
Abstract

The pipe organ, unlike many other instruments used in so-called classical music, is inextricably entwined with technology and contemporary improvements throughout its history. The craftsmanship of organ building is closely related to the evolution of the music played on pipe organs, as can be seen in musical literature. These two fields have always propelled each other: transformations of style have engendered the demand for changes and induced progress in the field of building techniques and vice versa. Newly invented devices and solutions implemented by organbuilders enabled the musicians to enrich their creations with artistic effects which were not achievable before.

This thesis is itself a continuation of that interdependency of the evolution of the device and its effect on the music. The project comprises two parts and closely links two supposedly distant fields. The first part is the instrument: a pipe organ designed and built with prototype mechatronic programmable key action. The other is the recording of the interpretations of existing baroque and contemporary literature and original improvisations. This second part demonstrates the improved elements of artistic expression enabled by the enhanced capabilities of the prototype.

Chapter 1, the introduction, presents the author's philosophical view on art, its evolution and nature, which integrates transcendental and physical realms. The connection between art evolution and theory of information is also discussed. The chapter introduces the interdisciplinary approach which is the basis for this thesis.

Chapter 2 refers to the history of the pipe organ and its music in strict reference to philosophy and to the so-called spirit of individual periods not without the connection to the development of technical possibilities and the evolution of organbuilders' craftsmanship. The reciprocity of these two is emphasized and described as a strong positive feedback that continues today. The pursuit for the "perfection" of each era, both artistically and technologically, is featured as a justification of the presupposition on which this thesis is based.

Chapter 3 discusses the perception of music and sound, components of elements of artistic expression and the nature of organ stops. It also describes the principles of operating mechanisms and airflow in pipe organs and the influence this operation has on the sound itself. It specifies pieces of equipment that can be modified and improved in order to expand the range of means of expression available.

Chapter 4 includes a comprehensive description of the newly built pipe organ with the prototype mechatronic key action, elucidation of its construction, and details of its operation.

Chapter 5 provides an analytic view of the recorded music and contains a detailed explanation of each of the newly acquired means of artistic expression applied to the performed interpretations and improvisations. All of these effects have been created with the use of automatic valve control which is unique to the prototype system.

Chapter 6 presents acoustic, mostly spectral, analysis of selected samples taken throughout the recording. Through this analysis, the physical causes of auditory sensations which result from perception of the new means of artistic expression are revealed.

Chapter 7 summarizes this work and explores further development in organ building craftsmanship, particularly concerning mechatronic key action and other similar devices. It examines the likelihood of the success and adoption of these new inventions and the new possibilities in organ music in the context of costs of adoption, willingness to implement, and artistic demand from composers and organists.