Ninja Had the Noise Canceling Technology: Mechanisms and Application of Saoto-Kikigane

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Saoto-Kikigane: "Trivial sound-listening metal" is a metal plate used by ninjas (Japanese spies in the Edo period (1603–1868) for spying. Ninjas used the Saoto-Kikigane to attenuate high-pitched sounds since high-pitched environmental sounds, such as rain and insect sounds, make hearing speech difficult. However, since studies on the Saoto-Kikigane are rare, its usage and mechanisms are unknown. In this study, we discuss its working mechanism and application. Furthermore, we have applied it in modern technology and examined variations in noise loudness level with and without Saoto-Kikigane. Consequently, we found that Saoto-Kikigane attenuated high-pitched sounds due to both sound diffraction and interference. In addition, we observed that the Saoto-Kikigane attenuates sound at its edge. Hence, we hypothesize that ninjas kept the edge of the tool close to their ear and used a kanzashi, a type of Japanese hair ornament, in their hair to fine-tune the position of the Saoto-Kikigane. Further, we calculated the signal-to-noise ratio (SNR) (sound below and above 2000 Hz classified as signal and noise, respectively) and reported that the Saoto-Kikigane makes hearing speech twice as easy. We produced and attached a device to easily realize the function of the Saoto-Kikigane in a modern microphone by employing the Saoto-Kikigane mechanism. The results revealed that hearing the speaker’s voice was 1.6-times easier with the device.

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