Relationships between Music 2 – 195 — feed each other

Music 2 . New approach — computer aid video feedback

new ways to use personnel resources
new methods of student teacher interaction

overall goal of music 2 stated
student sets own goal for quarter within overall goal –
How to aid realistic goal setting in terms of the student capacities versus the necessary skill to be attained .

Students are almost never well prepared with the necessary skills on entering the undergrad program – Especially crippled rhythmically.

How many students want just to learn to read music – they often feel at a disadvantage compared to music students – Computer aids would give every one a chance –

Ask Media Center to provide video feedback labs
How to use OLR , OASIS , Computer Center , Library

Oasis makes professional assistance available to faculty engaged in development of instructional materials.
want slides tape videotapes of equipment acoustical information
RA (David Jones) to help gather definitive collection of material for library
(John Celona?)

Ready access to instructional material the faculty develops –

Evaluation

Records

cost benefit
Saves faculty time
Self based learning from other fields

more attractive to students because of less emotional pressure –

What has been done by others? Peter Farrel
Jack Logan

Advantage of uniformity (output from computer) is that results easier to evaluate.

musical literacy — Service to University

Many G+E Students want to learn to read —

Mus 2 and 105 draws gen students

Tech Team

Rob Gross Digital Design
Bruce Rittenbach Analog Design
Bruce Liebig Software
100% RA Documentation
100% TA
work study?

— Meeting —

Users – Engineers – Consultants (Stanford)

air fare –
Per diem

What is each guy going to do?

Show 2 prongs
Student Involvement
Interdisciplinary between Science

Month of release time

Ed Harkins Consult on Rhythm aspect

Peter Farrell Consult on Sight singing

Balzano Consult on psycho acoustical aspects

Include Work Study

Several years of work

Practical system 2 years

Pilot 105 Center facilities (nothing needed)

$1000 for Computer maintenance
50% TA to run programs
6 to 8 students limit

Technical Horizons Staff

Pilot Computer Aided Learning

Departmental terminals for 105 next year

multiport
Appropriate interface ~~for~~ telephone lines from CMC
PDP 11 to Dept. terminals

Only direct link from our computer to the Burroughs is paper tape. Too tedious.

Students need to prepare data to input to our programs or PDP 11 How?

Synthesis Programs not suited to Burroughs
could have better

$10K computer time

UNDERGRADUATE

What = Introduce computer aided learning into the curriculum

A. Computer aided learning of Basic musical skills

1. Intonation
2. Pitch Patterns
3. Tempo
4. Rhythm
5. Dynamics
6. Timbre discrimination

B. Creative application of basic musical skills using the computer

1. Sound Generation
2. Sound manipulation

Why

Department undergrad commitment

A. The undergrad students want it (Petition)

B. undergrad Students should have access to current technology

move CMS Research into instructional program

C. Cost effective

1 Faculty time
2 TA time
3 Staff time

D. Reach more students

E. Relieve emotional pressure on the students

F. Affect the entire curriculum for the better

1) Student need more practice outside of class
2) All levels could participate including interested general students
3) Continue to encourage self paced learning

How.

A Pilot Course in Computer Music

B Fund team of specialists to implement transfer of Research to instruction

1) Hardware
2) Software

C Release time for faculty to ~~implement~~ plan a Planning meeting

Pilot programs

1 Train Staff
2 Train TAs
3 Train RA.

make use of computer Center music Computer Learning

D Pilot Computer aided learning in the fall program

E. Evaluate results by TA training sessions

Introduced

renovate 105 AB in terms of hard ware + soft ware for next year

Sound isolated booth for practice singing
Tape recorders for recording results and comparisons

Not only would we improve this course but would be providing ground work for improvement in the entire theory program

Movement of CME research into Dept of Music

Perception — How are we hearing -

Aiding students in any direction he wants to go.

Grand schemers what works what doesn't work?

Rhythm machine -

Computer analog of music 1 -

Make access

John - Ed. psych input design the courses

Ed - Evaluation

construction of analog + digital sound synthesis devices
for use in ~~at~~ MUS 105 sequence.
~~Computer~~ terminal at CME to promote undergraduate research.
Terminal interface ~~to accommodate 105~~
Microprocessor based system for control of analog
studio.

C Supplies + Expense
Computer maintenance Contract
Electrical system overhaul

F Computer time
$500 per quarter per student (if Computer Center)

To Pauline
From Bruce L
Re MUS/105

O.K., here's what I got:
Our immediate needs for 105 Spring Quarter are

50% TA to oversee computer useage

$1000 or some pro-ration based on the $2,000/yr quote from Technical Horizons for PDP-11 maintenance

The transfer of technology ~~to Bowle's micros~~ out of CME for future 105s might proceed in two directions. 1) Interface the CME Digital Synthesizer Board to Bowle's micros and provide software support for it 2) Write an optimal (meaning economic) B6700 synthesis program — listen to the sound at CME.

In the Digital Synthesizer case we would have a very interactive situation as the system would produce sound as soon as its user had completed editing the specifications of those sounds. The cost per channel (unit) for hardware materials would be about $2000, interface included. Minimally, a moderate amount of software would be required. ~~The cost of~~ The sonic capabilities of the DS are intrinsically related to the sophistication of the system that manages it; so that perhaps a large amount of effort in software utilizing a micro will not substantially utilize the DS's capabilities. (In our minimal "system" for CME we plan to have the PDP-11 and a micro;

and/or a dedicated micro for each board.) Computing some control rate waveforms between the editing and the production of sound will be required to escape from continual vanilla chowning FM.

I assume the micros would have the following:

1) A CRT graphic terminal (this we know)
2) At least 32K bytes of memory (hopefully 64K)
3) Some kind of disk storage

The B6700 ~~could~~ probably could not be located remotely to the micro because of the data transmission speed between them. Equipment for recording, amplification needed ?! Advantage — sound is free! when micro is accessible.

In the B6700 case 1) we would need a method of transferring computed sound to the CME computer for conversion to sound — most obvious media is mag tape. A used unit for the PDP-11 would be in the $5000.00 range; new, about $8000. 2) Would need to develop a cost-effective synthesis program for B6700. Probably $5,000 in B6700 charges for initial development. Disadvantage of this approach: a substantial wait for output; high cost in B6700 charges, continually, to run system. Advantages — more flexibility in synthesis techniques and their modification; B6700 terminals are available 18 hrs a day. This approach would not be feasible without at least a $250.00/student/quarter support. Probably $500 would be more like it.

Evaluation

I definitely favor the DS-micro approach. We probably won't have as much synthesis capability as quickly; but over the long haul it provides the most quality sound/dollar and its highly interactive. As budget I recommend

1st year - $2000/chnl : board & interface

2d & 3d years - $500-1000/chnl : enhancement in interface

By putting more smarts in the interface, the software will have to do less book work and spend more time in communication with user. Also sound performance capability would increase as DS could be driven harder. (Obviously this hardware needs to be designed so that if Bowle's micros go away or change, then the hardware can be used with other micros or mini's with a minimum of change.)

Music 2

After talking to Bruce R, who has looked into the pitch detection problem, I believe that this is a feasible, but perhaps expensive project: The speech research people have developed hardware to do pitch to voltage conversion. When you put it in a system to do what we need — also be able to do pitch/rhythm detection — we estimate about $2500/chnl in a quantity of 10, maybe $3000/chnl. We would need a quiet area for these systems. It is not clear if this area could be very remote from the micros because of data transmission speeds. In both the 105 and 2 systems we need hi-speed transmissions between the outboard hardware and micro. Working remotely would require 1) purchase of modems so the micros could talk over the phone to terminals (this slows down micro-terminal communication speed by possibly a factor of 8.

2) Acquisition of remote terminals — a duplication, since the ones local to the micros would not be useable when a remote was connected - 3) A co-axial cable between the remote site and micro for hi-speed stuff. There is also the problem of starting the computer from a remote site. I think its easier to get the proper environment for these machines initially (the 3d wing for CMC).

Evaluation

The costs are extremely difficult to estimate with investigating the design of the system further. E.g., is 1/8 semi-tone resolution adequate — how do we handle vibrato — what should we do in hardware and what in software. — when you think about it - there are oodles of these questions. I'm convinced this project is do-able given enough support.

Programming support from Bowles for our projects would have to be worked out. A substantial part of it would have to be written in assembler because of real-time requirements. Bowles favors high-level language approach, PASCAL currently. High-level languages are great and I love them but they are usually 4 or more times slower than assembler. Problems like part-writing are well-suited to PASCAL.

Hit on similar efforts!

Call Jon Appleton at Dartmouth. He developed a Real-Time FM synthesis teaching system on a Sloan foundation grant 2-3 years ago. Bruce R also thinks it is used in sight-singing — dictation. ??

Hope this helps. Be in Friday. Be interested to hear how your meetings go.

Bruce

Possible 2-105 connection:

When the MU2 project requires sound be played to the user, the DS board would be available

Music 105

B6700 sound synthesis

equipment needed

	use by 5 students	for pilot program
1. Magnetic tape unit	$8000	$8000
2. Computer time	$500-600/student/quarter	$2500-3000

Expenses would be incurred each quarter

first year	cost	$10,500
each year		$2500-3000

Microcomputer system — use by 5 students for pilot

Hardware 1 time expense $12,500

use of APIS microcomputers free

yearly cost would be $500-1000/yr for maintenance

Pauline-

The technical meeting will be held Tuesday at 1PM as scheduled.

Frances

9/24/76

Computer Facilitated Learning of Basic Music Skills

Ed Berkeley

I Initial phase of project: Preparation of a system for use in Music 2a-f (Basic Musicianship). The purpose of Music 2 is to develop the students ability to —

a) notate in tradional musical notation that which one hears, whether the hearing be acoustic or "in one's head".

b) perform (whether vocally or instrumentally) traditionally notated music accurately.

(of course, related to and even prior to these basic goals are many other skills such as intonation, scales, memory span, etc.)

the possession of these abilities is a prerequisite to the development of musicians, whether they be composers, performers, conductors, etc. and thus are the basis for all music curricula.

In order to improve, the student obviously needs a model of correctness — the teacher being the traditional one. But since most learning in these kinds of courses must occur as a result of work done outside of class (in no way diminishing the necessity of the class), other methods of help have been developed, eg. dictation tapes. these kinds of materials have the obvious advantage of great cost-benefits (no teachers needed) and the advantages accrueing from self-paced learning.

the present proposal if implemented would infinitely expand the effectiveness of out-of-class study by taking advantage of the capabilities of the computer (perfectly suited to a skill-oriented course). For example the computer is uniquely capable of —

1. Communicating (by immediate and specific graphic as well as auditory feedback) the inaccuracies in one's performance, whether it be performance that is simultaneous with a prepared computer tape or a student performance to which the computer simply "listens"
2. communicating any inaccuracies in one's notation, whether it be the notation of a composition "in one's head" or the notation of a prepared computer performance (ie. learning by auditorially comparing the computer performance of the student-programmed student notation with the original composition).
3. integrating the auditory and conceptual by having a musically-conceptually appropriate programming language plus the capability of exploring the entire system implied by traditional notation
4. generating an infinite number of exercises (the constraints being defined by the teacher and/or learner) to be used with or apart from the computer and the class.

additional notes — unifying proposal

A.

Music 2	Music 105
Computer aided learning of basic skills	Creative application of these skills using the computer

B. Music 2a-f has a cut-off of 105 students presently, the demand is approx. — 150
2d-f is presently at about 25 students

Computer Facilitated Learning of Basic Music Skills: some notes

I Especially appropriate for Music 2a-f and Music 101a-c.

II Skills to develop:
a) the ability to notate in traditional music notation what one hears
b) the ability to perform (read) traditionally notated music accurately
c) the ability to compose simple melodies

III Equipment needed (long-term):
a) 10 separate sound-proof booths (various campuses) each equipped with —
b) tape-machines, microphones, ear-phones, metronomes and
c) computer terminals

IV Student must be able to
a) Program in and hear back any pitch, rhythmic and "dynamic" structures possible in the traditional notational system plus a few different timbres and "articulations" (from 1-4 simultaneous parts).
b) Get immediate print-out feedback as to performance errors (the computer must "hear")
c) Generate (probably in alphanumeric notation) an infinite number of different exercises according to constraints specified by the programmer

also, the student must be able to sing into or drum by clapping or tapping and get feedback & correction. It should be possible to scale the "correctness" of timing & tempo.

Machine must be able to

Preliminary

V Work to be done by me:

systematic, comprehensive + numerous

a) Prepare tapes to be listened to
b) Write exercises to be learned
c) ~~Learned~~ Design ~~a program language~~ a language which is conceptually appropriate to musicians.
d) Prepare operators manuals for students

VI

the above work would necessitate a 1-month replacement salary ~~for~~ the summer and release from ½ of teaching obligations during academic year (also $10/page for copying)

VII

Efficient computer-human interfaces would include the following sequences

a) Student performs prepared notation – computer evaluates performance – computer performs exercise correctly – student repeats performance, etc.
b) Student invents an exercise and programs into computer – computer performs notation – student performs notation.
c) Student records improvisation – students listens to and notates improvisation – student programs improvisation into computer – computer performs notation – student compares with original taped improvisation.

d) Student listens to and notates prepared computer performance — student programs notation into computer — computer performs notation — student compares with original tape.

e) ~~Perform~~ Student performs ~~original material~~ prepared material simultaneously with prepared computer tape (especially effective in hocket, unison and imitation).

Ed Harkins

TO: Pauline Oliveros

FROM: John Andrews

RE: Educational Psychology input from me on the Music 2/105 development projects.

I. General virtues of the project

A saving of faculty/TA time would result from the self-instructional methods using computers.

The self-pacing aspect is of especial value here because it would handle the problems posed by wide variation in music background of the students in Music 2 and perhaps Music 105 as well.

Many of the skills taught in music 2 involve psychomotor activity and memory/recognition tasks for which immediate, frequent feedback is highly effective (as contrasted, say, with the complex concept formation required in a philosophy class). Individualized computer feedback is thus very well suited to this course.

The opportunity to practice the awkward first steps of, e.g., singing notes in private, and to choose the time for public performance would reduce the embarrassment and anxiety I have observed to be an inhibiting factor for less skilled students in Music 2 sections.

II. Specific functions I would perform

Helping to define the courses in terms of observable behavioral learning objectives.

Collecting data in Music 2 via questionnaires and interviews with students, observation and analysis of videotapes, re:

Tasks involved
Student learning styles
Specific obstacles to learning
General student attitudes toward course
Student suggestions for improvement

Providing psychological ideas for the design of the experimental Music 2, drawing on such areas as:

Experience with Personalized Systems of Instruction (PSI) in other disciplines
Biofeedback techniques
Behavioristic learning systems

Providing psychological ideas for the design of the experimental Music 105, drawing on research into methods of stimulating creativity.

For both courses, providing formative evaluation, via:

Assessment of student background preparation
Data on student learning styles
Monitoring rate and patterns of student learning periodically during quarter
Assessing student reactions and suggestions periodically via interviews and questionnaires
Assessing effectiveness of teaching with the new methods through questionnaires and videotapes

For Music 2, conducting a controlled study comparing the course as currently taught with the experimental version, as to:

rate of learning
student satisfaction
types of students, in terms of background and learning styles, who prefer each format

III. Budget

This would require approximately .10 of my time (a half day a week) during the course of the project. If we are to get underway in the spring, this would have to be included in the request. If my teaching development proposal is funded for 1977-78, the work could be done partly or wholly under this funding but still should be included in the music project budget since we will not know the response to my proposal before submitting this one. A note on this should probably be included.