Joint University/Industry Research Proposal Submitted to

THE NATIONAL SCIENCE FOUNDATION

on

Intelligent Systems for Music Analysis

by

Systems Control, Inc.
1801 Page Mill Road
Palo Alto, California 94304

Center for Computer Research
in Music and Acoustics
Artificial Intelligence Laboratory
Stanford University
Stanford, California 94305

June 1979

Perry
My only file copy -
Date
Intellectual property does not seem to be addressed

Research Proposal Submitted to the National Science Foundation

For consideration by Intelligent Systems Program, Computer Science Section, Division of Mathematical and Computer Sciences
For consideration as industry/university cooperative research activity

Proposed Amount $361,979 Proposed Start Date 1 January 1980 Proposed Duration 2 years

Title Intelligence Systems for Music Analysis

Principal Investigator John M. Chowning
Soc. Sec. No. 221-20-6149
Associate Investigator James A. Moorer
Soc. Sec. No. 263-72-2898

Submitting Institution Stanford University
CCRMA/Dept of Music/School of H&S.
Address Stanford University
Stanford, California 94305

Make grant to Stanford University

Endorsements:

	Principal Investigator	Department Head	Univ. Administrator
Name	John M. Chowning	Albert Cohen	S. MAXINE YOSHIMOTO
Signature	John M Chowning	Albert Cohen	S Maxine Yoshimoto
Title	Principal Investigator	Chairman	Sponsored Projects Officer
Telephone	(415) 497-4971	(415) 497-3811	(415) 497-2883
Date	17 April 1979	8 June 1979	6/13/79

Project Summary

Names of Institutions and Mailing Addresses:

Systems Control, Inc.
1801 Page Mill Road
Palo Alto, CA 94304

Center for Computer Research
in Music and Acoustics
Stanford University
Stanford, CA 94305

Principal Investigators:	Primary Field:
John Chowning (Stanford)	Music
James A. Moorer (Stanford)	Signal Processing
Robert J. Drazovich (SCI)	Artificial Intelligence

Title of Project: Intelligent Systems for Music Analysis

Summary of Proposed Work

The object of this proposal is to undertake research in developing methods and techniques for analyzing and understanding musical sound. The goal will be to more formally characterize the nature and characteristics of music and to explore the use of artificial intelligence and signal processing techniques in accomplishing and partially automating the task of musical sound analysis. The approach will be to develop a knowledge-based signal understanding system which will input a digitized performance of a musical sequence. The system will produce a characterization of the sound in the form of a "map" - a representation of the musical sound which involves not only an indication of the sounds (notes) and processes which were played, but also provides information about the style, timing, instrument identification, and loudness features of the performance. Many of the more subtle characteristics will be obtained by comparing similarities and/or differences between two performances of the same musical sequence and to utilize research efforts in the AI community involved with concept formation and learning to help identify the style features.

The research will have payoffs in both the fields of music and artificial intelligence. Musicians have long been attempting to develop techniques for (preferably in an automated fashion) characterizing music. This research will lead to a more formal specification of music. From an AI perspective, this domain will provide techniques and approaches for developing knowledge-based signal understanding systems as well as focusing on methods for knowledge acquisition and the integration of multiple types of information.

7. JOINT UNIVERSITY-INDUSTRY VENTURE

This research is a university-industry cooperative research program between Systems Control, Inc. (SCI) and Stanford University's Center for Computer Research in Music and Acoustics (CCRMA). This proposal is intended to qualify for funding under NSF's joint university-industry program.

The cooperation between SCI and CCRMA will take many forms. There will be strong technical support between the two organizations with SCI's knowledge of artificial intelligence (knowledge-based systems) and signal processing being coordinated with CCRMA's considerable knowledge about music and their experience in computer assisted analysis. Because of the unique abilities of both groups, a joint venture appears to be much stronger in considering the issues involved in analyzing musical sound.

It is anticipated that SCI and CCRMA will share research and computer facilities during this research project. SCI is located in the Stanford University Industrial Park adjacent to the Stanford campus. Because of the many disciplines involved in this project and because of the computer intensive nature of the research, we expect a large amount of joint activity, interaction, and sharing of computer resources (software, files, etc.).

Because of the proximity of SCI and Stanford to each other, there is frequent and ongoing cooperation on many informal levels between the two research establishments. These interactions take many forms, including colloquia, seminars, meetings, reviews, joint publications, and so on.

Several individuals involved in this project also have joint affiliations with SCI and Stanford. Dr. Cordell Green holds a joint appointment at SCI and Stanford University. He is Chief Scientist, Computer Science, at SCI and is also currently Assistant Professor of Computer Science at Stanford University. In October 1979 he will become a Consulting Professor of Computer Science at Stanford. In this role he will continue to act as research advisor for Ph.D. students and will give lectures and classes in his field of research. Dr. Joseph Rockmore of SCI, has been associated with Stanford University as a lecturer.

8. BIBLIOGRAPHY

[Atal and Rabiner-76] B. S. Atal and L. R. Rabiner, "A pattern recognition approach to voiced-unvoiced-silence classification with applications to speech recognition," *IEEE Transactions on Acoustics, Speech and Signal Processing*, vol. ASSP-24, pp. 201-211, June, 1976.

[Brooks and Drazovich-79] S. Brooks and R. Drazovich, "SIAP User's Guide," Systems Control Inc., Palo Alto, California, February, 1979.

[Brown-77] D.J.H. Brown, "Concept Learning by Feature Value Interval Extraction," *Proceedings of the Workshop on Pattern Directed Inference Systems, SIGART Newsletter*, Number 63, June, 1977, pages 55-60.