Bird song diversity influences young people's appreciation of urban landscapes

UFUG_25428

Published in Urban Forestry & Urban Greening 13, 469-474

http://dx.doi.org/10.1016/j.ufug.2014.04.002

Bird song diversity influences young people's appreciation of urban landscapes

Marcus Hedblom [1], Erik Heyman, Henrik Antonsson and Bengt Gunnarsson

Department of Biological and Environmental Sciences, University of Gothenburg, Box 461, SE 40530 Göteborg, Sweden

[1] Present address: Department of Forest Resource Management, Swedish University of Agricultural Sciences, Box 7044, SE 75007 Uppsala, Sweden

Correspondence:

Bengt Gunnarsson

bengt.gunnarsson@ bioenv.gu.se

Short title:

Bird song in urban settings

Abstract

Increased losses of green areas in cities reduce people´s experience of flora and fauna. Earlier studies have shown that biodiversity has benefits for urban inhabitants but the influence of animal sounds on people´s experience of green space is poorly known. A sample of young urban people (N=227) rated their reactions – positive or negative – to three bird song combinations (House Sparrow (*Passer domesticus*), Willow Warbler (*Phylloscopus trochilus*), 7 spp i.e. Willow Warbler, Chaffinch (*Fringilla coelebs*), Blue Tit (*Cyanistes caeruleus*), Great Tit (*Parus major*), European Robin (*Erithacus rubecula*), Common Blackbird *(Turdus merula*), Great Spotted Woodpecker (*Dendrocopos major*), three urban settings (residential areas with varying amount of greenery) and nine combinations of song and setting. Bird song was generally considered positive and singing by several species was more highly rated than singing by a single species. On average, urban settings combined with bird song were more highly appreciated than the settings alone and even more so where there was singing by several species rather than just one. We conclude that our data support the idea that bird song contributes to positive values associated with urban green space. Urban planners should consider preserving a variety of habitats in cities for hosting a diversity of birds and thereby boost conservation of songbird diversity and recreational experiences for urban people.

Keywords: biodiversity, green space, passerines, songbirds, urban soundscape, urban woodland

Introduction

Ecosystem services provided by green space in cities may become even more vital when humans become increasingly urbanized. Although the high societal value of green space in urban areas has long been acknowledged (Ulrich 1984; Kaplan 1995), there is an increasing need for detailed knowledge about the interaction between biodiversity and the built environment in cities (James et al. 2009). For instance, certain biodiversity components can add to the well-being of urban residents (Fuller et al. 2007; Luck et al. 2011). Maintaining highly diverse ecosystems in the parks of densely populated cities can be a critical investment in improving the quality of life of the inhabitants (Dean et al. 2011). This task may be urgent, because green urban area per capita is declining rapidly in e.g. European cities with high population density (Fuller and Gaston 2009) and future urbanization will reduce green areas and biodiversity hotspots worldwide (Seto et al. 2012).

The total environment perceived by urban inhabitants includes visual stimuli, sounds and smells. Earlier studies have stressed the interdependence of visual and acoustic stimuli (Carles et al. 1999; Viollon et al. 2002). For instance, in a study of scenes from national parks, anthropogenic sounds (e.g. air or ground traffic) seemed to disrupt the experience of beautiful landscapes whereas natural sounds (e.g. birds, wind in foliage) did not have negative effects on assessment of the settings (Benfield et al. 2010). Urban soundscape is often dominated by areas with man-made sounds that are perceived as less pleasant than sites with natural sounds (Carles et al. 1999; Viollon et al. 2002; Irvine et al. 2009). Although many studies of how people experience soundscape have included natural sounds like birds (e.g. Carles et al. 1999; Viollon et al. 2002; Irvine et al. 2009; Benfield et al. 2010), there are few studies that distinguish between bird species (e.g. Björk 1985) and none that evaluates species diversity.

In the present study, we examined how young, urban-dwelling people rated different bird songs and how song influences the assessment of urban landscapes. Special attention was paid to singing by passerines (order Passeriformes) because such birds are an obvious part of everyday life in most European cities with parks, woodlands and other green spaces. Here, our focus is urban woodlands close to residential areas. We are not aware of any other study exploring the importance of diversity of wild bird song and hypothesize that this diversity affects human evaluation of urban settings. Our hypotheses were: first, bird song is normally seen as positive. Second, bird song with high species diversity is more highly appreciated than song with low diversity. Third, bird song influences how urban settings are valued.

Methods

Participants

The study was conducted in Gothenburg (population ca 500 000), Sweden, in February 2011. The voluntary participants were trainee teachers and engineering students (N=227, average age 23.2 years; 54% women) at the University of Gothenburg and Chalmers University of Technology, respectively. An incentive of a sandwich lunch and a chance to win 10 cinema tickets in a lottery was provided.

Ethics

In our study, participation was fully anonymous and without any risk to participants. Concise verbal information of the broad aims of the research was given and participants were free to leave at any time during each session.

Experiments

Tests were conducted in a lecture hall with a sloping gallery in five sessions. In front of the participants were two loud speakers (KRK systems power Rokit 8) placed at a 60° angle to and 5.5 m from the nearest participant, at 108 cm above the floor. Sound levels were similar at all sessions. Pictures were shown on a white screen (approximately 3 m x 2 m). Daylight was blocked and a dim light in the hall enabled the participants to see the questionnaires. At the back of the hall a sound level meter (Brüel and Kjær 2260 ½-in. microphone) measured decibel level continuously. Average sound level in the lecture hall with people and bird sound was 34-38 dB in different sessions.

All groups of participants were asked to rate the different displays regarding how positive, or negative, they found the bird songs, settings and combinations of the two. The rating scale was graded from -7, “very negative”, to +7, “very positive”, with a possible neutral judgement of 0 (zero). The scale included both numbers and words. First, the participants were presented with three settings, then three bird songs, and finally nine combinations of setting and song, without rating the items. The sequence was then repeated but now with rating of the 15 items. Each item was displayed for 30 sec with a 5 s break between the items. The settings were shown in the same order at each session but songs and the combination of songs and settings was randomized between sessions. The entire procedure of each session lasted ca 20-25 min and time for the complete sequence was 17.5 min.

Bird song combinations were established using the recording software Steinberg Cubase 5. The song strophes were taken from the CD "Fågelsång", recorded in Sweden. We used three recordings: (HS) House Sparrow (*Passer domesticus* L.); (WW) Willow Warbler (*Phylloscopus trochilus* L.); (7 spp) Willow Warbler, Chaffinch (*Fringilla coelebs* L.), Blue Tit (*Cyanistes caeruleus* L.), Great Tit (*Parus major* L.), European Robin (*Erithacus rubecula* L.), Common Blackbird *(Turdus merula* L.), Great Spotted Woodpecker (*Dendrocopos major*

L., drumming heard). All species are common in suburban woodlands in SW Sweden (Hedblom and Söderström 2010; Heyman 2010), except for the House Sparrow, which mainly breeds in urban habitats such as hedges. The three song combinations had approximately similar song rates occupying 30 s with songs coming in sequence and sometimes overlapping (Appendix 1). The three songs used were originally selected from six song combinations that were tested on students and a panel of field biologists (Appendix 1).

Photos of residential areas (three-storey buildings) from two cities in the southern part of Sweden (ca 400 km NE of Gothenburg) were used to illustrate the settings of increasing greenery – low (LG), medium (MG), high (HG) – which consisted mainly of shrubs and trees (Fig. 1). The settings selected were based on pilot tests with panels of students and staff of the department. We did not show photos from Gothenburg, so the probability that the respondents would recognize the settings was very low. The settings were without humans, the sky of each photo was retouched into similar nuances and the landscape was shown from an eye level perspective. The photos served as examples of different urban settings, i.e. the tests were not designed for evaluating differences in the effect of greenery.

Statistics

The rating scale is ordinal and the non-parametric Friedman two-way analysis of variance by ranks was therefore used (Siegel and Castellan 1988). The post hoc tests were pairwise multiple comparisons with significance level $\alpha < 0.05$, which was adjusted due to multiple tests (Siegel and Castellan 1988). Forty-two of 105 possible comparisons were used (Fig. 2), testing differences between three bird songs and three settings on their own, and, the nine combinations of song and setting, both relative to each other and song on its own (eighteen comparisons) and to setting on their own (a further eighteen). All statistical calculations were performed using the software SPSS Statistics ver. 19.

Results

We tested our hypotheses by multiple comparisons of the scores given by 227 students. Overall, the difference in scoring of the three urban settings, three bird songs, and nine combinations of song and setting was highly significant (F_r =1081.21, df =14, p<0.001).

Bird songs on their own (without settings, Figs 2, 3) showed significant differences for three pair wise comparisons (all p<0.001). Participants rated the bird song with 7 spp as most positive, followed by WW; the least preferred was HS (Fig. 3). On average, the three songs were considered positive, but 13.6% of respondents disliked one or two of the songs.

Pairwise comparisons of the three urban settings on their own (Fig. 2) revealed that participants rated them significantly differently from each other (all p≤0.013) with the MG setting scoring highest, followed by settings HG and LG (Fig. 3).

Comparisons of combinations of song and setting were related to bird song and setting, respectively (Fig. 2). First, we tested the effect of setting variation on the valuation of different bird songs (Fig. 4). HS was rated lower when combined with LG (but not with MG and HG). WW and 7 spp rated lower in all combinations with LG, MG and HG than when on their own. Thus, in seven cases out of nine, bird songs were more highly valued (p≤0.001 in all 7 cases) on their own than in combination with a setting. All bird songs were valued significantly lower in combination with the setting LG than in combination with settings MG and HG (p<0.001 in 6 cases, Fig. 4).

Second, we tested how different bird songs influenced the valuation of settings. Setting LG was higher or equal with any of the bird songs (Fig. 5). All settings were rated highest with 7 spp in four (p<0.001 in all 4 cases) out of six cases, followed by WW and HS. Bird song combined with settings was in no case valued below the score given to a setting alone. Adding HS song to settings made no difference to rating. But combinations of settings with

WW and 7 spp songs gained a rating significantly higher in five (p <0.001 in all 5 cases) out of six comparisons than did the settings on their own (Fig. 5).

Discussion

From our test, we conclude that the participants generally liked passerine song, more so when provided by several species than by a single species, and that song often improved the rating given to urban settings in residential areas. We interpret these data as support for the idea that bird song enhances people´s experience of urban environments.

In two previous studies, presence of birds has been identified as important components of biodiversity, contributing to the well-being of urban citizens (Fuller et al. 2007; Luck et al. 2011). The cause of the subjective feeling of well-being associated with birds remains to be explored but our data suggest that bird song is part of the mechanism. Song by several species was highly valued, suggesting that variation and/or high species richness contributed to positive attitudes. Interestingly, recent data suggest that well-being may be positively related to subjectively perceived species richness and not necessarily actual richness (Dallimer et al. 2012). Bird song by several species is possibly quite easy to identify correctly as high species richness.

Not all bird sound is considered attractive, e.g. that of gulls, geese or ducks (Björk 1985; Bjerke and Østdahl 2004). Among songs of single species in our experiment, House Sparrow was the lowest rated but still considered positive. We speculate that the melody per se may be important because the song of the arboreal Willow Warbler was rated higher and possibly perceived as more pleasant than House Sparrow.

Why do young urban people like bird song? Brain pathways for vocal learning in humans and birds are surprisingly similar (Jarvis 2004). The evidence of parallels in the evolution of human language and bird song is increasing (Balter 2010), which may suggest that convergence has facilitated human perception (and appreciation) of avian vocal information. Young people also often have a keen interest in music, which may influence their judgment. There is, of course, a multitude of alternative hypotheses ranging from a positive subjective association between bird song and nice spring weather in the minds of participants to possible evolutionary reasons. Future investigations of the human perception of bird song will be needed to evaluate such hypotheses. However, small songbirds seem to stand out among animals as highly appreciated species (Bjerke and Østdahl 2004). We suggest that bird song, especially by several species, contributes to this positive attitude. Moreover, recent experimental studies support the hypothesis that nature sounds, including birds, facilitate stress recovery and well-being (Alvarsson et al. 2010; Annerstedt 2011), and thus corroborating Björk´s (1986) observation that at least some types of bird singing are associated with relaxation.

In southern Sweden, the bird songs used in our test are commonly heard in urban woodlands adjacent to the three types of residential settings. However, it is more likely to hear House Sparrow in the "low greenery" setting and seven species in the "high greenery" setting. In earlier studies, differences in the rating of soundscape and landscape were explained by the level of coherence between sound and setting (e.g. Carles et al. 1999; Viollon et al. 2002). If bird songs were not perceived as fully congruent with the settings shown in e.g. previous studies this may in part explain the difference between song alone and in a particular setting. But in our study, settings in combination with bird song were in nearly all cases more positively perceived than "silent" settings. Perhaps singing by birds is associated with relaxation (Björk 1986) and positive feelings and therefore indirectly enhances the rating of settings.

A number of natural sounds, other than bird song, can be perceived as pleasant, e.g. streaming water (Carles et al. 1999). Unspecified bird song can influence the rating of how pleasant or relaxing various sound combinations be perceived (Viollon et al. 2002). Our study suggests that diversity of bird song also contributes to how natural sounds are valued, i.e. it matters which combination of species that is heard. However, we recognize that our study is focused on a narrow part of variation in respect to bird song and urban settings. More investigations about songbird species variation and various urban environments and their influence on urban inhabitants are needed to fully evaluate our hypotheses. Combinations of various sounds can be tested by, e.g., a Perceived Restorativeness Soundscape Scale (PRSS) to evaluate the restorative potential (Payne 2013).

The contribution to ecosystem services by birds is diverse (Wenny et al. 2011). For instance, in suburban areas birds can be important for seed dispersal (Hougner et al. 2006) and regulation of arboreal arthropods (Heyman and Gunnarsson 2011). But in city centers the function related to recreation and well-being is probably of great significance (Fuller et al. 2007; Irvine et al. 2009). Both loss of habitats for birds in cities (Hedblom and Söderström 2010) and management of surviving habitats affect the configuration of birds (Heyman 2010; Mörtberg and Wallentinus 2000) and thereby indirectly the frequency of bird song. Human disturbance on bioacoustics, especially in urban environments, may contribute to habitat fragmentation and cause severe effects on animal populations (Lailo 2010). Several steps can be taken in urban planning and green space management to promote diverse bird populations in cities, including mimicking natural environments and developing high variation of vegetation in urban habitats (Taylor et al. 2013). We suggest that management of urban green space that includes areas with a mixture of suitable songbird habitats and a minimum of unpleasant sounds will help to produce sustainable cities (Irvine et al. 2009). Anthropogenic sounds are often being valued as unpleasant but a natural soundscape will instead be considered neutral or positive (e.g. Viollon et al. 2002; Benfield et al. 2010). Thus, urban planners can boost both conservation of songbird diversity and recreational experiences for urban people.

Green space in urban environments can generally be far more important to human health than previously thought (e.g. Grahn and Stigsdotter 2003; Ward Thompson et al. 2012; White et al. 2013). Our results suggest that singing birds can be one important component of biodiversity in urban green space that contributes to well-being of the city inhabitants.

Acknowledgments

We thank the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) for financial support (to B.G.), K. Wiklander and M. Östensson for statistical advice, K. Persson Waye and A. Agge for lending sound level meter, S. Toresson, T. Appelqvist and U. Molau for expert bird song support, S. Wahlström and the Swedish Society for Nature Conservation for allowing us to use bird songs from their CD, D. Arlt, B. Söderström, B. and T. Vowles for comments on the manuscript and anonymous reviewers for helpful assistance.

Appendix 1

In our experiment, three bird song combinations were played for 30 sec each.

(1) House Sparrow (HS). 22 song verses (strophes/syllables) or chatterings from a single bird and a background flock 1-10 s and 13-26 s.

(2) Willow Warbler (WW). 12 song verses with occasional overlaps between songs.

(3) Seven species (7 spp). 17 song verses: Willow Warbler 3, Chaffinch 2, Blue Tit 4, Great Tit 1, European Robin 2, Common Blackbird 5, plus 2 drummings by Great Spotted Woodpecker, with occasional overlaps between songs.

The three song combinations as MP3 files can be downloaded from the following website: http://www.slu.se/en/departments/ecology/hemsidor/hedblom-marcus/

In a pilot test, 44 students of environmental science were rating six different bird song combinations. Each song was played for 45 sec. The following sequence, from low to high average preference, was obtained: House Sparrow 33 song verses; Willow Warbler 8 song verses; Willow Warbler 23 song verses; Five species (Willow Warbler, Chaffinch, Blue Tit, Great Tit, European Robin) 8 song verses; Five species 15 song verses; Seven species (addition of Common Blackbird and Great Spotted Woodpecker). A panel of three experienced field biologists also gave their opinions about bird song combinations. Based on the results of the pilot test and comments from the field biologists, three bird songs were selected (see above). However, the playing time for songs was changed and set to 30 s each in the present study.

References

Alvarsson, J.J., Wiens,S., Nilsson, M.E. 2010. Recovery during exposure to nature sound and environmental noise. International Journal of Environmental Research and Public Health 7, 1036-1046.

Annerstedt, M. 2011. Nature and Public Health. Aspects of Promotion, Prevention, and Intervention. Acta Universitatis agriculturae Sueciae, 98, pp. 86 (doctoral thesis).

Balter, M. 2010. Evolution of language, animal communication helps reveal roots of language. Science 328, 969-971.

Benfield, J.A., Bell, P.A., Troup, L.J., Soderstrom, N.C. 2010. Aesthetic and affective effects of vocal and traffic noise on natural landscape assessment. Journal of Environmental Psychology 30, 103-111.

Bjerke, T., Østdahl, T. 2004. Animal-related attitudes and activities in an urban population. Anthrozoos 17, 109-129.

Björk, E.A. 1985. The perceived quality of natural sounds. Acustica 57, 185-188.

Björk, E.A. 1986. Laboratory annoyance and skin-conductance responses to some natural sounds. Journal of Sound and Vibration 109, 339-345.

Carles, J.L., Barrio, I.L., de Lucio, J.V. 1999. Sound influence on landscape values. Landscape and Urban Planning 43, 191-200.

Dallimer, M., Irvine, K.N., Skinner, A.M.J., Davies, Z.G., Rouquette, J.R., Maltby, L.L., Warren, P.H., Armsworth, P.R., Gaston, K.J. 2012. Biodiversity and the feel-good factor: Understanding associations between self-reported human well-being and species richness. BioScience 62, 47-55.

Dean, J., van Dooren, K., Weinstein, P. 2011. Does biodiversity improve mental health in urban settings? Medical Hypotheses 76, 877-880.

Fuller, R.A., Irvine, K.N., Devine-Wright, P., Warren, P.H., Gaston, K.J. 2007. Psychological benefits of greenspace increase with biodiversity. Biology Letters 3, 390-394.

Fuller, R.A., Gaston, K.J. 2009. The scaling of green space coverage in European cities. Biology Letters 5, 352-355.

Grahn, P., Stigsdotter, U.K. 2003. Landscape planning and stress. Urban Forestry Urban Greening 2, 1-18.

Hedblom, M., Söderström, B. 2010. Landscape effects on birds in urban woodlands: an analysis of 34 Swedish cities. Journal of Biogeography 3, 1302-1316.

Heyman, E. 2010. Clearance of understory in urban woodlands: Assessing impact on bird abundance and diversity. Forest Ecology and Management 260, 125-131.

Heyman, E., Gunnarsson, B. 2011. Management effect on bird and arthropod interaction in suburban woodlands. BMC Ecology 11, 8 DOI:10.1186/1472-6785-11-8.

Hougner, C., Colding, J., Söderqvist, T. 2006. Economic valuation of a seed dispersal service in the Stockholm National Urban Park, Sweden. Ecological Economics 59, 364-374.

Irvine, K.N., Devine-Wright, P., Payne, S.R., Fuller, R.A., Painter, B., Gaston, K.J. 2009. Green space, soundscape and urban sustainability: an interdisciplinary, empirical study. Local Environment 14, 155-172.

James, P. et al. 2009. Towards an integrated understanding of green space in the European built environment. Urban Forestry Urban Greening 8, 65-76.

Jarvis, E.D. 2004. Learned birdsong and the neurobiology of human language. Annals of New York Academy of Sciences 1016, 749-777.

Kaplan, S. 1995. The restorative benefits of nature: Toward an integrative framework. Journal of Environmental Psychology 16, 169-182.

Luck, G.W., Davidson, P., Boxall, D., Smallbone, L. 2011. Relations between urban bird and plant communities and human well-being and connection to nature. Conservation Biology 25, 816-826.

Lailo, P. 2010. The emerging significance of bioacoustics in animal species conservation. Biological Conservation 143, 1635-1645.

Mörtberg, U., Wallentinus, H.G. 2000. Red-listed forest bird species in an urban environment - assessment of green space corridors. Landscape and Urban Planning 50, 215-226.

Payne, S.R. 2013. The production of a Perceived Restorativeness Soundscape Scale. Applied Acoustics 74, 255-163.

Seto, K.C., Güneralp, B., Hutyra, L.R. 2012. Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. Proceedings of the National Academy of Sciences 109, 16083-16088.

Siegel, S., Castellan, N.J. 1988. Nonparametric Statistics for the Behavioural Sciences, 2nd ed. McGraw-Hill, New York.

Taylor, L., Taylor, C., Davis, A. 2013. The impact of urbanisation on avian species: The inextricable link between people and birds. Urban Ecosystems 16, 481-498.

Ulrich, R. 1984. View through a window may influence recovery from surgery. Science 224, 420-421.

Viollon, S., Lavandier, C., Drake, C. 2002. Influence of visual setting on sound ratings in an urban environment. Applied Acoustics 63, 493-511.

Ward Thompson, C., Roe, J., Aspinall, P., Mitchell, R., Clow, A., Miller, D. 2012. More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. Landscape and Urban Planning 105, 221-229.

Wenny, D.G., DeVault, T.L., Johnson, M.D., Kelly, D., Sekercioglu, C.H., Tomback, D.F., Whelan, C.J. 2011. The need to quantify ecosystem services provided by birds. Auk 128, 1-14.

White, M.P., Alcock, I., Wheeler, B.W., Depledge, M.H.. 2013. Would you be happier living in a greener urban area? A fixed-effects analysis of panel data. Psychological Science 24, 920-928.

Figure legends

Figure 1. Photos of residential settings with low greenery (LG, top), medium greenery (MG, middle) and high greenery (HG, bottom) used in preference tests.

Figure 2. Design of statistical analysis by pairwise, multiple comparisons in a Friedman ANOVA of scores given to 15 items in preference test. Abbreviations: LG, MG, HG - low, medium, high greenery (settings), respectively; HS - House Sparrow, WW - Willow Warbler; 7spp - Seven species (songs, see Methods for detailed description); LG+HS, etc, are combinations of setting and song.

Figure 3. Comparisons between scores given to settings and bird songs. Mean (± s.e.) and median (dark bar) are shown. High score indicates a high positive valuation. N= 227 students. Abbreviations, see Fig. 2. N.B! LG had a zero median. Design of tests of "Setting" and "Bird song", cf Fig. 2. Statistical comparisons between items are shown by arrows, *$p<0.05$, ***$p<0.001$.

Figure 4. Comparisons between scores given to bird songs and nine combinations of setting and song. Mean (± s.e.) and median (dark bar) are shown Abbreviations and design of tests of "Setting and song vs song alone" , cf Fig. 2. ***$p<0.001$, n.s not significant.

Figure 5. Comparisons between scores given to settings and nine combinations of setting and song. Mean (± s.e.) and median (dark bar) are shown Abbreviations and design of tests of "Setting and song vs setting alone" , cf Fig. 2. **$p<0.01$, ***$p<0.001$, n.s not significant.

Figure 1

Figure 2

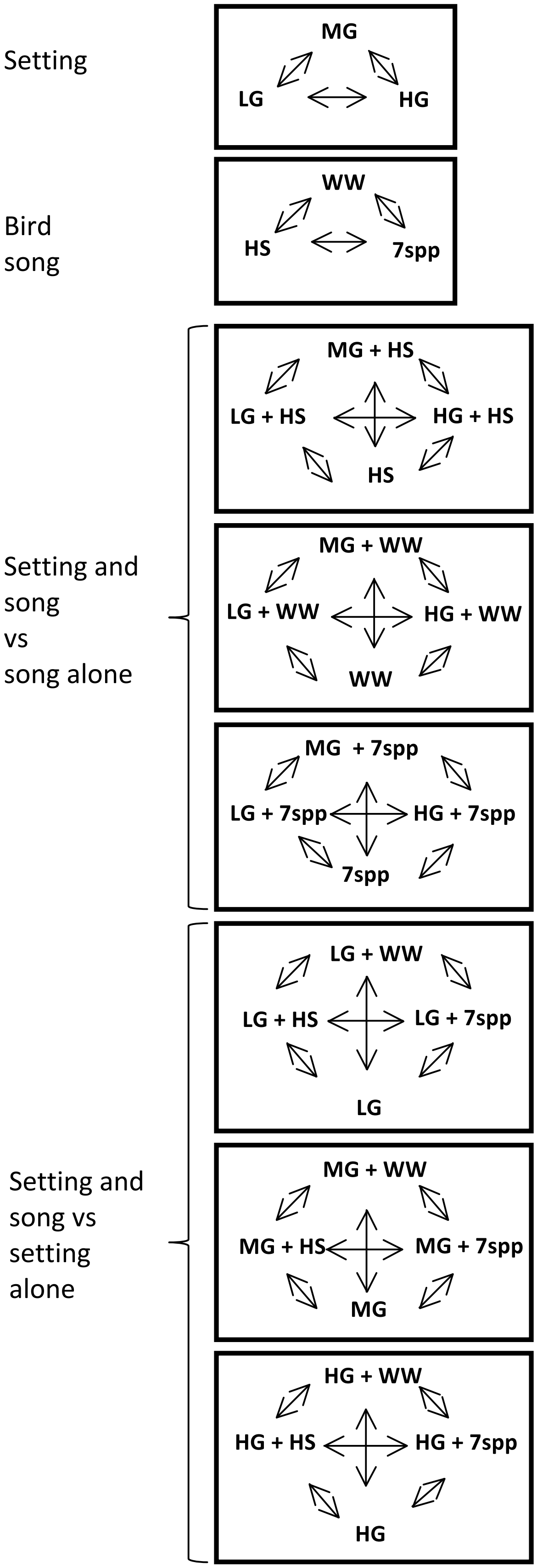

Setting
MG
LG
HG
Bird song
WW
HS
7spp
Setting and song vs song alone
MG + HS
LG + HS
HG + HS
HS
MG + WW
LG + WW
HG + WW
WW
MG + 7spp
LG + 7spp
HG + 7spp
7spp
Setting and song vs setting alone
LG + WW
LG + HS
LG + 7spp
LG
MG + WW
MG + HS
MG + 7spp
MG
HG + WW
HG + HS
HG + 7spp
HG

Figure 3

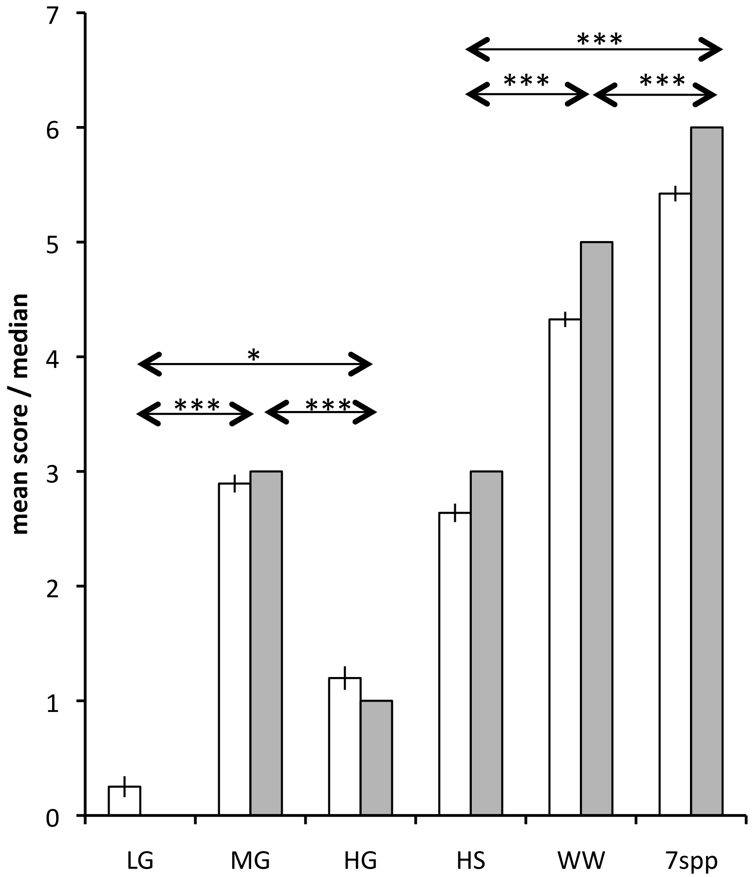
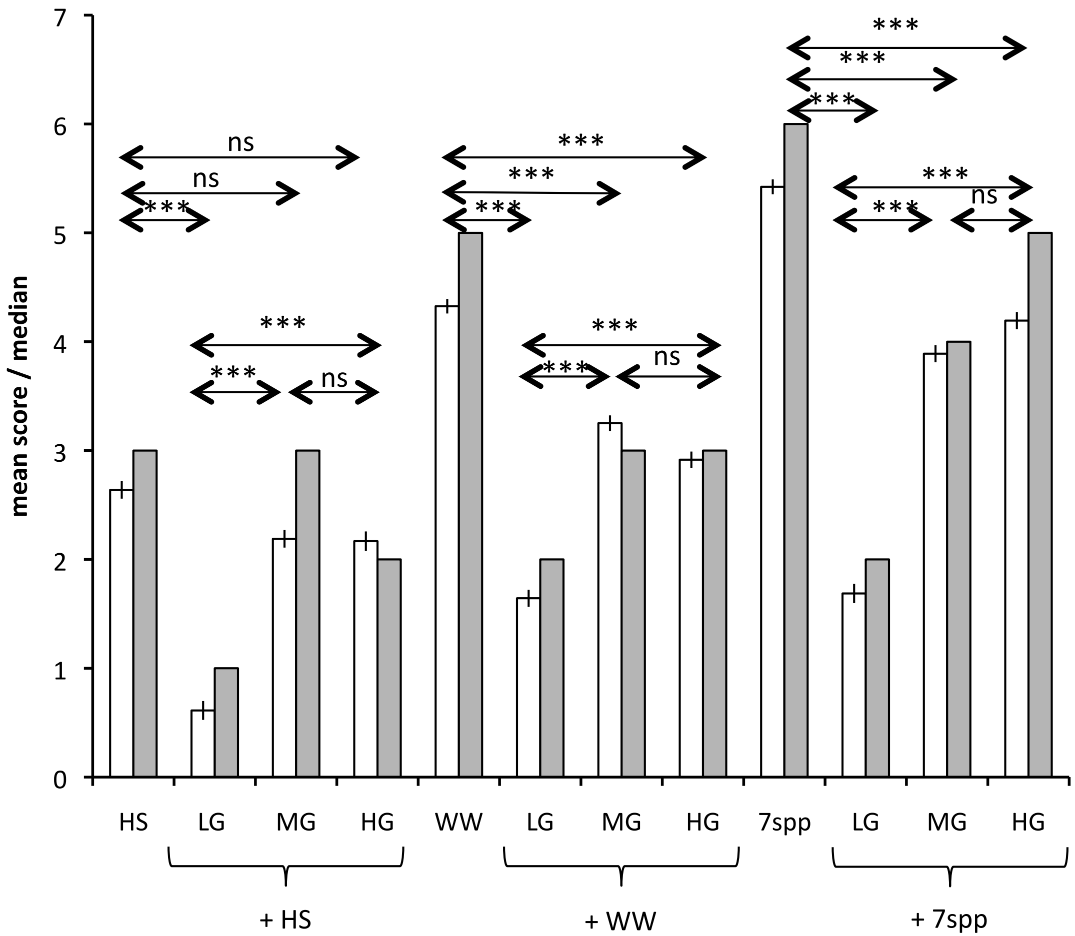
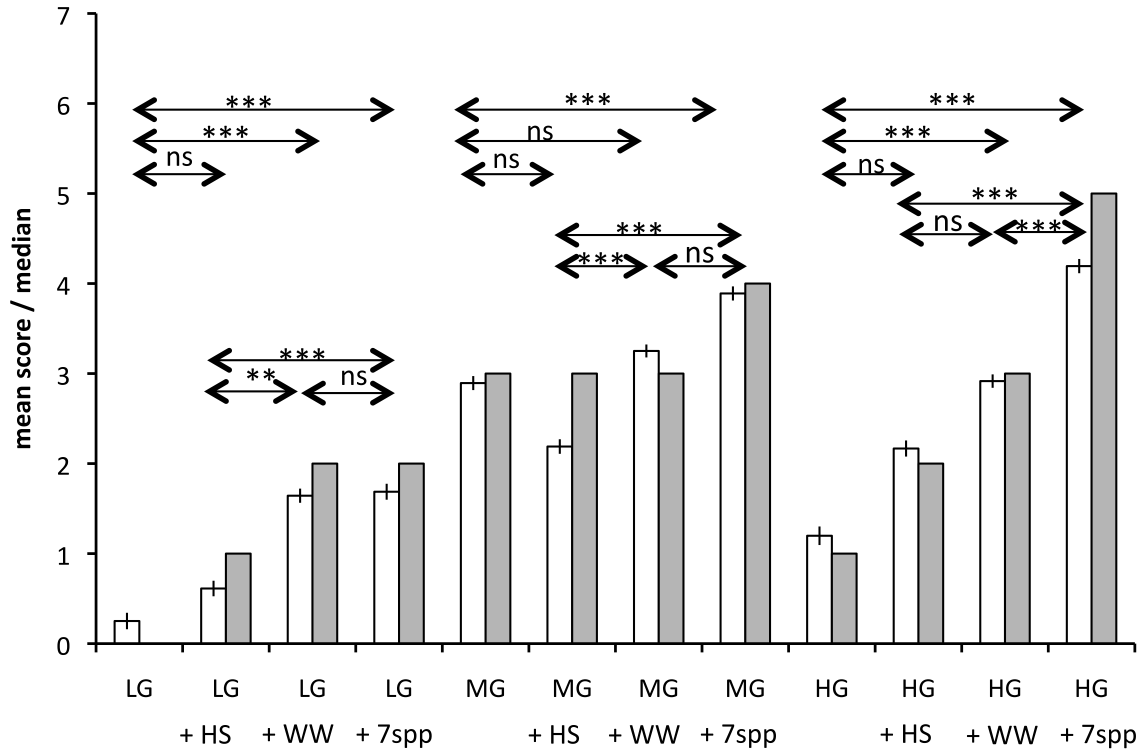


Figure 4



mean score / median
7
6
5
4
3
2
1
0
ns
ns
***
***
***
ns
***
***
***
***
***
ns
***
***
***
***
***
ns
HS
LG
MG
HG
WW
LG
MG
HG
7spp
LG
MG
HG
+ HS
+ WW
+ 7spp

Figure 5



mean score / median
0
1
2
3
4
5
6
7
***
***
ns
***
**
ns
***
ns
ns
***
***
ns
***
***
ns
***
***
ns
***
LG
LG + HS
LG + WW
LG + 7spp
MG
MG + HS
MG + WW
MG + 7spp
HG
HG + HS
HG + WW
HG + 7spp