

Introduction to the Special Issue on COVID-19

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Citation: [The Journal of the Acoustical Society of America](#) **153**, 573 (2023); doi: 10.1121/10.0017033

View online: <https://doi.org/10.1121/10.0017033>

View Table of Contents: <https://asa.scitation.org/toc/jas/153/1>

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Introduction to the Special Issue on COVID-19^{a)}

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ABSTRACT:

The COVID-19 pandemic has been a global event affecting all aspects of human life and society, including acoustic aspects. In this Special Issue on COVID-19 and acoustics, we present 48 papers discussing the acoustical impacts of the pandemic and how we deal with it. The papers are divided into seven categories which include: physical masking and speech production, speech perception, noise, the underwater soundscape, the urban soundscape, pathogen transmissibility, and medical diagnosis. © 2023 Acoustical Society of America. <https://doi.org/10.1121/10.0017033>

(published online 26 January 2023)

Pages: 573–575

I. INTRODUCTION

When COVID-19 was first identified in Wuhan, China in December 2019, the world's hope was that its outbreak could be contained quickly and extinguished. That hope was short lived, and given the mobility and connectedness of the modern world, the virus quickly spread. Though the time lag for this spread was different for different regions of the globe, and travel restrictions and regional isolation made some impact, the COVID-19 virus and its subsequent variants eventually penetrated everywhere to a greater or lesser degree.

The COVID-19 virus hit strongly in the northeast region of the United States in approximately March 2020. The social impacts were quick and severe, and “life-as-usual” ground to a halt. We became isolated, businesses shut down, traffic by air, land, and sea slowed to a crawl, and an eerie stillness settled upon normally bustling cities and towns. Worse still was the personal impact—many of us lost friends and relatives, or became severely ill. COVID-19 reached global pandemic status.

As it became clear that this was to be an epic global event, it also became clear that chronicling it for the present and future would also be important. Having to wear masks and take solitary walks through then quiet cities convinced the editors that there were obvious acoustic effects of the pandemic, and that there were likely more to be found beyond these “tip of the iceberg” effects. We began to discuss this, and soon after produced a call for papers for this special issue.

One more point should be discussed before describing the content of our article. Overall, much has been written about COVID-19 and its effects on the world, as is befitting a global event. So, why have a Special Issue in a peer-

reviewed journal? It is these editors' opinion that the scientific aspects of the pandemic (sound being one of them) should be reported, not just in popular terms to an anxious public, but also in the dispassionate and tightly screened manner in which peer-reviewed journals operate, so as to make reliable results available for researchers and other users. Pandemics are common enough events that any reliable information that we can gather and assemble about their effects and how to deal with them is useful.

We will mention that, since COVID-19 was an unexpected event (to most of us, if not to the epidemiologists) with some unique aspects, some of the studies in our Special Issue do not have the baseline that one would expect in a carefully pre-planned experiment on a given phenomenon. This was not automatically considered a disqualifying factor for the submissions—we just asked for the best scientific approach available in dealing with an unexpected event.

Having discussed the general background of the Special Issue, let us turn to the papers themselves. To try to organize this collection, we have broken the papers into seven categories: (1) physical masks effects and speech production, (2) speech perception, (3) noise, (4) the underwater soundscape, (5) the urban soundscape, (6) pathogen transmissibility, and (7) medical diagnosis. As always, there will be some category overlap in the papers, but that is not a major concern.

A broad look at the topics is given next. As mentioned above, to bring some order to this presentation of the many acoustical studies undertaken in response to the pandemic, these 48 reports are grouped into rough categories having similar topics.

A. Physical masking and speech production

One of the most common of the early approaches to slowing spread of the pandemic was the use of masks to block both inhalation and exhalation of viral particles. An unfortunate side effect of this was a range of problems in

^{a)}This paper is part of a special issue on Covid-19 Pandemic Acoustic Effects.

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speech production. These were studied by several authors who studied effects of types of material used in various masks,^{1,2} effects on the mechanics of phonation,³ on the spectral characteristics of spoken words and phrases,^{4,5} and on the strength of radiated speech.⁶ Finally, a study on the effects of masks on the recall of spoken sentences was conducted.⁷

B. Speech perception

Given the well-known difficulties in speech production associated with masking, it is not surprising that proper perception of such speech was also a significant problem. Several reports resulted from studies on various aspects of this difficulty. Problems in both perception and intelligibility were noted,^{8,9} as well as changes in memory¹⁰ and recall in both children and adults.¹¹ Unexpected difficulties were found in the use of online facilities for remote data collection and analysis.^{12,13} Effects on singing education were also noted.¹⁴

C. NOISE

While several studies were undertaken to quantify changes in the general soundscape of a particular area or region as discussed in Sec. IE, a few considered the effects of the pandemic on noise levels in particular and reactions to those changes. Changes in noise levels were measured using several end points,¹⁵ and the response of the public to noise levels was quantified in terms of annoyance¹⁶ as well as a proxy for compliance¹⁷ with regulations intended to combat the pandemic itself. An unusual study dealt with the correlation between noise and air pollution¹⁸ in and around the site of a school.

D. Soundscape, underwater

Five reports described changes in the underwater soundscape in the ocean. Four of these studies were conducted off the Pacific coast of North America,¹⁹ including Oregon²⁰ and Monterey Bay,²¹ and in a lagoon near La Paz, Baja California Sur, Mexico.²² A fifth report, this one from the Atlantic side of the continent, dealt with a dolphin habitat in Sarasota Bay, FL.²³

E. Soundscape, urban

Approximately one-third of the papers in this collection consider changes in the terrestrial urban soundscape, i.e., in the general region common to most of the population of the planet. These included towns and cities in Asia,^{24–26} Australia,^{27,28} Europe,^{29–34} North America,³⁵ and South America.^{36–38} Specific topics include interior and exterior noise in and around residential areas, and more general levels of noise generated by roadways and airports.

F. Pathogen transmissibility

Effects on increased transmissibility of pathogenic particles ejected by humans while speaking, due to the increased volume

needed to overcome heightened ambient noise levels, were the subjects of two reports.^{39,40} A third study considered the possibility that the flow of pathogenic bacteria or viruses from brassy sounding musical instruments might require increased spacing among the musicians or between the musicians and their audience.⁴¹

G. Medical diagnosis

The very name of the virus responsible for COVID-19, i.e., severe acute respiratory syndrome (SARS-CoV-2) suggests that acoustic measurements of lung sounds may be of value in diagnosing the disease. Reports on this were given by three groups,^{42–44} while two additional studies investigated the use of artificial intelligence to analyze lung and breathing sounds for diagnostic purposes.^{45,46} An interesting comparison of the classic acoustic diagnostic technique of auscultation⁴⁷ with the current (and possibly future) state of the art⁴⁸ completes the introduction to this Special Issue.

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