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## Are low-frequency songs sexually selected, and do they lose their potency in male–female interactions under noisy conditions?

We agree with Halfwerk et al. (1) on the importance of including the receivers when studying the impact of anthropogenic noise. However, we find the conclusion that the use of low-frequency song is sexually selected in great tits and that noisy conditions affect male–female communication premature for several reasons.

First, the evidence that low-frequency songs are more potent than high-frequency songs is not convincing in great tits or in other songbirds. The only evidence in great tits came from the observation that noncuckolded males sing lower-frequency songs than cuckolded males (1). However, this comparison is based on a very small sample size, which could make results prone to type I error. Furthermore, it does not control for many confounding variables known to affect extrapair paternity such as age, breeding synchrony, and personality (2). Second, because extrapair fathers were not identified, the realized reproductive success could not be determined, making conclusions about whether low-frequency singing is sexually selected premature. A pairwise comparison of frequency characteristics between social and extrapair fathers could have provided a strong test. Interestingly, such a comparison has been made in chestnut-sided warblers: here, males singing high-frequency songs obtained more extrapair paternity (3), thus actually displaying the opposite pattern. A recent review also showed that females respond more strongly to high- than to low-frequency songs in most songbird species (4). Finally and most importantly, the playback experiment under control conditions clearly showed that female great tits did not respond more strongly to low- than to high-frequency song (1). It still needs to be shown whether this is an artifact of the time period (i.e., during incubation), as low-frequency song appeared to be particularly important the day before egg-laying (1). Given the large clutch size in great tits, it

is unclear why this day is of such importance because extrapair copulations at any time during the fertile period may have fitness consequences. It is puzzling why males should produce low-frequency songs only close to the start of egg-laying, the more because males also sing to attract extrapair females, which are not necessarily fertile at the same time.

Whereas low-frequency songs may indeed be more easily masked in noisy conditions (1), male great tits may use a previously described behavioral mechanism to facilitate communication with their females when they are not stationary as during playback. Male–female communication occurs mostly during the second part of the dawn chorus, when males move to their female in the nest box to try to make vocal contact with her (5). This occurs in a very interactive way involving a lot of male close-range calling, which is much more important than song in eliciting female responses (5), but not considered in this study (1). If a female does not respond, males approach closer and continue singing and calling until she reacts. In other words, approaching behavior is probably an effective strategy to improve signal detectability in noisy environments.

In conclusion, there is little evidence that low-frequency songs are sexually selected, and the effectiveness of male movement/approaching behavior as a counter strategy to noisy conditions should be examined.

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The authors declare no conflict of interest.

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