A Computer-Aided Music Composition Application Using 3D Graphics
(Research and Initial Design)

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Outline I

Outline II

Abstract

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3. Literature relevant to the project is reviewed, similar available software products are surveyed, and appropriate methodologies and technologies for implementation of the various project modules are proposed.
4. Two different design environments are explored - OpenGL and Smalltalk-80 implementation called Squeak. And a prototype with limited functionalities was developed in Squeak.

Introduction and Basic Idea

The basic pipeline that will be imployed for this project will be:-

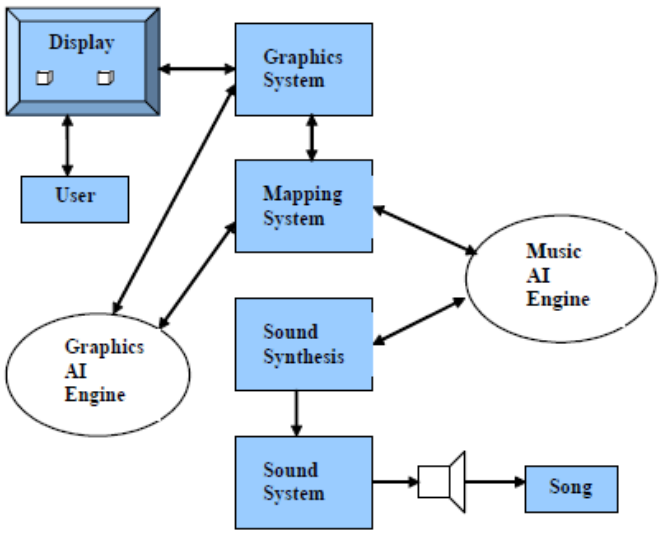

Figure 5: Project Diagram [Appendix A]

(1)

The modules that were considered in the initial phase of the project are highlighted in blue.

- GUI (Graphical User Interface) - User/Display Module

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  2. Initially a 2D mouse will be utilized, but 3D input devices will also be explored for future development.
  3. The user interface will be a "scene building" system that will give the user access to 3D objects that can be created and manipulated through the graphics module.

- Graphics Module

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  2. It is envisioned as an environment where the user can select an object that can be viewed as a lump of clay that can be sculpted into a differently shaped 3D object that can then be mapped to a sound by the mapping module and the graphics artificial intelligence (AI) engine.

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  2. The job of the graphics AI engine will be to provide certain rules that will be used by the system to prevent impossible scene outputs while subtly augmenting the operators design.

- Mapping Module

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  2. An initial mapping scheme for some of the more simple graphical/musical elements was proposed:
     a. Pitch
     b. Duration
     c. Volume
     d. Timbre

Pitch

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(ii) Figure 1 is a screenshot of an OpenGL scene in which the purple object would be higher in pitch than the yellow.

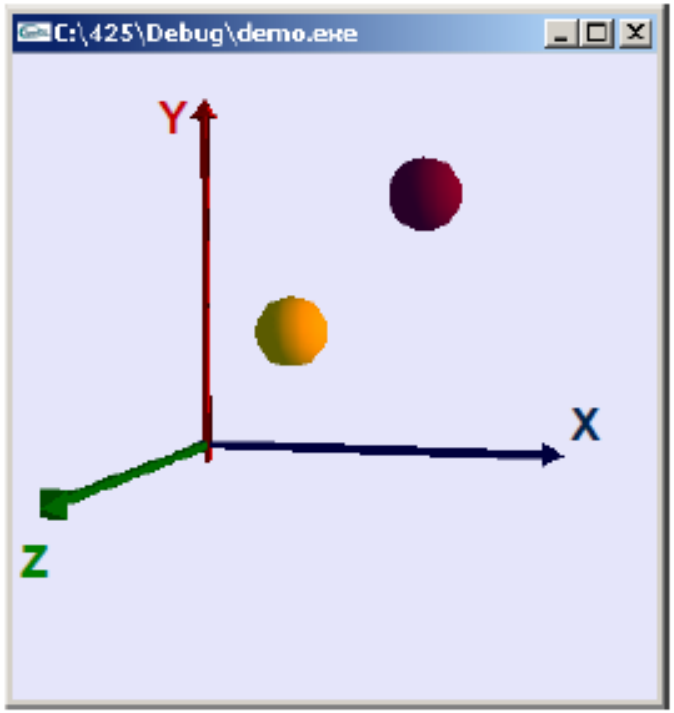

Figure 1: Pitch mapping

Duration

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(i) The width of the object in the x-axis could determine the length of time the note would be held.

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(ii) In figure 2, the yellow object would be mapped to a musical note of longer duration than the purple.

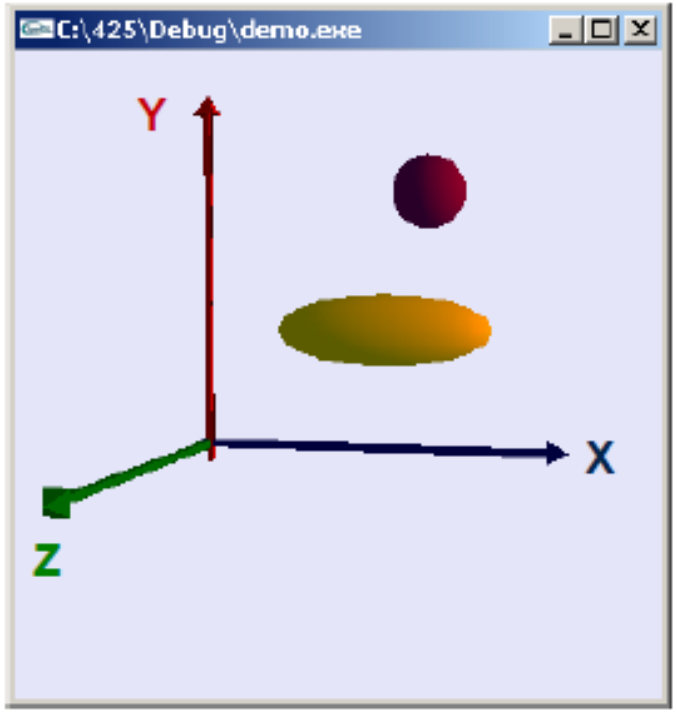

Figure 2: Duration mapping

Volume

Volume

(i) The overall size of the object could be mapped to the intensity, the loudness or softness, of the note.

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(ii) The purple object in figure 3 would correspond to a louder note than the yellow object.

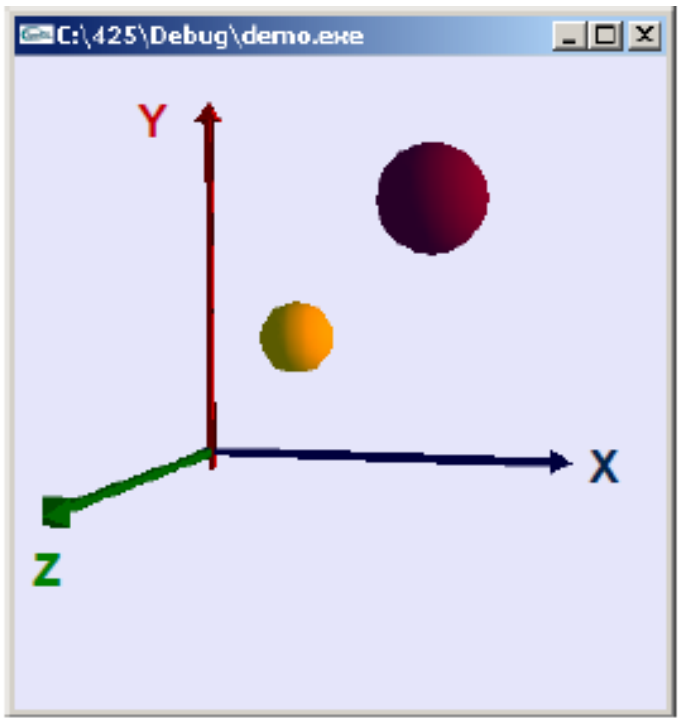

Figure 3: Volume mapping

Timbre

Timbre

(i) The color or texture of the object could determine the musical instrument represented by the shape.

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(ii) For example, the gold object in figure 4 may be mapped to a brass instrument and the warm red ball to a woodwind sound.

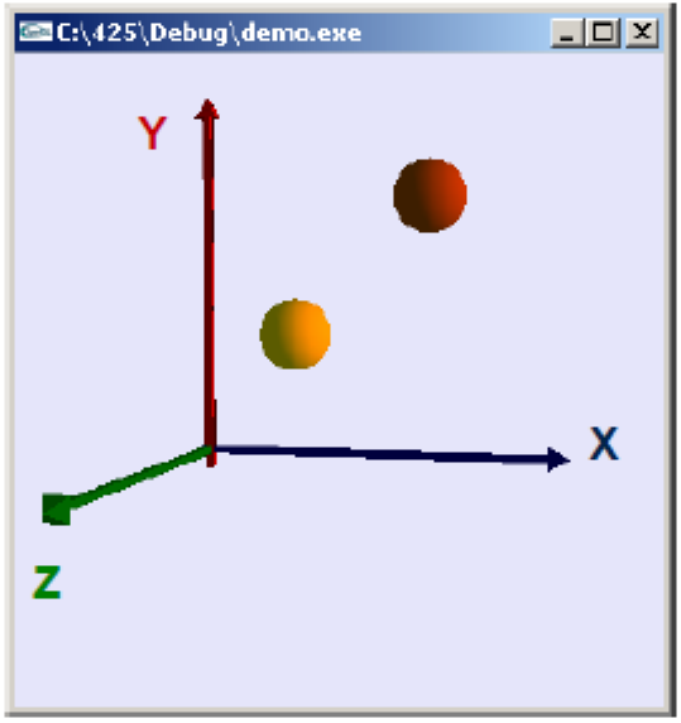

Figure 4: Timbre mapping

- Sound Synthesis Module

Sound Synthesis Module

The sound synthesis module will be responsible for taking the musical parameters obtained from the mapping module, with input from the music AI engine, and using these to output music.

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  2. Possible user defined parameters such as time signature, tempo, or mood could serve as input to the engine and musical attributes that follow the given rules would be produced.

Related Work

The work on this project began with a review of relevant literature and a search for, and survey of, any available similar software products. The main subject areas explored were music visualization, computer-aided music composition, mapping of graphical objects to musical elements (and music $\rightarrow$ graphical objects), virtual musical instruments, and representation of musical characteristics.

Literature Review

Survey of Existing Products

Methodologies and Implementation

Initial Design

Squeak

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Result

From the research work mentioned in the paper, it could be concluded that:-

- The papers refered gave the project a direction, as most of them were on ways to implement the exact opposite features.
- By studying similar softwares, it was realised that the project was really possible, and also the possible flexibilities were recognised
- The time spent researching and becoming familiar with Squeak could have been used in the construction of a prototype following the initial design, but it was decided that the Squeak environment offered enough inherent capabilities useful to the project that it was appropriate to consider Squeak as an alternative to the initial design.

Future Work

Most of the future work on this project falls into three categories:

1. work on project modules not yet considered, such as the AI engines
2. exploration of advanced features to enhance the project, such as the visualization of the expressiveness and mood of a musical piece
3. implementation of a fully functional product with the chosen methodologies and technologies

Conclusions I

1. The goal of this project is to take advantage of the vast array of computer sound and graphics technologies available today to develop an application that lets users of any musical background create music easily and visually
2. Multiple computer-aided music composition tools are currently obtainable and many of them share characteristics with this project, but it appears that the concept of sculpting and manipulating 3D objects and creating a mapping between the resulting objects and sound parameters to build a 3D scene representing a musical composition may be unique.
3. The uses and applications for the product are varied:
   - as an educational musical exploration tool for children or music students

Conclusions II

- as a therapeutic aid for people struggling to express their feelings and emotions and for those who cant communicate effectively through language
- as a fun way to actively participate in the creation of art and music without rules.

Bibliography

written using LaTeX
All pictures were taken from the original technical paper [Dic13]

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