approach the mentors and experts provided very valuable input for us, which allowed us to change our approach and greatly improve LightBeat.

The possibilities of the AcousticBrainz and Echonest APIs, which now are a core part of the system, were brought to our attention by Thomas Lidy. This allowed us to make great improvements to our concept and the finished prototype.

The timeframe was adequate and even allowed for a significant change in approach, which was important for our project.

We want to thank the great team of #MusicBricks and especially Thomas Lidy for the great support and help!

3.2 Feedback on the #MusicBricks Tools

In Deliverable 6.1 we compiled the feedback that was collected *during* the incubation process in the Industry Testbed, according to each software or hardware tool that was offered in the #MusicBricks set of tools.

The **Final Feedback** that is provided here in the following section is reflecting feedback that was collected *after* finalization of the incubations. Most of it was provided as a response to the explicit feedback question we sent out after incubation:

- MusicBricks tools
  Which software or hardware tools did you make use of?
  What is your feedback about the MusicBricks tools provided? Did they help you? What was missing, or how do you think they should evolve and be improved to help you in a better way?

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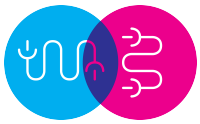

To be in line with the previous deliverables 6.1 we list the feedback we received ordered by the tools and then mention the feedback that each incubated team using this tool was providing. Most of the feedback is provided *verbatim*, which is emphasized in *italic* letters.

Feedback to the R-IoT gesture sensor board

Dolphin

I pretty much only used the R-IoT sensor and it is a great tool. The only thing about it was that, I received it a little late and after I received it, I needed some support, but the experts were away for about a month, therefore I had difficulties with using it properly.

Also the software solutions were not complete and ready to use for the sensor when I received it, and that delayed for at least one and half months.

I believe, if the sensor's software solutions were more mature and developed, I could progress even more and implement even more features into my framework.

Hi Note

The R-IoT sensor is the heart of our project. It could be improved by providing a breakout development board to allow access to the I/O pins and a proper battery socket.

Enboard

We used the R--IoT sensor. It is a fine piece of hardware, and we believe our project put it to the maximum test. It did very well, it constantly needed some patching in its cables and some adjusting but we are aware that we were literally sticking it on a skateboard. We were a bit tied to Max initially so it was great that they updated the firmware and that it is now available for other platforms.

GIRD

We found the R-IoT sensor to be stable and quite extraordinary. It was however very challenging to isolate gestures from the data streams, beyond the gesture analysis provided in the IRCAM patches. It would be great to see these patches developed further to recognize a wider range of gestures.

[At one point] We found we got quite lost with the R-IoT Sensor and the best approach to analyse the rich data stream it provides. Given our lack of expertise with the software we needed to use we feel we didn't get to take full advantage of the people and expertise involved with #MusicBricks.

We didn't ask for too much help as we needed to learn the software before we had any relevant questions. However we did find the meetings very inspiring and informative. Our team helped us with direction, scoping and especially with how we could turn our ideas into a product.

Airstrument

The sensor is [also] great... Beautiful smooth data.. The patches were great so it was also very easy to get started. The only thing is having an easy set up on other platforms. Having some Python/C++/other languages boiler plate code to get running with the sensor would have been delightful. Big pleasure!

The R-IoT sensor is at the core of the prototype. Happy to share that it proved to be more effective and reliable than other 9-axis IMUs I've used. The sensor was very helpful in getting a lot of technical issues

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out of the way when it comes to motion tracking, and enabled me to focus on developing the product, the UX and the musical aspects.

Working with the sensors have taught me a lot about network and communication. As well as C programming and working with sensors and devices (going through the code on the device and getting an inside view into how all these raw sensor data is (very professionally) processed , broadcasted and conveniently received via a UDP socket in any language possible.)

The sensors are a pleasure to work with. Solid, consistent data, with built in non-raw data coming out (Euler Angles and Quaternions) and nice externals for motion analysis . Also insightful towards computationally understanding motion.

I also learned math (Euler Angles and Quarternions) and physics (What sensors are) due to this project. Which I think could make a nice educational complement to the sensors PDF. Some knowledge of what the sensors are actually doing (i.e. how they work) can help with using them. And learning about Euler Angles and Quaternions can be very helpful as well.

However, I wouldn't say it feels like a 'ready for market' solution just yet, at least as an-out-of-the-box motion sensor for musical applications. One main suggestion would be making it much simpler to connect other sensors to it, so it could be expanded upon easily. For Airstrument specifically, I would want to experiment with adding flex sensors, LED, buttons and switches to the mix during the next phase of development. This kind of process should ideally be built-in to the R-IoT workflow, so that the necessary connections and setups are intuitive and mapped out comfortably, while the communications between the different components (including the Ethernet router) are as automated as possible.

That is obviously no small task, but I believe that starting by pre-configuring the R-IoT to work with a curated assortment of expansions (sensors, microcontrollers, etc.) will already go a long way.

Would love to brainstorm this further if you'd like.

Feedback to Essentia

The Snitch

We have used EssentiaRT~, a version of MTG's Essentia running inside Pure Data. This was the way we could achieve the main goal of our project, that is, embedding analysis tools in a smartphone (via libpd + essentiaRT~).

EssentiaRT~ is a powerful technology, yet lacking the documentation that could make it usable by a larger semi-technical audience (pd-programmers, musicians, artists).

EssentiaRT~ is under constant development so the addition of more musical features and stable support on all platforms will be welcome improvements.

LightBeat

For our final prototype we used the AcousticBrainz API [based on Essentia] as a core component. We can see potential for improvement in connecting and matching content of AcousticBrainz with existing (commercial) services, such as Spotify and Deezer, which currently is a significant challenge. (e.g. quickly find the MusicBrainz ID for a Spotify song.)

Feedback to the #MusicBricks Transcriber

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Airstrument

The Transcriber was extremely usable and profound to witness and use. Very easy to set up ... the downside is 0% adjustability... For example, with some songs, it gives great output, with others notably solo piano pieces, the output is totally unusable.. So I missed having options... arguments ... to feed into the algorithm .. I'm sure there's quite complex and impressive analysis mechanism set and it is a bit weird to not expose ANY control to the user to maximise the efficiency, to make it fit to different types of signals...

Also impressive was the parsing, I haven't even fully explored the other (music) XML!

[At the moment], we only use [the Transcriber] to detect the root note and scale type (E.G. 'E flat minor scale'). However, we have used the notes to detect more subtle changes in the harmony progression, and since the current usage is minimal, I'm even looking into alternative libraries to use...

[...] the transcriber was a nice lesson of using libraries as well as parsing! It also showed me the MusicXML format which I'm quite fond of by now.

I would have LOVED it if the transcriber was open source for watching and learning, as that seems to be a part of the project. (Other tools are). Not only for learning, but also for potentially improving the algorithm's functionality by adapting it to different data inputs. It was annoying when the algorithm failed to produce to desired result, to not have access to the core engine and have to deal with the output which has already been fully processed. But of course, making it open source is a big consideration!

LightBeat

The very well documented tools were easy to use and provided great value during development.

While analyzing the first test files we noticed the unexpectedly long time, the software needs to finish the analysis. Are there reasonable ways to speed this process up?"

LightBeat originally used the #MusicBricks Transcriber to derive beat onsets from the audio to control the Philips Hue light system. To account for the delay of the Philips system, they pre-analyzed the audio tracks using the Transcriber, and buffered the audio to sync with the lights. They **asked if the performance of the #MusicBricks Transcriber** (processing 3 minutes of audio in 20 seconds) **can be further improved, towards real-time** applications. Although further optimisations were made the requested processing time of less than 1 second for 3 minutes of audio is not feasible with current hardware.
LightBeat later changed their application entirely to use online APIs that perform the music analysis offline beforehand (such as AcousticBrainz echonest from Spotify)

Sound in Translation

The beat detection from Fraunhofer IDMT Transcriber is a very important technology for our prototype, since we rely on the position of the detected beats. Also the downbeat detection is very important, since we use it to find the loop start.

As feedback, it would be great to have a more exact beat and downbeat analysis, since it is the most importants technology for our tool.

Feedback to RhythmTimbre

Airstrument

The rhythmic descriptors was nice to see some math and for bridging the gap between math and external usable libraries.

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Sound in Translation

The Rhythm Pattern music feature extractor was useful to retrieve rhythmically similar songs / loops, and an extra added functionality helped to retrieve the parts of the songs which were most similar. Tom was very helpful with us in this respect.

As feedback, it would be great to have a more exact beat and downbeat analysis, since it is the most importants technology for our tool.

General Feedback to MusicBricks

Sound in Translation

The tools were very useful at various levels.
[…] we missed bricks allowing a deeper and lower level tonal analysis, (e.g. HPCP in Essentia).

Manuphonia

We were really impressed about the provided #MusicBricks tools. They were essential to make our idea come true. The support of the tools was available at any time and there was enough documentation to get easily started.

Airstrument

I used mostly the Riot Sensors & the Music Transcriber. but have also played with the real time pitch detection and the rhythm descriptors.
All of them have been helpful.

With regards to all the tools, as more and more people have/will use them, it seems natural that the tool base will include app examples and creative developments with the tools, including explanations of how these were developed and the troubles that arose on the way. Kind of a app development troubleshoot vs a technical one.
E.g. I could provide feedback on the Transcriber and where it performed well vs. where it flunked and was unreliable … To save people time and give a (technically) better and more informed understanding of what the tools are capable of, to adjust expectations and give people a good idea as they set out vs. let them spend who knows how long figuring out these limitations on their own…

3.3 Sustainable Ideas for the Future

In addition to above comments on the incubation and the #MusicBricks tools, we received several ideas from the incubatees on how to **make the mentorship** that they received during this incubation **more sustainable** and have outreach far beyond the incubation of the 11 projects nominated for the #MusicBricks Industry Testbed.

Airstrument, for example, suggested collecting and providing feedback among the people who use or have used the tools, to enrich the documentation with typical use cases and pitfalls.

The GIRD team, in addition, proposed the following:

> *Some ideas we would offer to the #Musicbricks incubation team would be to have an **ongoing mentorships** with the tools experts. We know we would really get value from this as having overcome the learning curve in the past few months we now have many questions to ask and would like to integrate more tools into the project.*

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Another future idea could be to have a day session with a mentor that is knowledgeable with the tools that the incubatees are using.

Moreover, in a discussion which started via email, but was then extended in the #MTFNetwork research symposium sessions during #MTFCentral (and thereafter), the #FindingSomething_ BondingSounding team motivated the **creation of a PhD programme for Music Technologies**. More than that, they challenged the current methodologies of teaching and created a very constructive and fruitful discussion. We are citing the core statements of the discussion here. These ideas have been taken up already and receive support from the academic partners in #MusicBricks and beyond. They will be further strengthened in ongoing discussions before and at the upcoming #MTFBerlin research symposium, around a pan-European PhD in music research.

"One thing I was willing to ask […] was if you plan to create some kind of research programme (like a PhD) inside the network, like an official MT PhD programme where all the institutes and universities already involved in the Research network could be the official hosts of the research programme and the students could circulate around this institutions. I think it could be an amazing idea. I would definitely join your PhD programme if that could happen."

"Without contradicting and exclude any option I feel —and this aligns with a broader current of thinking—that, in fact, academia is needing to rethink some aspects, namely its rigid vertical approach, including in fields where it could be more understandable that this is a "need" and so, by a still consensual, but I should say "clichéed", it remains like that (e.g., hard sciences).

The very last years where massively productive on all the fields of knowledge and technology, with an incredible number of inventions / innovations emerging everyday. But I think that a vast part of this reality was due to internet and what this medium has been facilitating: exchange of ideas, iteration on the technology development and massive input from "sources" (singulars and groups) we never imagined they could come from.

One of the consequences was the rise of the feeling that even academic institutions weighted by importance, history and prestige have to accept that the approach have to change sooner or later. By the way, some are —in fact, some initiatives are emerging from institutions we never imagined that they could pioneer 180° changes.

Another factor is that, still, most of us in the adult age are not very open to the children, teenagers and young adults' ideas, creativity and even knowledge (yes knowledge). The digital age come to stay, the distribution of knowledge is massive, the access is easy and the absorption is huge even if the capabilities of filtering are not "matured". I do teach for many years young adults that just enter and do the first three university years and I must say that I am feeling (slightly?...) that we are beginning to lose "something"... and well, I don't want to become a dinosaur! So I try, everyday, to become more "young and crazy" in the approach to my students and to myself by the way!

Maybe the term "leverage" things is not appropriate. We do not have to lose certain academic rules —e.g., pertinence, correctness, truth— to make curricula more open and more permeable to lateral and interdisciplinary input. Creative thinking is a common behavior of any field of science, but lateral thinking might not be so common. In communication and graphic design it is a kind of obligatory to create a manifesto and methodology. That´s why, as a humble example, when we go to an advertising film festival, massive creativity and unprecedented ideas abound.

So, yes I do support that it is time to begin another approach even in advanced studies, but maybe with the idea of making things happen in mind and not just wait!

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- "A society's competitive advantage will come not from how well its schools teach the multiplication and periodic table, but from how well they stimulate imagination and creativity."
- Einstein, 1953"

3.4 Resources invested on behalf of MusicBricks

As we outlined earlier, 11 projects have been mentored in a 3-6 months incubation process, which involved *all* partners in #MusicBricks, some external advisors to #MusicBricks plus additional mentors and industry participants which we put the incubatees in touch with.

The following table lists the number of hours the partners inside #MusicBricks alone invested in assisting the incubatees, to get from a hackathon idea to a real prototype:

MusicBricks - Mentoring Hours

Incubated Project	Skype meetings	Events	Face 2 Face	Individual Coaching	eMail/Slack	TOTAL HOURS
Airstrument	18	15	10	12	2	**57**
Interactive Cube	6	6	12	0	3	**27**
Dolphin	15	10	96	54	4	**179**
FindingSomEthing BondingSoUnding	22.5	8	12	0	9	**51.5**
Hi Note	15	6	16	0	3	**40**
The Snitch (ear we go)	6	3	16	0	3.5	**28.5**
Sound in Translation	9	16	30	0	5	**60**
Enboard	18	6	60	6	4	**94**
GIRD - Interactive Remix Dance Floor	15	9	12	0	6	**42**
Manuphonia	12	10	12	0	5	**39**
Light Beat	20	3	12	5	4	**44**
						662

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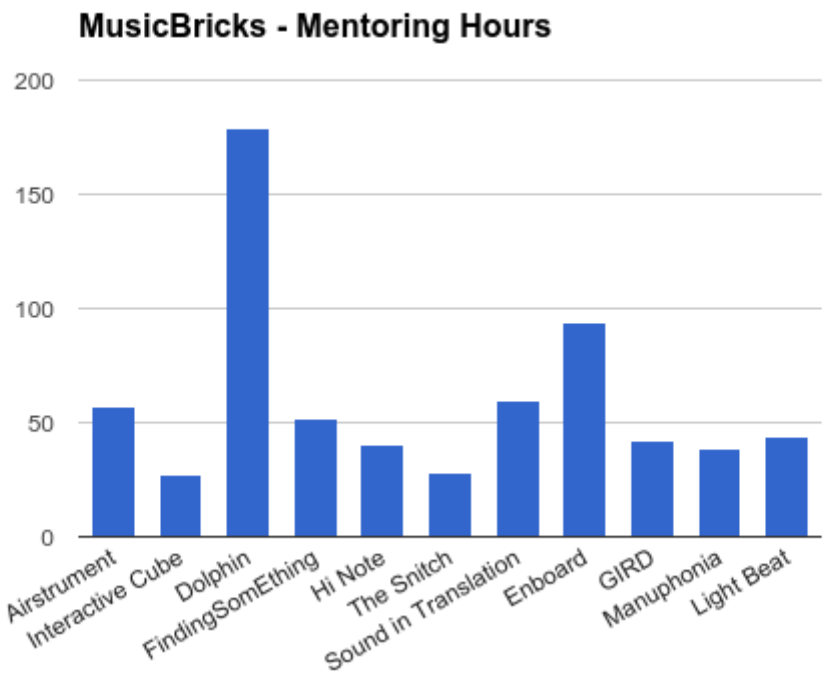

Next to mentoring directly at the events, **face to face meetings** took place with the incubatees and the mentors. Some of them requested dedicated **individual coaching** on a particular topic, such as machine learning, while others had a research background and did not need individual coaching at all. This explains some outliers in the table and graph above. Besides continuous communication via eMail and Slack, **regular Skype meetings** were held with all of the projects.

The mentoring by #MusicBricks partners **totals to 662 hours incubation assistance** provided, which excludes additional external mentoring, and preparing, setting up, summarizing, reviewing and reporting about the Industry Testbed. It also does not include any communication among the #MusicBricks partners, nor any improvement of the tools and internal communication thereon. This graph and table provide purely the **hours provided directly to the incubatees.**

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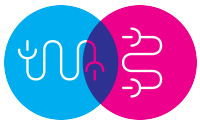

4. Summary and Conclusions

From the four very successful Creative Testbed events held throughout 2015, 11 projects were nominated for the #MusicBricks Industry Testbed. The **Industry Testbed was realized as an in-depth incubation** programme for the 11 hacker ideas and supported them extensively by providing funds, advice on both #MusicBricks tools and external tools, connections to partners and mentoring throughout the incubation. The goal of these 3-5 months incubations was to progress the 11 initial ideas towards prototypes that can be demonstrated to market players such as music tech firms, industry and investors.

In this deliverable we summarize the **achievements and results of the incubation programme**. An assessment of their market readiness is provided in Deliverable 7.1.
All projects completed the Industry Testbed presenting a final prototype and a video explaining the achievement and its usage and features. Several of the projects progressed beyond their original roadmap and realized a prototype that is already exhibiting more features than originally planned for the incubation period. Some of the project teams experienced communication issues (in particular the ones that were geographically more separated within the team) and were therefore granted an extension of the originally planned 3-months of mentorship to 5, or even 6 months in an exceptional case. Through this extension, which was still within the planned period of WP6 (until February 2016), **we could guarantee the realization of demonstrable prototypes from all projects** for the final #MusicBricks event: #MTF Berlin. This will be a unique opportunity for all the projects to present their ideas on stage to an audience of professional musicians, established startups, large companies and investors.

Several of the projects made progress far beyond the state of a “hacker prototype”. **One new startup was founded** among our incubated teams, **3 further teams incorporated their new prototype into their startups** that they had founded shortly prior to participating in the #MusicBricks Testbed. **One new art collective** was formed. One incubated project has **filed a patent** for their new innovative idea, which is applicable to many industries beyond music.

Several of the projects **presented their outcome already at major public, scientific and industry events**, such as:

- Munich Maker Faire
- Barcelona Loves Entrepreneurs
- ICT15 Lisbon
- International Society of Music Information Retrieval Conference
- Music Interaction Design (MiXD) Symposium at Birmingham Consservatoire
- and two projects have been nominated for the Prix Ars Electronica 2016.

The #MusicBricks consortium provided **a total of 662 hours** in assisting, communicating with, and mentoring the incubatees plus providing valuable support and feedback. Additional effort was provided free of charge by numerous external advisors from music tech companies, music industry players such as labels, and business advisors,

This Industry Testbed not only provided important mentoring to the incubatees, but also created very valuable learnings for the mentors as well. The idea of the Industry Testbed involved two important feedback loops: One to the tool providers in #MusicBricks - the academic software creators who benefit vastly from valuable feedback to improve their tools towards industry. The second one to the #MusicBricks consortium as a European project, to provide valuable feedback on the incubation process as such and learnings for similar future endeavours for innovation creation processes.

There was **overwhelming positive feedback** about the incubation process and mentoring, where the incubatees said they both learned a lot and progressed a lot in this incubation. Many projects where so

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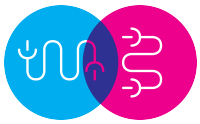

grateful that they thanked particular mentors by their individual name. We received some feedback about the time frame of 3 months for incubation towards the market being too limited, and reacted to that by granting up to 5 (or 6, in one case) months to ensure proper outcome.

While most of the incubatees stated that the funding was just right to cover first costs, for some of the projects, the funding seemed certainly tight as well, especially when more hardware and a larger team were involved. However, the most critical feedback was not on the amount of funding, but the timeline of payments (which was 33% upfront and 66% at completion). This seemed to be a major challenge for a majority of the incubatees, which are young designers, hackers or entrepreneurs generally low on funds to pre-finance.

A second important finding was about communication issues within the teams that are geographically spread out. The mentors tried to help on this by taking interconnecting and mediating roles. Yet, in one case, a team member dropped out due to continuing issues and divergences within the project. The #MusicBricks team as a mediator helped to keep the project on track by assigning clear development and business roles, which helped the project ultimately to move forward to reach a demonstrable prototype.

Feedback on the #MusicBricks tools was also **vastly positive**, with **some demanding feedback** for more real-time capabilities, additional analysis and input/output features (in particular for the R-IoT sensors, which are desired to be interconnectable with other sensors). Also, there was a demand for possibilities to adjust and tweak parameters on the one hand, and to have a working pre-configured hassle-free tool on the other hand. Regarding the adjustability there was the desire for more open-source tools in order to be able to do any kind of change and adjustment to the original tool, for maximum flexibility.

Finally, there was a higher demand on gesture sensors than could be satisfied during the incubation, which slowed down prototype development in 2 cases, but can also be seen as a positive feedback, given the tremendous popularity of the R-IoT gesture sensors (a total of 18 sensors were provided to the incubatees). #MusicBricks partner IRCAM reacted to that with a batch order of several thousand sensor boards to satisfy the increased need for the next stage after the incubation.

All of the 11 projects fulfilled their goals for the incubation roadmap in the Industry Testbed and are eligible to move forward to the Market Testbed in WP7 which will do a thorough assessment of their market readiness.

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