Computer Simulation as a Teaching Tool

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The Practice

Of all musical disciplines, orchestration (the technique of combining instruments) is perhaps the hardest to teach, because of the difficulty in providing direct feedback for students' work. Ideally, one would want an orchestra available for each class, to demonstrate every situation discussed; however, in the real world, this is wildly impractical. In the past, students were exhorted to study the scores of masterpieces, and the teacher criticized their own work. However even the best such criticism is weakened by the fact that the students never actually hear what works and what does not in their assignments. Occasionally, a fortunate few are lucky enough to hear an exercise or two read at sight by an available instrumental group. However, since music is largely a practical domain – the main issue is always how the music sounds – this situation is not ideal.

With the advent of affordable computer music equipment, it is now possible to create fairly realistic simulations of orchestral sound. In the world of film music this has been done for years, for budgetary reasons: It is much cheaper to have one person play in all the parts than to hire a whole orchestra. However, to the best of my knowledge, this technique has not been applied in an academic setting.

Hardware and software for sound synthesis are in rapid evolution, but at a minimum, orchestral simulation requires a computer with midi sequencing software, some synthesizer modules, and a decent sound system.

My own procedure is as follows: After analyzing examples from the repertoire in class, I assign exercises focussing on a specific orchestral technique. In the next class, some students will arrive with their own simulations (a fairly recent development), and I direct the discussion mostly by asking questions: Is a given musical element sufficiently clear? Are foreground and background sufficiently differentiated? Does the orchestration respect the musical character? And so forth… I may propose alternatives, which I promptly simulate in front of them, so that we can make comparisons. I rarely give my own opinion directly; I just keep trying to make the questions more and more specific until the students arrive at a considered judgement. Questions either focus on the ends (what is the highest standard that one can require in such work?), or the means (given a specific character desired, are we using the best orchestral means to achieve it?). For work which students do not simulate themselves, I will simulate all or part in class, and direct the discussion in the same way. It takes only a few minutes for me to enter a small piece. However even this process is of interest, since the music must be entered one instrument at a time, which allows the students to hear the music broken down, part by part, in a way not feasible with recorded repertoire. Usually there is time for two or three such simulations in a three hour class. In addition, numerous minor variants can easily and quickly be tried within each piece.

The main advantages of this method are:

- it encourages judgement based on direct aural experience
- it allows students to use their mistakes for learning, since several versions can be directly compared
- it encourages active discussion
- it is much more motivating for students to hear their work then just to get written comments.

Guiding Principles Behind the Practice

1. Students learn better through direct experience.
2. It is as useful to examine why poor solutions don't work as it is to analyze "perfect" solutions.

Sources of Inspiration or Influence for the Practice

Although computer simulation of the orchestra has been used in film music for years, I know of nobody else using it as a teaching tool. Perhaps this is because it requires a combination of disparate skills that is still relatively uncommon: The professor must be expert in conventional orchestration, completely at ease with computers and computer music equipment, and finally, very adept at sight reading (often complex) music at the keyboard (for data entry).

The idea of exploiting the learning potential of unsuccessful orchestrations is an instance of the general idea of learning from one's mistakes and failures, an idea that can also be found in such teaching methods as Problem-Based Learning and the case study approach. In my case, one strong influence concerning this idea has been reading the work of Charlie Munger, lawyer, investor, and business man.

Frequently Asked Questions About the Practice and Responses

1. To what degree can computer simulation really replace experience with a live ensemble?

   Not completely. As a complement to this method, a student should attend orchestral rehearsals, listen to good recordings, and study scores. However, the advantages of having direct feedback are so enormous that, provided the student does not ignore such other sources of information, I can't imagine going back to the older methods alone.

2. Don't computers require their own artistic approach? Isn't it misplaced to ask them to do things which instruments played by human beings can do better?

   A computer is not an instrument in the same sense as a violin: It is a <u>general</u> machine for manipulating symbols. Thus no approach is intrinsically "idiomatic" or not. In many disciplines where doing real experiments is either too costly or too dangerous, computer simulation has proven its value. There is no reason why music should not benefit from such technology. Although I attended a very good school and had a fair amount of experience there with the orchestra, in my own work I have learned so much from computer simulation that I wouldn't consider doing without it.

3. Aren't you making it too easy for the students? Shouldn't a successful orchestrator be able to "hear" the results without any real feedback?

   A professional orchestrator gradually develops the capacity to imagine sound combinations, based on accumulated experience. But such imagination must be nourished, and it is useless to demand it of a student who has little or no occasion to hear his own first efforts played by a real orchestra.

For More Information (References and Links)

Although there is some literature about using computers to simulate the orchestra for film music (the best places to look for this - rapidly changing - information are popular magazines like Keyboard, or Electronic Musician) their use as teaching tools seems to have gone largely unexplored. I have been using them for around ten years now, and have yet to encounter anybody else doing the same thing, in my field.

To read more about my ideas on developing the tools for composing music see [A Practical Guide to Musical Composition](#) and [Principles of Counterpoint](#).