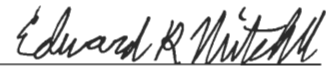
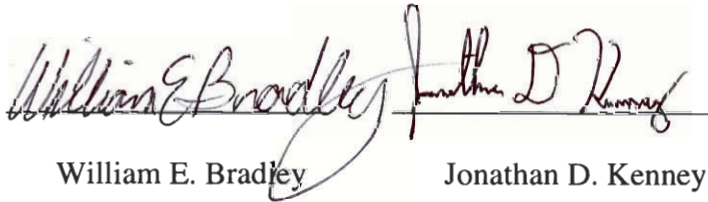


Music Technology Implementation at JoMP

An Interactive Qualifying Project Report
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Abstract

The IQP team produced a list of recommendations for implementation of music technology at JoMP. After extensive research in the areas of audio and video recording technology, educational software, sequencing and composition software, and current music school technology capacities was conducted, the IQP team formulated hardware and software recommendations for implementation of four workstations, three of which were realized, allowing for implementation in stages based upon available finances, and providing a foundation from which grants could be generated.

Table of Contents

Table of Contents	2
Introduction	5
Literature Review	13
Introduction	14
Recording Technologies.....	14
Audio Recording Technology.....	15
Video Recording Technology.....	27
Audio Manipulation Software	33
Sequencers	37
Tone Generators.....	43
Music Education Software	44
Reviews	45
Computer Hardware Upgrades (Current Technologies)	46
All-inclusive PCs	47
Macintosh	47
Universal Computer Hardware	48
Background on Other Music Schools	49
The Wilmington Music School.....	49
The Music and Arts Center for Humanity	52
Methodology.....	55
Introduction	56
Overview	56
Faculty Workstation.....	60
Educational Workstation	65
Listening Station	67
Recording Station.....	74
Conclusions	76
Works Cited.....	78
Works Cited	79
Bibliography	82
Appendices	83
Appendix A.....	84
Appendix B.....	86
Appendix C.....	90
Appendix D.....	93
Appendix E.....	94
Appendix F	102

Introduction

The Joy of Music Program, known as JoMP, is a community music school located at 1 Gorham Street in Worcester, Massachusetts. The JoMP facility is a one-story, U-shaped building set in woody surrounds at the end of a dead-end street. The facility, a former nursing home, is comprised of 33 rooms, including a large recital hall, dance studio, spacious reception area, and many individual lesson rooms. The 17,600 square foot building was purchased as a project in December 2000 for \$600,000. Since then, the building has undergone a complete renovation, converting this location into a first-class music facility.

Wendy Ardizzone originally founded the Joy of Music Program in 1986. Mrs. Ardizzone's vision was to create a medium upon which to introduce preschoolers to a world of music. JoMP's first facility was rented space from the First Unitarian Church on Worcester's Main Street. Though JoMP would remain at this size-restricted location for the next fifteen years, the program itself expanded exponentially. In 1989, Wendy Ardizzone decided, in the best interest of JoMP, to change the school to a non-profit organization. Wendy and her husband Rich Ardizzone have since been the administrators of the JoMP program, helping the program expand and flourish. Now, JoMP offers children, adults, and families opportunities to develop talents and skills in music and dance. On December 27th, 2001 the Joy of Music Program completed its biggest transformation yet: officially moving into the Gorham Street Facility.

The official mission of the Joy of Music Program is to "foster community through accessible music education and performance" (JoMP.org). JoMP offers a wide range and variety of classes for students of all ages. Included in JoMP's offerings are classes in Chamber Music, Chamber Orchestra, Children's Chorus, Intergenerational Chorus,

Classical Instrumental Ensembles, Creative Dance, Modern Dance, Adult Modern Dance, Combination Dance, Afro-Caribbean Teen/Adult Drumming, Children Drumming, Flute Choir, Music Theory, Jazz Ensembles, Movement for Women, Music and Movement Classes, Music and Movement and Recorder Classes, Private Instrumental Lessons, Recorder Classes and Ensembles, and the Worcester Hills Recorder Society.

JoMP's mission is carried out in part through the assistance of the community groups of which it is a member. These groups include the National Guild of Community Schools of the Arts, ArtsWorcester, Worcester Regional Chamber of Commerce, and the Worcester Cultural Collation (JoMP brochure).

The Joy of Music Program last year operated on an annual budget of \$705,523. JoMP's income was comprised of \$485,023 from tuition and fees, \$36,000 in individual contributions, \$7500 from events, \$100,000 from facility operating support, and \$77,000 from foundations and grants from the following: Allegro Micro Systems, Inc., Amateur Chamber Music Players Foundation, Murray & Ethel Abramoff Scholarship Fund, Douglas P. Butler Fund at the GWCF, Fred Harris Daniels Foundation, Fletcher Foundation, George F. and Sybil H. Fuller Foundation, Furumoto Research Foundation, Greater Worcester Community Foundation, David R. and Rosalie A. Grenon Fund at the GWCF, Hart Foundation, Hoche-Scofield Foundation, Landmann Family Fund at the Upper Valley (NH) Community Foundation, Massachusetts Cultural Council, Paul and Fay Rossley Fund at the GWCF, Stoddard Charitable Trust, Tenet Healthcare Foundation, Amos E. & Ann Laura Wasgatt Fund at the GWCF, Worcester Cultural Commission. Expenses, also totaling \$705,523, were comprised of staff, faculty and

fringe benefits of \$477,986, administrative operations of \$36,810, financial aid of \$65,000, program expenses of \$17,000, and occupancy of \$108,727 (JoMP budget sheet).

The Joy of Music program offers scholarships and work-study opportunities for students in need of financial assistance. The Financial Aid and Outreach Program is comprised entirely of generous donations and contributed funds. Funding was sponsored this year by the following contributors:

Amateur Chamber Music Players Foundation

Fletcher Foundation

Fuller Foundation

Greater Worcester Community Foundation

Individual Contributions

JOMPATHON Student Recital

Stoddard Charitable Trust

Worcester Cultural Commission

as well as other local foundations and corporations. \$65,000 was awarded in scholarships to qualified students attending JoMP classes. An additional \$6,000 was awarded in work-study packages to students as well. Through this extraordinary program, many less-fortunate Worcester citizens were able to enjoy a one-of-a-kind music experience they could normally not afford.

All told, the Joy of Music Program is comprised of almost 700 people. JoMP has an annual student body of 550 students. Fifty-five percent of the students live right in Worcester, while the rest commute from a surrounding three-town radius. JoMP employs 35 highly educated and experienced music teachers, each with his/her own specialties.

34 of these instructors have college degrees. JoMP also has four staff members, 11 members of the Board of Directors, and 15 members of the Advisory Board. Annually, JoMP is graced with 75 volunteers who donate their services during school events. These volunteers help with making food, buying wine, setting up and cleaning up, taking money and tickets at the door, helping with the craft fair, and running the snack bar (JoMP website).

The Joy of Music Program ensembles perform for a host of audiences in various regional venues. JoMP's performing ensembles include:

Chamber Orchestra

Jazz Ensembles

Chamber music groups

Afro-Caribbean drumming.

JoMP also hosts in their concert hall various recitals performed by students, faculty, and guest artists. JoMP music ensembles made guest musical performances for First Night Worcester, the Festival of Trees, Worcester Public Schools, and at other various community events.

Instilling music technology throughout its halls is the latest challenge the Joy of Music Program is undertaking. Before the start of this WPI IQP, music technology was quite limited at the Joy of Music program. JoMP did not use any form of music software, and all computer hardware was solely used for administrative and clerical work. JoMP wanted to have available music sequencing, ear-training, skills-training, and notation software to its students and faculty, as well as audio and video recording, mixing, and

editing hardware and software. JoMP entrusted this IQP group to research and install this music technology within its school.

The Joy of Music Program is continually working to better its program. JoMP's ten-year plan includes doubling enrollment at the school, which currently stands at 550 students, or 70 percent of its capacity. JoMP future plans include instilling music technology, expanding the facility, and acoustically re-engineering its rooms for better sound.

To financially meet its vision of improvement, the Joy of Music program started a fundraising drive on September 1, 2000. In just over two years of this campaign, JoMP has already raised \$1.5 million dollars. These donations are broken down into four categories; facility, endowment, operations, and financial aid. \$1,067,074 was donated to improving the facility itself, \$110,478 was given towards funding operational costs, \$92,685 was specified for financial aid, and \$230,100 was prearranged for starting an endowment. Once the endowment reaches its goal, its interest will be divided amongst the other three categories. However, JoMP does not have any money specifically set aside for their new music technology workstations (Ardizzone).

JoMP's vision of music technology led the school to create a Music Technology Resource Team in September 2002. In order to further its goals of instilling music technology, this team was created with two main objectives: to investigate technologies which may benefit JoMP faculty and students; and to find funding for technology so that the technology may be implemented in stages over the next two years. The Resource Team is constructed of volunteers already involved in the JoMP program, including teachers and parents of students, who have knowledge in the field of technology.

Our Music Technology Expansion Study could not have been timed more perfectly. Finding funding for music technology is relatively straightforward, as many grants exist for community music schools, and specific grants may exist for music technology and software. In addition, donations from music software companies or individuals have the potential to occur as well. Obviously, the volunteer-composed Music Technology Resource Team does not have the countless hours of time required to fully research music technology for JoMP. However, our dedicated IQP team was well suited to meet this objective. Richard Ardizzone asked our team to complete a study in music technology such that we could present to the JoMP Music Technology Resource Team answers to the following questions:

Which technologies exist which could benefit JoMP?

How could JoMP best implement those technologies?

What are the actual costs involved?

Can parts of the technologies be phased in and updated?

What is the learning curve for the faculty and students?

Where does JoMP stand in relation to similar community music schools with regards to music education technology?

This last question was of particular importance to the Music Technology Resource Team. If it was discovered that JoMP was far behind other similar music schools with regards to technology, then grants and funding could be accrued easily, as funders would see just how badly JoMP needed to catch up to their peers. Conversely, if it was discovered that JoMP would be leading the pack by instilling new music technology, it would be a great recruitment tool for JoMP to exploit in their promotional

material, and could be used to instill excitement in its current staff and students, stirring up donations from them at the same time.

It was assumed that JoMP would take our research results and IQP recommendations very seriously and begin acting on them immediately, as the implementing of educational technology was a high priority for JoMP. The IQP team felt the weight of this responsibility and understood the impact their project would have on a not-for-profit community music school like JoMP. With clearly defined goals and a mission and vision from JoMP, the IQP team enthusiastically undertook the first stage of the project, which was a thorough investigation of music technologies. Knowing that any recommendations needed to be supported by hard data, thorough research was done, including Internet research, reviewing printed resource material, interviews with industry and education experts, and analysis of industry trends to avoid poor investments. The second stage, implementation, involved physically purchasing and setting up the technology in the JoMP facility. The third stage was to create detailed user manuals for each piece of hardware and software, as well as the constructing of a recommendation “wish-list”, detailing our suggestions for future upgrades. A single, but effective outcome assessment tool also was created to track use of various technology tools by JoMP faculty and students. This device will guide JoMP in all future purchases and investments and could even provide enough hard data to support further grant writing.

Literature Review

Introduction

In discussion with Richard Ardizzone, Associate Director of the Joy of Music Program [JoMP], the group proposed to complement the curriculum at the facility with updated musical education technology in a dynamic, stepwise fashion.

In order to provide dynamic and informed upgrade suggestions for multimedia technology at JoMP, the team researched the following areas, which will be relevant to the technological expansion at the facility: audio and video recording technologies; general music education software; notation and scanning software; audio manipulation software; computer hardware; and technologies at other community music schools similar in size and philosophy to JoMP.

Recording Technologies

Audio and video recording technologies will provide faculty and students with a means to record performances for the purposes of:

- Individual student coaching via immediate feedback, through the playback and analysis of recorded student performances of mock recitals and for technique analysis
- Archiving for the purposes of documenting ensemble growth
- Providing students applying for admission into various organizations (i.e. schools of music, orchestral groups, etc.) with a video sample of their ability
- Production and sale of large-scale concert performances or compilations thereof, as a means of raising revenue for JoMP.
- Providing audio and/or video clips for the JoMP website

The first three of these purposes can easily and inexpensively be realized through the dynamic use of a simple 8 mm camcorder and a television. However, because camcorders use tape to record video and audio, the quality of these sensory elements and speed of navigation within the movie is far from optimal (Delorey).

The team also researched the possibility of implementing a recording workstation, consisting of a computer, web cam, specialized microphones, and software to process the visual and audio data. This option offers a robust upgrade to an 8mm camcorder and television. Working with the digital medium, the potential quality of video and audio significantly improves, and navigation within the movie becomes as quick as two mouse clicks on the screen. This will result in superior immediate feedback and movie production.

The team gathered resources from several different sources. Specifically, these were mostly websites, magazines, interviews with WPI music faculty, and previously written IQP's. For background information, the about.com website proved to be invaluable for providing clear, concise information.

Another valuable website was Consumer Guide.com, the online counterpart of Consumer Guide magazine. The site helped with background as well as suggesting specific models that meet our research needs. This research allowed us to determine the best approach to design a recording workstation.

Audio Recording Technology

Audio Recording technology will be used along with video recording technology to provide immediate feedback, archiving of performances for academic settings such as classrooms and ensembles, and for mass distribution capabilities. (Falco)

One of the most essential elements of a musician's development is feedback (Delorey). Audio recording and playback is the chief method to providing immediate feedback for musicians. With audio recording and playback, musicians are able to hear what they have played and are able to extend their playing capabilities by picking out the parts of their performance that need work. (Delorey)

An additional benefit of having audio recording technology is the ability to archive all future performances occurring at the JoMP facility into a library. Once this library has been established, students, faculty, and staff will be able to analyze and interpret past performances, and apply this knowledge to the betterment of future performances. This will benefit both faculty and students (Falco).

There are many schools of music, summer music camps, and other organizations where musical ability is reviewed prior to admission. Most students looking to gain admission will need a demonstration of their talent. By implementing audio and video recording technology, students will have the option of making a "demo" that they can send in along with their admissions packet. (Falco)

JoMP will also gain financially from the production and sale of performances of its students. Since JoMP is a not-for-profit organization, funding from all possible sources is important to the longevity and continuation of the program (Ardizzone). Using audio and video technologies, additional funds may be generated through the distribution of recorded productions, which have taken place at the JoMP facility. (Falco)

After initially collecting information from magazines, websites, and previously written IQP's, the team felt it necessary to deeply research audio recording technologies.

Recording Devices

There are several formats, or mediums, of audio recording devices that can be used for the purposes of this project. They are reel-to-reel, CD Recording, cassette recording, and direct to disk recording. Each was considered at great length, but two were researched as potential options for implementation at JoMP.

Recording devices make possible the generation of medium for distribution to students. Blank medium is purchased for the purposes of recording and distribution; recording devices are the means for “writing”, or transferring to this medium.

Reel-to-reel Recorders

Reel to reel recorders are costly, outdated, and difficult to maintain, so they will not be considered for the purposes of this project (Musical sampler for JoMP).

Cassette Recorders

The cassette recorder has become a dwindling technology in today’s world. Many manufacturers have stopped offering new models. Other manufacturers, such as cassette pioneer Philips, have started replacing the tape decks in their home systems with CD-R disc recorders (Consumer Guide).

One of the main drawbacks of cassette recorders is tape noise. This shortcoming is the most pronounced when a cassette is created by recording from another cassette. However there are many methods that are used for noise reduction, the most popular of which are designed by Dolby Laboratories (Consumer Guide).

The principle of Dolby Noise reduction is not to remove noise from a recording, but rather to keep it from existing. It works by boosting the high frequencies during recording. When the cassette is played back, the Dolby-Circuit returns the high frequencies to their original level and effectively quiets tape noise. (Dolby Laboratories)

Dolby- B is the original system used for noise reduction. Upon its arrival in 1970, Dolby changed the cassette from an inexpensive medium for recording voice to a viable option for music reproduction (Dolby Laboratories).

Another system introduced shortly after was Dolby-C. It works on similar principles to Dolby-B but offers 20 db of noise reduction as opposed to the 10db offered by Dolby-B. (Dolby Laboratories)

A newer technology introduced in 1990 is Dolby-S. It provides a full 24db of noise reduction in the high frequency ranges and 10 db of low frequency noise reduction. This provides a sound comparable to Compact Discs, but only on playback devices with Dolby-S. (Dolby Laboratories)

Dolby-HX is a technology that was designed to reduce tape saturation, allowing louder recordings to be produced without distortion. It is offered on higher end recorders, and is used by the recording industry for prerecorded tapes. Since there is no encoding being used, there is no playback circuitry required to realize the benefits of Dolby-HX. (Dolby Laboratories)

Reviews

Consumer Guide offers several recommendations for cassette recorders. The first is a single transport (tape slot), deck offered by Sony. The Sony TC- KE500S, reasonably priced at \$299 is a fully featured cassette deck. It offers 3 tape heads, one for recording, one for erasing, and one for playback. This allows for maximum fidelity and tape monitoring while recording. (Consumer Guide)

The Sony cassette deck comes with Dolby-B, Dolby-C, Dolby-S, and manual bias adjustment to achieve some of the best sound available from a cassette tape. Other

features include high speed fast forward and rewind and real time tape counter.

(Consumer Guide)

A double transport system, such as the Pioneer CT-W606DR, offers several recording options not possible on a conventional tape deck. This deck features digital signal processing to allow a cleaner recording. At \$285, the CTW606DR is slightly more expensive than a standard analog unit, but the clearer recording ability is well worth the price. This deck also features Dolby-C, Dolby-B, and Dolby-HX to further increase performance. Other features include headphone outputs, CD syncro start, and full logic control. The latter is a mechanism that stops the tape when the leader is sensed in order to prevent tape damage. (Consumer Guide)

CD Recorders

Since the introduction of Compact Discs (CD's), there has been a demand for recording capability via this medium. CD's produce superior sound quality when compared to cassette tapes. Unlike the analog format of cassettes, there is no sound degradation in copying in this digital medium. There is no noise or hiss and the copy enjoys the same random-access, digitally recorded benefits of the original, such as track searching. (Consumer Guide)

For the purposes of practice among music students, optimal quality and track searching capability is a boon. With higher quality sound production, students can more precisely recognize the individual parts and subtleties of a piece of music. Track searching provides a quick and easy method of navigation through one or several selections on a single medium. Every bit of information stored on a CD is represented by

a specific digital time and track number, so specific locations within the CD can be written down and returned to later for further practice.

Additionally, CD's are currently the most common form of stored audio. Therefore this medium becomes the logical choice for distribution among students wishing to take home recorded performances for their personal listening, study, and practice (Delorey).

There are two basic kinds of recordable Compact Discs: CD-R and CD-RW. CD-R technology first appeared in 1992 as a single-write format for recording digital audio. (Consumer Guide)

There are several attributes of compact recordable discs. A typical CD-R can hold either 74 or 80 minutes of music (650MB and 700MB respectively) in up to 99 tracks. Once a CD-R is written, it cannot be written again. Most CD players can play CD-R discs. For standalone audio CD recorders, a higher grade of CD is required. (Consumer Guide)

Compact Disc Rewritables (CD-RWs) allow the user to write, erase, and rewrite on a disc. The user may write and rewrite audio tracks during initial recording, but once the disc is "finalized", it must be fully erased before it can be written to again. CD-RWs are primarily used for data storage in that they are not compatible with standard CD players. Because of this, CD-RW's would not be of use in this project (Consumer Guide).

Standalone CD Recorder Products

Consumer Guide recommends several models of standalone CD Recorders. The Marantz DR4160, at a MSRP of \$649.99, is touted as an exceptional deal for a CD Recorder. Its special features include a three disc changer in addition to the recording

drive. This allows the user to compile and mix CD tracks from the discs in the changer and burn them. There also inputs to allow the user to record from a variety of sources. One advantage that Consumer Guide notes is the ability to adjust the digital recording level, which allows the user to balance tracks compiled from multiple sources.

(Consumer Guide)

Another recommended recorder is the Pioneer Elite PDR-W37. Consumer Guide rated this machine a best buy, with a MSRP of \$750. Like the DR4160, this recorder also has a three disc changer to accompany it. There is a full complement of features, which include random, repeat and program play modes. The user can then use these features to construct a playlist and burn it to either a CD-R or CD-RW. One noted feature is the keyboard, which allows the user to enter track and album titles in CD-Text format. Other features include fading, sync start, auto-finalize, as well as an abundance of inputs. Supported types include: analog, digital, coaxial, and optical digital. (Consumer Guide)

Recommended as a “budget-buy” by Consumer Guide, the TEAC RW-D250, affordably priced at \$299, warrants some attention. The RW-D250 comes as a dual tray system, with one recording and one playback tray. Its 2x high-speed dub feature allows both CD’s to spin at twice their normal rate. Using this, the recorder can burn an entire 74 minute disc in 37 minutes. The recording level is also adjustable, for smoother recording. Playback features include shuffle mode and a programmable playlist mode. The RWD250 also has optical and coaxial digital inputs for recording from an external source and outputs for recording (Consumer Guide).

In addition to stand-alone CD recorders, there are computer-based CD-recorders. These devices look and act like regular CD-ROM drives, but record onto CD’s as well.

(about.com) Typically cheaper and more flexible than standalone units, these CD-ROM drives are another viable option for CD recording, and will be explored later in this paper.

Direct-to-Disk Recording

Direct-to-disk recording, for our purposes, is the process through which sound is recorded and stored digitally onto a hard disk drive in a computer. This process requires the implementation of a microphone, computer, a means to input data into the computer (i.e. PCI cards, IDE drives), as well as recording and mixing software(Bianchi).

The SoundBlaster Live! Platinum is an IDE drive that allows for two channels of audio to be recorded simultaneously. The Live! Drive, which installs into a typical 5 1/4" drive bay, places all the audio inputs within easy access. This eliminates having to reach around behind the machine to connect inputs, which is what is necessary when dealing with most PCI cards. This card also employs something known as sound fonts, which are samples which can be downloaded from the internet, and are recordings of most every sound imaginable (Music Gear Review). Sound fonts work hand in hand with software sequencers, which will be mentioned later.

Microphones

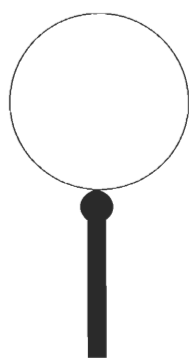
Microphones are one of the most vital components in recording live sound. They are the first step in the signal chain and thus, for quality recording, a proper microphone must be chosen. (Musical Sampler for JoMP, 7)

There are two main types of microphones, dynamic and condenser. Both types have a thin membrane called the diaphragm, which translates physical vibrations into electronic signals using a transducer. A dynamic microphone requires no auxiliary power to operate whereas a condenser microphone requires either batteries or phantom power to

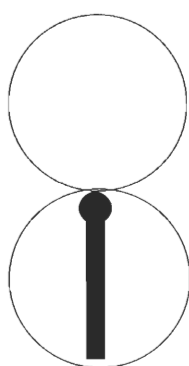
operate. Phantom power is power sent through the transmission lines to power the internal electronics of the microphone (Musical Sampler for JoMP, 7)

There are several types of pickup patterns with microphones. The pickup pattern is the three dimensional area of sound to which the microphone is sensitive. The standard pickup patterns are omni-directional, unidirectional, bi-directional, and cardioid.

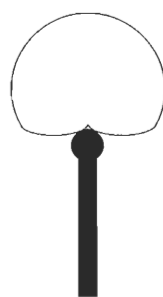
(Musical Sampler for JoMP)



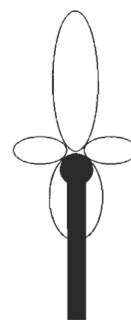
Unidirectional



Omnidirectional



Cardioid



Shotgun

Omnidirectional microphones are commonly used to record ambient sound. The pickup pattern, as depicted in the above figure is on all sides of the microphone, including behind it. This makes these microphones a logical choice for recording in situations where ambience and reverb are desirable, such as orchestral, choral, and chamber settings. However this pickup pattern makes these microphones a poor choice for proximity recording, due to the lack of a clear, focused sound (Musical sampler for JoMP, 8).

Unidirectional microphones are designed to focus on a single direction or sound source. The term “unidirectional” also refers to very tightly focused pickup patterns,

such as a shotgun microphone. These microphones are commonly used for interviewing and picking up point sounds. (Musical sampler for JoMP, 9).

Bi-directional microphones are another type of special purpose microphone. These microphones were developed with 2 spherical pickup patterns, either in front of and behind the microphone, or on the sides. Originally developed with duet vocals in mind, this microphone can also be used in some stereo recording placements. (Musical sampler for JoMP, 9).

Cardioid microphones are generally the most popular microphones. These microphones have a heart shaped pickup pattern. As shown in the previous diagram, this causes an effective canceling of sound behind the microphone, which allows for a reduction in ambient sound. The tone of these microphones is governed by the cardioid proximity effect. As the source gets closer to the microphone, bass response is increased, and conversely, recording from afar produces a high treble tone. (Musical Sampler for JoMP)

For the type of situation in which JoMP intends to record, John Delorey has suggested that either a pair of cardioid condenser microphones should be used, or a single microphone capable of recording in stereo (Delorey).

Mixers

A mixing console, commonly referred to as a “board”, “desk,” or “mixer”, is an audio control panel that consists of several identical modules, running parallel to one another. Individual inputs from various sources are connected to these modules. Each module can be separately manipulated to adjust tone, volume and stereophonic balance.

The typical controls on a module are gain trim, auxiliary output, equalization of output, left and right channel panning, and fade. Also, there are a set of these controls which affect the final stereo output channel. (Music Gear Review)

Gain trim is used to regulate the input signal from each microphone to the desired output level. Pan is used to control the level of the input in the left and right output channel. The fader is a slider or knob based volume control, which has the ability to bypass line output. Equalization, also known as tone control, is intentionally changing the amplitude response of specific frequency ranges, known as bands. The number of bands differs depending on the model (Music Gear Review).

Outboard Mixing Consoles

Outboard mixing consoles vary greatly in price and features. Since this is not intended to be a professional recording studio, some of the more inexpensive models will be reviewed.

Reviews

A simple six track mixer is the M-Audio MultiMixer 6. It features six 1/4" input jacks and a one 1/4" output jack. Also included are master left and right channel level controls. The \$99.95 price tag demonstrates that this is an inexpensive option, and may be used for the most basic setups (M-Audio).

For only \$20 more, one could upgrade to the MultiMixer10. It features 6 channels with pan and volume control, as well as 4 unity channels with no gain or pan. These channels are designed for sources that can be controlled directly, such as other playback devices. An interesting feature is the inclusion of 1/8" input and output, which is designed for hookup to a sound card. (M-Audio)

At \$249.95 the MiXiM 10, also by M-Audio, is a fully featured mixing board in a compact package. It features 4 mono inputs, 2 stereo inputs, as well as two more mono inputs with unity gain (M-Audio).

Phantom power is also supported with this mixer, and the first two inputs can be switched between XLR input and 1/4" jack input. XLR inputs are a type of microphone input that offers a higher quality sound reproduction with less signal noise. All channels also feature gain, pan and a 3-band equalizer.

Software

Mixing using software is a practical option that is vastly more cost effective than outboard mixers. Most sequencing packages, which will be discussed later, have a plethora of features that make them versatile as well as inexpensive.

In order to process the sound coming into the computer, a sound input card, discussed previously, is needed. This card functions along with software components to create a complete mixing package. (Bianchi)

Effects

Effects are when sound is processed to simulate audio tendencies. These can be applied to reintroduce to some extent sonic elements that have been lost in the recording process. In an interview with Delorey, the professor recommended that the only effects necessary for this project will be reverb and compression (Delorey).

Reverb is when a signal is electronically delayed slightly and is then overlaid with the original signal. This process simulates the effect of reflected sound. Reverb is supported in most all software sequencers and other editing software.

A compressor is a variable gain device, which attempts to smooth out the dynamic range of a signal. In this environment, compression will be primarily used to prevent clipping if a signal becomes too high.

Conclusions

After extensive research on several feasible options for audio recording, the team felt the most promising of these was a computer-based option that uses condenser microphones and the direct-to-disk recording method. This would allow for easy and inexpensive production of quality recordings.

Video Recording Technology

The benefits of video recording technology are closely related with those of audio recording technology, as discussed in the previous section. Video recording technology is used to augment the specific advantages of audio recording technology discussed previously, by adding an additional visual element to the sound.

For example, video recording technology increases learning capability with regards to feedback. It allows a student to get a sense of how they perform, and how they handle themselves on stage. Falco suggests that students will also be able to record individual performances in order to analyze fingerings and other musical techniques related to playing the instrument. Delorey feels that immediate feedback could be a useful tool in these types of musical performance training.

With regards to purposes of recording such as archiving, distribution, production and sale, the finished product becomes more complete and desirable, as JoMP has recorded not only the music of the performance, but the visual production as well.

Video Cameras

Video cameras are the means by which video data is captured, so that it may be stored for future playback.

There are two basic types of camcorders, analog and digital. An analog camcorder takes samples of video information and records them onto video tape as a continuous track of magnetic patterns (about.com). A digital camcorder takes the analog information, and, rather than storing it magnetically, translates it into bytes of data to be stored on the camcorder itself or a computer (about.com).

The audio on most affordable camcorders is not appropriate for JoMP's needs, as sound is most important and there are few reasonably priced cameras that have high quality audio recording capabilities built-in. The most effective option would be to use existing audio recording equipment, as previously discussed.

Analog Recorders

There are 5 categories of Analog Recorders: 8mm; Hi-8; VHS; VHSC; and SVHS-C. Each has its advantages and disadvantages; some are more relevant to the creation of a recording workstation at JoMP.

The 8mm format has been a staple in hand-held camcorders since its introduction. Before digital camcorders appeared on the market, this format was the most compact and sharpest format available. 8mm tapes typically hold about 2 hours of video and have a resolution of about 240 horizontal lines. These camcorders are small and can be operated with one hand. To view or re-record to VHS, one simply has to attach the camera to a TV to view, or to a VCR to record (about.com).

Hi-8 is an offshoot of the 8mm recording format. This format offers the sharpest picture available without using a digital camera, with resolutions between 400-440 lines.

To obtain playback at these resolutions, one needs to have a TV Setup with S-Video inputs. Other than that, the playback setup is the same as 8mm (about.com).

VHS is the standard video cassette format that most VCR players accept. The resolution average is about 200 lines. Most VHS camcorders are comparably larger than their 8mm counterparts, as the VHS medium is large itself. The sole advantage of the format is that the recorded tapes can be directly played back in the VCR (about.com). However, for JoMP students, a standardized format such as VHS may be the only viable video recording solution, as the format can easily be played in most home VCR's (about.com).

VHS-C is a compact version of the VHS cassette. At an average of 30 minutes of playback per cassette, these units are designed for recording shorter events. Playback requires that the smaller cassette tape be placed in an adapter that is playable in a standard VHS player.

SVHS-C is related to VHS-C as Hi-8 is to 8mm in that it offers an analogous gain in quality. With similar resolutions to Hi-8, this format will produce some of the best quality video found in analog recording. For playback, the use of an adapter is required, as in the same manner of VHS-C.

Since simplicity was a concern stressed by both Delorey and Bianchi, the IQP team chose to review only VHS camcorders, as this will be the simplest method for distribution and playback at the JoMP facility as well as in home VCRs.

Reviews

The RCA CC4352 AutoShot camera is one of the few remaining VHS cameras available on the market. This indicates that this is a dwindling technology and may be

soon obsolete. Outdated technology is harder to get repaired. At \$449, its cost is rather prohibitive and offers few upgrade options. Useful features include a 3" LCD Screen to make filming easier, a 72x zoom, and automatic exposure control.

Digital Video

There are three types of digital video recording formats: Mini-DV; Digital8; and DVD.

Mini-DV is the most commonplace of the digital video formats. Its small size and 500 line resolution make it a versatile camera suitable for most needs. The cassette needed is 1/12 the size of a VHS cassette and holds as much video, at more than twice the resolution (about.com)

Digital8 exists as a format for customers who wish to upgrade to digital recording, but already have 8mm tapes. Features are similar to the Mini-DV format with one notable exception. The Digital8 camcorder has the ability to play old 8mm and Hi-8 tapes. It uses 8mm tapes but records at twice the resolution, with half the recording time.

DVD camcorders are a relatively new product to hit the market. The format uses the popular Digital Versatile Disc (DVD) format. Using a non-tape medium allows for random access viewing, which is not possible through the use of tape-based recorders. Recording media ranges from \$0.35-\$1.60 apiece, depending on quantity purchased (Pricewatch.com).

Desktop Cameras

A desktop camera is a small digital camera designed to work with a computer. Because the actual recording requires computer software, and there is no recording

mechanism on the camera itself, these cameras can produce a quality image fairly inexpensively. There are several features that define the quality of the camera.

One factor to consider is frame rate. The higher the frame rate, the smoother the picture will appear. Frame rate is typically affected by two factors. The first is the quality of the camera itself, and the second is the method in which it is connected to the computer. If the connection method is slow, then there is a bottleneck effect, which reduces frame rate (Consumer Guide).

Another factor to consider is resolution. Digital pictures and movies are composed of a matrix of square dots of color. A single dot in an image is called a pixel. Typical resolutions are 320x240 pixels to 640x480 pixels. Again, if the connection method is slower, then resolution will suffer in addition to frame rate (Consumer Guide).

Since the type of connection affects both aspects of picture quality, the team felt it to be worth elaborating on the differences. Connection method varies between cameras, and often some cameras are identical in aspects excluding this method.

The Universal Serial Bus (USB) is a connection protocol designed to allow easy connection of peripherals to a computer. It offers a transfer rate of up to 12MB/sec, which is fast enough to allow smooth video. It is easy to use, and therefore makes it a good choice for those with limited technical ability (Consumer Guide)

A parallel port is a 25-pin port located on the back of most computers. It is designed for high bandwidth applications, which makes it good for streaming video. It is slightly harder to work with than USB, though is not exceedingly difficult (about.com).

Firewire is the Apple Computer name for IEEE 1394 Serial bus. Through this bus, up to 63 devices can be connected and it has an amazing transfer speed of up to 400Mbps. (Apple.com) This makes this a great connection protocol for video. The downside is that most PC's currently do not come with Firewire connectivity. This means that a separate card must be installed and configured in order to utilize the technology. However once this has been accomplished, its ease of use is similar to USB.

Reviews

A desktop camera that meets the recording needs of JoMP is the Philips Vesta Pro Scan PCVC690K. It offers a 640x480 resolution at up to 30 frames per second. This is enough to provide smooth video at television-quality resolution. It also offers a built-in microphone and USB Connectivity. This makes the camera a great value at \$99, which is significantly cheaper than digital camcorders.(Philips.com)

Another camera we researched is the Orange Micro iBot. At an average market price of around \$85, this firewire camera offers a 640x480 resolution at more than 30 frames per second. This is exceptional speed which yields a smoother picture than what is possible from USB-based cameras such as the VestaPro. This camera seems an excellent choice for its price, with a nice combination of features and affordability (Orange Micro).

Audio for Video

There are two ways to approach the recording of an audio track onto video. Options include a separate audio setup, or the audio setup proposed previously could be tied in with the use of a camcorder(Delorey)

If audio recording were done on the computer, all that would be required would be a program that would accept different audio and video inputs. This is a common feature in most video editing software(Bianchi).

Another approach taken could be to establish separate audio hardware for the video setup. Since there is onboard hardware that already handles audio, this option only becomes an unnecessary expense(Delorey).

Conclusions

There are several workable options available to suit the needs of the JoMP with regards to video recording technology. Delorey suggests that the most inexpensive method may be the best. On the most basic level, any camcorder could meet the desired goals. However, in terms of quality with regards to price, the most cost effective option seems to be located within the Desktop Camera market, as quality video can be achieved at a fraction of the cost of standalone camcorders (Delorey).

Audio Manipulation Software

Computers can simplify the task of many musicians. Providing a simple interface to work with the elements of music, there is software available on the market for virtually any musical purpose. Expert and novice musicians alike can benefit from the advantages made available through the use of software. Music software can save time and effort in creation, organization, and modification of a musical work.

There are many kinds of audio manipulation software on the market today. For the purposes of this project, we researched two types of audio manipulation software: MIDI format accompaniment generators such as Band-in-a-Box, and software sequencers

such as Cakewalk. The team researched many books, magazines, and internet web sites, and conducted interviews with professionals in the field in order to establish which software would be the most beneficial for JoMP.

Band-in-a-Box is a means of inputting chord and tempo changes so that they may be played via the MIDI format in a given musical style. Because of the precise timing of the MIDI format, this software provides flawless MIDI format accompaniment for students. Using CD burning software, musicians are able to make CD's containing this musical accompaniment for play-along practice purposes. Accompaniment generated by Band-in-a-box can be exported and saved as a MIDI file for the purposes of listening or further manipulation (PG Music).

Software sequencers such as Cakewalk, Logic, and Digital Performer are designed to record, play, and manipulate MIDI as well as digital audio data. This software works hand-in-hand with audio and video recording technologies as well as notation software to provide general recording / playback capabilities and additional control over MIDI files (Bianchi).

Whereas a MIDI player will simply play the song, sequencing software displays the piece with all instruments' parts listed as tracks or in traditional notation staff format. The user is able to then mute or delete individual instruments, and manipulate the components of the piece in countless other ways (Twelve Tone Systems).

Bianchi suggests that using sequencing and notation software along with recording and playback features during music lessons, boundless educational implementations become available for both students and faculty. Students may record themselves directly onto the computer, with a computer generated accompaniment that is

perfectly timed and in tune. From here, students may then play back their performance along with the rest of the instruments in the piece, minus the one part they play (Bianchi).

Alternatively, students will have the option of muting out all of the other instruments in the piece except for the one they play, so that they can listen to the part, while simultaneously viewing the staff notation of the part. Tempos are easily changed to meet the needs of developing students. As the music plays, guidelines follow and highlight the notes of the piece in real time. This enables students to achieve total interactivity with the music, audibly and visually. Students will have virtual personal accompaniment for every piece they study (Bianchi).

Notation software becomes important for advanced students and faculty who wish to compose music. Through an intuitive interface, users of notation software are able to manipulate various elements of written music including note placement and duration, time signature, dynamics, and most any other notational marking. Additionally, most notational software allows the user to listen to what they have written through the speakers or headphones connected to the computer. This serves as a mode of immediate feedback for the composer, so that he or she may make changes to the instrumentation, notation, or any other musical element. With the connection of a printer to the computer, scores that are written or changed in the notational software may be printed out for distribution among students (Bianchi).

Music scanning software is closely linked with notation software. It provides a means for scanning scores into the computer so that they may be manipulated within the notation software. The modified scores can then be printed and distributed or converted

into a Musical Instrument Digital Interface [MIDI] format for listening by the students (Falco).

As Jeff Bowen (1994) affirms, “Visionary music education teachers are incorporating music teaching labs into their school music programs—not to eliminate the interest in “live” instrumental and vocal performance, but rather to stimulate interest in music in general,” (p. 5). Bowen (1994) emphasizes computers can help musicians to create and modify music, as well as teach the traditional concepts of music theory (p. 5).

The MIDI [Musical Instrument Digital Interface] format, released in 1983, is a protocol used to transmit and store data: musical and otherwise. MIDI has had a profound effect on the music industry, as manufacturers of music equipment, computers, and software have agreed and continue to use this format as the universal means for musical data communication. Originally stemming from keyboard-based electronic synthesizers, MIDI ‘programming’ has worked its way onto IBM-compatible and Macintosh computers (Rothstein, 1992).

MIDI recording, or ‘programming’, differs from ‘live’ audio recording, via cassette or compact disc, in that it uses a sequence of numbers to represent musical tones, instrumentation, pan, intonation, timing, volume, and effects. MIDI recording and storage allows for manipulation of these elements of music through the use of a sequencer (Young, 1996).

In order to hear the musical data that has been created or modified by the sequencer, the MIDI setup must have a tone generator and speakers. The sequencer connects to the tone generator, where the MIDI data is then translated into an analog or digital signal. Speakers take the analog or digital signal from the tone generator to

produce audible sound. Incorporation of a computer into the MIDI setup classifies it as a MIDI workstation (Young, 1996).

For input purposes, the most common MIDI input is a keyboard, although adaptations for other MIDI-based musical instruments have been developed. (Bowen, 1994).

Sequencers

Using a sequencer, one is able to record and manipulate MIDI data, and through this, learn traditional music theory concepts (Bowen, 1994).

There are two types of sequencers: software and hardware. Both types of sequencers serve the same basic function as MIDI recorders, editors, and players. However, for the purposes of this project, hardware sequencers will not be necessary (Young, 1996).

Software Sequencers

Current software sequencers are the standard and preferred system for musical data recording. Young (1996) claims that the pattern-based software sequencer provides an “intuitive graphic portrayal of [musical] patterns” through the use of a computer display (p. 12). Once musical data is recorded, graphical blocks are displayed on the monitor to represent MIDI data corresponding to each individual recording track. This type of display is the major advantage of software sequencing. The functionality of the software sequencer is chiefly evident in its connection to a computer. From the large graphical display, one is able to immediately ascertain which instruments are playing, and can then mute, solo, delete, move, and manipulate instrument parts. In addition, software sequencers are designed for the musician, so learning the program for the purposes of this project is simple for anyone with musical training (Young, 1996).

A software sequencer is the technological element that will most greatly benefit the students and faculty at JoMP. Major software sequencer manufacturers, in response to public demand, have incorporated many extra features in their software, including the capability to utilize direct-to-disk audio and video recording technologies. This provides the comfort of an all-inclusive software package designed for user-friendly functionality in every aspect of immediate feedback (Bianchi).

Additionally, most software sequencers only require about 200 MHz of processing power and 64 MB of RAM. With respect to JoMP, these specifications are met by those computers dedicated to this project (<http://www.techtv.com/audiofile/musictech/story/0,23008,3358711,00.html>).

Although there are shareware versions of software sequencers available for download, commercial manufacturers have more firmly established compatibility and user support. Since the technological comprehension and general understanding of computers for the faculty at JoMP has not yet been developed, compatibility and technical support become major concerns. Taking these variables into consideration, the team has chosen not to investigate shareware sequencing software, but rather to research only reputable sequencing software which has been established commercially. Major manufacturers of sequencing software include: Twelve Tone Systems, Steinberg, Emagic, Voyetra, Opcode, Musicator, Mark of the Unicorn, Midisoft, G-Vox, and PG Music. Each manufacturer generally offers a line of sequencers, which most often corresponds with differing price ranges (Bianchi).

From these manufacturers, Professor Frederick Bianchi (date), a music technology specialist, recommended that the team investigate the following: Twelve

Tone Systems, Mark of the Unicorn, and PG Music. These companies make full-functioning software sequencers with integrated direct-to-disk audio recording technology (Bianchi).

Below is a screenshot from Cakewalk Music Creator 2003, a software sequencer, which looks and functions similarly to most other software sequencers.

(Cakewalk HomePage).

Twelve Tone Systems' flagship software package is Sonar 2.1. Building upon the features included in Home Studio, Sonar offers a variety of extra features to music schools, including:

Multiple input / output support for advanced audio recording

Additional audio effects, timbres, and MIDI effects

Advanced MIDI and audio editing tools for high school and college students

A guitar fret-board view for those students wishing to view music in tablature form (Cakewalk HomePage).

Hardware Sequencers

The hardware sequencer contrasts its software-based rival in that it does not require or utilize a computer in its functionality. It is a standalone box that contains a built-in (generally small) display monitor, a button configuration, as well as its own ports, knobs, and disk-drive for data storage. Young (1996) points out that the hardware sequencer is less complicated, and more portable, although it is restricted in its data processing and storage abilities. Generally, a hardware sequencer will cost a bit more than a software sequencer (p. 9). Hardware sequencers are usually limited to eight mixable tracks (Young, 1996).

Young (1996) claims that, because of these restrictions, the hardware sequencer is less complicated and "often easier to use". However, its display size limits interactivity (p. 9-15). As a result, hardware sequencers are used almost exclusively for recording live performances of experienced musicians, and as a temporary MIDI data storage space.

Because of these specifications, the IQP team did not find it necessary to evaluate hardware sequencers as a valid option for the JoMP project (Young, 1996).

Tone Generators

Tone generators take MIDI data and supply it with different timbres in order to create distinguishable sounds. Tone generators include self-contained sound modules as well as sound cards for use with the computer. Most soundcards can function as a basic tone generators.

Sound Modules

For the purpose of this project, a self-contained sound module adds unwarranted complexity to the workstation, and provides little advantage over its computer-based competitors. The team did not find it necessary to evaluate self-contained sound modules.

Sound Cards

A sound card is a piece of hardware in a personal computer that processes sound data and translates it to an analog or digital signal to which speakers react.

Aside from processing all sound data that is heard from computers, sound cards are at the heart of the music technology workstation. A sound card acts as a translator between synthesized sounds produced by software sequencers and the speakers.

MIDI Keyboards

For compositional purposes, Bianchi strongly recommends that a keyboard is incorporated into the MIDI workstation. It provides simplistic input that is paralleled in most sequencing software.

Music Education Software

Music education software will assist beginner to advanced students in learning such elements of music as pitch recognition, melody, harmony, rhythm, and notation. This software will reinforce the faculty pedagogy through fun and interactive exercises and additional practice. Bianchi states that while most music education software is “relatively the same”, the educational software should contain the elements of ear, rhythm, skills, and notation training (Bianchi).

In a buying guide on the basics of children’s educational software, found on the Consumer Guide website, it is suggested that the software purchased for children should include a “mix of entertainment and challenge to encourage exploration and develop confidence and skill”. The Guide also suggests that software be purchased that “fits the child’s learning style”. Since there are many children studying at JoMP, there can be no individual learning style focus, and software selection became more difficult. One precaution the buying guide had was not to buy bargain software. This software is often designed for use on older systems and may not work on newer computers (Consumer Guide).

One possible approach to selecting software for JoMP was recommended within the same Consumer Guide article. The Guide states that many companies have demo versions of their software available on their respective web sites. The buying guide suggests testing individual software packages in order to decide which software is most appropriate for a specific academic environment (Consumer Guide).

The team scoured the internet, and through the search for various music education demo programs available on the internet, the team found several references to the acclaimed Music Ace, and its sequel, Music Ace 2. Additionally, Falco suggested the ear

and rhythm training software, Ear Power. The team promptly researched and reviewed these two programs.

Reviews

Music Ace

Music Ace is a series of music education software packages designed to teach children the fundamentals of music. Currently, Music Ace and Music Ace 2 are the only software pieces in the series. These programs feature colorful singing notes on a staff and a seasoned animated instructor who speaks to the student playing the game (Harmonic Vision).

Southtown Daily states that Music Ace lives up to their advertised slogan, “Makes Learning Music Fun!”. The periodical states that the extras, such as the Music Doodle Pad (a place for children to experiment with notation and hear it played back instantly), as well as their “whiz-bang graphics and super sound” make this software stand above the rest (Harmonic Vision).

David L. Dixon, writer for the Tennessee Musician, the journal of the Tennessee Music Educators Association, calls the program “charming, captivating, and effective”. Dixon states that the program combines clever animations such as the staff stretching and bouncing, the maestro dancing and sliding across the screen, and the note heads singing is “impressive programming”. Dixon writes that the twenty four “carefully planned” lessons included in Music Ace introduce “the basics of music theory”. He gives Music Ace his highest recommendation (<http://www.gresham-ms.knox.k12.tn.us/ma.html>).

Music Ace has received numerous awards and honors from several publishers, including Macworld, Family PC, PC/Computing Magazine, and Homeschool PC.

Additionally, it received the 1996 Parent's Choice Gold Award from the Parents' Choice Foundation.

Ear Power

Ear Power is a ear and rhythm training software that was recommended by Falco to accommodate the older students at JoMP. The software helps anyone, from the rank beginner to the professional musician. The program includes an “intuitive interface and useful training”, as well as voice pitch recognition, MIDI instrument compatibility, as well as a “simple but efficient system for learning the notes on piano or guitar” (EarPower.com).

A representative of CNET states that, “Whether you're tone deaf or musically oriented, you might stand to benefit from this program, which teaches voice pitch recognition and how to recognize basic chords on your PC (CNET).

The software was nominated as “The Program of the Month” by the German Magazine *Keys*.

Computer Hardware Upgrades (Current Technologies)

Computer hardware that accomplishes the tasks of the software is integral to the project's success. However, researching every possible distributor of each part of the computer is not only impossible in the time period available for the project, it is also unnecessary. Although this project relied mostly on donated and stored computer hardware, the team researched computer system distributors such as Dell, Compaq, and Gateway so that JoMP may be informed in their future decisions when the administration of the facility decides to upgrade the computers.

All-inclusive PCs

Any new mini-tower computer will serve the music technology purposes at the JoMP facility. The specifications for the software used do not require even the processing capabilities of the lowest available modern models.

Additionally, Bianchi recommends that the purchase of the least expensive brand-name PC is usually available online, and may be the best option for JoMP.

Macintosh

The Apple Macintosh computer, first introduced in 1984, is a system that has several notable advantages over Windows based machines. Most current Macintosh systems use OS X which is based on the UNIX kernel (MacWorld).

The first advantage that Macintosh has is that the system hardware and the operating system are fully and exclusively compatible, since the same company produces both. Apple is also known for having quality hardware (Bianchi).

Another advantage is that Macintosh is the standard in recording studios (Delorey). This means that the best recording software available will be designed with the Mac OS in mind. Since software is designed with the specifications and features of Macintosh in mind, the Macintosh version will commonly be more robust than it's PC counterpart (MacWorld).

The onboard video and audio on Macintosh are of high enough quality to achieve a quality product (albeit on limited channels) without the addition of a sound card and a video card (Recording Musician).

Full Systems

For \$949 for a system with a CD-ROM to \$1399 for a system with a DVD-Burner, The eMac is a system that can handle all JoMP music technology needs at an affordable cost (Apple Website).

It comes standard with a GeForce2 Video Card, 2 USB and 5 FireWire ports, as well as a 700Mhz PowerPC processor. This covers many of the features required for a JoMP audio /video workstation, without add-ons. With Mac OS X, the system would be extremely reliable, and is extremely user-friendly. The bundled software provides the tools necessary for processing video, to alleviate yet another cost. The downfall to this machine is that any add-ons would have to be external, due to it's lack of expandability (Apple Website).

For a more expandable option, the researched the Power Mac G4. The Entry Level option (\$1199, more for faster Models), provides enough power to handle JoMP's multimedia requirements. This model is somewhat more powerful than the eMac and has several PCI Slots and an additional 5 1/4" drive bay in front. This allows users to install any other peripherals with minimal hassle. The software package is similar to the eMac, with some education software. Apple also has discounts available for educational institution customers, which would be worth exploring (Apple Website).

Universal Computer Hardware

PCI Cards

There are a plethora of different types of PCI cards. For the purposes of this project, what was needed and what was researched were components that connect to the

computer via the Firewire format. This format requires a PCI card that plugs into the back of the computer.

Sound Cards

Most sound cards can handle processing the type and quantity of sound data that will be required for this project. The SoundBlaster Live! Platinum, as mentioned previously, is the best choice for this project, but most any sound card will work.

Background on Other Music Schools

In this section, other music schools with characteristics similar to the Joy of Music Program are reviewed. These schools were used as references for helping the IQP team make decisions in the area of music technology and potential growth areas for JoMP.

The Wilmington Music School

Founded in 1924, The Wilmington Music School [WMS] is the Wilmington, Delaware area's primary local resource for music education. The Wilmington Music School provides music instruction and programs for people of all ages and levels of ability including private instrumental and vocal instruction, introductory and supplemental music classes and ensembles, public performances and performance opportunities for students, faculty and special guests.

The history of WMS is long and storied. When WMS opened in 1924, enrolling 70 students, the goal was to provide high quality music education to students of all economic backgrounds. During the first years of the school, the WMS Orchestra and the S. Coleridge Taylor Choral Society were begun. In 1928, Musicianship classes and an

introductory music program for very young children were added. Community support helped the school subsist during the country's worst economic depression. Generous faculty musicians, including the Curtis String Quartet, donated their talents for special events. In 1929, the school's orchestra merged with another to become the Wilmington Symphony Orchestra, predecessor to the Delaware Symphony Orchestra. Postwar enrollment jumped to 200 (following a wartime dip). Then, a renovation created the school's first concert hall.

By 1946, the WMS Board voted unanimously to accept students "regardless of race, color, or creed." During the 1950's, Merit scholarships were added to the already-established financial aid awards. In 1959, WMS moved to its present location at Washington Street and Lea Boulevard.

Then, as Jazz and Suzuki Violin instruction began in the 1960's, enrollment reached 900. During the 1980's, a "Conservatory Division" was established for the most serious students, with an alternate "General Studies Division" for those wishing a less rigorous course of study. Also, a program aimed at reaching and serving the elder population of Wilmington was established with help from the Delaware Foundation. Further, the WMS faculty initiated the Early Childhood curricula that later become known nationally as Kindermusik™.

In 1997, renovations to the facility were completed, including a digital piano lab, large ensemble room, two early childhood rooms, nine new teaching studios, a large atrium lounge, and a courtyard. Enrollment reached its highest point in the history of the school, topping 2200 by the year 2001. The school rededicated itself to quality instruction, diverse offerings, and outreach by bringing back its Jazz Band, renewing its

Certificate Program, adding Steel Drums and forming numerous partnerships with other community organizations.

It is the mission of WMS to serve the people of Wilmington and surrounding areas by employing a dedicated faculty of expert artists and educators, a competent and conscientious staff, and by ensuring that its facilities are well equipped and maintained. WMS strives to encourage public participation by: 1) providing instruction that can serve as a foundation for many types of musical expression; 2) embracing opportunities for partnership and outreach in keeping with the mission of the school; and 3) administering a financial assistance program that recognizes and responds both to financial need and to special merit.

The Wilmington Music School is dedicated to maintaining and advancing its role as a premier regional resource for music education. The Wilmington Music School is a member of the National Guild of Community Schools of the Arts. This school is authorized under federal law to enroll non-immigrant alien students. The Wilmington Music School is a nonprofit organization and its admission and scholarship policies encourage motivated students regardless of age, race, creed, gender, national origin, or disability. WMS employs 82 highly skilled music professionals who have dedicated their lives to the world of music.

Funding for The Wilmington Music School is derived from a combination of sources including tuition revenue, individual and corporate contributions, and state and federal grants. Contributions help ensure that tuition rates can remain moderate at the same time that the commitment to quality remains strong. WMS is a 501 (c) (3) tax-exempt organization, and donations to the school are tax deductible.

Programs of The Wilmington Music School are made possible, in part, by the National Endowment for the Arts, Chamber Music America, and the Delaware Division of the Arts, a state agency committed to promoting and supporting the arts in Delaware. The Delaware Division of the Arts provides technical and financial assistance to artists and arts programs and serves as a clearinghouse of information on the arts (Wilmington Music website).

The Music and Arts Center for Humanity

The Music and Arts Center for Humanity [MACH] is a continually growing and expanding music school located in Bridgeport, CT. Formerly known as the Music and Arts Center for the Handicapped, MACH changed their name in order to express its broadening range of programs. At the Music and Arts Center for Humanity, they believe in the power of art to shape and change the world. Creativity is a method of sharing and communicating and the universal language of the arts allows everyone to articulate both common and diverse human experiences. It is through the arts that people learn tolerance and understanding and begin to take an active role in their communities (musicandartscenter.org).

The Music and Arts Center for Humanity is a not-for-profit community school of the arts. The mission of MACH is to enrich the lives of children and adults with special needs through active participation in arts in education programs and services. Established in 1977 by Patricia P. Hart, it became the first music school for the blind in Connecticut. Since that time, MACH has expanded its services in a variety of visual arts, performing arts, design and media arts. The offices are located on the campus of the University of Bridgeport in Breul Hall - Room 107, 600 University Avenue, Bridgeport, CT.

In an atmosphere of spontaneity and creativity, MACH offers instruction visual art, music, dance, theater and creative communication, and various computer technologies. Students learn to create with their hands, move with their bodies, sing with their voices, and listen with their ears and in the process, learn to imagine with their minds and express themselves with their hearts (musicandartscenter.org).

“During the past quarter century, literally thousands of school-based programs have demonstrated beyond question that the arts can not only bring coherence to our fragmented academic world, but through the arts, students’ performance in other academic disciplines can be enhanced as well,” said Ernest L. Boyer, president of the Carnegie Foundation of the Advancement of Teaching (musicandartscenter.org).

The primary goal of the Music and Arts Center for Humanity is to deliver life-enhancement skills through an arts curriculum. MACH offers the finest visual and performing arts programs in order to serve the needs of their entire community. MACH also gives the community an opportunity to take an active role in the creative process by participating in the diverse programs offered. The MACH Music School offers private instruction in piano, strings, brass, woodwind, guitar, percussion and ethnic drumming. There are also offerings in Theory, Jazz Studies and Chamber Music. The rich and varied schedule of programs, classes, events, performances, concerts, lectures and exhibitions offer much variety for students of all ages, talents, and interests (musicandartscenter.org).

The Music and Arts Center for Humanity is staffed by 30 highly skilled and talented music instructors, backed by ten dedicated administrative staff. A 28-member Board of Directors makes all the executive decisions. Funding for the school is provided

in part by various foundations, Federal, State, and City support, and personal donations
(musicandartscenter.org).

Methodology

Introduction

The simultaneous construction of the four workstations suggested to JoMP by our IQP team proved to be a rather “dynamic” process, often even frustrating. Mr. Ardizzone would often remind us that “this is the ‘Real World’ of community music schools.”

The team’s intensive research and physical presence at JoMP apparently stimulated a great deal of interest in the use of technology for music education, and specifically, interest in our project. Through our written “Goals and Objectives for Music Technology at JoMP” (see Appendix A) and many meetings, excitement grew on the part of JoMP faculty and staff. JoMP grant writing requests included references to our project, requesting partial or full funding for four proposed workstations. On a mere “grass roots” level, families of JoMP students and JoMP board members were solicited for either financial or computer hardware donations.

As funding became available for this project (limited as it was) and equipment was donated, our original designs needed to be constantly re-thought and updated.

However, the project ultimately proved extremely successful with three completely operable workstations and one additional completely designed station which will be funded and constructed in the future.

Overview

At the start of this project in early October 2002, the team toured the Joy of Music Program facility with Richard Ardizzone and Professor Falco and assessed the available space for the project. On October 11th, the team met again with Ardizzone and Professor Falco in the library of the JoMP facility to propose the design and implementation of

four music technology workstations to aid the students and faculty at JoMP. These stations include:

Faculty Workstation

Educational Workstation

Listening Workstation

Recording and Multimedia Lab

(Each station will be discussed at length later.)

Following the proposal meeting, the team assessed the two computers that were available in storage at the JoMP facility – a Sony and a TCS3. Based on the specifications of these two computers and the assumed budget Ardizzone had dedicated to the music technology project, it was the decision of the team to implement two of the four stations as the first phase, with the intention of future upgrades.

The team conducted a seven week literature search and review in order to establish a basic background on hardware and software that might be utilized. Interviews with experts in the specific areas of the project gave the team a professional knowledge base with recommendations in regard to the project. Possible software purchases were considered and implementation of three of the four intended stations was initiated on January 14th, 2003.

An email, which included a breakdown of the intended setup and estimated price for each component of each station, was sent to Richard Ardizzone for review on December 12, 2002 (see Appendix B for breakdown). This breakdown included the purchase of two additional computers. The station breakdown was accepted, and in response, the team assembled an itemized list of the breakdown (see Appendix C for

itemized breakdown). Each station contained two to three scenarios, or steps. These scenarios were prioritized according to the overall functions and benefits of each hardware or software component in relation to anticipated use by JoMP faculty and students and the available budget for the project. Concrete prices were assembled for these purchases and added to the itemized list. Ardizzone gave this itemized price list to his grant writing professional, and a grant for \$7000 was processed and sent in to Fleet Bank for consideration.

On January 21st, the team accepted a donation of two computers and other related equipment from the Reverend Ronald Falco, pastor of Saint Anna's Church in Leominster, MA, although the hard drives were excluded. Due to the results of an MIT study, which stated that no data could be completely erased from any hard drive, the hard drives could not be donated, for fear of potential data theft. The team offered to perform a low-level format, a process that restores every bit of data to 0, on these hard drives, but rules governing such donations by the Roman Catholic Diocese of Worcester disallowed the donation of the drives altogether. Only some components of these computers proved useful to our project.

On January 23rd, Ardizzone approved the purchase of selected items on the price list, and allowed an estimated three hundred dollars for the team to spend on chosen software programs and an 80 GB hard drive for the listening workstation. Software programs included: Band-in-a-Box, Music Ace 1, and Music Ace 2. On January 25th, the team purchased these software programs via the internet. JoMP received these software programs on February 11th, and the team installed them on that date. The total came to \$330.

At this time, Ardizzone emailed Fleet regarding the status of the grant proposal. He was informed that Fleet would be deliberating the grant some time in February, although an exact date could not be established. A week later, Fleet refused the grant, stating that the bank does not fund “materials” such as computers; only services.

The team was left with only the few installed software programs, with no additional computers acquired (using only the two aforementioned computers in storage at JoMP) and no additional funding. During the week of February 13th, the team worked to set up two of the four intended stations: the faculty station and the education station. Ardizzone made the decision to put all music education software onto the education station. The team installed the intended software on both machines.

During the week of February 16th, JoMP received the donation of another computer: a 600 MHz Compaq. It was decided that, since this computer was far superior to JoMP’s current machines, this would become the new faculty workstation computer, the Sony would remain the educational computer, and the TCS³ would become the listening library computer. Through software installations, as well as attempted installations of a hard drive for the listening station, three stations were up and running, but the project fell back when it was realized that the TCS³ machine was randomly resetting itself. The team replaced the power supply, and the machine worked flawlessly for the first day.

The next day, February 28th, the team demonstrated the features and capabilities of the software on the computers to Ardizzone and Falco; however, the TCS³ computer began resetting again.

On March 18th, JoMP received four computer donations from a grandparent of a current JoMP student. They included three Compaq SCSI-based servers, and a dual-processing 350 MHz custom-built computer. Unfortunately, the servers were of no use to this project because Ardizzone thought that the noise they made would be too distracting for any of them to be installed as a station. This problem was particularly problematic in regards to the recording studio, where the sound generated by the computer's fan would be picked up by the microphones. The dual- processing computer, however, was decidedly a good choice for the listening station.

The team worked to finalize the educational workstation and faculty workstation, while one member worked to log on to the new listening station. However, there were several combinations of passwords used, and none worked to open the station so that programs could be installed so that the station could be set to run.

Guided by Ardizzone's prioritization, anticipated use, and the limitations of our hardware, software, and funding, the team refined the design of each workstation and began the "realization" of each.

Hard-copy manuals were created for all of the installed software programs, and would be left at each station. These manuals were a compilation of brief descriptions of what the team deemed would be the most commonly used simple tasks that each software program could accomplish, in other words, "suggested uses" for each station.

Faculty Workstation

At first, the team used the TCS³ computer found in storage at the beginning of the project, a Pentium II, 350 MHz computer, for the purpose of the faculty workstation. The

computer did not come with a monitor, but the team was able to retrieve a thirteen inch monitor from a storage closet in the WPI music department, with the permission of Professor Richard Falco. It was determined that this station should include: CD burning capabilities for student play-along and listening exercises; Band-in-a-Box composition software for the creation of play-along song files; a Real Book Tunes sheet music library which could be viewed on the screen or printed out; scanning capability for adding to the sheet music library; and PhotoScore Professional and Sibelius software packages for scanning and manipulating scores and creating MIDI sound files, which could be written onto audio CD's; and Winamp for the storage and organization of a listening library.

Once the monitor was installed, the first priority for the faculty was the installation of Band-in-a-Box. This software would allow the faculty to create audio files of a jazz rhythm section for the purpose of creating student play-along opportunities. CD's could then be burned and the file saved for future use. JoMP's students could take home these CD's for individual practices.

With part of the three hundred dollars Ardizzone had allowed us, the group downloaded the economical version of Band-in-a-Box from PG Music via the internet. The group installed the software, and a hard copy of the program was sent to the JoMP facility via U.S. mail.

The next priority for the faculty lounge computer was the network cable hook-up. A cable was run from the facility's router to the faculty lounge, however there was no end capped on it at this point. Over the next few weeks, JoMP hired a technician to apply the end cap on the cable, and the faculty lounge gained access to the local network and the internet.

The team analyzed the TCS³ computer, starting from the boot process, and noticed that while the computer had the capability of accessing its hard drive at a faster rate with the use of S.M.A.R.T., this option was not enabled. The team enabled this. Additionally, the color quality in Windows was previously set to 8-bit. It was the general knowledge that the computer could still run at 16-bit color, so this was changed as well.

The thirteen inch monitor that the team had installed for this workstation was small, so the team switched this monitor with the one from the educational computer workstation in order to help establish the faculty workstation. (At this point in time, it had been established that the educational workstation was going to be used by young children in the waiting room, so the least valuable equipment was going to be used at this station.) The monitor that came with the educational station had built-in speakers, so the team had to move the speakers from the faculty computer to the educational workstation as a replacement. Additionally, the Sony computer at the educational station had a zip drive built in. The team moved this from the educational workstation to the faculty station, with the thought that the faculty would have more administrative use for zip drive than would the education station.

On January 28th, Falco donated a disc containing jazz compositions from a collection known as the Real Book which were already formatted for Band-in-a-Box. These files included selected styles and solos from the jazz Real Book, and would save hundreds of hours of formatting work by the jazz faculty at JoMP.

Simultaneously, we received an offer for a financial donation from Edward Mitchell's father, Daniel Mitchell Sr., for the purchase of a CD burner for the faculty computer. This CD burner could be used for distributing accompaniment discs to

students, as well as aiding the faculty in data transfer from computer to computer in the facility.

The team arrived at JoMP on January 30th, and replaced the current operating system, Windows 98, with Windows 2000. It was the group's general knowledge that this operating system is the most reliable, and will run fluently aboard an older machine. During and after this replacement, we discovered that the floppy drive was malfunctioning and would not read any disks.

After Windows 2000 was set up, we installed Band-in-a-Box on to the faculty computer with the Real Book formatted files Professor Falco had given us. This was the only piece of software the team had installed on this computer up to this point.

On February 11th, Band-in-a-Box arrived in the mail, and included SlowBlast. This was software that enabled the user to slow down a professionally recorded piece of digital music so that one could better analyze exactly what was occurring in the music for ease of transcription. The team assessed this piece of software and decided to install it on the faculty machine, though no specific demonstration of the software was intended.

On February 20th, as mentioned earlier, JoMP received a donation of a 600 MHz Compaq machine, equipped with Windows NT. The team set up this new computer in the faculty lounge, replacing the TCS3, and installed Band-in-a-Box and SlowBlast on it. It was decided the TCS³ computer the team had originally set up in the faculty lounge would now become the listening station computer.

On February 26th, Edward Mitchell picked up the CD burner from his father: a Norcent 52X recorder. Later, that night, the team installed the CD burner in the new Compaq machine.

The next task was to install the scanner that was donated by the Reverend Ronald Falco, so that the faculty could scan scores into the computer to be viewed in the faculty station and the listening station. The idea was that both faculty and students could listen to professional recordings or MIDI files in the library via Winamp, and be able to view the scores for these recordings simultaneously. For the purposes of the listening station, these files would be stored on the faculty computer and a “window” would be created from the listening station to the faculty machine in order to gain access to these scores.

With this in mind, on February 26th, frustrated with previous attempts at installing the newly purchased 80 GB hard drive in the other computers, the team attempted to install the hard drive on the Compaq computer. This caused Windows to load only partially. The team experimented with different jumper settings on the hard drive, but none made the hard drive function properly. At this point, the hard drive would have to be taken home to be tested on another computer.

The next day, Ardizzone, through the repeated use of Band-in-a-Box, decided to purchase Cakewalk Music Creator 2003 in order to import files from Band-in-a-Box to change the instrumentation. Cakewalk had already been recommended by the group, so the team gladly purchased this software.

On March 25th, the team created five icons on the desktop in Windows: Jazz Real Books 5th Edition Lead Sheets (original), Band-in-a-Box Real Book 5th Edition (original), Listening Library (professional recordings), Cakewalk, and CD-Burning Software. The Real Book 5th Edition files were stored in PDF format. The team installed Acrobat Reader onto the faculty computer for viewing this format.

The team also installed the printer and additional scanning software, which was in storage.

In summary, this workstation currently contains Band-in-a-Box composition software, a CD-burner with CD-burning software, a scanner with scanning software, Real Book Tunes lead sheets in standard notation viewable through Adobe Acrobat Reader software, hundreds of Band-in-a-Box audio files of real book tunes, Cakewalk Music Creator software, and a MP3 library playable through Winamp audio playback software. From this station, faculty can compose music, scan and store sheet music and scores, view stored lead sheets and scores, change instrumentation of Band-in-a-Box files, and listen to the stored music collection, burn CD's of professional versions or Band-in-a-Box versions of jam pieces, create play-along MID generated CD's for their classical students.

The team suggested to JoMP the following upgrades: Sibelius music notation software and Photoscore Professional music scanning software. With these two packages, JoMP will have many more musical manipulation tools, most notably the ability to scan and manipulate scores and create MIDI sound files, which could then be written onto audio CD's.

Educational Workstation

The educational workstation is set up in the JoMP lobby for skills training, ear training, and interactive timbre training. Based on research and interviews conducted during the team's literature search and review, these were deemed the most necessary skills for young musicians to learn. The workstation is composed of a computer,

computer keyboard, mouse, and a pair of headphones, set up on a rolling cart to allow for JoMP staff to move it out of the way for events.

During our literature review, Professor Falco recommended a website which suggested several programs designed for ear training and skills training. The team tested several of the programs on this website and found them to be outdated, as most were intended for use with Windows 3.1.

In addition, the team reviewed several programs that were recommended by Professor Falco and other sources. The team found the best of these to be Music Ace 1, Music Ace II, Ear Power, and Nutcracker Music. Since the target age group for this workstation was ages six through eighteen, these software programs seemed age appropriate.

Initially, the computer designated for use was a Sony Vaio (See Appendix D for specifications). This computer was originally intended for use as both a listening station, and an educational workstation. The workstation's original monitor was designated for use with the faculty station, as its built-in speakers were unnecessary in the setup, which utilized headphones. Additionally, the faculty workstation required a larger screen, and the least expensive equipment was to be implemented on the educational workstation.

The next step was to install the software that was purchased for use with this station. Music Ace I and Music Ace II were installed on February 1st, but basic installation requires that the original install CD be in the drive. As a solution to this, most of the files on those CD's were copied manually to the hard disk. The software was then redirected to look for resources in these folders, instead of defaulting to the CD.

Since another usable computer was obtained on February 20, 2003, it became possible to implement a third station setup instead of the two station setup that we were restricted to previously. The Sony computer was deemed the best suited for the educational station. It can effectively support the software necessary for the educational station, but may be too slow for other purposes.

On February 27, 2003, additional funds were made available by JoMP. The team, with the recommendation of Falco, then used a portion of these funds to purchase Ear Power and Nutcracker Music. Upon receipt of these software packages they were installed, and the station was completed.

The completed station now contains Music Ace I, Music Ace II, Ear Power, and Nutcracker Music educational software. Students working at this station now have these four fun musical training packages at their disposal. Colorful icons for each package were created for the desktop.

As with the other stations, there was a manual prepared.(See Appendix E). Its intent is to direct users to the programs and suggested uses of the station. The manual is very simple and straightforward, as the software selected for this station is designed to be self explanatory.

Listening Station

The listening station, located in the library room of the Joy of Music Program, is intended to be used as an audio and visual resource for students in the JoMP facility. The two main purposes of this station are as follows: to provide students with a plethora of classical and jazz compositions to listen to; and to provide students with access to stored

sheet music for them to study and review. These two applications may be used simultaneously by the students.

The listening station is comprised of a desktop Pentium II 350 mHz dual-processor computer, and its only necessary accessories are a high-speed scanner, a connection to JoMP's network, and a pair of headphones. Audio files, stored in MP3 format, are acquired by ripping audio tracks from compact discs. Ripping, or copying tracks from a CD and saving them to the JoMP network as MP3 files, is accomplished through the simple use of a dedicated program called AudioCatalyst. AudioCatalyst automatically contacts an online database and tags the MP3 files with the proper track title, album title, and artist information. The files can then be listened to using WinAmp, an audio playback program. Winamp can also be used to play audio files directly from a CD, without needing to first rip the tracks into MP3 format.

Sheet music and scores are stored on the JoMP network in two formats: as Real Book pdf files, and as jpeg images, created by manually scanning paper copies of lead sheets. The Real Book files are stored in Adobe Acrobat format, and can be viewed using Adobe Acrobat Reader software. The collection of jpeg-format stored sheet music can be expanded by using the high-speed scanner and accompanying LaserFiche scanning software to store digital copies of lead sheets on the JoMP network. These sheets can then be viewed using Microsoft Imaging software.

Two additional facets of the listening station were ultimately not realized. The first would have allowed JoMP access to the Grove Music library, an online music database containing articles, biographies, and selected works of various artists. The WPI campus has full access to Grove Music, but unfortunately WPI was unable to extend its

rights for this service to the JoMP facility. The second would have allowed students the ability to listen to and record LP's for the purpose of playback, but we were unable to obtain a record player for the listening station by the culmination of this project.

The physical listening station setup has gone through three iterations since its conceptual design was first presented at the beginning of C-term. The first version of the listening station was set up on the Sony Pentium I 166 MHz computer. As we were bound by the ties of limited equipment, this incarnation of the listening station was actually a dual-purpose machine, being used also as our educational station.

Our first work on the listening station was attempting to acquire additional funding for the station. Up to this point, we were told by JoMP we had a very limited budget, so we decided we would try to find alternate means of buying equipment and software. We inquired in the Project Center regarding funds for our project, but were informed that we must personally front money for our desired purchases, submit a request to the WPI Project Center for reimbursement, and may get reimbursed, after a large deductible was subtracted. Our group did not have any personal funds available for this project, so we decided this would not be a plausible option.

Since we were unable to acquire funding for this station, we were stuck using a third-rate machine (Sony Vaio) as both the listening and children's station. Our first significant progress on the station came on February 10th. On this day, we convinced Richard Ardizzone, our liaison at JoMP, to grant us funding to order a large hard drive, 80 Gigabytes, for storage of MP3 files. We also acquired a handful of Jazz CD's donated by Professor Falco to be used in starting the MP3 library. We ripped these tracks onto a CD so that they could be quickly installed onto the listening station's new hard drive.

Also discussed was ripping onto this new hard drive the personal audio teaching libraries of Richard Ardizzone and Jerry Sabitini, the director of Jazz Studies at the JoMP facility.

On February 11th, the new hard drive arrived, and this is where the trouble began. We should have guessed something was not right with this hard drive from the onset. The hard drive came with no box, no instruction manual, no installation disk, no rails, which are brackets that hold the hard drive in place, and not even installation screws. Instead, all we received was a hard drive in a static-resistant bag. At the time, we were excited to get the station setup underway, so we ignored the incompleteness of the package and went right to attempting installation. We removed the tape backup drive from the Sony in favor of the new hard drive, as we needed the slot the tape drive was occupying. Additionally, the tape drive was outdated technology and became unnecessary with the addition of another hard drive. However, the rails from the tape drive were not the right size, so we were unable to complete the installation of the hard drive on that day.

Wanting to get the listening station up and running that day, we decided to proceed by using the small hard drive the Sony station came with. We copied Falco's jazz MP3's onto that hard drive, and also installed WinAmp 2 audio playback software. We chose WinAmp 2 over the new version of the software, WinAmp 3, because WinAmp 2 is a simpler interface and contains a convenient search function, critical for quickly locating tracks from a large musical database. We also installed SlowBlast, a program which slows down music playback for better comprehension. SlowBlast was included free in our order of Band-in-a-Box, a software package we ordered for the faculty station. Additionally, we discussed with Ardizzone the logistics of getting a

network connection in JoMP's library room, which was the ultimate location for the completed listening station. We discussed running network cable through the attic, as well as quicker and easier alternatives, such as running the cable externally along the base of the wall into the library.

We regrouped and returned to JoMP on February 13th. Team member William Bradley donated a set of rails and screws to the hard drive installation cause, and began work on getting the hard drive operable. We only ended up with four screws that were the correct size (out of eight), but we were able to make do. Later, Ardizzone would provide us with screws which, although longer than necessary, were sufficient for holding the hard drive in place. However, upon installation, the computer did not recognize the hard drive at all. We then tried adjusting the jumper settings on the back of the hard drive. This resulted in the BIOS of the computer recognizing the hard drive, but Windows still would not recognize it. We attempted to run the hard drive install, but found out that the BIOS of this computer could only support up to an eight Gigabyte hard drive, obviously smaller than what we were trying to install. We confirmed that the BIOS on this machine was indeed the original from the factory. Our next approach was to update the BIOS of this machine via an Intel Flash update. However, we were unable to find a flash compatible for the chipset and motherboard we had. We then searched Sony's website for a BIOS update, but none were available. We realized then that we would be unable to install this hard drive on this particular machine.

On February 20th, we received word that our project would be receiving another computer. Therefore, we would finally be able to have a dedicated listening station, and not have to share the Sony computer with the educational station. We discussed how the

new machine would be used, and determined it would take the place of our current faculty station, and the TCS3 machine currently being used for faculty would become the dedicated listening station. This was decided based upon the performance requirements of each station's respective software: the faculty station had the most demanding software, while the educational software would run just fine on the Sony machine as originally confirmed. Our only concern with the TCS3 machine was that it would randomly reboot itself, but given the limited resources we had, we had no choice but to use it in our project.

February 25th marked the introduction of the TCS3 machine to its listening station duties. We attempted to install the 80GB hard drive into this machine, but found out we did not have the required IDE cable. Unfortunately, this prevented us from installing our music library, which was our main goal for the day. We decided instead to install a new floppy drive on the machine, as the current floppy drive was broken and we had acquired another through a donation. We also installed Music Ace I and II on the listening station, originally intended for the educational station, as Ardizzone decided the programs were more suited for the age group the listening station would be serving.

Through further experimentation the next day, we determined the power supply of the TCS3 may be causing the machine to reboot. Team member William Bradley donated his new power supply to the cause, and successfully installed it into the TCS3 machine. Despite getting an IDE cable, though, we were still not successful in installing the hard drive. The hard drive would not be recognized on any jumper setting in this computer, either. We decided at that point that we could install the hard drive on the faculty machine, and use the listening station as a portal, storing the MP3's and sheet

music on the faculty station. However, the hard drive did not function in the faculty station either, nor did it function in Mr. Bradley's new personal computer. We were finally convinced that the hard drive must be faulty.

February 27th we decided to use the faculty's modest hard drive as our storage for our MP3 and sheet music files. We installed Falco's MP3s on the faculty machine, and also ripped a large collection of Ardizzone's teaching CD's onto the faculty machine as well. We installed WinAmp onto the listening station and set up a link so that the listening station could play MP3s from the faculty station. We also installed the Real Book pdf files onto the faculty station and made a link so that sheet music could be accessible from the listening station. Further, we installed AudioCatalyst onto the listening station so that CD's could be ripped and have their tracks added to the growing MP3 library. Lastly, we removed Music Ace I and II from the listening station, as Ardizzone felt having games in the library would create too much commotion. As of this point, the listening station was completed, although the computer was still randomly rebooting itself.

On March 18th, a new dual-processing computer was donated, and it was decided we would use it to replace the malfunctioning listening station. Ardizzone made it clear that he did not want anything stored on this station, so we continued to execute our plan of having the faculty machine store the listening station's files. The new computer came with high-quality LaserFiche scanning software and a high-speed scanner, which will prove useful in scanning large quantities of photocopied scores to add to the database. A "For Faculty Use Only" sign was placed on the scanner to discourage students from attempting to use it.

As of April 8th, the password still had not been discovered for the new listening station. Apparently, the donor cannot remember what the proper password was, and without it, the computer cannot be accessed. We did replace the video card in the new machine with one from the TCS3 machine, as the video card in the new machine was not functioning. This was successfully completed, and solved the visualization problem, but still does not allow anyone access to the machine. Ardizzone had his tech team reformat the computer, but it was still not functioning properly. When the computer was finally up and running on April 15th, the team simply installed icons and links to WinAmp, AudioCatalyst, Acrobat Reader, and Microsoft Imaging, therefore rendering the listening station fully functional.

Ultimately from this station, students will be able to call up hundreds of professional recordings in all styles to listen to while looking at the printed music on the screen.

Recording Station

The recording station was designed for the recording of audio and video. Based on extensive research conducted during the literature review, the team made several recommendations. It was understood from the outset that the team was to design this station based on extensive research in the latest technologies. However, it was also understood that this design would be funded and implemented at a future point.

For audio recording, the path that the team has chosen to recommend is a computer based approach. This requires a high-end computer, which is available rather inexpensive. The team recommends Dell Computers, as our research showed that they had the best combination of price features, and customer service.

The next piece needed was the sound card. The SoundBlaster Live Platinum is the recommendation of the team for audio input. Our research shows that its combination of convenience, power, and many inputs make this an optimal choice.

For video, the team recommends the Orange Micro iBot 2. This desktop camera can provide the quality necessary for JoMP's purposes, at an affordable price. Included is Teveo Video Suite, which, in combination with Cakewalk, can handle all of JoMP's video editing needs.

The microphone most ideal to this setup would be any quality microphone that is a cardioid condenser. Two options are to have a single stereo pair microphone, or to utilize two single cardioid condenser microphones. Also needed are two 20-foot microphone cables, microphone clips, and two boom stands.

This design will allow for immediate playback and storage of audio and video data. Standard VHS and DVD formats can be made available for home study. JoMP also has the option to sell VHS copies of concert performances to generate income.

The team also obtained an audio recording manual previously designed by another IQP team specifically for the JoMP instrumental and choral ensembles. This, along with our own design layout of the station, can be found at Appendix F.

Conclusions

The IQP team, working to implement music technology at the Joy of Music Program, successfully determined a focus and path for the project, conducted extensive research in the field of music technology, and implemented three music workstations for use by the JoMP students and faculty. The music workstations had an enormous impact on the JoMP community, spawning much interest and excitement amongst students and instructors alike. Young students engulfed the opportunity to “play games” on the educational station, learning such music fundamentals as rhythm and melody, while the older students enjoyed studying at the listening station, where a library of lead sheets complimented the enormous collection of classical and jazz audio tracks. JoMP faculty quickly realized the benefits of being able to make play-along CD’s for their students to take home and practice with, and valued the simplicity and powerful features of the composition and notation software packages.

The IQP team realized many frustrations throughout the course of the project. In dealing with a non-profit organization, the IQP team learned how to work with second-hand equipment, a very limited budget, and constantly changing views and outlooks of the JoMP faculty. However, these trying times proved to be a valuable learning experience for the IQP team and led to the ultimate success of the installation of invaluable resources for the Joy of Music Program.

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Appendices

Appendix A

Goals and Objectives for Music Technology at JoMP

Friday October 11th, 2002

Purpose

To plan and design:

- Waiting area space - 1-3 workstations for student use
 - Can be designated for specific age groups
 - Younger Age Group
 - Music related games
 - Simple ear training (Which pitch is higher?)
 - Basic music reading (Which note is this?)
 - Middle Age Group
 - Ear training
 - Simple Band in a Box
 - Older Age Group
 - Notation software
 - Band In A Box
- Multimedia Lab:
 - Designated space - audio production studio, video production studio, faculty dedicated workstation
 - Audio and video can be linked
 - Immediate feedback
 - Applications for students for music schools
 - Video studio for instant feedback
 - Formats:
 - Current-VHS
 - Future-DVD
 - Audio recording studio:
 - Real-time recording
 - Formats:
 - CD
 - Cassette tape
 - Electronic keyboard for recording
 - Write a song by playing it, burn copy
- Faculty workstation:
 - Includes Internet support - online help, download new versions, surf for new resources, mailing lists
 - Notation software that will support scanning
 - I.e.: scan music, manipulate, and print in 10 minutes
 - Two other software tools:
 - Band in a Box

- Record examples (student copies)
- Format (later upgrade - external sound processor)
- Burning CD's, cassettes for students to take home
- Music Minus One
 - Also, similar packages to this with variable tempo (downloadable)

The Plan

3 - 7 week frames

• **Research**

1st term: October 22, 2002 – December 12, 2002

- Gain perspective on other schools - what other schools have for equipment
 - Faculty
 - Students
- Current software and hardware - prioritized and priced out
- Instruction manual - simple
- Trends - is new technology coming out which will make current technology obsolete

• **Implementation**

2nd term: January 9, 2002 - February 27, 2002

- Three potential levels of setup
 - Entry-level
 - Most basic configuration
 - Upgradeable
 - Mid-Range
 - Uses some newer technologies
 - Upgradeable
 - State of the Art
 - Uses all the latest technologies
 - Upgradeable to future technologies

• **Conclusions**

3rd term: March 11, 2002 - April 29, 2002

- How-to manual for all equipment
- Suggestions for future upgrades
- Paper submittal with full recommendations

Appendix B

Dear Mr. Ardizzone:

We have compiled the following to clearly show you what we plan on doing at the JoMP facility.

Faculty Workstation: This will be located in the faculty lounge. We suggest the purchase of a new Dell computer. Although the prices vary with consideration to sales, the cost of the computer will be in the \$600 area, which includes the cost of a 15" monitor, a CD burner, and burning software. There is free shipping on all Dell orders. Software we wish to install is Sibelius notation software (site license), PhotoScore Professional scanning software (\$100 with site licence), Cakewalk Music Creator 2003 (\$45), and Band in a Box (\$88 or \$249).

Sibelius and PhotoScore together will allow faculty to compose and scan in pieces, so that they can be transposed and distributed to the students.

Photoscore is the most advanced software of its kind and will be able to read slurs, articulation notes, hairpins, double & repeat barlines, text, triplets and tuplets, and dynamics.

Cakewalk Music Creator 2003 is designed to take the pieces that are scanned with Sibelius or downloaded, in the form of MIDI files from the internet and mute out individual instruments. CDs can be created for students to take home to practice.

Band in a Box is software that plays a steady accompaniment of a given style and allows the faculty to input a list of chord changes to be looped. From here a MIDI file can be created of the accompaniment to be burned on to a CD. This is useful if the faculty wishes to provide the student with chord changes so that the student can practice a song's melody or to improvise. The difference in the prices for this software is mainly dependent on the amount of styles the software offers for accompaniment.

We will provide a comprehensive manual with pictures that will illustrate how to do these tasks using the software. Also, we would like to explore the option of getting Jerry Sabatini to train faculty in the use of the software.

Waiting Room Cart

We will be using one of the old computers from the back with the Music Ace 1 software on this computer. We hope that the younger children will use this

software for ear training, skills training, and to learn the notes on the staff. The price for this workstation is \$50 for the Music Ace software. We will be putting a manual for the kids to use. It will be approx. 3 pages, and have large graphics and text, as well as simple language and easy to follow diagrams so the kids cannot go wrong in loading the program and getting engaged.

Listening Station:

The listening station will be located in the library. It will have 1 or 2 computers with the same software on them, depending on the budget. If we use one computer, it will come from storage. The workstation will need headphones (\$30 each) and a keyboard tray (\$50 each). On the computer, we are looking to implement Music Ace 2 software (\$50), Sibelius Notation software (site license), and Ear Power (\$25) and Winamp (free).

Music Ace 2 and EarPower will be used to ear and skill train the more advanced students. This software is relatively inexpensive, and an upgrade to Auralia (\$119) and Musician (\$119), which are more professional and comprehensive training software.

Sibelius will allow the students to compose, and to view scores that have been scanned or downloaded at the faculty workstation.

At your discretion, we would like to give the options of allowing Internet access to be able to exclusively browse the Grove Music website (www.grovemusic.com [<http://www.grovemusic.com/>](http://www.grovemusic.com/)). >From here the students will have access to a huge database of composer's biographies and other music-related information including sample pieces of music. These samples are compatible with a free Internet browser plug-in called Sibelius Scorch, which allows the student to view a line of music, transpose it, slow it down, etc so that they can analyze musical ideas.

Listening capabilities will be provided by Winamp. We will set up a way to transfer the listening library to the workstation. This may include recording in real time from the record player to the computer or ripping the CD's to the computer (whatever the case may be) and changing the files into MP3 files. MP3 files are a compressed format for music, taking up about a tenth of the hard disk space that raw CD data takes up. Even though the MP3 files are compressed, the hard drive that is included with the computer is not an appropriate size for storing any substantial amount of musical data. A new hard drive will need to be purchased. A forty gigabyte hard drive (\$70) will be sufficient for the amount of data that will ever need to stored on the machine.

One question for you from the group is an estimate on the amount of vinyl

records and CDs the JoMP facility has at its disposal.

Recording Station:

The recording station will be located in one of the far rooms on one of the wings. We believe this is room 9 or 10? At the base level, we will have a camcorder and TV/VCR (pending donation). On the upper level, we recommend the use of a computer to take care of the video and audio recording. We recommend the same computer from Dell that is in the faculty lounge. This computer will be more than capable of performing the tasks necessary. With the use of Cakewalk Music Creator 2003 (\$45), a video camera (\$200), and a microphone (\$50), the students and faculty together will be able to record the student's performance on to the hard drive. >From here, they can edit the performance or burn it on to a CD.

We expect the students to be able to learn from hearing themselves play. We also expect the instructor to be able to easily create a video that illustrates proper technique (ambiture, fingering, etc) for the students to take home and watch. We also expect students to be able to send their videos to colleges for the application process.

Another application is the possibility of recording group recitals. For this application, the group would use a cart with speakers that could be wheeled to film the performance, and wheeled back so the children could watch and analyze. If you decide to sell these videos, they will need to produced (add credits and such). This requires that a new piece of software be purchased so that the video will be professional-looking.

We believe that's everything. If you have any questions or concerns, don't hesitate to send us an email. Thanks for your time.

Have a happy holiday!

William Bradley

Jonathan Kenney

Edward Mitchell

Appendix C

Faculty Station

Item	Price
Hardware	
<i>Phase 1</i>	
Dell Dimension 2350 after \$100 mail in rebate	\$319
Monitor through Dell	\$80
CD-RW 40x/10x/40x Max	\$0
Network Printer at JoMP facility	\$0
Scanner at JoMP facility	\$0
<i>Phase 2</i>	
Soundblaster Platinum (accompanies Cakewalk Music Creator)	\$200
Dedicated Printer from Dell	\$145
Software	
<i>Phase 1</i>	
Sibelius Notation Software	\$300
Cakewalk Music Creator 2003	\$45
Band in a Box	\$88
CD burning software	\$0
<i>Phase 2</i>	
Sibelius Photoscore Professional	\$150
Band in a Box Mega-Pak Upgrade	\$249

Listening Station 1

Item	Price
Hardware	
<i>Phase 1</i>	
Dell Dimension 2350 after \$100 mail in rebate	\$319
Monitor through Dell	\$80
Headphones	\$35
<i>Phase 2</i>	
Hard Drive Upgrade	from \$40
Software	

Phase 1

Music Ace 1 and 2 Software	\$100
Ear Power	\$25
Winamp	\$0
Sibelius Scorch	\$0

Phase 2

Sibelius Notation Software	\$300
Sibelius Teaching Tools	\$70
Auralia Ear Training Software	\$119
Musition Music Theory and Musicianship Software	\$119

Listening Station 2

	Item	Price
Hardware		
<i>Phase 1</i>		
	Computer from Storage	\$0
	System Upgrades to the Computer (RAM, etc.)	approx \$100
	Monitor from Storage	\$0
	Hard Drive Upgrade	\$70
	Headphones	\$35
<i>Phase 2</i>		
	Dell Dimension 2350 after \$100 mail in rebate	\$319
	Monitor from Dell	\$80
Software		
<i>Phase 1</i>		
	Music Ace 1 and 2 Software	\$100
	Ear Power	\$25
	Winamp	\$0
	Sibelius Scorch	\$0
<i>Phase 2</i>		
	Sibelius Notation Software	\$300
	Sibelius Teaching Tools	\$70
	Auralia Ear Training Software	\$119
	Musition Music Theory and Musicianship Software	\$119

Waiting Room Cart

Item	Price
Hardware	
Sony Computer from facility	\$0
Sony Monitor from facility	\$0
Cost of Cart	
Software	
Nutcracker Music	\$20
Recorder Teacher 98	\$40
Music Ace 1	\$50

Multimedia Workstation

Item	Price
Hardware	
<i>Phase 1</i>	
Camera	Pending Donation
TV/VCR	Pending Donation
<i>Phase 2</i>	
Dell Dimension 2350 after \$100 mail in rebate	\$319
Monitor through Dell	\$80
CD-RW 40x/10x/40x Max	\$0
Soundblaster Platinum (accompanies Cakewalk Music Creator)	\$200
Orange Micro Ibot Digital Camera	\$200
Cardiod Condenser Microphone	\$200
Cost of Cart	team will build if necessary
Software	
<i>Phase 2</i>	
Cakewalk Music Creator 2003	\$45
CD burning software	\$0
<i>Phase 3</i>	
Adobe Premiere Digital Video Editing Software	\$550

Appendix D

	TCS Custom-Built	Sony Vaio
Processor	Pentium II 350 mHz	Pentium 166 mHz
Memory	64 MB	32 MB
Hard Drive	10 GB	2.3 GB
Zip Drive	Yes	No
Networking	Ethernet Card	Ethernet Card
Printer	Yes	No
Scanner	Yes	No
Monitor	Sony	Samtron
Speakers	Built In	Seperate

Appendix E

1) Faculty workstation

Faculty suggested use:

- A) Write a jazz play-along of any tempo
1. Open Band-in-a-Box by clicking the icon on the desktop
 2. Hold control and tap F9 on the keyboard to change the style of the composition
 3. Change the key by clicking the respective pull-down menu
 4. Change the tempo by clicking the up or down arrow next to the tempo field
 5. Enter chords into the numbered bar fields next by clicking to the right of the numbers and typing in the chord name.
 6. Click the play ► button to listen
 7. Click the save button to save your work
- B) Make an audio CD of play-alongs live recordings
- For Play-Alongs, first:
1. Open Band-in-a-Box by clicking the icon on the desktop
 2. Click on the CD-burning icon on the interface (it looks like a CD)
 3. Click Choose
 4. Choose the appropriate directory
 5. Click OK
 6. Click Render to WAV file
 7. Wait
 8. Close Band-in-a-Box (required before WAV file can be used)
- For Play-Alongs and Live Recordings:
1. Open Nero Burning Software by clicking the icon on the desktop
 2. Choose Audio CD
 3. Click Add
 4. Select the audio files from the proper directory (the play-along will be in the directory it was saved with the .WAV extension on it)
 5. Click Add
 6. Repeat procedure until all desired tracks have been selected
- Note: The blue bar at the bottom of the window indicates how much space has been reserved on the CD – do not fill the CD up past the yellow line
7. Click Finished
 8. Click Next
 5. Click BURN.
- C) View/Print a copy of Real Book Tunes
- To View:*
1. Open the “Real book Tunes” Folder

2. Choose the Real Book Needed
3. Consult the index on page 2 to find desired song

4. In the lower left- hand corner of the screen, click on the white box, enter the page number and press return

To Print:

1. Open Document to be viewed using above directions
2. Press Ctrl-P to bring up print window
3. Under the heading "Print Range", in the line Pages, enter the page number of the first and last pages of the desired lead sheet into the two white boxes
4. Select "OK"

D) Scan in sheet music for viewing on the listening station

1. Double-click on the "Adobe Photoshop" icon
2. Place your music face-down on the scanning bed and close the cover
3. Click "File" and then "Import", and choose the scanner
4. If the image is not suitable, adjust the sheet in the scanning bed and repeat step #3
5. Once the image is suitable, click "File" and then "Save as..."
6. Select the proper directory, either c:\classical sheet music, or c:\jazz sheet music
7. Select "JPEG" file-type under "Format"
7. Type in the composer, piece name, and page number, and hit "Save"

E) Scan in any piece of sheet music, manipulate it, and create a MIDI file which can be played back and burned to a CD

This operation requires PhotoScan Professional, presently owned by the Joliff organization.

Breakdown of station hardware:

Compaq Pentium II 600 mHz computer
 128mB RAM
 11 GB hard drive
 Norcent 52x CD burner
 HP ScanJet scanner
 HP printer

Breakdown of station software:

Band-in-a-Box
 Adobe Photoshop
 Nero Express CD Burning software

Specific noted settings:

Music files stored in d:\music
 Password for computer is "iqp"

Real Book Tunes saved in c:\real book tunes

Scanned sheet music saved in c:\ classical sheet music or c:\jazz sheet music

2) Listening Station

How to use:

- A) Listen to stored music
 1. Double-click on the “WINAMP” icon
 2. Press “Shift – L”, which loads the list of songs into WINAMP (it should default to d:\music)
 3. Click “OK” (the first song on the list will start playing)
 2. Press the “J” key on the keyboard – this will bring up a search window
 3. Type in what you are searching for, which can be any of the song title, artist, or album title
 4. When you see the name of the song you wish to hear, double-click on it

- B) Listen to audio CD’s
 1. Insert Audio CD into the CD Drive
 2. Double-Click on the “Winamp” Icon
 3. Right-click on the title bar and select the play menu then select “Audio CD(D:)”
 4. Click the triangle marked “Play”

- C) Copy CD music into the listening library
 1. Insert CD into CD drive
 2. Double-click on the “Audio Catalyst” icon
 3. To load CD data, click “CDDB” icon
 4. If data needs to be imputed manually, right-click on each track name and type in the title of the track. Also, input the Artist and Album Title information in the fields located in the top-right of the screen
 5. Make sure “Norm” and “MP3” checkboxes are checked
 6. To change the directory where MP3 files are stored, click “Settings”, “General”, and then “Browse”, and choose the appropriate directory (default is d:\music)
 7. Click “Grab” to copy these tracks to the hard drive

- D) View stored sheet music
 1. Open either the “Classical Sheet Music” or “Jazz Sheet Music” Folder
 2. Locate the piece of music needed
 3. Consult the index on page 2 to find desired song
 4. Double click on the the desired file’s icon(s)

- E) View Real Book Tunes
 1. Open the “Real book Tunes” Folder
 2. Choose the Real Book Needed
 3. Consult the index on page 2 to find desired song

4. In the lower left-hand corner of the screen, click on the white box, enter the page number and press return

Breakdown of station hardware:

Microsoft NT Pentium II 350 MHz dual-processor workstation

Headphones

Breakdown of station software:

Winamp audio playback software

AudioCatalyst CD ripping software

Adobe Acrobat Reader viewing software

Specific noted settings:

Password for workstation is blank (nothing)

All programs are installed on Faculty station and accessed through this station as a portal

3) Educational station:

To play these games:

A) Music Ace I:

1. Double-click on the “Music Ace I” icon
2. Type in your name and press “ENTER”
3. The **YELLOW** arrows move back and forth between lessons
3. Click on one of the following buttons:
The **RED** button starts the lesson
The **GREEN** button starts the game
The **YELLOW** button shows your lesson progress so far
The **BLUE** button starts the “Doodle” section which allows you to compose your own song using different instruments
4. To quit at any point, click the “MENU” icon located on the top of the screen

B) Music Ace II:

1. Double-click on the “Music Ace II” icon (insert picture of icon here)
2. Type in your name and press “ENTER”
3. The **YELLOW** arrows move back and forth between lessons
3. Click on one of the following buttons:
The **RED** button starts the lesson
The **GREEN** button starts the game
The **YELLOW** button shows your lesson progress so far
The **BLUE** button starts the “Doodle” section which allows you to compose your own song using different instruments
4. To quit at any point, click the “MENU” icon located on the top of the screen

C) Ear Power:

1. Double-click on the “Ear Power” icon
2. Click on the “New” icon in the top-left corner
3. Click on the picture of the instrument you would like to work with, located in the lower right corner of the screen
4. Click on the tab, located across the top of the screen, of the musical skill you wish to work on: Melody, Rhythm, Intervals, or Chords
5. To change the skill level of the program, click to a different setting in the lower left corner of the screen

D) Nutcracker:

Double-click on the “Nutcracker” icon
Click on the picture of the game you wish to play
To quit, click the icon located in the top right corner of the screen

Breakdown of station hardware:

Sony VAIO Pentium I 166 mHz

32 MB RAM

2 GB hard drive

Headphones

Breakdown of station software:

Music Ace I

Music Ace II

Earpower

Nutcracker

Specific noted settings:

Music Ace I software stored in c:\musicace

4) Multimedia Recording Station

Suggested faculty use:

- A) Record student audio tracks for immediate feedback
- B) Record Recitals/Performances for Distribution
- C) Record Student videos for immediate feedback

Breakdown of station hardware (needed):

High-end computer (400 mHz bare minimum, faster highly recommended)

Camera – Orange Micro IBOT 2 (\$90)

Microphone – Cardioid Condenser stereo pair preferred

Soundcard – SoundBlaster Live Platinum (\$200)

CD burner – Norcent 52x Burner (\$65)

Breakdown of station software:

Cakewalk (already have)

Teveo Video Suite (included with camera)

Nero CD burning software (included with CD burner)

Appendix F





**Live Recording Handbook
for WPI Music Ensembles**

Table of Contents

List of Figures	2
Introduction	3
Overview of Live Recording	4
Equipment Overview	5
AKG C1000s condenser microphone.....	5
Mackie 1202 VLZ mixer.....	6
Panasonic SV-3800 DAT machine.....	9
Recording Techniques	11
Coincident Pair.....	11
Spaced Pair.....	12
Near Coincident Pair.....	13
Setup Procedures for WPI Ensembles	
Orchestra.....	16
Wind Ensemble.....	17
Medwin String Ensemble.....	18
Trombone Ensemble.....	19
Concert Band.....	20
Brass Ensemble.....	21
Jazz Ensemble.....	22
Stage Band.....	23
African Drumming and Dance Ensemble.....	24
Men's Glee Club / Alden Voices / Concert Choir.....	25
Interstate 8 / Simple Harmonic Motion.....	26
References	27

List of Figures

Figure 1: Signal Flow Diagram.....	4
Figure 2: AKG C1000s.....	5
Figure 3: C1000s Polar Patterns and Frequency Response.....	5
Figure 4: Mackie 1202-VLZ.....	6
Figure 5: Back Panel of Mackie 1202 VLZ.....	8
Figure 6: Input Panel of Mackie 1202 VLZ.....	8
Figure 7: Main Control Panel of Mackie 1202 VLZ.....	8
Figure 8: Channel Strip of Mackie 2102 VLZ	8
Figure 9: Front Panel of Panasonic SV-3800 DAT Machine.....	9
Figure 10: Back Panel of Panasonic SV-3800 DAT Machine.....	10
Figure 11: Coincident Pair Diagram.....	12
Figure 12: Spaced Pair Diagram.....	12
Figure 13: Near-Coincident Pair Diagram.....	13

Introduction

This handbook has been created to aid all of the WPI music ensembles in their efforts to capture live performances, both locally and abroad. It is designed so that it can be used as either a step-by-step guide to live recording, or as a quick reference depending on the experience and knowledge of the person performing the duties of recording engineer.

The information contained here is based on knowledge gained from classes and extensive research conducted on microphone characteristics, stereo recording techniques, and stereo imaging theory as well as personal experience. Many artistic and technical factors were taken into consideration in developing the recommended setups for the various music ensembles.

This booklet is divided into four main sections: overview of live recording; equipment overview; recording techniques; and setup procedures for WPI music ensembles. The overview of live recording provides a list of all the equipment needed and a general procedure for live stereo recording. The equipment overview section contains information on the equipment specifically owned by the WPI music department. This section provides information regarding the equipment specifications as well as instructions on how to set it up, and operate it. The overview of stereo recording techniques explains how to setup and adjust the microphones to achieve a desired sound and stereo image. The last section of the handbook contains specific recommendations for the angles, spacing, and placement of the microphones and a basic setup procedure for each individual music ensemble.

Overview of Live Recording

The following list of equipment is owned by the WPI music department and is needed:

- 2 – AKG C1000s microphones with microphone clips
- 1 – Mackie 1202VLZ mic/line mixer with power cable
- 1 – Panasonic SV-3800 DAT machine with power cable
- 1 – pair of headphones (preferably with closed earphones)
- 2 – microphone stands
- XLR cables
- Power strip

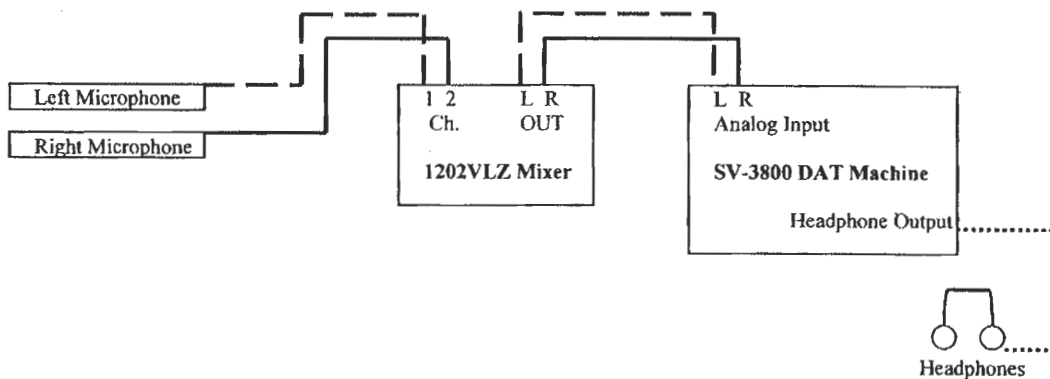


Figure 1: Signal Flow Diagram

Basic Steps to Stereo Live Recording:

1. Gather all required equipment.
2. Setup mixer, DAT machine, and headphones (preferably in an isolated room)
3. Choose stereo recording technique (see recommendations for specific ensembles.)
4. Setup and place microphones in desired location.
5. Check all connections and signal flow (see Figure 1)
6. Set microphone trim levels for both left and right channels.
7. Set DAT machine recording levels
8. Record concert
9. Monitor the signal on the DAT machine for clipping and listen for any distortion.

Equipment Overview

AKG C1000s:

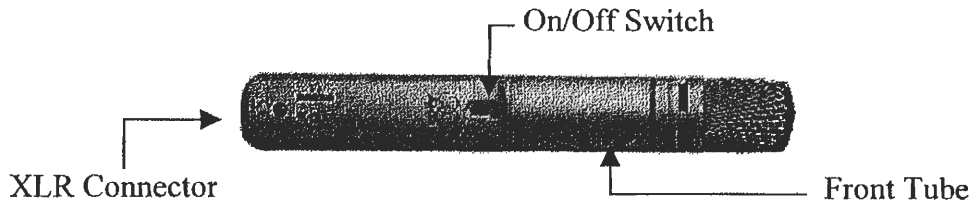


Figure 2: AKG C1000s

The WPI music department owns two AKG C1000s small diaphragm cardioid condenser microphones. The polar pattern on these microphones can be converted to hypercardioid with the addition of the PPC 1000 capsule, which comes with the C1000s. Both polar patterns and respective frequency responses can be seen in Figure 3.

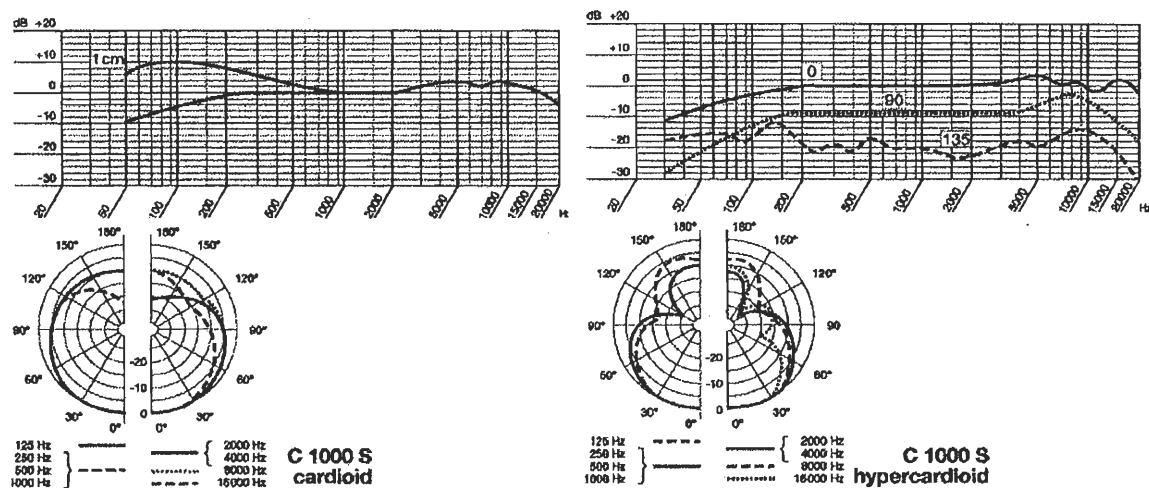


Figure 3: C1000s Polar Patterns and Frequency Response

This microphone is equipped with an internal 3 pin male XLR connector. In order for this microphone to operate properly, it needs to be powered externally either by *phantom power* or a battery. The microphones are most easily powered using phantom power supplied by the mixer. For more information on this microphone reference the users manual. For those interested in experimenting with different polar patterns, use the following instructions to install the PPC1000 capsule.

How to install the PPC 1000 polar pattern converter:

(This is optional, and not needed for normal recording purposes.)

1. Unscrew and remove front tube with wire mesh cap.
2. Hold the capsule and black rubber shock mount firmly with your thumb and forefinger.
3. Slip the PPC1000 on fully, slightly turning as you push it on.
4. Screw front tube back on.

To remove the PPC1000 follow the above steps in reverse making sure to grasp the capsule and rubber shock mount firmly as to prevent the capsule or shock mount from damage.

Mackie 1202-VLZ Mixer:

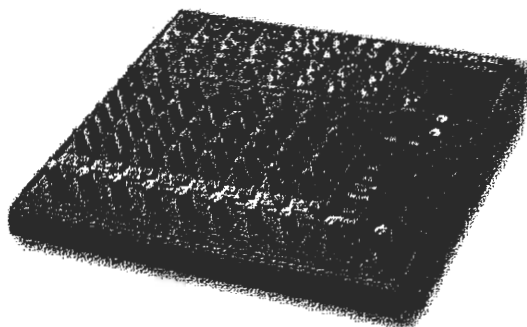


Figure 4: Mackie 1202-VLZ

The Mackie 1202-VLZ is a 12-channel mic/line mixer (see figure 4). This mixing board has many more features than are needed for stereo recording. Only the features and operating procedures relevant to stereo recording will be discussed in this section.

For more information on the mixer and its features consult the operators manual.

How to setup the mixer:

1. Plug in mixer and turn on the mixer using the power switch located on the back of the board (see figure 5).
2. Plug XLR cables from the left and right microphones into channels 1 and 2 respectively (see figure 6).
3. Turn the pan knob on channel strip 1 (see figure 8) all the way to the left and on channel strip 2 all the way to the right.
4. Check and make sure all 3 EQ knobs on both channels are set to unity (see figure 8)
5. Set the Output Level button (See figure 5) in the raised position, +4dB.
6. Connect the left and right XLR outputs from the mixer (see figure 5) into their respective analog inputs on the SV-3800 DAT machine (see figure 10).

How to apply phantom power to the microphones:

After both microphones are connected to the mixer, turn on the phantom power by flipping the switch on the back of the mixer (figure 5).

WARNING: Do not plug in nor unplug the microphones when phantom power from the mixing board is turned on, doing so could damage the transducer element.

How to set microphone trim levels:

1. Unmute microphone channel by depressing the mute button on the channel strip (figure 8) until it is in the raised position.
2. Depress the channel solo button (figure 8) so that the solo light on the main panel (figure 7) begins to flash.
3. Turn the Gain Knob (figure 8) on the channel strip to unity (U).
4. Gradually turn the trim knob for channel (figure 6) up while watching the meter bridge on the main panel (figure 7). Stop when the lights begin to peak around 0dB (half way up the meter).
5. Depress solo button on the channel again, solo light should stop flashing.

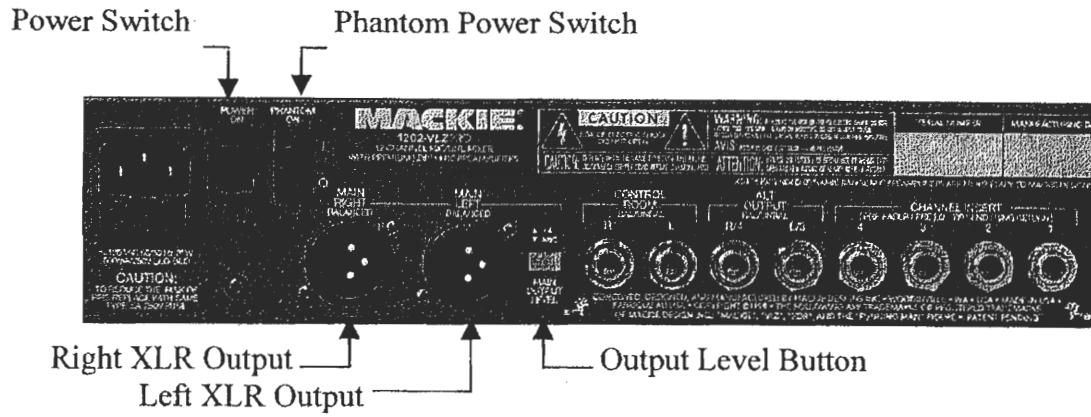


Figure 5: Back Panel of Mackie 1202VLZ

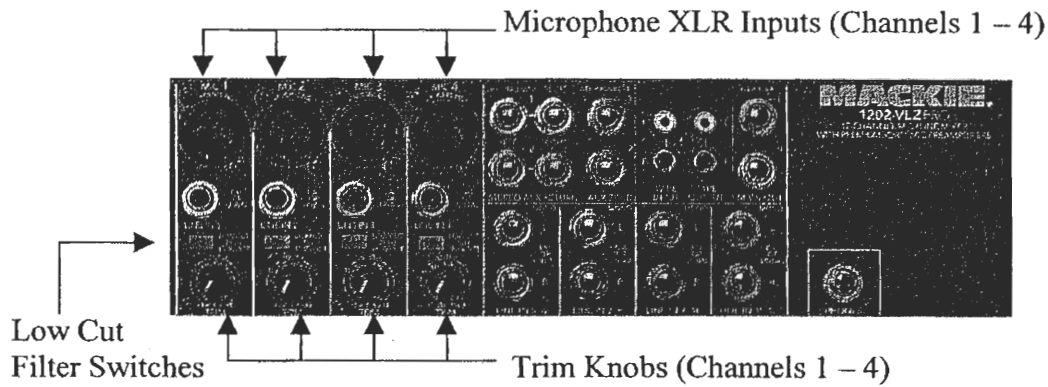


Figure 6: Input Panel of Mackie 1202VLZ

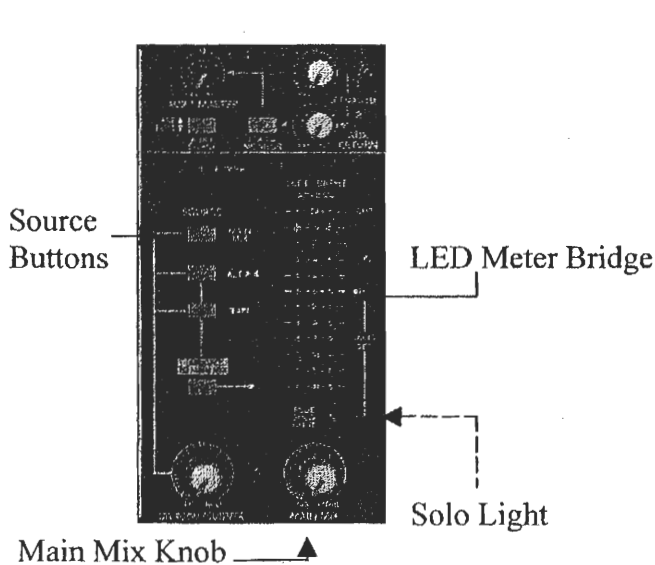


Figure 7: Main Control Panel of Mackie 1202VLZ

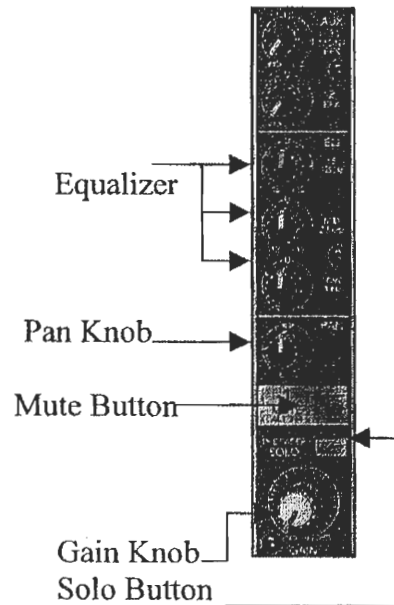


Figure 8: Channel Strip of Mackie 1202VLZ

Panasonic SV-3800 DAT Machine

The Panasonic SV-3800 is a Digital Audio Tape (DAT) Recorder. Before you record with this machine it is important to make sure that the input select button is set to analog, and the sampling frequency switch set to 44.1kHz (see figure 9).

In order to detect any errors or problems with the tape or machine do the following two tasks before recording the concert. Fast-forward the tape all the way to the end and then rewind it back to the beginning before recording. Record roughly 60 seconds of sound before actually recording the concert. This is a general rule of thumb because if a problem is to occur with the tape or the machine it normally happens within the first 60 seconds of recording.

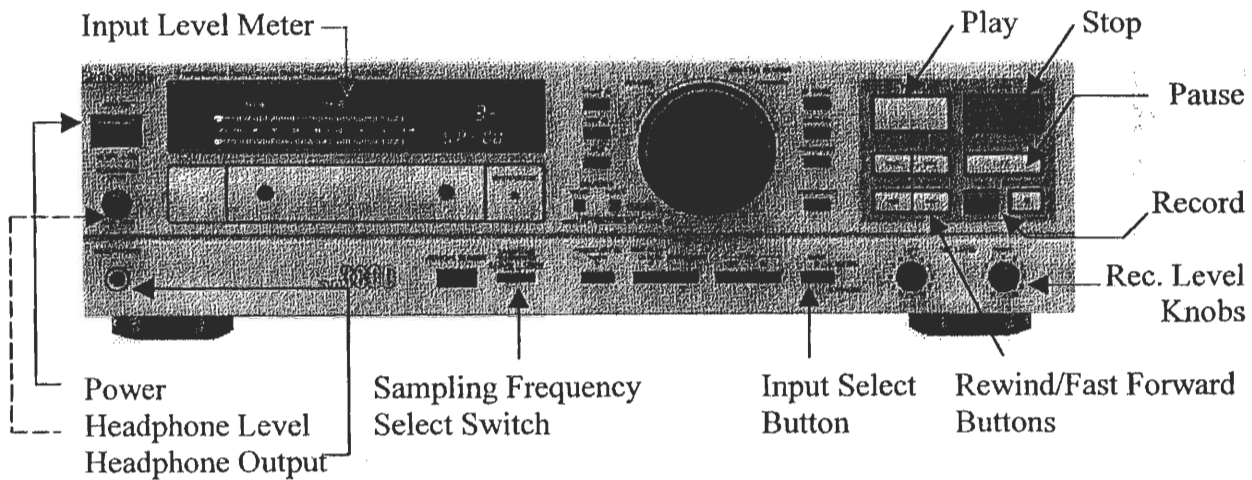


Figure 9: Front Panel of Panasonic SV-3800 DAT Machine

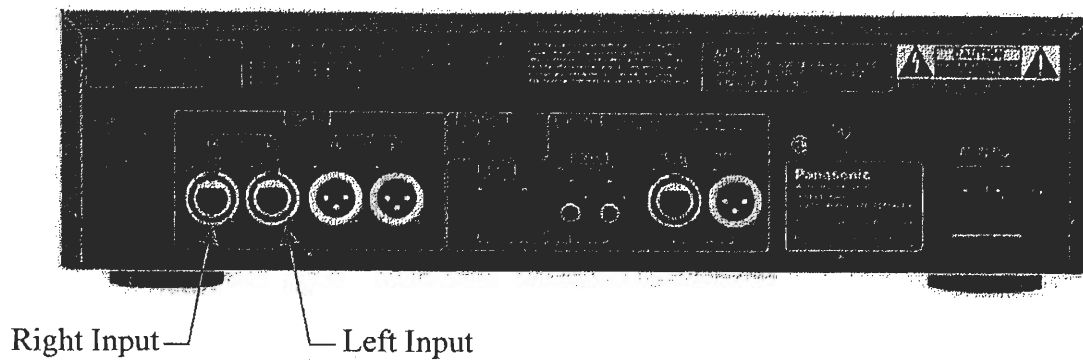


Figure 10: Back Panel of SV-3800 DAT Machine

How to record using a DAT machine:

1. Insert DAT into SV-3800
2. Fast forward tape to end, then rewind to beginning.
3. Press the 'record' and 'play' buttons together then pres 'pause'
4. Set the recording levels by adjusting the rec. level knobs to so that the left and right signals peaks are around -18dB on the input level meter.
5. Press 'play' to record test sounds.
6. Press 'pause' after 60 seconds.
7. Press 'play' again to begin recording the concert.
8. Press 'stop' at the end of the concert.

To add track id numbers for different musical selections during the concert simply press play while the DAT machine is recording. It is best to leave the machine recording throughout a performance; this lessens the chance of any problems occurring between the recording heads and the tape.

Overview of Stereo Recording Techniques

There are three main techniques used to record concerts in stereo: coincident pair, spaced pair, and near-coincident pair. This section will describe how to set up and adjust the microphones to achieve a desired sound and width of stereo image for all three techniques.

The width of the stereo image refers to how close the left and right most instruments in the ensemble are to the left and right speakers when played back. For example, if an image is narrow, the left most instrument may sound as if it is coming from half way between the center and the left speaker, versus in a wide image, the left most instrument may sound like it is coming directly out of the left speaker only. The wider the image, closer the left and right most instruments are to the speakers when a recording is played back.

Coincident Pair

The coincident-pair method uses two directional microphones placed so that the diaphragms of the two microphones are one above the other. They are symmetrically angled apart from the centerline and aimed approximately at the left and right sides of the ensemble (see Figure 11).

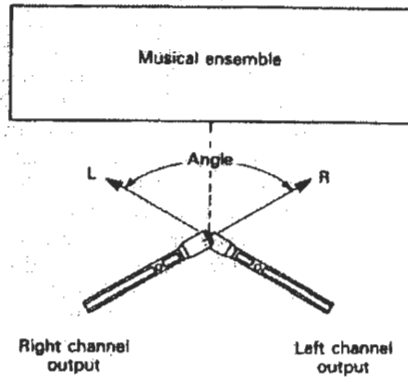


Figure 11: Coincident Pair Diagram¹

The width of the stereo image is controlled by both the polar pattern and the angle between the microphones. Increasing the angle between the microphones and/or using a pair of microphones with a narrower capture window (i.e. hypercardioid vs. cardioid) will broaden the stereo image. In general coincident pair recordings produce a narrow image and lack spaciousness.

Spaced Pair

The spaced pair method uses two identical microphones with any polar pattern placed several feet apart and aimed directly toward the ensemble (see Figure 12). The width of the stereo image is controlled solely by the distance between the microphones. The farther apart the microphones are, the wider the image.

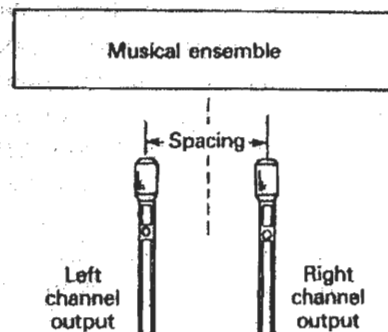


Figure 12: Spaced Pair Diagram²

¹ Bartlett, Bruce, *On-Location Recording Techniques* (Boston, MA: Focal Press, 1999), p. 79.

To achieve a good musical balance, it is often necessary to have the microphones spaced between 10 and 12 feet apart.³ This separation creates an exaggerated spacing in the stereo image and can cause a ‘ping-pong’ effect to occur between the left and right speakers for instruments located just off center. However, recordings using the spaced-pair technique are said to provide a warm sense of ambience. This technique is useful when it is desired for the recording to have a diffuse or blended sound.

Near Coincident Pair

The near-coincident technique uses two directional microphones, angled apart with their diaphragms spaced a few inches apart (see Figure 13). The width of the stereo image is controlled by the angle and spacing of the microphones. The greater the angle and/or distance between the microphones the greater the stereo spread.

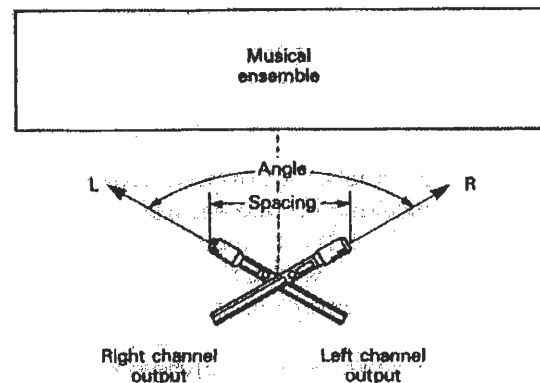


Figure 13: Near-Coincident Pair Diagram⁴

Compared to the coincident pair method, the distance between the diaphragms in near-coincident pair setups, adds a sense of depth and airiness to a recording as well as a wider stereo image.

² Bartlett, Bruce, *On-Location Recording Techniques* (Boston, MA: Focal Press, 1999), p. 81.

³ Bartlett, p. 82.

⁴ Bartlett, Bruce, *On-Location Recording Techniques* (Boston, MA: Focal Press, 1999), p. 84.

Once the recording technique is decided upon, the following adjustments can be made to achieve the desired sound and image width.

Increasing the angle: Increases the stereo spread
Increases ratio of reverberation to direct sound
Increases depth of the image.

Increasing the spacing: Increases the stereo spread
Degrades the focus of the image.

Increasing microphone directivity: Increases stereo spread for coincident and near coincident pair techniques

Increase Distance from ensemble: Increases ratio of reverberation to direct sound

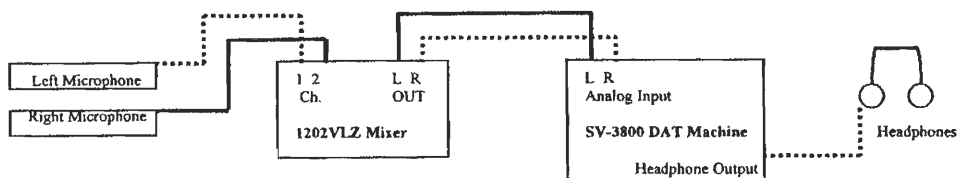
Setup Procedures for WPI Ensembles

Orchestra

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

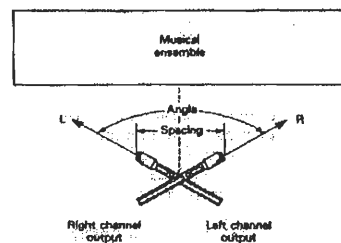
General Setup:



1. Plug the mixing board and DAT machine into the power strip.
 2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
 3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
 4. Turn on DAT machine, mixer, and phantom power.
 5. Insert tape into DAT machine.
 6. Fast forward tape to the end, then rewind back to the beginning.
 7. Pan channel 1 hard left and channel 2 hard right.
 8. Turn the gain knobs on channels 1 and 2 to unity.
 9. Make sure channels 1 and 2 are not muted.
 10. Place and adjust microphones
- ORTF Near-Coincident method.

Microphone Placement:

Distance from ensemble: 10 feet
 Spacing between mics: 6.7 inches
 Angle between mics: 110°
 Height: 10 feet



Microphones should be parallel to the floor

Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 – 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

Recording:

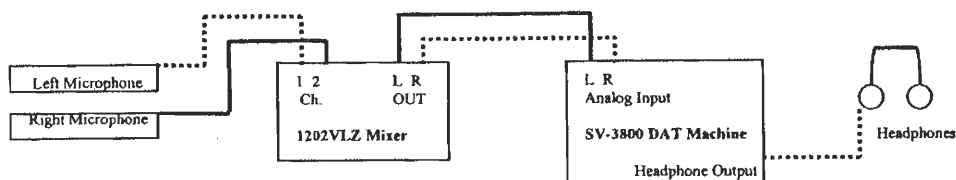
1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Wind Ensemble

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

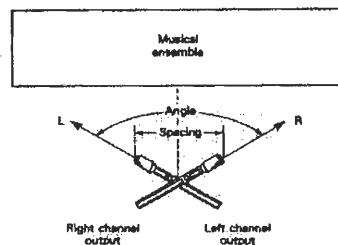
General Setup:



1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Near-Coincident method.
Distance from ensemble: 8 feet
Spacing between mics: 8 inches
Angle between mics: 90°
Height: 10 feet



Microphones should be parallel to the floor.

- Set Levels:**
1. Get ensemble to play some music.
 2. Depress 'solo' button on channel 1.
 3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
 4. Depress 'solo' button on channel 1 again.
 5. Follow steps 2 – 4 for channel 2.
 6. Turn main mix knob to unity.
 7. press 'play', 'record' together then press 'pause' on the DAT machine.
 8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
 9. press 'play' and record about 60 seconds of music then press 'pause'
 10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

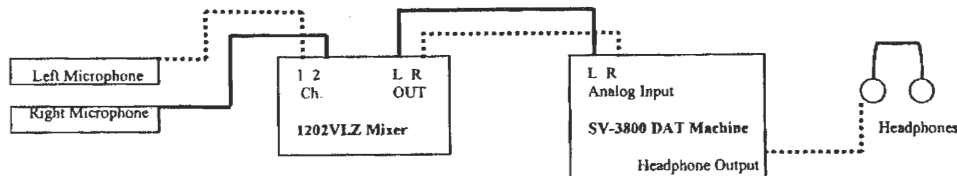
- Recording:**
1. press 'play' again to start recording concert
 2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
 3. press 'play' to add a track ID number
 4. press 'stop' then 'rewind' when concert is finished.

Medwin String Ensemble

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

General Setup:

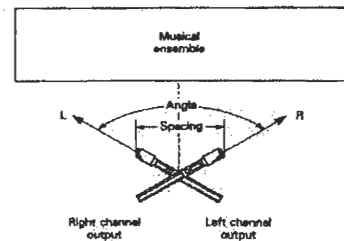


1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Near-Coincident method.

Distance from ensemble: 8 feet
 Spacing between mics: 8 inches
 Angle between mics: 90°
 Height: 8 feet



Microphones should be parallel to the floor

Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 – 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

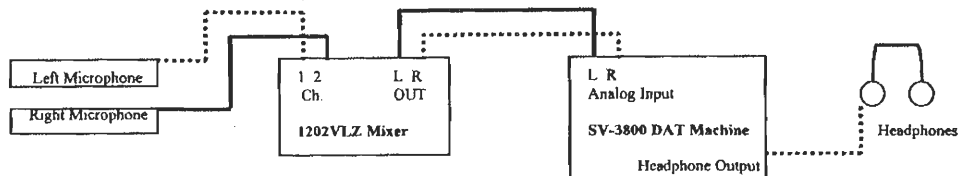
Recording:

1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Trombone Ensemble

Equipment Needed: 2 - AKG C1000s microphones with microphone clips
 Mackie 1202VLZ mic/line mixer with power cable
 Panasonic SV-3800 DAT machine with power cable
 Pair of headphones
 2 microphone stands (or 1 stand with a stereo bar)
 XLR cables
 Power strip

General Setup:

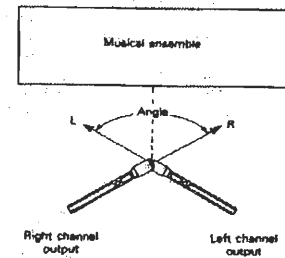


1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

ORTF Near-Coincident method.
 Distance from ensemble: 8 feet
 Angle between mics: 120°
 Height: 8 feet

Microphones should be parallel to the floor



Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 – 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

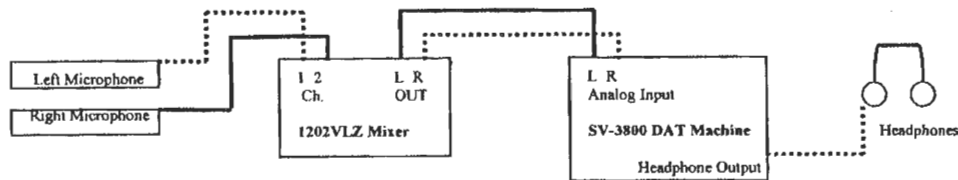
Recording:

1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Concert Band

Equipment Needed: 2 - AKG C1000s microphones with microphone clips
Mackie 1202VLZ mic/line mixer with power cable
Panasonic SV-3800 DAT machine with power cable
Pair of headphones
2 microphone stands (or 1 stand with a stereo bar)
XLR cables
Power strip

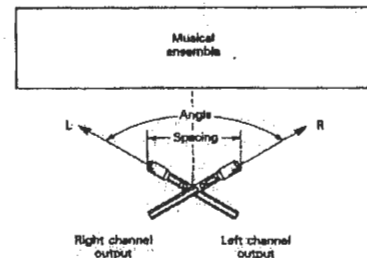
General Setup:



1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

ORTF Near-Coincident method.
Distance from ensemble: 10 feet
Spacing between mics: 6.7 inches
Angle between mics: 110°
Height: 10 feet



Microphones should be parallel to the floor

Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 – 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB .
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

Recording:

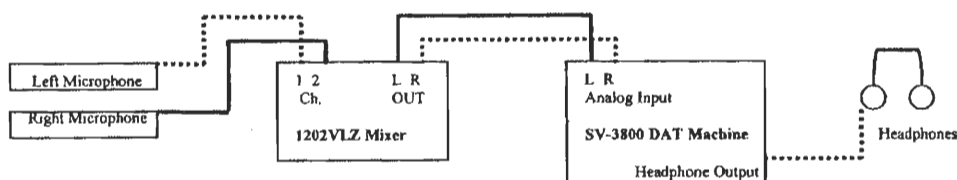
1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Brass Ensemble

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

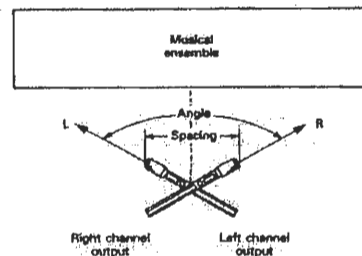
General Setup:



1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Near-Coincident method.
 Distance from ensemble: 8 feet
 Spacing between mics: 8 inches
 Angle between mics: 90°
 Height: 8 feet



Microphones should be parallel to the floor

Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 - 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

Recording:

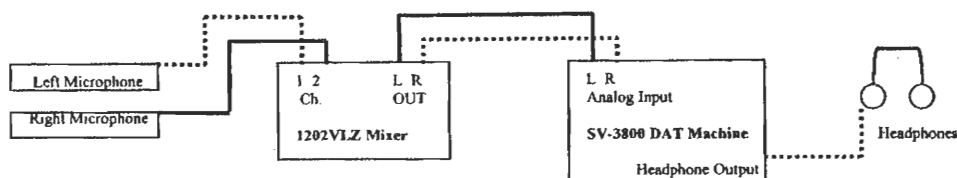
1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Jazz Ensemble

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

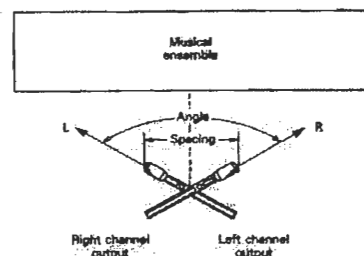
General Setup:



1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Near-Coincident method.
 Distance from ensemble: 6 feet
 Spacing between mics: 8 inches
 Angle between mics: 90°
 Height: 8 feet



Microphones should be parallel to the floor

- Set Levels:**
1. Get ensemble to play some music.
 2. Depress 'solo' button on channel 1.
 3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
 4. Depress 'solo' button on channel 1 again.
 5. Follow steps 2 – 4 for channel 2.
 6. Turn main mix knob to unity.
 7. press 'play', 'record' together then press 'pause' on the DAT machine.
 8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
 9. press 'play' and record about 60 seconds of music then press 'pause'
 10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

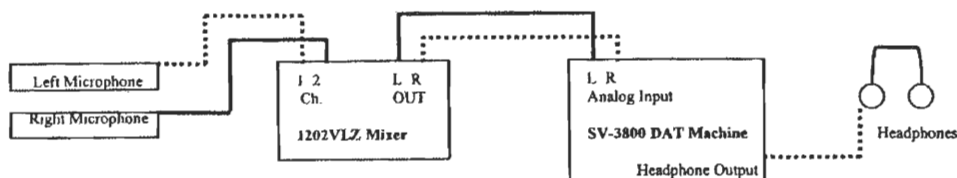
- Recording:**
1. press 'play' again to start recording concert
 2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
 3. press 'play' to add a track ID number
 4. press 'stop' then 'rewind' when concert is finished.

Stage Band

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

General Setup:

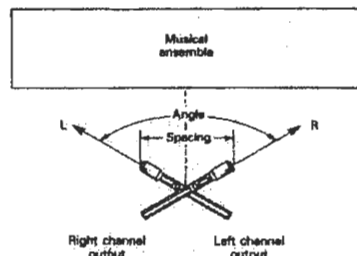


1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Distance from ensemble: 10 feet
Spacing between mics: 6.7 inches
Angle between mics: 110°
Height: 8 feet

Microphones should be parallel to the floor



- Set Levels:**
1. Get ensemble to play some music.
 2. Depress 'solo' button on channel 1.
 3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
 4. Depress 'solo' button on channel 1 again.
 5. Follow steps 2 – 4 for channel 2.
 6. Turn main mix knob to unity.
 7. press 'play', 'record' together then press 'pause' on the DAT machine.
 8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18 dB.
 9. press 'play' and record about 60 seconds of music then press 'pause'
 10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

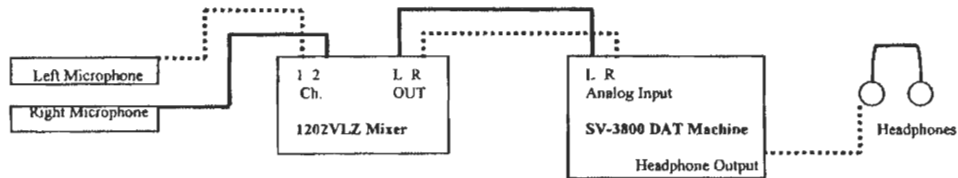
- Recording:**
1. press 'play' again to start recording concert
 2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
 3. press 'play' to add a track ID number
 4. press 'stop' then 'rewind' when concert is finished.

African Drumming and Dance Ensemble

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

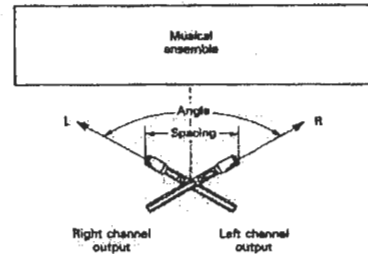
General Setup:



1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Distance from ensemble: 8 feet
 Spacing between mics: 8 inches
 Angle between mics: 90°
 Height: 8 feet



Microphones should be parallel to the floor

Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 – 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

Recording:

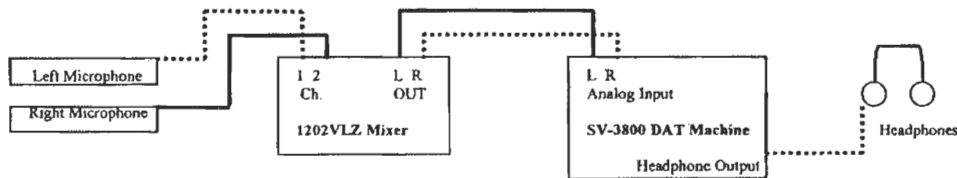
1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Men's Glee Club / Alden Voices / Concert Choir

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

General Setup:

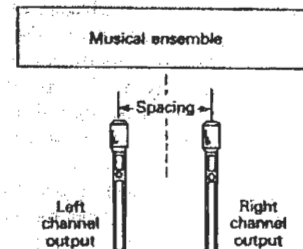


1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Use Spaced Pair method.
 Distance from ensemble: 10 feet
 Spacing between mics: 8 feet
 Height: 10 feet

Microphones should be parallel to the floor and aimed directly toward the ensemble as shown



Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 - 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

Recording:

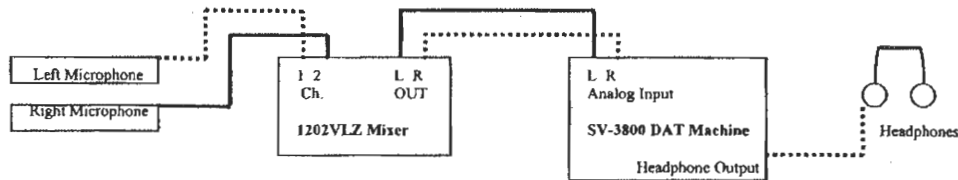
1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

Interstate 8 / Simple Harmonic Motion

Equipment Needed:

- 2 - AKG C1000s microphones with microphone clips
- Mackie 1202VLZ mic/line mixer with power cable
- Panasonic SV-3800 DAT machine with power cable
- Pair of headphones
- 2 microphone stands (or 1 stand with a stereo bar)
- XLR cables
- Power strip

General Setup:

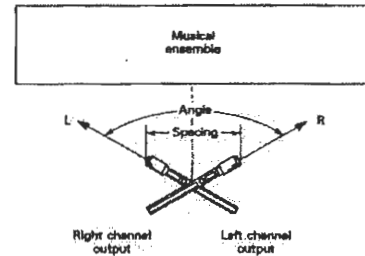


1. Plug the mixing board and DAT machine into the power strip.
2. Connect the left and right XLR outputs from the mixing board into the respective XLR analog inputs of the DAT machine.
3. Connect the Left and Right microphones into channels 1 and 2 respectively using XLR cables.
4. Turn on DAT machine, mixer, and phantom power.
5. Insert tape into DAT machine.
6. Fast forward tape to the end, then rewind back to the beginning.
7. Pan channel 1 hard left and channel 2 hard right.
8. Turn the gain knobs on channels 1 and 2 to unity.
9. Make sure channels 1 and 2 are not muted.
10. Place and adjust microphones

Microphone Placement:

Near-Coincident method.

- Distance from ensemble: 6 feet
- Spacing between mics: 6 inches
- Angle between mics: 90°
- Height: 8 feet



Microphones should be parallel to the floor

Set Levels:

1. Get ensemble to play some music.
2. Depress 'solo' button on channel 1.
3. Gradually turn the "trim" knob on channel 1 until the lights on the mixer meter bridge peak around 0 dBu.
4. Depress 'solo' button on channel 1 again.
5. Follow steps 2 – 4 for channel 2.
6. Turn main mix knob to unity.
7. press 'play', 'record' together then press 'pause' on the DAT machine.
8. Use the recording level knobs to adjust both right and left signals on the DAT machine to roughly -18dB.
9. press 'play' and record about 60 seconds of music then press 'pause'
10. Have ensemble play loudest section. Watch the meter on the DAT machine and make sure the red 'over' lights don't turn on. If they do turn down the recording knobs.

Recording:

1. press 'play' again to start recording concert
2. Monitor signal level on DAT machine while recording **DO NOT CLIP INPUTS!**
3. press 'play' to add a track ID number
4. press 'stop' then 'rewind' when concert is finished.

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