AI for Music in the Creative Industries of China and the UK

Report on Shanghai Workshop: 15-17 April 2019

Summary

A China-UK research–industry partnering workshop was held from 15-17 April 2019 in Shanghai, China. Hosted by Tongji University in partnership with Queen Mary University of London.

Workshop participants identified 33 topics of interest in AI for Music in the Creative Industries of China and the UK from which two themes were developed during the workshop for future research proposals:

1. **AI for Engaging Music**: How can AI, HCI and multimedia make Chinese music more accessible and engaging to creative people in both China and the UK?
2. **AI for Adapting Music**: What are the opportunities for AI to adapt audio content and production to benefit audiences in both UK and China?

These two themes would bring together UK and Chinese researchers and industry to address challenges of music access, production, and consumption in China and the UK building on expertise from both countries. The next workshop, to be held in London, UK, will develop these proposals in more detai.

This report describes the workshop structure, process, and research themes and topics identified.

Workshop Aims

The workshop had two primary aims:

1. **Develop partnerships for funding** – bringing together research and industry stakeholders in UK and China.
2. **Map of AI for Music** – undertake an initial survey of uses of AI in digital music research and the Music Industries to generate a draft map of the landscape across UK and China.

The 15th and 16th April involved workshop activities at Tongji University as reported here. The 17th April involved a visit to Alibaba's Xiami music division in Huangzhou, China – a key industry player in music in the Creative Industries of China.

Participants

There were 44 participants: 9 from the UK and 35 from China. See Appendix for details.

Pre-Workshop Activity

Participants were surveyed for their opinions on current topics and trends in AI for Music prior to the workshop to inform the workshop discussion topics. This activity produced 33 topics of interest listed in the Appendix from which five themes were collectively identified by participants using an on-line theme generation system.

Five Themes:

1. Assistive AI for Composition & music generation

2. Production workflow management & studio practice

3. Catalogue management & recommendation systems

4. Privacy, Security, IP management

5. Cross-cultural challenges and opportunities

Workshop Day 1: 15 April 2019, Tongji University, China

The first day of the workshop opened with a short tour of Tongji College of Design & Innovation followed by brief (one minute) introductions by participants to set the scene for the workshop.

Introductory presentations were made by:

Nick Bryan-Kinns	QMUL (UK)
Ben Timms	Steinberg (UK)
Johan Pauwels	QMUL (UK)
Beici Liang	QMUL (UK)
Oliver Kadel	1.618 Digital (UK)
Brad Cohen	Tido Music (UK)
George Fazekas	QMUL (UK)
Justin Paterson	University of West London (UK)
Yanqing Chen	Xiami Music of Alibaba Group (China)
Yishu Mao	Xiami Music of Alibaba Group (China)
Yixi Chen	Xiami Music of Alibaba Group (China)
Qi Mengjie	Central Conservatory of Music (China)
Rudy Wimmer	CBi China Bridge (China)
Zhao Liu	Tongji-Dadawa Sound Lab (China)
Yinan Zhang	Tongji-Dadawa Sound Lab (China)
Aozhi Liu	PingAn Technology (China)
Qingying Zhu	PingAn Technology (China)
Sunny Sun	Sunny Touch Studio (China)
Anthony Zhan	Zera Culture Group (China)
Xiao Lu	QQ Music under TME (China)
Hui Zhang	Next Lab, Zhejiang University (China)
Zhao Yang	BaroxTech (China)
Hao Zhang	BaroxTech (China)
Zijin Li	China Conservatory of Music (China)

After lunch Dr. Bryan-Kinns provided a recap of the AHRC funding call, topics, and timeline.

Participants then explored the four themes (1. Assistive AI for Composition & music generation; 2. Production workflow management & studio practice; 3. Catalogue management & recommendation systems; 4. Privacy, Security, IP management) focussing on:

- Identifying similarities and differences between China and the UK
- Identifying cross-cultural challenges and opportunities
- Identifying possible topics for collaborative research proposals and partnerships

Initial theme topics

During the afternoon discussions it was found that theme 3 "Catalogue management & recommendation systems" attracted a diminishing amount of interest and so participants exploring theme 3 were re-distributed to the other three themes: 1, 2, 4.

Results of these discussions were then presented to whole group at the end of the day. Participants then 'signed up' to topics that they would be interested to work on (whether

in their workshop group or not) to inform selection of the most popular proposals for workshop Day 2. The day was concluded with a networking dinner.

Initial Proposal Ideas Generated

Below are the ranked proposal ideas generated in Day 1 preceded by the number of sign-ups in brackets to indicate popularity of topic within the workshop.

- (11) Using AI to create models of the playing techniques of Chinese instruments

- (9) AI modelling for better Chinese sample and synthesis libraries

- (9) Cross-cultural semantic control of music production tool chain

- (8) Motion tracking and AI for musical performance and dance

- (8) Using AI to create 'style transfer' between Chinese and Western music styles

- (8) An AI+Object environment for cross-cultural music composition and performance

- (6) Using AI and historical recordings to analyse the evolution of performance playing techniques

- (6) Adaptive personalised and cross-cultural media content delivery

- (5) Gamified music education system assisted by AI

- (4) Using AI to build a universal monitoring system for radio + TV output for China

- (3) How can creative professionals be rewarded for the value they created for others e.g. using blockchain and AI

- (3) Enhanced listening experiences across cultures

- (3) Music education tools for China using AI

- (2) Procedural audio for adaptive music across cultures

- (1) AI Monitoring system to find fake/ bot accounts for Creative Industries e.g. film stars

Many of these research topics were rather narrowly defined and lacked connection to the broader Creative Industries, and some of the topics also did not directly address UK-China collaborations. Other topics showed potential for combination. In light of this, participants were tasked with reflecting more deeply on the Creative Industries and UK-China partnerships in Day 2.

Workshop Day 2: 16 April 2019, Tongji University, China

The second workshop day opened with a brief introduction of the Tongji Soundlab which is one of the labs at Tongji most comparable to the hosts at QMUL's Centre for Digital Music.

The aims of the workshop were recapped, along with brief re-introductions to the main themes 1, 2, 4 to trigger participants' memories of the proposals and to regroup participants ready for further workshop activities.

Participants were split into three teams to write short descriptions of research proposals building on the topics and themes. The proposal descriptions included:

- Identify project challenge, aims, outputs, and impact
- Identify project partners
- Make outline project plan

Teams then presented their proposals to the whole group for feedback, questions, and participant regrouping.

The team examining theme 4 "Privacy, Security, IP management" found that whilst there were interesting similarities and differences between China and the UK in terms of, for example, royalty payments for streaming services, it was felt that there were was little potential for AHRC funded research to make an impact in this theme as there were too many large players in the market and too many commercial interests to allow for research innovation. For example, since 2016 the Chinese system for music royalty payments has been overhauled to ensure that companies must pay relevant royalty fees and currently in China large companies such as Tencent pay large royalty fees to music labels for the use of their music on their streaming services. In contrast, in the UK royalties are instead paid per track. There is an opportunity to change the royalty payment mechanisms in China to a micro-payment model, but currently there is no commercial incentive to do so. Furthermore, in terms of detecting copyright infringements for music, both the UK and China have advanced technical solutions for automatic music detection, but the current challenge is, again, incumbent large music providers and distributors who currently have no incentive to change their business models.

Participants regrouped to develop proposals for the two remaining themes: 1. Assistive AI for Composition & music generation; 2. Production workflow management & studio practice. Participants developed written proposals to address the following questions:

- What is the research question?
- What are the current creative industry challenges?
- How are they different in China and UK? – what is the landscape?
- What are opportunities for growth and innovation in Creative Industries in UK and China?
- What/ how does proposed research contribute to Creative Industries?
- Who are the partners: Research + Industry & China + UK

The day was concluded with a Networking Dinner.

Outputs

Two outline proposals were generated by the end of the workshop:

1. AI for Accessible Music

Summarised by Ben Timms, Steinberg Media Technologies GmbH (UK).

Research question: How can AI, HCI and multimedia make Chinese music more accessible and engaging to creative people in both China and the UK?

Current creative industry challenges include barriers to the knowledge, learning, appreciation and promotion of Chinese music. This stems from both a lack of education and dissemination of Chinese musical styles and practice beyond China and also an inherent bias towards Western musical traditions in professional music production systems and practices. This contributes to the fact that support for Chinese music in digital music production tools is quite poor which in turn reduces access and exposure to Chinese music. Furthermore, there is a significant gap between appreciation of traditional and modern Chinese music that isn't reflected in Western music styles. For example, influences of older styles of UK music are quite prevalent modern media such as film scores. Whilst western music styles are comparatively pervasive in Chinese culture and media, the converse is less so.

Relevant work from Chinese workshop participants includes:

- The China Conservatory of Music have an established and ongoing project capturing recordings of Chinese music instruments including every pitch at multiple dynamic levels as well as each instrument's individual playing techniques. Recordings of each instrument in context of a short music excerpt were also recorded. These recording are being indexed, tagged and made available on a website as part of a database of information of Chinese musical instruments which also includes photos and text. These are currently targeted at Chinese audience, but have the potential to be developed into a resource for creatives across the world.
- PingAm Technologies are working on a project capturing and analysing regional Chinese music from minority groups such as the unique music of the Mongolian region. Their aim is to allow melodies to be generated based on the analysed styles allowing composers to bring those influences into their music.

Research between China and the UK on AI to increase the accessibility and use of Chinese music in the Creative Industries could include some combination of the following activities:

A. Using AI methods to analyse the collection of samples from the China Conservatory of Music and produce a dataset of metadata describing the ranges, pitch intervals, semantic playing techniques for each instrument. The resulting dataset could then be used to build or enhancing existing tools with a better understanding of Chinese instrumentation. One possibility being an app to take an existing western melody and advise the user on how it could be conformed to Chinese instrumentation.

B. Using PingAm's technology in combination with the audio samples from the China Conservatory of Music. The work would involve preparation of the audio samples for use in playback of the generated melodies, building an app to bring

the elements together in a user-friendly UI and visualisation for exploring and experimenting with Mongolian music.

C. Using AI tools and methodologies to provide a mechanism to determine the instrumentation an online video or audio stream of Chinese music. As the music is played, details of the currently sounding instruments would be displayed with hyperlinks to discover more about those instruments.

2. AI for Adaptive Music

Summarised by George Fazekas, Queen Mary University of London (UK).

Research Question: What are the opportunities to adapt audio content and production to benefit audiences in both UK and China? How might this be done through semantic and object-based transformation?

The creative industry challenge is that professional-level music-production tools tend to dominate in western culture, whereas there are many smartphone-based apps (e.g. karaoke) in China aimed at a mass consumer market. Consumer listening in China is dominated by the smart phone, whereas in the UK 'living room listening' prevails, although the smart phone consumption is rapidly rising. Traditional Chinese instrumentation is common in Chinese popular music, yet almost unknown in its western counterparts, although there is appetite for 'new sounds'. Music mixing also differs, for instance with more prevalent vocals in Chinese music. Performance nuances also differ, from more formalised ornamentation in the west to more intuited forms in China.

This challenge can be addressed by creating adaptive personalised object-based content for specific regional audiences, primarily utilising existing technologies. This would use AI to create a style-transfer model between Chinese and Western performance and production techniques, and utilise the semantic control of the music-production tool-chain to create transferable cultural features. Such technology has been developed by the BBC (and others) in the UK, but has yet to receive significant attention in China

These solutions could pervade the creative industries, including production, broadcast, music streaming, games, virtual reality, app-based and cinema. As such, they could enhance the listener experience for a vast audience, and offer profound economic benefits to all sectors of the production/ distribution chain.

Two broad frameworks where AI could contribute to adaptive audio for the creative industries of UK and China were identified by participants for future research proposals:

Framework 1: Personalized Music Production and Playback

Research challenges in music production and playback which could be addressed by adaptive audio include:

A. Digital audio workstations and music production tools are not adapted to Chinese music producers. Furthermore, better understanding of cross-cultural aspects of production (e.g. the way sounds and transformations are described) could also lead to new ways of delivering adaptive personalised content. This could be addressed by training AI models to map between semantic terms and acoustic features and map semantic terms to production parameters. (e.g. Mixing and Mastering parameters, Choice of instruments, synthesis parameters, Expressive performance parameters incl. ornamentation etc.,)

B. Personalised listening experiences are predominantly targeted at Western audiences. For example, Head Related Transfer Function (HRTF) for spatial audio

reproduction data sets include very narrow demographic groups, predominantly western population based. Capturing new data set in China would significantly improve the accuracy of binaural decoding algorithms across wider demographic groups by focusing on generating the new data sets in the UK and China.

C. Music production is usually finalised using specialised equipment built on western listening and production practices and tastes. Whilst the engineer is able to optimise the mix at the point of sign-off, individual customers might experience the music differently. The opportunity exists to control the production aesthetic in response to listener preferences more typical of either UK or Chinese consumers. For instance, it is common in Chinese popular music to feature a more prominent lead vocal than in the UK. Capturing such metadata from the mixing and mastering processes can provide semantic data to an AI System that could govern the style of playback to intelligently optimise it for a regional or personalised preference.

Framework 2 – Music Performance data analysis

Research challenges which could be addressed by AI for Music include:

A. Two aspects of music performance practice important are common to both Chinese and western music: i) pitch transitions and ii) ornamentation. The challenge is that whilst these techniques are well-documented in western music (eg J S Bach's ornaments table), they are not well documented in Chinese music. The Chinese musical tradition is communicated through praxis, rather than theory or nomenclature. These two contrasting means of transmission offer an interesting research possibility for the use of AI rather than theory to establish and map both similarities and divergences across performing traditions.

B. People from different cultural backgrounds have different priorities for music selection, including preference for music genre, emotion, performer, composer and other elements of music metadata. User profiles for different regions could be used with AI to generate personalised music recommendations without the requirement for extensive recommendation model training.

C. Techniques for automatically mixing a user's vocal recording with a background instrumental track are western music focused. What is needed are "Smarter" ways to process the vocal track – to produce excellent automatic mixing with one click. For example, semantic-friendly options for editing and processing audio for amateur users, and techniques to deal with poor quality recordings from smartphones and bad recording environments

D. Techniques for singing voice synthesis are predominantly based on western vocal traditions. There are opportunities to use adaptive audio to identify the similarities and differences between traditional Chinese instruments and modern instruments, popular music from China and the UK in terms of signals and acoustic parameters, and, based on these cultural differences, synthesize music that is more fascinating to people in this culture.

Outline Landscape

Participant discussions generated a number of themes of similarities and differences between use of AI for music in China and the UK as outlined in the following table and used as the basis for selecting research proposals for development.

Table: Outline comparison between music in the UK and China

Topic	UK	China
Automatic mixing	Predominantly used in professional production systems	Predominantly used in karaoke apps
Digital Audio Workstations	Tailored to Western music production and styles	Lack of Chinese tools for audio production
Audio libraries	Extensive, high quality libraries of audio from Western instruments	Lack of high quality an accessible recordings of Chinese instruments
Copyright infringement detections	Advanced audio fingerprinting technologies	Advanced audio fingerprinting technologies
Royalty payments (e.g. for streaming services)	Per track payments	Per label payments
Music performance theory and practice	Well documented	Learnt by praxis
Tools for music education	Extensive tools for learning and practicing in Western musical styles	Lack of tools for learning Chinese musical instruments and performance style
Audio consumption preference	HiFi systems	Mobile phone

Next Steps

A workshop will be hosted by QMUL in London (UK) to develop the two outline research proposals into draft research proposals meeting the criteria of the AHRC UK-China Creative Industries Partnership call.

Appendix: Participants

Nick Bryan-Kinns	Queen Mary University of London	(UK)
Justin Paterson	University of West London	(UK)
Brad Cohen	Tido Music	(UK)
Maurice Ashkenazi-Bakes	MXX	(UK)
Johan Pauwels	Queen Mary University of London	(UK)
Beici Liang	Queen Mary University of London	(UK)
Benjamin Timms	Steinberg	(UK)
Oliver Kadel	1618 Digital	(UK)
George Fazekas	Queen Mary University of London	(UK)
Rudy Wimmer	CBI China Bridge	(China)
Zhou Chongling	Tongji University	(China)
Mileece Abson	Children of Wild	(China)
Qin Yi	Shanghai Conservatory of Music	(China)
Xiaojing Liang	China Conservatory of Music	(China)
Jan Dornig	Tongji University (CDI)	(China)
Hua Dong	Tongji University	(China)
Hui Zhang	Zhejiang University	(China)
Zhao Yang	BaroxTech	(China)
Benjamin Bacon	Dogma Studio	(China)
Qi Mengjie	Central Conservatory of Music	(China)
Cai Yuening	Tongji University (Soundlab)	(China)
Liu Zhoa	Tongji University (Soundlab)	(China)
Yinan Zhang	Tongji University (Soundlab)	(China)
Qingying Zhu	Ping An Technology	(China)
Yanqing Chen	Alibaba	(China)
Kang Ming Zhan	Shanghai Conservatory of Music	(China)
Peng Dong	ACRCloud	(China)
Sun Xiaohua	Tongji CDI	(China)
Aozhi Liu	Ping An Technology	(China)
Yaluo Sun	Sunny Media	(China)
Xiao Lu	Tencent Music Entertainment Group	(China)
Roxy	Crust Music	(China)
Junqi Deng	Hangzhou Alibaba Music Technology Co., Ltd.	(China)
Jianzong Wang	Ping An Technology - Deep Learning Team	(China)
Minwei Gu	Tencent Music Entertainment Group	(China)
Yangzihao Wang	Tencent - AI Platform	(China)
Rongfeng Zhu	BaroxTech	(China)
Anthony Zhan	Zera Culture Group	(China)
Yanqing CHEN	Xiami Music of Alibaba Group	(China)
Yishu MAO	Xiami Music of Alibaba Group	(China)
Yixi CHEN	Xiami Music of Alibaba Group	(China)
Zhao Yang	BaroxTech	(China)
Hao Zhang	BaroxTech	(China)
Zijin Li	China Conservatory of Music	(China)

Appendix: Survey of Topics

Prior to the workshop participants were invited to use well-sorted.org to propose topics of interest in AI and Music and to sort the topics into groups. These groups were used as the basis for the first day of the workshop activities and are outlined below.

Red	1	Trends of using AI for music in the Creative Indus	As far as I know musicians are attempting to use AI music as a tool/collaborator in their creative process. For instance, they may get inspired from some randomly generated melodies or beats. Some people try to improvise with AI for fun and for training.
	2	Trends - Simple AI composing	Ai being used for simple composing.e.g. Rhythms and background music.
	3	AI and the Future of Music Creation	We have seen a rise of start-up activity employing AI technologies that can break down some of the typical barriers to making music. How else can we harness AI tech to create a new generation of music making tools and instruments.
	4	AI as Creative Partner	How can AI be used as a creative partner in music making, not just for automating processes or replicating existing styles?
	5	Trends - Latent space exploration	Ai for exploring latent space in music, augmenting the human by creating variations of given music/sounds.
	6	What are opportunities for using AI for music?	- Context-aware assistive technologies - Compositional tools - Generative music - Rights management - Converting audio to semantic data - Converting images to semantic data - Modeling human expression in playback
	7	Opportunity-Real time "composing" for experiences	In gaming, and other experiences involving music, it can be imagined that AI can provide a benefit to the user by composing/tailoring the music towards the user in real time.e.g. excited behavior of user - leads to more dynamic music playing.
	8	AI automatic composition is a promising direction.	I think the trends of using AI for music in the Creative Industries is to create music. Computer automatic composition has great research and commercial value in video music and sound production.
	9	What are opportunities for using AI for music?	Procedural Audio Physics Driven Synthesis Acoustic Modeling for VR/AR/MR Adaptive Music Situational Awareness/ enhanced Functionality for AR/MR
	10	Trends of AI for the Creative Industries?	Procedural Audio Physics Driven Synthesis Convolution / Sample-based procedural audio Adaptive Music
Blue	11	How are you using AI for Music?	My research involves using deep learning techniques to improve the performance of music information retrieval tasks, such as automatic transcription and sound event detection. This helps to bridge the semantic gap if enough data is given.
	12	How are you using AI for Music?	In our particular area of music notation we are at the beginning of our AI journey, exploring the possibilities to enhance and complement the compositional process. In other areas, we have active projects regarding AI-assisted mixing and mastering.
	13	How are you using AI for Music?	Audio Restoration / Audio Precision-Processing (Izotope RX Advanced) Sound Design (Krotos Tools) Adaptive Music (based on biometric data/geolocation)
	14	How Can AI Technologies Improve Studio Workflows?	Using AI technologies to improve studio workflows and automate some tasks, leaving more freedom for the human element in the recording/mastering process.

Green	15	Catalogue management using AI	How can AI algorithms be used to index music according to searchable high-level descriptions?
	16	Using AI to recommend music	The increasing amount of digital music bringing increasing requirements of automatic music retrieval. Users expect music software to automatically find music they like, which means AI should know how to recommend appropriate music.
	17	Opportunity- Redesigning content search interaction	AI can provide new interactions with content. Dimension reduction/clustering ML can be used to create maps of music rather than lists. And the agentive nature of AI might provide new ways for personalized recommendation with a training aspect.
Orange	18	Workflow optimization	I use commercial tools that employ AI to assist my music-production workflow. I am often dissatisfied with the results, since I can generally make things sound better manually, but AI allows me to test ideas very quickly first. Let's bridge the gap.
	19	Buss processing	Object-based audio offers many opportunities. Currently, it is not possible to apply buss processing due to the in-situ rendering. AI tools could form a pipeline from mixroom to local DSP at the point of render taking account of playback system and room.
Purple	20	What are current challenges to using AI for music?	For us, one challenge is balancing user privacy topics with the need for collecting data to train and refine models. Managing user expectation as to how effective these technologies can be is another challenge.
	21	What are current challenges to using AI for music?	A unified/simplified implementation strategy
Yellow	22	Current challenges to using AI for music	To be realistic, AI music at this stage is not able to constantly produce catchy melodies and narrative musical phrases, which might be the essence of good music. Also, rendering really nice sounds is still challenging technically.
	23	What are current challenges to using AI for music?	For artist, we don't really have the tech to develop AI music. What we do is to utilize some existing tools, such as Magenta, to create the "AI music". The problem is all artists share the same database and may create the similar works.
	24	Current challenges to using AI for music	High-quality datasets are limited for different music-related tasks. Reproducing a task to achieve the same performance level is not always available. Evaluation metrics could be hard to define, especially for evaluating the AI generated music piece.
	25	Adoption	AI systems can do things better, or do them faster. A challenge is to make them to both. Even then, few people care unless they really do something that cannot be done otherwise. This context presents a challenge for the future.
Pink	26	Training for AI in the Creative Industries	How to train people competent in AI to work in Creative Industries and appreciate Creative Industries workflows? How to raise awareness in Creative Industries of potential and limitations of AI?

Silver	27	Challenges between China & the UK	To include music data from both countries, copyright may be an issue. If social data is required, there are differences in data privacy between China and the UK.
	28	China/UK	A clear challenge for collaboration between our nations will be to find funding streams that accommodate and support us both. As such, there is scope from our meeting to build momentum that could underpin a compelling funding bid in either location.
	29	AI understanding music between China & UK	People from different cultures have different understandings of music especially music with lyrics. But music in different languages has similar emotional expression methods. I think we can use emotion as a bridge to study universal perception technology.
	30	Cross-cultural study of music popularity	Using big data, see if the difference in music between music popular in UK and China is mostly language-specific, or if other musical characteristics are different too.
	31	Opportunities between China & the UK	Since AI hasn't been widely used in Chinese music industry, UK side could offer more experiences through collaborations. China side could provide large data to promote cross-cultural research on music.
	32	Usage of Music AI in industry across China and UK	What is the current state of usage of AI in the UK and China and are there similarities/differences?
	33	IP and business differences between UK and China	Do the different economic systems and IP laws between China and the UK make it possible to be successful on both markets with the same product? Or is the only way to set up two essentially parallel companies?