The Effects of Natural Sounds and Proxemic Distances on the Perception of a Noisy Domestic Flying Robot

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When flying robots are used in close-range interaction with humans, the noise they generate, also called consequential sound, is a critical parameter for user acceptance. We conjecture that there is a benefit in adding natural sounds to noisy domestic drones. To test our hypothesis experimentally, we carried out a mixed-methods research study (N = 56) on reported user perception of a sonified domestic flying robot with three sound conditions at three distances. The natural sounds studied were, respectively, added to the robot's inherent noises during flying; namely, a *bird*song and a *rain* sound, plus a control condition of no added sound. The distances studied were set according to proxemics; namely, *near*, *middle*, and *far*. Our results show that adding *bird*song or *rain* sound affects the participants' perceptions, and the proxemic distances play a nonnegligible role. For instance, we found that participants liked the *bird* condition the most when the drone was at *far*, while they disliked the same sound the most when at *near*. We also found that participants' perceptions strongly depended on their associations and interpretations deriving from previous experience. We derived six concrete design recommendations.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**; **Auditory feedback**;

Additional Key Words and Phrases: Close-range human-drone interaction, natural sounds, domestic flying robots, consequential sound

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