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Forming a Collaborative Relationship between an Applied Researcher and the Researched Subject in Contemporary Taiwan: A Case Study from Beiguan Opera (北管戲)

ABSTRACT

In contrast to the practice of the one-way collection and analysis of data from the field as found in existing *beiguan* literature, this article presents a role-changing process used in the recording of *beiguan opera* with the *Qinghexuan* ensemble (慶和軒) in Taiwan, formed in order to generate bilateral benefits through a collaborative applied project. I discuss both the practical recording skills needed in the field and the mixing down skills employed in the studio to demonstrate how the designed interactive process reflects the needs in the community and how the collaboration aspect creates an interface with each step of the recording process, from making to checking. Firstly, I examine the recording process in the field, including microphone placement and recording strategy. Secondly, I discuss how the utilisation of plug-ins (equaliser, compressor, panning, balance) in the mixing of tracks is similar to, and based on, that seen in popular music and also on the research collaborators' opinions, as shared during the fieldwork. Also presented are details behind the dynamic range of the *suona* (嗩吶) and the percussion instruments in this genre, for example the natural frequency arrangement on the spectrum.

Thus, this discussion shows how an ethnomusicologist can be responsive to needs shared by the community if they apply their professional training in relation to the recording process; it also reshapes the relationship between researcher and informant in an ethnographic context, in comparison to previous *beiguan* research, by engaging the musicians as collaborative listeners in the curation of their own art form.

KEYWORDS

Beiguan opera

Recording industry

Qinghexuan

Applied ethnomusicology

Recording at home

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Introduction

Beiguan music was imported from mainland China to Taiwan around the 17th century and since then has further evolved within Taiwan society. *Beiguan*[1] is a traditional musical genre in Taiwan, with *beiguan opera* one of its four subgenres, with opera performances, usually in front of temples, often praying, praising, or depicting the lives of celestial deities (Lu, 2011). *Beiguan opera* involves a combination of three musical groups: percussion instruments, melodic instruments and vocalists. The performers are typically amateur musicians—traditionally male, but some mixed and female groups have also arisen over the last two generations—who affiliate to local temple- or community-based groups for whom performance may be an expression of brotherhood, faith or a combination of the two. The earliest surviving group is the *Lichunyuan* (梨春園, founded in 1811), based in Changhua (in the middle of Taiwan; Lu, 2011). Other *beiguan* groups are distributed around Taiwan. *Qinghexuan*[2], located in the Budai area, Chiayi County (in the south of Taiwan), is one of them. In Budai, *beiguan* music was particularly popular during the Japanese colonial period (1895-1945). At its peak, there were three *beiguan* groups in Budai (Tsai, 2010: 23-24); however, as *gezixi* (歌仔戲)[3] became popular in 1960s, all of them were disbanded. In 1999, *Qinghexuan* regrouped with descendants of the first generation of members and, with access to surviving scores, they also invited senior experts from other *beiguan* groups, including *Lichunyuan*, to reconstruct some of the repertoire (Tsai, 2010: 59-60). Presently, *Qinghexuan* is the largest active *beiguan* group playing *beiguan opera* in Chiayi County. Here, I focus on the problems and solutions in a recording project carried out with the *Qinghexuan* group. This is a topic not previously examined in research into this genre, and the study reveals viewpoints and specific skills used in recording and mixing sound that might be of value to applied researchers working more generally in musical collaborations.

In 2017, the leader of *Qinghexuan*, Huang Jing-Cai (黃錦財), invited me to watch the process of recording the *beiguan operas tianguan cifu* (*Heavenly Gods bless people*, 天官賜福) and *dazui baxian* (*Drunken eight Gods*, 大醉八仙), which will be released as a CD

[1] For further on this genre, see Lu (2005, 2007, and 2011), and Shih (2016)
[2] *Beiguan opera* uses official language (*guanhua*/官話) to distinguish it from other dialect operas or plays, for example, Taiwanese opera (Shih, 2016: 15)
[3] *Gezixi* is a musical genre in opera with Taiwanese dialect, and became popular in the 1960s in Taiwan.

album in their annual *beiguan opera* preservation project. Huang (2017) disclosed four main purposes of the recording:

1. To preserve the musical genre for the future.

2. To enable teaching: an album could help *Qinghexuan* members and students to recollect the music, and to practise it at any time.

3. To provide an achievable goal for the members, based on their years of practice, thus reinforcing their confidence in playing in the community.

4. To facilitate marketing. With a CD they could promote *Qinghexuan* and acquire further opportunities to perform and earn money.

As they have practised for several years, recording an album can reinforce their confidence around playing in the community and help them reach an achievable goal. As Ottosson (2007: 55) reveals, "making music is a means to craft oneself as a representative for one's home community", as releasing a CD album means the group is visibly qualified in the community. As Stock (2004: 36) puts it, technology plays a crucial role, as learners worldwide can now hear the music of another time and place; and hear it repeatedly until they can perform it in detail perfectly. An album can help members and students of *Qinghexuan* to recollect and practise at any time.

Many other *beiguan* groups and researchers have made recordings together, but it has been rare for researchers to ruminate on how to record this genre with up-to-date recording equipment and skills. As Topp Fargion (2009: 76) comments, recordings are a vital component of the raw material from which we may theorise, so that this collaboration gave me an opportunity (as a recordist and researcher) to theorise the mixing process alongside Huang and the other *beiguan* musicians. My professional work in recording and mixing ensured that the process is responsive to the needs and vulnerabilities of research collaborators (Bendrups, 2015: 72). This article will explore these aspects.

Literature Review

In Taiwan, an abundance of researchers has focused on variegated aspects of *beiguan*. For example, at the time of writing, the *National Digital Library of Theses and Dissertations in*

Taiwan contains at least 73 theses about *beiguan*[4]. They include *beiguan* music analysis (singing styles, instruments, and comparisons, e.g., Li, 1988; Pan, 1998; Su, 2003; Wu, 2015); ethnographic surveys of activities in *beiguan* groups (e.g., Chen, 2000; Weng, 2010; Fu, 2014; Jian 2019); analysis of extant scores (e.g., Lu, 2014; Lin, 2017); analysis of representative *beiguan* musicians (e.g., Wu, 1999; Liao, 2000; Chou, 2009; Liao, 2017); and exploration of traditional and modern transmission processes (e.g., Huang, 2005; Chen, 2008; Huang, 2010; Tu, 2020). Other items have been published as articles, books and recordings, (e.g., Huang, 2012). Within this corpus, there has been analysis of the music of *beiguan opera* and of the history of the *Qinghexuan* ensemble (e.g., Lin C., 1999, Lin S., 1999, 2000; Tsai, 2005; 2010).

These research outcomes disclose much in-depth knowledge and reveal a dominant methodology in *beiguan* research over the last two decades of one-way data collection and analysis from the perspective of a neutral participant-observer. Recording in the field is treated primarily as an opportunity for preservation, "to record tradition to preserve it for future generation[s]" (Topp Fargion, 2009: 77), and to allow further analysis and investigation. The relationship between researcher and informants or consultants is rarely discussed as a methodology. By contrast, the methodology in this article aims at "solving concrete problems rather than hypothetical ones" (Tan, 2015: 109), "involving and empowering music-makers and music-cultures in collaborative projects and results in practical action in the world" (Titon, 1992: 315), and "moving the researcher into a reciprocal stance in relation to the people whose music one studies" (Summit, 2015: 202).

Several researchers have provided foundational perspectives on recording, exploring its relationship with the development of ethnomusicology as a discipline (e.g., Topp Fargion, 2009, Stock, 2010) or developing analytical notions such as that of the sound box (space design in the stereo setting, see further Dockwray and Moore, 2010). Neuenfeldt (2007a; 2007b) offers reflections on his role in collaborative recording projects, while Meintjes (2003) and Ottosson (2007) provide close ethnographic observations on recording studio interactions around traditional music. In the recording industry, recording engineers and experts have discussed their experiences with recording drum sets and mixing tracks in the studio. For example, Savage (2011) argues that at least 13

[4] https://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi/ccd=aa5F3M/webmge?mode=basic (accessed on 22/03/2020)

microphones are used to record a set of drums (kick drum, tom-toms, snare drum, hi-hat). Techniques used in these setting can be adapted and applied to the recording of *beiguan opera*. Huang, Kang-Ning (2017) reveals the necessity and important of multi-track recording while recording *beiguan* instruments without offering more details on the process. Also, Ostashewski (2014) comments that the dialogic processes of collaborative and community-based research characterise much of this work, facilitating respectful and productive dialogue between academics, the communities with whom they work and partners across various sectors. This article mainly reveals the details of the dialogic process in recording *beiguan opera* in Taiwan.

In 2017 and in preparation for the work with *Qinghexuan*, I examined some previous recordings along with Huang and their principal player, Qiu Ding-Jin (邱丁進). For instance, Huang noted that in some the voices were too prominent, which seemed to separate them out from the rest of the ensemble, while in others it sounded as though a reduced number of instruments had been used, which aided sonic clarity but also distanced the sound from that of a standard traditional performance (Jing-Cai Huang and Ding-Jin Qiu, personal communication, 16 January, 2017).

Consequently, in this article, I illustrate all the details of the recording process in the field (including setting up microphones and strategy) and of mixing in the studio (including analysing, using an equaliser, panning, balance and compressor), to establish a practical model for recording *beiguan opera* in Taiwan. Also revealed are the gradual shifts I undertook in my own position and roles, moving from acting as a neutral observer to engaging with the ensemble as an applied ethnomusicologist and changing from being present as an external amateur to an involved professional expert as a consultant for sound recording. The "needs and vulnerabilities" (Bendrups, 2015: 72) of the field played an important role in reshaping the relationship into an interactive, collaborative and balanced partnership (Hood, 1971: 222; Myers, 1993: 12-13; Titon, 1995: 288; 2009: 134). This case thus reveals the "presumption of respect, equality and reciprocity among the research participants" (Hofman, 2010: 23) since our collaborative partnership was not established at the beginning and was only achieved gradually, exemplifying the ensemble members' resilience in collaborating with a researcher.

First Recording

Two weeks later, we're arranging a recording session for *beiguan opera*. Can you come and make some suggestions[5]? (Jing-Cai Huang, personal communication, 09 January, 2017)

At first, I was acting as a neutral observer and new learner, while Huang was an expert informant on *beiguan*. As a musician and researcher in traditional music at a university for several years, it was felt that my profession might offer some useful suggestions to improve the sound quality in recording (their need and expectation). In fact, before I was invited to assist with the recording, I had been learning how to play a common piece for beginners (*fengrusong*, 風入松) out of personal interest. At that time, although I am an academic researcher, I did not have a project on *beiguan* and my role was merely that of a neutral observer. When I was invited to collaborate, my informants were not familiar with my professional training in recording. The main reason they invited me was due to the trust they placed in a colleague's reference, introducing me as an experienced player and researcher in traditional Chinese music, and also to my existing personal relationship with them as an amateur learner in *Qinghexuan*. When I joined the two-day recording session as an observer, I did not attempt any professional intervention. Before we started, there was no discussion about the details, with regard to the strategy or the arrangement.

Based on Huang's (the leader) introduction about their instruments in the recording process, all the sound they intended to record could be divided into three categories:

1. Melodic instruments: *suona* (double-reed instrument), *kezaixian* (two-stringed fiddle, 殼仔絃), *hexian* (two-stringed fiddle, 和絃), *sanxian* (three-stringed lute, 三絃) and *qinqin* (three-stringed lute, 秦琴). All players perform *suona* and other stringed instruments at different points in the music.

2. Percussion instruments: *daluo* (large *gong*, 大鑼), *xiaoluo* (medium *gong*, 小鑼), *xiangzhan* (small *gong*, 響盞), *dachao* (large cymbal, 大鈔), *xiaochao* (small cymbal, 小鈔), *bangu* (leading drum, 板鼓), *tonggu* (assistant drum, 通鼓) and *bangzi* (woodblock, 梆子).

[5] 兩周後我們要錄北管戲。你可以來給點建議嗎? (Original conversation in Mandarin)

3. Vocalists: female singers and male singers (most instrumentalists are also vocalists).

At the recording session, Mr Huang (the leader) had set up microphone placement as typical for a normal performance with the following configuration (illustrated in Figure 1).

1. All bronze percussion instruments (small and large cymbals and small, medium and large *gongs*) were to the right of the drummer (leader): one microphone for all bronze percussion instruments (with a star in Fig. 1) with three microphones shared between them (placed in front of musicians doubling as vocalists)

2. All melodic instruments were to the left of the drummer (leader): one microphone for each instrument, except for the *suona*. In their view, there need be no specific microphone for *suona* players, because it can be recorded by all the microphones they had placed.

3. The drummer was the leader, responsible for maintaining the fluency and momentum of the whole piece (especially important in flexible rhythmic patterns) so that each microphone was set up for each drummer (leading drummer and assistant drummer) and one extra microphone (with two stars in Fig. 1) was in front of them.

4. Most instrumentalists are also vocalists: one microphone for each vocalist.

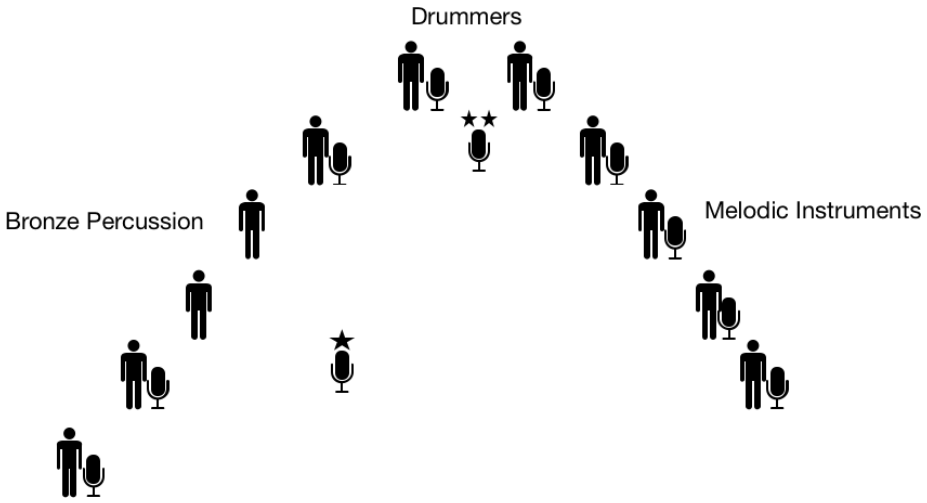

Figure 1. Layout of microphones

After all microphones were set up, the cables were linked to the analog mixing console in the control room next door (Figure 2) so that the recording engineer could communicate with the players. Each player tested their microphone individually, and the recording engineer modified the volume. From the studio monitors, the recording engineer[6] could evaluate the balance, revealing his personal preference in recording *beiguan opera*. Once the settings were finalised, the musicians were asked to play from the beginning to the end of the opera so that it could be recorded, a process that took a minimum of 40 minutes[7]. When an error occurred, the whole opera was recorded again. During the two-day recording session, I noticed that everyone quickly became exhausted, and the group was only able to concentrate properly for the first two rounds of recording each day. After the second round, a high quality of playing could not be maintained, a situation that led to an "increasing frustration with the slow process" of the recording from the sound engineer (Ottosson 2007: 53) and the players alike. Throughout the process I did not make suggestions or interrupt, because they were evidently all confident with their habitual recording process. As an observer, I realised they had considered all aspects of recording; for example, purchasing enough equipment (e.g., microphones and cables) and inviting a reliable recording engineer. At the time, it was obvious that all participants believed the quality of the product would be better than any previous recordings they had done.

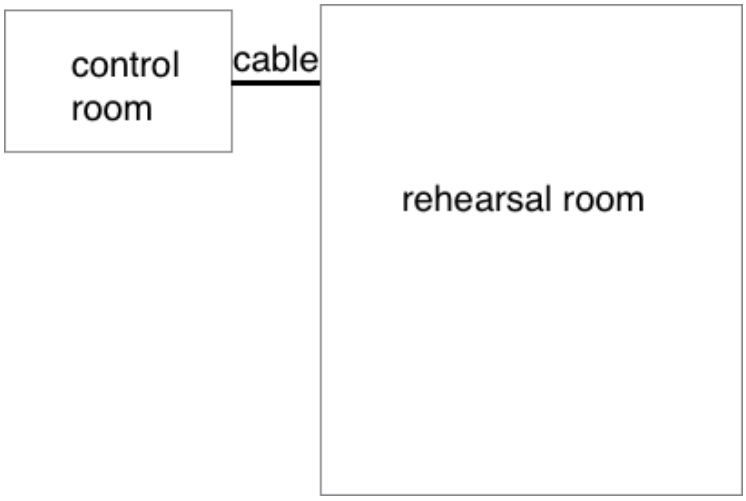

Figure 2. Layout of rehearsal room and control room

[6] This recording engineer was an audio director in TV company in Taipei.
[7] The whole repertoire would last at least 40 mins while playing without stopping.

Studio Listening

I know you are not familiar with *beiguan* like us, but you know other things which we do not. Thus, let's discuss and find a solution to our recording project through collaboration[8]. (Jing-Cai Huang, personal communication, 16 January, 2017)

Our collaborative partnership began three weeks after the recording session, when Huang and I met to listen to the results in the studio. Huang made it clear as follows:

I was not satisfied with the recording. I thought that a state-of-the-art studio would be the best recording option, an opinion shared by others in *beiguan* groups generally. However, due to geographic factors, difficulty transporting instruments and the anxiety of players, arranging this would have been a big challenge for the group. Thus, I had bought enough professional microphones and headphones to record in *Qinghexuan*'s rehearsal room, hoping that recording in a familiar place would help group members relax (feeling at home) as compared to visiting a professional studio somewhere else[9]. (Jing-Cai Huang, personal communication, 16 March, 2017)

He could not identify anything specific about his dissatisfaction with the production, only indicating that he could not hear each voice clearly and that the sound quality was not satisfactory overall. He asked me how I thought it might be improved and what strategies could be applied. From that point, my role changed from acting as a neutral observer to that of a professional expert in sound recording to "articulate the goal and concerns of the musicians in the field (Titon, 2015: 29) and to "solve concrete problems" (Tan, 2015: 109), specifically the recording quality.

Based on his demands, I examined the production of the recording and the recording process I had observed, and was able to identify some issues for discussion with Huang. There were two problems to be resolved. The first was that, using an analog mixer and recording method, the recording engineer had linked all voices in the mixer and then just recorded one track in the digital audio workstation (DAW). This method meant that no

[8] 我知道你不像我們那樣了解北管，但是你知道其它我們不知道的事。因此，我們可以試試一起合作，討論看看我們的錄音計畫有沒有解決方式 (Original conversation in Mandarin)

[9] 我對這個錄音不太滿意，雖然我覺得去專業錄音室是最好的選擇，其它北管團也都這樣說。但是，因為距離的關係，搬運這些樂器的難度，還有團員會緊張，做這樣安排對我們是很大的挑戰。因此，我就買了足夠的專業麥克風和耳機，想直接在慶和軒的練習室錄，希望在熟悉的環境錄音，會比在專業錄音室錄音來得放鬆，就像在家一樣 (Original conversation in Mandarin)

one could modify the track later. The engineer had modified the volume of each voice until each could be heard clearly; then, when they played together, the engineer had made smaller ongoing modifications to maintain balance, based on his own evaluation. This was not done on the monitor as it was not digital. This method resulted in the recording engineer deciding the balance of the voices and the overall sound quality, before the players or group leader had examined the sound (see further, Crowdy, 2007: 111). In fact, as there were enough microphones and headphones, each voice could have been recorded on the DAW separately, which would have allowed a later process of rebalancing, should the musicians have asked for it. At this moment, Huang did not understand the difference between a single-track recording and a multi-track recording, and so part of my role was to explain the technology and its various possibilities in terms that made sense to him.

A second issue arose from the microphone placement. As Figure 1 shows, a vocalist is also an instrumentalist, which means that the loud and sudden sounds of bronze percussion instruments were recorded by the same microphones as the softer vocalisations—many passages in *beiguan opera* combine vocal performance with percussion accompaniment. So, although a microphone's volume could be modified for voice-led passages, turning it up meant that it picked up more of the percussion (unless the latter overloaded the microphone, in a phenomenon known as clipping). The resulting disruptions in the balance of a single-track recording could not be corrected later by the recording engineer.

Through our discussion, Huang and I identified strategies that could be applied to improve the quality of recorded sound in such an endeavour. Firstly, we needed to ensure that microphones were set up based on the recording demands (leading to a clear sound for each voice and part on each track). Secondly, we needed to produce a recording that could be effectively remixed in the studio. At this stage, although Huang and the musicians did not fully understand the recording techniques that were now in discussion (from single-track recording to multi-track recording), they were willing to arrange another recording session to try out this new strategy. My role evolved slowly from that of an invited external listener to that of an expert given the opportunity to supervise the next recording session. With this change in role, I would be more able to offer interventions, even if the musicians did not yet completely understand the difference such interventions might make. In the meantime, their roles also shifted from hosts whom I could observe

and consult to research collaborators who shared an interest in solving a concrete problem.

Second Recording

It is my first time recording with headphones. Can I hear the sound of the *suona*? I can see the gestures from the drummer to keep the beat. When I sing, can I hear my voice? If so, I feel safe and I can control my pitch. In the previous recording, I could not hear myself[10]. (Jin-Dui Weng [group member], personal communication, 13 April, 2017)

About one month after our first collaborative conversation in the studio, I met with the ensemble in a second recording session. In a study of Aboriginal music production in Queensland, Ottosson noted that the recording engineer can take an "intervening role as a producer and professional coach" (2007: 54); and in the same way, I intervened in the recording process by offering practical suggestions over the placement of microphones and in the making of the recording itself. Setting up the microphones properly is a big challenge in the field (practice room), with previous research in *beiguan* and the recording industry not including thorough information on the best ways to do this. The symphony orchestra seems to offer a partial parallel, as another large and variegated ensemble with potentially wide dynamic differences between individual instruments. But, as Savage (2011) notes, orchestral recordings are made primarily using microphones placed at a distance from the orchestra, with the room ambience contributing a major portion of the sound that is then captured. However, *beiguan* ensembles typically practise in narrow concrete rooms where the echo and volume from the bronze percussion instruments and *suona* is out of control, without the absorptive material that would be present in a professional recording studio, and their live performances are often staged outdoors in open spaces with a great deal of background sound. My only option was to record the direct sound of the ensemble only, reducing the room ambience as far as possible. We used dynamic microphones (SM 57 and SM 58), which are able to "withstand loud sound" (Savage, 2011: 23), set at a distance of 12-15 centimeters from each instrument. To overcome the issue of balance of the vocal parts, we utilised directional dynamic microphones to record each voice, thus reducing the

[10] 這是我第一次戴耳機錄音。我可以聽到嗩吶的聲音嗎? 我可以看鼓手的手勢來對拍子。當我唱的時候，我可以聽到我自己的聲音嗎? 如果可以，我會覺得比較安心，而且我可以控制我的音準。在之前錄的時候，我都沒辦法聽到我自己唱的 (Original conversation in Mandarin)

reflection and sounds of other instruments on the vocal tracks. Meanwhile, the bronze instrument musicians argued that they could not hear the vocalist or the sound of the *suona* during the recording, so every player was equipped with headphones so that the recording engineer could communicate with them and send them the sounds of the vocalists and *suona* during recording.

Recording a drum set can be one of the most challenging jobs for a recordist (Savage, 2011). At this session, I started by applying the settings used by Savage and modified them for recording the *beiguan* percussion instruments through a significant testing process. To avoid the problems mentioned above, we tested each microphone one by one, setting the volume on the digital mixing console, using an audio interface, at the point where the volume was loud enough (not overloading) for further editing. The following table lists the equipment used in the recording and mixing of *beiguan opera.* I refer to some of the settings and processes used to reveal more details.

Table 1. Equipment list

Equipment	**Brand/Version**
Digital audio interface	Behringer X32
Microphones	Dynamic microphone Shure SM 57, SM 58
Digital Audio Workstation (DAW)	Logic Pro X 10.2 (Mac)
Headphones	ATH-M50x
Studio monitor	KRK Rokit 5 G3
Computer	Mac Book Pro (2015)

As an ethnomusicologist, I had observed their typical performance during their first recording session. Through my observation and personal communication with the leader and group members in the field and my studio, I had noticed that group members primarily rely on the drummer in the middle (visual) and the sound of *suona* (aural) to keep the beat. These two elements are crucial to the group members during their performances, as they contribute to their feeling of safety, confidence, and comfort. Also, when they sing, they must rely on hearing their own voices to control the pitch. When considering recording strategies, it is important to preserve a natural performance style without altering how they play. Therefore, I divided the recording process into two stages: in the first, the full ensemble performed but the aim was primarily to record the

instrumental parts clearly, and vocal microphones were not used; in the second, the vocalists could listen to the first round through headphones, singing their parts through the directional microphones, so that the vocal parts could be recorded cleanly. The layout of the microphones was modified from stage one to stage two, illustrated in Figures 3 and 4 below, with further detailed as follows:

1. Three overhead microphones were used (marked with a star in Fig. 3), one in front of two drummers, one in front of the bronze percussion and one in front of the melodic instruments.

2. One directional dynamic microphone was used for each instrument to minimise the picking up of indirect and reflective sounds from the other instruments.

3. No microphones were set up for vocalists.

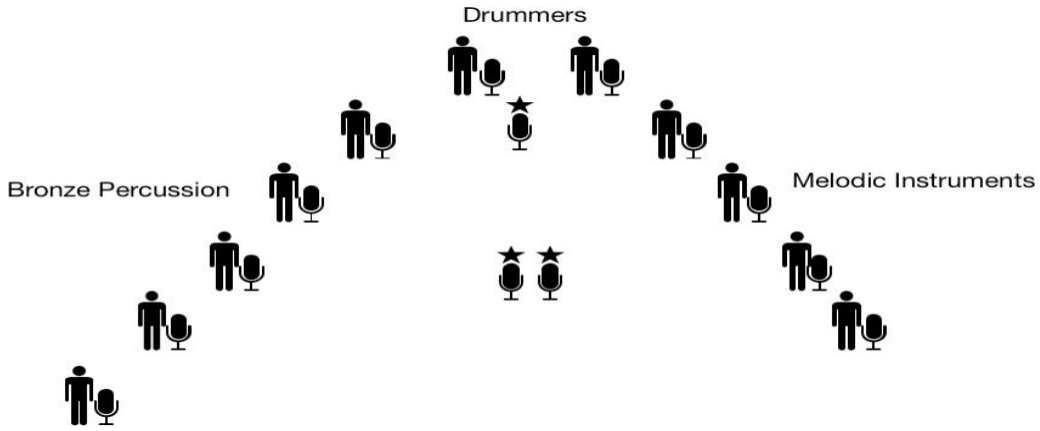

Figure 3: Microphone layout for first stage (instruments)

During the recording process, the musicians played as usual (including the vocalists) to ensure they could play with confidence and fluency. All the players could hear both the sound of *suona* and that of the vocalists, coupled with the gestures of the leading drummer, while playing with headphones. After the first round was complete, I selected two parts to play back to everyone through their headphones to see whether the clarity was acceptable to the ensemble musicians themselves. At this moment, Huang realised the difference between single-track recording and multi-track recording, and he commented that he could already see that the vocal parts recorded in this way, which we were about to undertake in round two, would be more easily heard. This method revealed another advantage – the repetition by the whole ensemble of whole pieces to correct

mistakes in one part was unnecessary, thus avoiding exhaustion. Removing fatigue and frustration from the players and sound engineers (Ottosson, 2007: 53) resulted in an environment in which trust and respect between the research collaborators intensified as the process continued.

In the second stage, the vocalists were the focus. In the microphone placement for a singer, as Savage (2011) argues, the microphone is placed so close to the singer's mouth that room reflections are virtually non-existent relative to the direct sound of the voice. All vocalists sing with the headphones on. Through the headphones I could play back from the beginning, and the vocalists could sing in the correct place. If an error occured, we only needed to re-record the specific phrase and not the whole piece. The layout of the microphones for round two is illustrated in Figure 4 below:

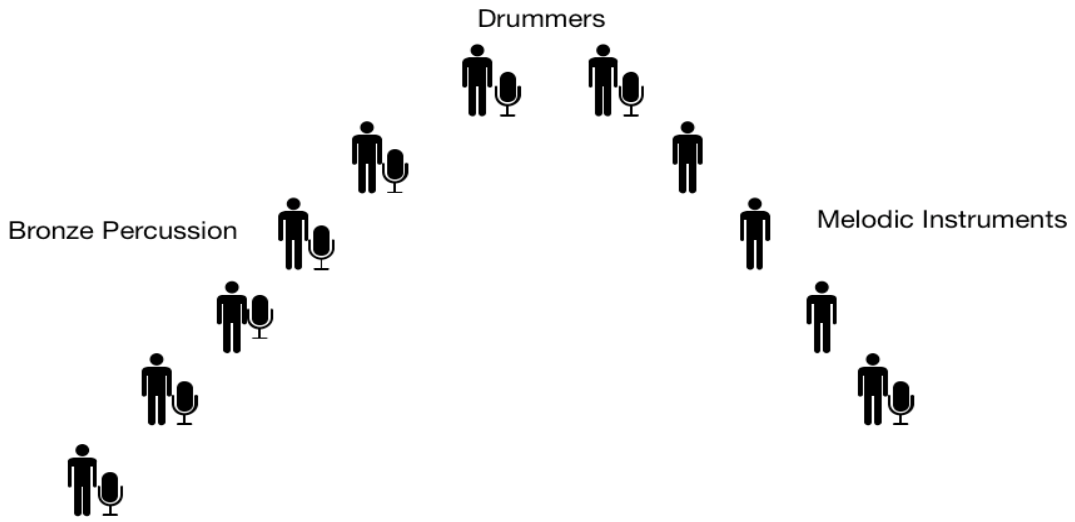

Figure 4. Microphone layout for second stage (vocalists only)

The vocalists began feeling slightly anxious, as it was their first time recording the pieces in this way. When they found that they did not have to sing and play the whole piece repeatedly, they became more confident and less worried about pressure from their peers. For example, if one vocalist was not satisfied with their singing, they could record it again alone while the other members had a rest. They were able to relax a bit more while recording, as they were not so worried about the consequences of making minor mistakes. Notably, and although they were unfamiliar with the strategy, these ensemble members remained open to suggestions, demonstrating resilience, in part due to the collective ethos characteristic of *beiguan* ensembles but also because they were

motivated to improve the sound of the production. Having everyone aware of the benefits of this process encouraged an interactive, collaborative and balanced partnership (Hood, 1971: 222; Myers, 1993: 12-13; Titon, 1995: 288; Titon, 2009: 134) and fostered respect, equality and reciprocity among the research participants (Hofman, 2010: 23).

Using this method, we spent three hours recording the same repertory as the group had recorded at their previous recording session of two days' duration (excluding my own personal preparation time). This overall efficiency actually raised some doubts among the team, who wondered if something that had been so arduous could really be done satisfactorily in such a short period. To address these concerns, we held a post-recording gathering where I was able to balance the tracks and play the result back to all through loudspeakers. This was a good opportunity for me (as an ethnomusicologist) to understand their standards and expectations regarding balance (aesthetic preference). In this unfinished version, they felt it sounded better than before – with no muddy sound, overloading or unexpected volume changes (resulting from microphones being suddenly boosted to pick up the voices). I explained again that since we had recorded each instrument separately, we could mix them more effectively later, and demonstrated some of the ways I could now elevate a part in the mix. The benefit of multi-track recording became clear to the team, just as their feedback on what they were able to hear in the mix was crucial to me as recording engineer.

Figure 5. The recording process[11] (Photo by Ming-Hui Ma)

[11] As Huang was aware of echo from percussion instruments in the recording from the production, he improvised some sound-proofing, including a carpet on the floor, and blankets hanging on the walls and behind the large *gong*.

At this stage, the live recording process was finalised but the subsequent step of mixing in the studio remained. This was at least as challenging, in part because there is no literature on how to mix *beiguan*, and the musicians themselves found it hard to articulate precisely the listening parameters that they had acquired over many years of performance. As such, I needed to work through original experimentation based on my own experience and on my understanding of the input from *Qinghexuan* members.

Mixing in the Studio

If the recording strategy is the first consideration needed when looking to improve the sound of a recording, a mixing strategy is the second. For many instruments and ensembles, recording engineers can refer to parameters for these instruments, with their respective frequencies, as well as to reflections from expert recordists on how best to mix these instruments on the DAW. Such information is not available for the recording of *beiguan opera*, as noted above, and I spent a six-month period exploring digital plug-ins that are routinely used to help mixing: equaliser, compressor, panning, balance. In each case, I aimed to find final settings that worked both in terms of my pre-existing experience as a recordist (first, mixing without their feedback) and according to the standards of my collaborators (second, mixing with their feedback), the results of which are presented here for the first time in *beiguan* literature.

Equaliser

The equaliser (EQ) is a plug-in designed to help cut or boost a specific frequency to avoid overlapping frequencies which result in a muddy sound while mixing (Savage, 2014: 79 and Izhaki, 2018: 210). During this stage, I analysed all the human voices and instruments based on their frequency and ranges, considering how best to arrange these components smoothly on the spectrum, with the aim of ensuring that all parts could be heard clearly without distorting the overall atmosphere characteristic of a *beiguan opera* performance. This meant that I had to analyse the frequency of each part first and then design how to arrange them based on their respective key frequencies. I used the plug-in (noise gate) after my frequency analysis to cut unnecessary frequencies in the recording that came from environmental sounds or from other instruments; this is because we recorded in the field, rather than in an isolated studio.

Percussion instruments

Figure 5 shows the frequency of the *daluo* (large *gong*, 大鑼) on the spectrum. The lowest frequency is around 141 Hz, and the frequency of the first overtone is around 282 Hz. These two form an important timbre and the foundation (bass) for all the percussion instruments.

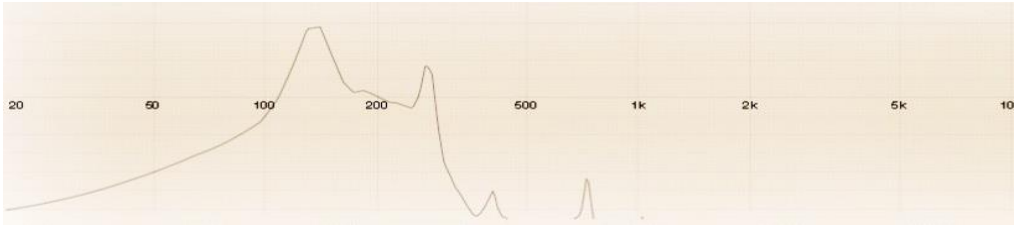

Figure 5. Frequency array of the *daluo* (x-axis: frequency, y-axis: dB)

Figure 6 shows the frequency of the *xiaoluo* (small *gong*, 小鑼) on the spectrum. The frequency of its fundamental tone is around 252 Hz, and the frequency of the first overtone is around 480 Hz.

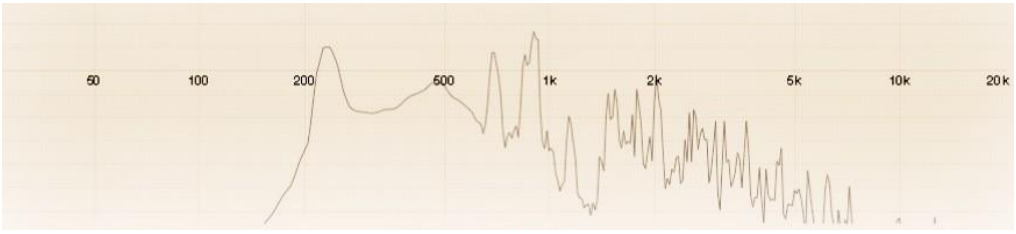

Figure 6. Frequency array of the *xiaoluo* (x-axis: frequency, y-axis: dB)

Dachao (large cymbal, 大鈔) and *xiaochao* (small cymbal, 小鈔) are a pair of bronze percussion instruments. The *dachao* is usually played on the downbeat and *xiaochao* on the upbeat. Figure 7 shows the frequency of *dachao*, the fundamental tone of which has a frequency of around 605 Hz.

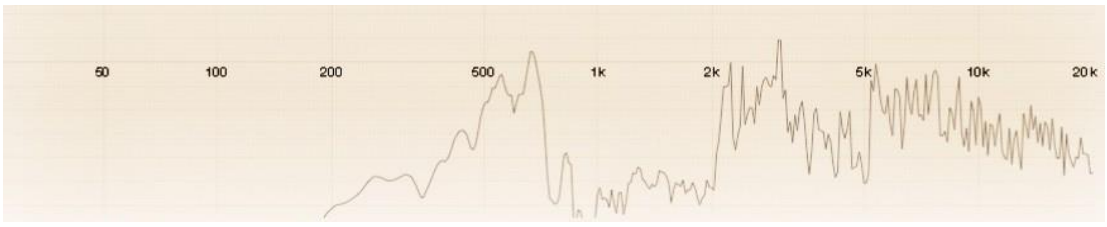

Figure 7. Frequency array of the *dachao* (x-axis: frequency, y-axis: dB)

Figure 8 shows the frequency of the *xiaochao* on the spectrum. The frequency of its fundamental tone is around 654 Hz. The importance of these two instruments lies in the brightness of their higher frequencies. For *dachao*, this means above 3.5k Hz and *xiaochao* is above 4k Hz.

Figure 8. Frequency array of the *xiaochao* (x-axis: frequency, y-axis: dB)

Figure 9 shows the frequency of the *xiangzhan* (medium *gong*, 響盞) on the spectrum. The frequency of its fundamental tone is around 793 Hz.

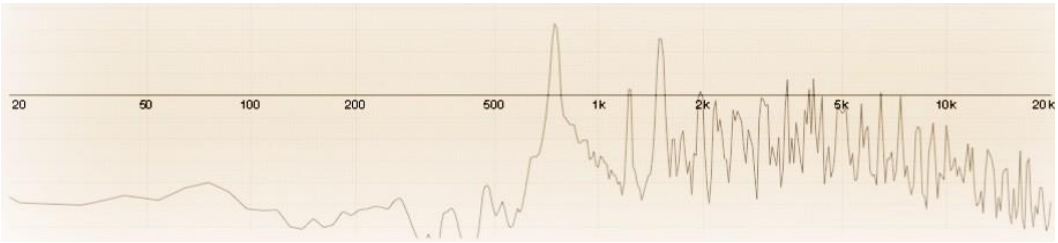

Figure 9. Frequency array of the *xiangzhan* (x-axis: frequency, y-axis: dB)

Figure 10 shows the frequency of the *bangu* (板鼓) on the spectrum. The frequency of its fundamental tone is around 1883 Hz.

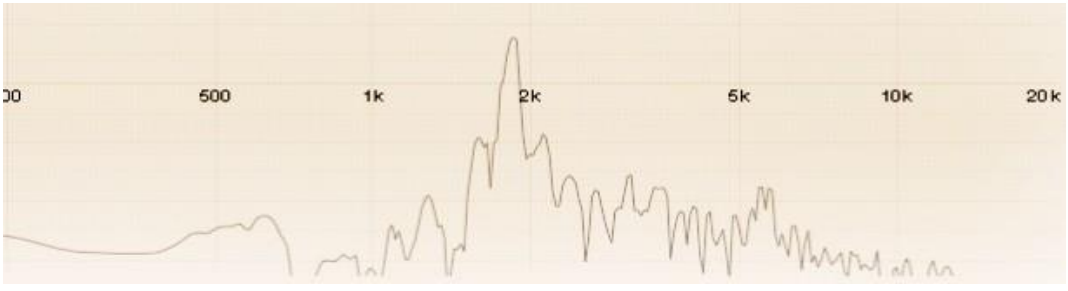

Figure 10. Frequency array of the *bangu* (x-axis: frequency, y-axis: dB)

Figure 11 shows the frequency of the *tonggu* (通鼓) on the spectrum. The frequency of the fundamental tone of this instrument is around 444 Hz.

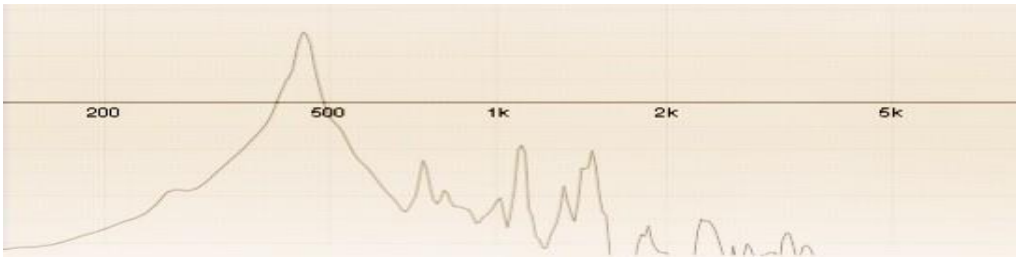

Figure 11. Frequency array of the *tonggu* (x-axis: frequency, y-axis: dB)

Figure 12 shows the frequency of the *bangzi* (梆子) on the spectrum. The frequency of its fundamental tone is around 1456 Hz.

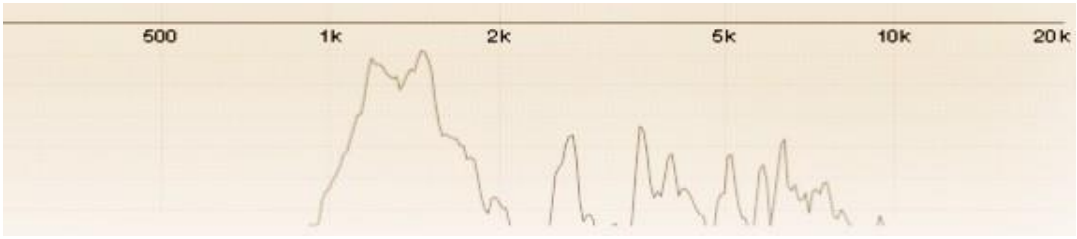

Figure 12. Frequency array of the *bangzi* (x-axis: frequency, y-axis: dB)

Melodic instruments

Figure 13 shows the frequency of the *kezaixian* (殼仔絃) on the spectrum. The frequency of its lowest pitch is around 396 Hz.

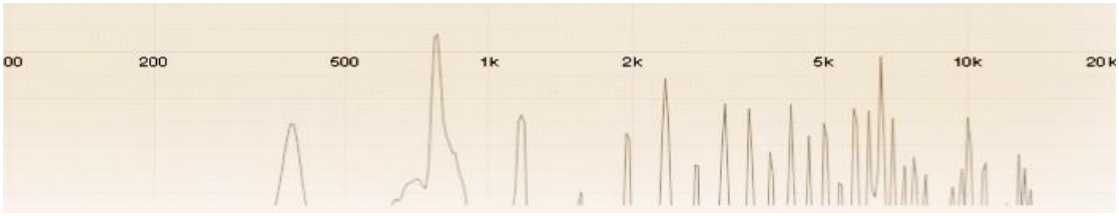

Figure 13. Frequency array of the *kezaixian* (x-axis: frequency, y-axis: dB)

Figure 14 shows the frequency of the *qinqin* (秦琴) on the spectrum. The frequency of its lowest pitch is around 193 Hz. *Sanxian* (三絃) shares the same tuning with *qinqin*.

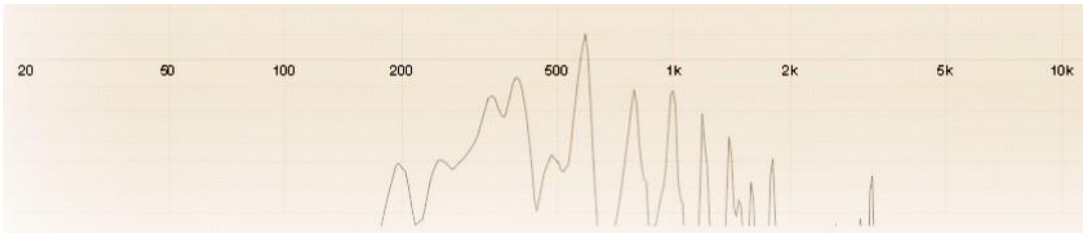

Figure 14. Frequency array of the *qinqin* (x-axis: frequency, y-axis: dB)

Figure 15 shows the frequency of the *hexian* (和絃) on the spectrum. The frequency of this instrument's lowest pitch is around 262 Hz.

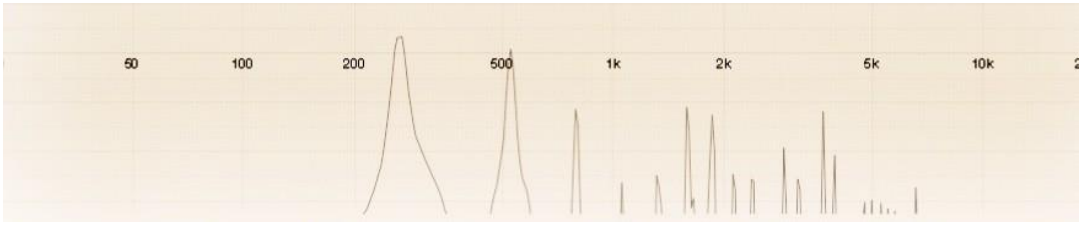

Figure 15. Frequency array of the *hexian* (x-axis: frequency, y-axis: dB)

Figure 16 shows the frequency of the *suona* (嗩吶) on the spectrum. The frequency of the *suona*'s lowest pitch is 500 Hz.

Figure 16. Frequency array of the *suona* (x-axis: frequency, y-axis: dB)

Vocalists

Figure 17 shows the frequency of a male vocalist on the spectrum. The frequency of the lowest pitch is around 220 Hz.

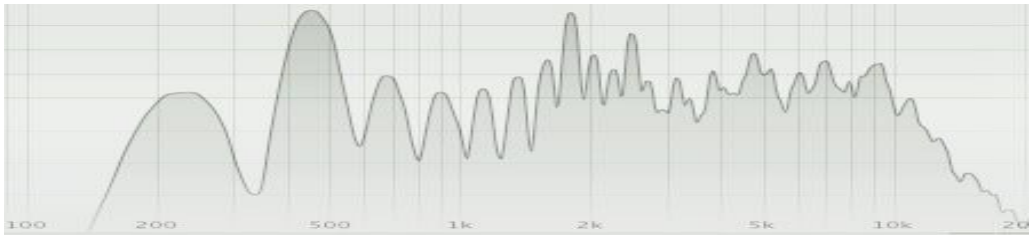

Figure 17. Frequency array of the male voice (x-axis: frequency, y-axis: dB)

Figure 18 shows the frequency of the female vocalist on the spectrum. The frequency of the lowest pitch is around 420 Hz.

Figure 18. Frequency array of the female voice (x-axis: frequency, y-axis: dB)

After analysing the frequency of each instrument and voice, I arranged the percussion instruments into the best possible frequency arrangement (from low to high) on the spectrum, as listed in Table 2:

Table 2. Frequency arrangement of percussion instruments from low to high

Instrument	*daluo*	*xiaoluo*	*tonggu*	*dachao*	*xiaochao*	*xiangzhan*	*bangzi*	*bangu*
Frequency	141 Hz	252 Hz	444 Hz	605 Hz	654 Hz	793 Hz	1456 Hz	1883 Hz

The frequencies of all these percussion instruments are fixed and form a continuous backdrop on the spectrum (Figure 19). I and J in Figure 19 are the high frequencies in about 3.5k Hz and 4k Hz for *dachao* and *xiaochao* respectively, which can be enhanced to increase the brightness of these two instruments. To acquire a clean sound, I cut unnecessary frequencies in each instrument's lower tone by using a high pass on the DAW. For example, I cut frequencies under 141 Hz for the *daluo* and those under 252 Hz for the *xiaoluo*. By doing this, all the percussion instruments could be heard clearly while mixing.

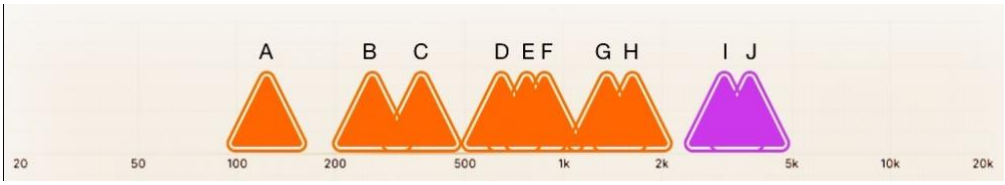

Figure 19. A (*daluo*), B (*xiaoluo*), C (*tonggu*), D (*dachao*), E (*xiaochao*), F (*xiangzhan*), G (*bangzi*), H (*bangu*), I (*dachao*-high frequency), J (*xiaochao*-high frequency)

In *beiguan opera*, there are two further sets of parts – vocalists and melodic instruments. In general, the vocalists and the various melodic instruments work together; the lowest frequencies of both melodic instruments and vocalists are listed in Table 3.

Table 3: Frequency arrangement of vocalists and melodic instruments from low to high

Instrument	*hexian*	*male voice*	*qinqin/sanxian*	*kezaixian*	*female voice*	*suona*
Frequency	140 Hz	220 Hz	262 Hz	396 Hz	420 Hz	605 Hz

To acquire a clean sound, I cut in the same way as for the percussion. For example, I cut frequencies under 140 Hz for the *hexian* and those under 220 Hz for the male voice. By doing this, all the melodic instruments and vocalists could be heard clearly while mixing (Figure 20).

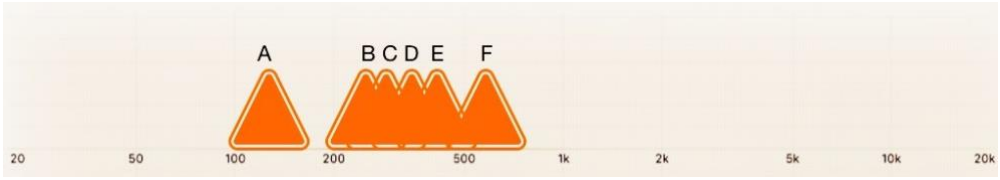

Figure 20. A (*hexian*), B (male voice), C (*qinqin/ sanxian*), D (*kezaixian*), E (female voice), F (*suona*)

In some parts, the *suona*, vocalists and percussion instruments were present at the same time. In terms of using an equaliser, after the previous cutting I mentioned, modifying frequencies was unnecessary because there were no overlapping frequencies (Figure 21). This reveals a smooth sonic conception underlying this traditional Taiwanese music genre, quite independent of any western influence. This is exemplified through the combination of *suona* and percussion instruments. In the lower frequency (under 400 Hz), any two instruments (A, B and C) were not overlapped, resulting in an overall sound with some spaced out and a more tightly clustered centre in the middle and higher ranges (between 400 Hz and 1000 Hz). Specifically, in the highest range on the spectrum (above

1000 Hz), the frequencies of a pair (*xiaochao* and *dachao*) it was possible to increase the brightness. This balance between tracks (especially the combination of *suona* and percussion instruments) reveals an acoustic preference through the transmission process from generation to generation. Previous researchers have not displayed this arrangement on the spectrum like this. It looks similar to the arrangement of the Harmonic Series.

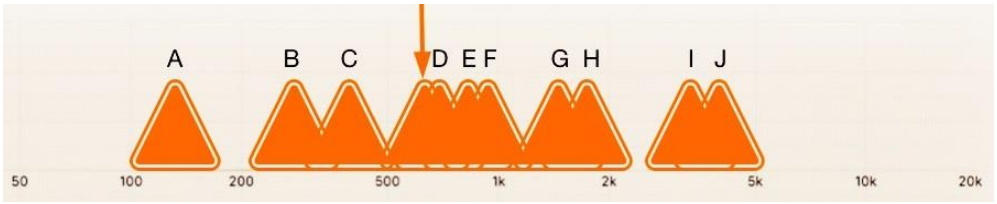

Figure 21. A (*daluo*), B (*xiaoluo*), C (*tonggu*), D (*dachao*), E (*xiaochao*), F (*xiangzhan*), G (*bangzi*), H (*bangu*), I (*dachao*-high frequency), J (*xiaochao*-high frequency), Arrow (*suona*)

Compressor

After arranging frequencies on the spectrum, sound engineers use compressors to tighten up dynamics, particularly when recording percussion instruments (Savage, 2014: 90 and Izhaki, 2018: 274). To acquire clearer impacts without any distortion in timbre, I used a compressor based on four parameters for the vocalists and the percussion instruments. No compressor was necessary for the melodic instruments because they could already be heard naturally and clearly. The four parameters manipulated were ratio, attack, release and threshold, and the values I used differed for each group (Table 4). In each case, I worked by experimentation, modifying each parameter until the sound closely resembled that of a live performance.

Table 4. Parameters on compressor

	Ratio	Attack	Release	Threshold
Percussion	8.22:1	2.19 ms	223.4 ms	-12.98 dB
Vocalists	2.18:1	0.85 ms	243.4 ms	-16.92 dB

For the percussion instruments, use of a higher ratio (8.22:1) allowed these sounds to acquire more impact through the loudspeakers. I used a lower ratio (2.18:1) to energise the sound of the vocalists. Meanwhile, the shorter attack time for the vocalists meant they could be heard faster (or more closely) as compared to the percussion instruments, as it

is a human tendency to latch onto the voices (and words) of others in musical performance. I deliberately reduced the reverberation of the percussion instruments and held the vocalists' ambient sound longer, as shown in the shorter release time for the percussion (223.4 ms) as compared to the vocalists (243.4 ms). By doing this, excessive reverberation did not block other instruments and a dry sound from the vocalists was avoided. All of the modifications in these areas would differ for other groups or for the same group recording on another occasion; still, the parameters of the compressor noted here and the accompanying comments offer a starting point for other recordists, as well as for those thinking about what they hear when listening to recorded music much more widely.

Panning

Space design is another important method for avoiding overlapping frequencies and a muddy sound; it is also a way to ensure that listeners can feel the layout (L-R) of the virtual space in a stereo setting (Savage, 2014: 73 and Izhaki, 2018: 190). Here, I applied my experience at mixing other genres and designing virtual space (mostly from the viewpoint of a listener in front of a loudspeaker), working in dialogue with my collaborators whose listening responses enabled me to further modify my approach. Based on the frequency of the *daluo* (the lowest tone in instruments), it seemed best to put the *daluo* in the middle of the virtual space, ensuring a left-right balance when listening. The two drummers were the leader and assistant leader, so I put these two voices on each side of the *daluo* to ensure balance stability when listening; for example, *tonggu* (-3) and *bangu* (+3). *Dachao* and *xiaochao* are a pair, so I arranged one on the left (*xiaochao*, -20) and the other on the right (*dachao*, +20). While playing, listeners could hear the conversation between these two instruments from the relative extremes of either side. For the rest of the bronze percussion instruments, I placed the *xiangzhan* on the left (-17) and the *xiaoluo* on the right (+5).

There are three *suona* tracks in the recording. Because the volume of the instrument is high, I arranged one track in the middle, another on the left (-38) and the last on the right (+38) (Figure 22); this maintained the balance for the listener. There were ten vocalists, which I arranged on both sides without overlapping. For all other melodic instruments, I randomly arranged them, simply ensuring they did not share the same place as any other.

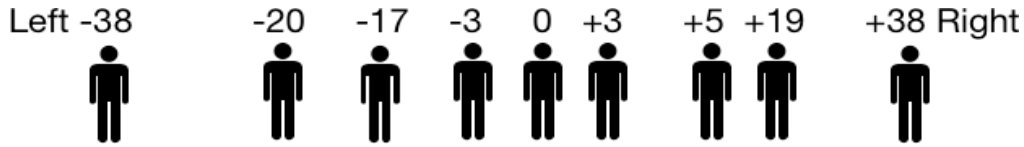

Figure 22. Arrangement of vocal and instrumental tracks from left to right.

Balance

Balance can help listeners hear the locations and the voices of players in an ensemble. Before the team examined the balance, I modified the volume roughly to ensure that balance was reasonable based on my own experience. Here, the basic principle was to put instruments with lower frequencies at the back and other instruments at the front, in order to avoid the latter being blocked by the former. This method acquired more clarity in sound to fulfil the demands of the leader of *Qinghexuan* based on his criticism of sound quality in the earlier recording.

First, I applied the *daluo* as the standard around which I would modify the other parts. Second, I arranged the percussion parts one-by-one based on a comparison between each instrument and the *daluo*; additionally, I arranged the *xiaoluo*, *xiangzhan*, *dachao* and *xiaochao* from lower frequency to higher frequency. Third, after I had arranged percussion instruments, I arranged the melodic instruments and vocalists using the same rule. By doing this, it seems that the *daluo* (the instrument with the lowest frequency) supported all the instruments without disturbing the clarity of sound. Figure 23 shows the ratio of the voices of percussion instruments and *suona* in volume.

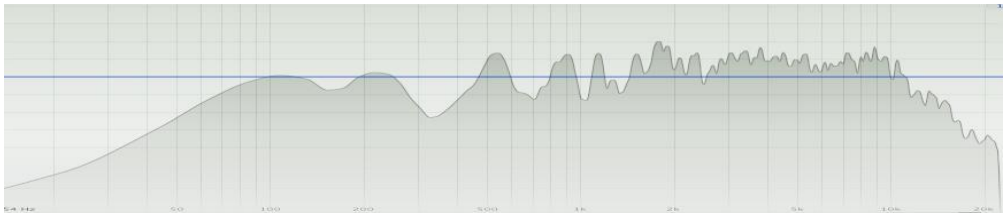

Figure 23. frequency arrangement on the spectrum from low (left) to high (right) (x-axis: frequency, y-axis: dB)

Listening in the Studio

The production sounds better in the studio than previous one, but I feel the human voices

are too loud. The voice of the *suona* should be heard more loudly from my viewpoint[12]. (Jing-Cai Huang, personal communication, 19 October, 2017)

Six months later, after I finished the preliminary mixing, I invited Huang and their principal player (my two primary research collaborators) to listen to the studio-mixed recording. We reminded ourselves that this production was not merely for 'authentic preservation', but that another aim was to produce an acceptable recording for prospective new audiences from both younger and older generations. Thus, we would need to consider viewpoints from both inside and outside the *beiguan* tradition.

First, I played the previous recording and the current one through the same studio monitors so that they could hear the difference between a single- and a multi-track recording. They noted that the sound quality of the new recording was acceptable and that it sounded as though a live performance was happening in front of them. They noted that it was not noisy as before (removal of the muddy sounds and restraining of the piercing sound of the bronze percussion instruments), and they commented that the details of the instruments plus vocalists could be heard easily. So far, so good. However, they both demanded that I modify the balance of the *suona* and the human voices. In my experience at mixing, the human voice is always the most important part because it conveys lyrics. My *Qinghexuan* collaborators, though, insisted that the *suona* was more important than the human voice. I not only modified the volume of these two parts, but I also thought again about how to present them both, as the range of each slightly overlapped. To solve this problem, I slightly reduced the overlapping range of the *suona* and increased its frequency in the higher range. In doing so, the human voice and *suona* no longer overlapped (Figure 24), and the *suona* could be heard more clearly than the human voice without reducing the clarity of the vocal voice.

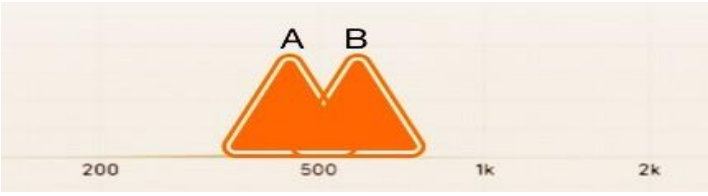

Figure 24. A (vocalist), B (*suona*)

[12] 這個版本的錄音在工作室裡聽起來比上次的好，但我覺得人聲有點太大聲，我覺得嗩吶應該要聽起來更大聲 (Original conversation in Mandarin)

After listening to this next mix of the music, Huang and his disciple reflected that in practices or in performance they could not hear as many details (or parts) due to the loudness of the *suona* and the bronze percussion instruments. When they sing, they cannot hear their own singing voices properly. When they listened to this recording, the excessive reverberations and piercing sound of the bronze percussion and *suona* did not block other voices, so they could hear more details, especially the vocalists and string instruments. The spatial design allowed the position and direction of all the voices to be heard clearly, even though they also noted that the layout I had used was slightly different from that used in a live performance. They could accept this modification in layout, because the sound quality is more important when listening through loudspeakers; also, during a live performance the layout is designed in part for the audience who are watching as well as listening.

Notably, both my collaborators and I took it for granted that we should arrange the two drummers and the *daluo* close to the middle of the sound. This demonstrates that players are aware that the sound of *daluo* acts as a stabiliser (lowest frequency in the middle). In live performance, all the *suona* players are placed on the left and the other percussion instruments on the right (Figure 25). This is because one group can see the other group and the leading drummer's gestures to keep the beat; however, in the mixing process in the studio, this requirement is not necessary. In the studio, I played two versions, one in each layout for my expert listeners. Their insider perspective was that the rearranged layout, where I had placed the *suona* and percussion to each side of the centre, sounded better than the version that clustered these tracks more closely together in their respective real-life spaces. They did not feel that the rearrangement destroyed the music; they insisted that they preferred it. This reveals that some components of the production (namely the drummers and *daluo*) are fixed, and some are flexible in the mixing process.

Figure 25. Layout in performance of the *Qinghexuan* ensemble[13] (photo by *Qinghexuan*)

Their arguments led me to ruminate further on some issues. Firstly, in previous research, *beiguan* music is considered loud and the relationships between the instruments when heard in combination are not much discussed; see, for example, Lu (2005, 2011) which mostly assesses the characteristics of each instrument and how to use it. This might be due to the paucity among researchers of recording tools and related skills in recording and mixing. Certainly, the first impression one acquires of *beiguan* recorded in the field is of its fervent atmosphere, and of the loudness of the *suona* and the bronze percussion instruments. However, when we examine further, behind the loud volume, some further details are uncovered. For instance, the distribution of the percussion group across the pitch spectrum and its resulting sound quality forms a natural and complementary arrangement. Secondly, in the recording and mixing process, as high-tech recording equipment improves and has become more affordable, more of us are able to gain experience of mixing and recording, and can access places where associated skills are discussed, particularly with regard to popular music. However, if a researcher is not familiar with this area, they must still cooperate with an expert from the recording industry in order to produce a good result. Furthermore, and even with sufficient equipment and an amenable expert sound engineer, they will still not necessarily be able to complete the recording process without guidance and collaborative input from listeners who are deeply habituated in the tradition. As discussed above, some of my intuitions as a recordist who was already somewhat familiar with *beiguan* proved accurate, but in certain other cases—such as the relative importance of the voice—Huang's critical input was essential to the production of a final mix that represented important aspects of his music close to the ways he heard it himself.

[13] In this photo, each *suona* player is also a stringed instrumentalist and each percussionist is also a singer while they play in another part of music.

Listening in the Field

I want to sing this part again because my voice does not sound nice. Can I just sing these phrases and record it[14]? (Xiu-Yue Li [group member], personal communication, 18 January, 2018)

After I had finalised my recording (three months later), Huang arranged an event to showcase the product to the whole team. At this event, I was able to interact with the musicians and they were able to share their experiences in a relaxing atmosphere. I did not divulge too much information about the mixing process before I played the recording. Afterwards, it was clear that the team felt something was missing. I played the recording for them a second time. They were able to concentrate more closely, and they noted further differences.

I feel the sound is not piercing and irritating even when I listen to it twice, and I can hear all the voices clearly with a reasonable balance [i.e., neigher too loud nor too weak][15] (Jin-Dui Weng [group member], personal communication, 18 January, 2018).

At that moment, Huang said that we should enjoy our feast and listen to the recording a third time. As they ate, more members commented that this production could be enjoyed many times without fatigue and they noted an overall improvement in the sound quality, compared to their experiences with previous recordings. Their collective approval confirmed the benefits of the collaborative strategy taken in the project.

Conclusion

In this article, I discussed the recording and mixing process used when I was invited to assist the production of a *beiguan opera* in Taiwan. Demands from the community saw my role evolve from that of an observer to that of an applied ethnomusicologist and from an amateur onlooker to an expert participant. Negotiation and collaboration with musicians led me to new insights into their aesthetic preferences and into the balance and distribution of timbral and pitch components in this traditional genre, allowing me to listen beyond the superficial impact of the high volume. I was also able to reciprocate

[14] 我的聲音聽起來不太好聽，我想要把這段再唱一次，我可以再錄這幾句唱的嗎? (Original conversation in Mandarin)
[15] 我覺得聲音聽第二次的時候，聽起來沒有那些刺耳，而且我可以清楚聽到所有的聲音，大小聲不會差太多 (Original conversation in Mandarin)

to the ensemble for the earlier training I had received and sustain and grow a relationship between this group and the academy. The musicians gained access to a fresh model of recording and working together on a recording project, one that was less onerous than that they had previously used, and which resulted in a recording that they claimed better represented their artistry to listeners. The ensemble's leader gained a recording produced in a state-of-the-art studio at a university and, most crucially, the opportunity to intervene in the recording and mixing process to ensure that the final product accurately represented the most important characteristics of their tradition.

This exact experience may not be replicated elsewhere. Indeed, specific details relevant to other projects will vary according to the tradition in question, the recording venue, conditions in the field, the present-day repertoire, available recording equipment and the aesthetic preferences relevant to the production in question. For instance, the collaborative production might be intended to allow multi-functional use (e.g., for marketing, creation of a collective memory, further analysis and research or teaching material) or reflect other demands distinct from those my consultants brought forward. Nevertheless, the example still reveals the benefits that can emerge when a researcher is able to work together with musicians in the field through a well-formed collaborative relationship. Until the end of 2023, I have collaborated with them to make six recordings using the same model. Furthermore, Huang shared the recordings with other *beiguan* groups, and two of these groups are now planning similar recording sessions in the same setting for future projects. As we have worked together multiple times, some group members have learned how to set up everything for recording. However, acquiring specific professional skills in manipulating DAW for mixing still needs more time for these group members. In the initial recording project, they had planned to release their CD albums. However, due to the pandemic in 2019, they had to adapt and instead set up channels on YouTube, Facebook, and Instagram to stream their recordings online. Now, all the group members can use their mobile phones to access our collaborative productions and promote themselves at any time. As an ethnomusicologist, I also learn about their aesthetic preferences and musical characteristics in this traditional music genre through this collaborative process.

Beyond these direct benefits for me and my collaborators, the project illustrates how an ethnomusicologist with experience of recording processes can contribute to a field-based

recording project. In the first part of this article, I shared details of the recording strategy I used in the field, including my rationale for the selection and deployment of microphones and other equipment. In the second part, I focused on the how I utilised mixing skills, including setting the parameters for the equaliser, compressor, panning and balance, and how I worked together with two key consultants to finalise the recording. I hope this case study encourages other researchers to engage with this approach, as one possible way of contributing expertise to the needs of the musicians whom we study and thus sustain a socially responsible form of ethnomusicology.

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