Preface

Although percussion instruments may be oldest musical instruments (with the exception of the human voice), relatively little has been written about scientific research on these instruments. By way of contrast, string and wind instruments have been the subjects of several good scientific books in recent years. Because the sounds of percussion instruments change so rapidly with time, their study and analysis require equipment that wasn't widely available until quite recently.

I began to study the science of percussion instruments some 25 years ago when Garry Kvistad, who was teaching percussion at Northern Illinois University at that time, asked me some interesting questions about their behavior. Garry and I did some experiments together, and we had many interesting discussions, some of which he carried with him, I believe, when he started his own company. Meanwhile we have studied the acoustics of a wide variety of percussion instruments. Many of them are discussed in *The Physics of Musical Instruments* (Springer-Verlag, New York, 1991, 1998).

Studying the science of percussion instruments has taken me all over the world and has put me in touch with a large number of interesting people: performers, teachers, instrument builders, and other scientists. Besides Garry Kvistad, I would especially like to mention Jacob Malta and André Lehr. Jake Malta, founder of Malmark, Inc., has been a friend for many years. André Lehr, who I consider to be the world's foremost authority on bells, has retired from the Royal Eijsbouts foundry but still devotes much time and effort to the National Carillon Museum in Asten in The Netherlands.

Is it necessary for a musician or a musical instrument builder to understand the science of their instrument? I would argue that it is if they want to compete with the best of their trade. Most builders of fine instruments have mastered the science of their instruments, although in many cases they have done it rather painfully by trial and error. Likewise, skilled performers have learned the science of their instruments by experience. I often remind my students that Stradivari knew all about the physics of violins but it took 300 years to learn it! It is my hope that studying this book will shorten the learning curve for both instrument builders and performers.

This book is written primarily for musicians, but it should be of interest to students of science as well. I have kept the mathematics as simple as possible by translating ideas from the language of physics (mathematics) to non-mathematical language. Readers who wish to go beyond the simple ideas in this book can easily follow the references to more scientific books and to the original scientific literature. Where some principles of physics or perception are necessary to understanding the concepts, these principles are briefly presented in "interludes."

Needless to say, I welcome comments from readers. Who knows, some of these comments may lead to further research. Happy reading.

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