

BAR-ILAN UNIVERSITY

**The Relationship between
the Act of Hearing with Regard to Halacha
and the Physical Process of an Audio Signal**

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Abstract

”שְׁמַע בְּנִי מוֹסֵר אָבִיךָ וְאַל תִּטַּשׁ תּוֹרַת אִמְךָ” (משלי א, ח).

My son, hear the instruction of thy father, and forsake not the law of thy mother (Proverbs A, H).

What is the meaning of hearing here, as well as at of the other places where it appears? The root "ש.מ.ע" has two meanings in Hebrew: a. Hearing by the ear - the physical hearing process. b. Listening, receiving things - understanding.

Poskim have discussed whether there is Halachic significance to the process in which one hears, or just the result itself? The question arises during recent times, a technology advancements lead to the development of artificial sound systems, which improve hearing quality, and even allow a deaf man to hear. Halachic questions arose in the context of these systems, and this study provides Halachic rules based on the physical process the audio signal passes.

This research investigates **the relationship between the act of hearing with regard to Halacha and the physical process of an audio signal**, in order to be used by Poskim in Halachic analysis of future audio systems. The research will serve as a common language between the auditory systems developers - the scientists, who speak in technological terms, and Poskim, who deals in Halachic terms (those who believe that there is a place in Halacha also for non-natural hearing).

The research deals with Halachas related to technological systems. The Poskim have realized that one cannot set the Halacha in these areas without understanding the

scientific background of the matter. **Chapter 1 - "Scientific Background"** describes the scientific background of the Halachas discussed in this work. This chapter describes the following: 1. Sound waves and their propagation. 2. The person's auditory system. 3. The principles of operation of artificial sound systems. 4. Deafness and main hearing disabilities. 5. Methods for dealing with hearing disabilities. 6. Active noise control (ANC). 7. Amplification using acoustic mirrors.

Halachic questions related to new technologies are discussed based on the Halachic principles, which were set by our sages and the Poskim. **Chapters 2 and 3** explain the basic Halachic issues that helped deciders establish new rules regarding the subjects discussed in this research.

Chapter 2 - "Halachic background for 'hearing dependent mitzvahs' " discusses the relationship between the one who makes the sound and the one who listens to it, in order that the latter will fulfill the "hearing dependent mitzvah". The discussed subjects are: 1. Fulfilling "hearing dependent mitzvahs" while the listener is far away from the sound source. 2. The required sound quality for "hearing dependent mitzvahs" - "KOL SHOFAR" and "KOL HAVARA". 3. "AMEN" answer while the blessing is not heard - "Synagogue of Alexandria".

Artificial auditory systems allow the deaf to hear and become a listener. The Poskim discuss the question whether the Halachic status is altered by the change in their situation? **Chapter 3 - "Background to Halachic status of the deaf"** introduces the principles that the Halachic Deciders relied on when discussing these new subjects. The chapter deals with the Halachic status of the deaf through the ages, as a basis

for the discussion on the Halachic status of deaf while using an artificial hearing system.

Chapter 4, the main chapter in this work, clarifies the **"The relationship between the act of hearing with regard to Halacha, and the physical process of an audio signal"**.

Investigation of this relationship is based on the Poskim's responses regarding the **"hearing dependent mitzvahs"** and the **status of the deaf**. Each case was analyzed in three stages: 1. Analysis of the physical process that the audio signal passes. 2. Understanding the decider's decision and their attitude toward the physical process. 3. Draw a conclusion on the Halachic definition of the physical process that the signal passes.

The chapter deals with a number of situations of the audio signal propagation and a number of types of audio systems:

- A. The effect of the way in which sound waves propagate on the fulfilling of "hearing dependent mitzvahs".
- B. Fulfilling of "hearing dependent mitzvahs" by using "ear trumpets", and Halachic status of "hard of hearing" who listens through "ear trumpets" - Discussion of the Halachic definition of a sound heard through "Grama" (indirectly).
- C. Fulfilling of "hearing dependent mitzvahs" by using recorded sound.
- D. Fulfilling of "hearing dependent mitzvahs" by using electrical systems (loudspeaker, telephone and radio) - Discussion of Halachic definition of sound that transforms into an electrical signal.

- E. Fulfilling "hearing dependent mitzvahs" by using non-electrical sound amplification - Discussion of Halachic definition of sound that gets external energy.
- F. Fulfilling of "hearing dependent mitzvahs" by using a "hearing aid" and Halachic status of "hard of hearing" who listens by using a "hearing aid".
- G. Fulfilling of "hearing dependent mitzvahs" by using a "cochlear implant" and Halachic status of "hard of hearing" who listens by using a "cochlear implant".
- H. Fulfilling "hearing dependent mitzvahs" by using "FM system".

Chapter 5 presents the **conclusions of the research**.

The first part of this chapter presents the **Halachic definition of the physical process the audio signal passes**.

The study deals with two elements of voice communication process:

- A. **The medium in which the sound spreads** - This section lists the characteristics of different medium types, and their Halachic definition regarding the "hearing dependent mitzvahs" and the deaf Halachic status:
 - 1. **Natural medium** - Generally, any "natural" process of sound propagation is kosher for "hearing dependent mitzvahs". Low quality sound - is unacceptable. "Echo" is unacceptable for hearing the shofar.
 - 2. **A medium in which the sound passes acoustic amplification** - most of the Poskim accept this sound for all the "hearing dependent mitzvahs". "Hard of hearing" who hears by using acoustic amplification is treated as listener.
 - 3. **Recorded sound** - is not accepted for "hearing dependent mitzvahs", since this sound is a machine sound and not a human voice.

4. **Electric medium - sound wave transforms into electrical signal** - there is a disagreement among the Poskim whether this sound is not accepted because it is a machine sound and not a human voice, or if there is no importance of the medium type in which the voice passes through.

5. **Medium of high pressure air** - there are some deciders who accept this sound because it remains air movements throughout its spread, while others don't accept it since there's additional external energy and it is considered as machine sound.

B. **The hearing process using the ear** - This section lists the Halachic definition of audible sound that is heard by 'hearing aids' and implants, and the Halachic definition of the hearing process:

1. **Definition of the sounds heard through implants and hearing aid devices** - there is controversy if implants and hearing aids are treated as audio signal processing, or are considered secondary to the ear - the signal detector?

2. **Definition of the hearing process** - there is controversy in the defining **act of hearing with regard to Halacha**. If the hearing should be by the natural way, or the act of hearing depends on the understanding by the brain?

The second part of the conclusions chapter demonstrates the use of the research's conclusions for Halachic analysis of new audio systems that have not been discussed yet in the Poskim's literature: 1. Active Noise Control (ANC). 2. Acoustic amplification using parabolic Reflector (Sound mirror). 3. Tympanoplasty - surgical operation performed for the reconstruction of the eardrum and the small bones of the middle ear, and ear transplant from another person. 4. New auditory implants ("Middle Ear

Implant", "Bone Anchored Hearing Aid" (BAHA), "Auditory Brain stem Implant " (ABI)
and "Auditory Midbrain Implant (AMI).