

The Australian pied butcherbird and the natureculture continuum

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Background in zoömusicology. The discipline of zoömusicology is a pioneering enterprise that requires the collaboration of practices, methodologies, and expert knowledge from a variety of areas. Pre-existing models for such research by musicologists are either absent or at best insubstantial. The various tasks at hand include the collection of extant recordings, the observation and recording of animals in the field, sonographic examination (and notation where feasible), and various types of musicological analyses. Zoömusicology contends with the methodological and conceptual issues that arise when music theory, designed to illuminate human musical traditions (especially the Western classical one), is applied to animal song.

Background in ethology. With the break with the Cartesian tradition of the animal machine, an authentic science of animal behaviour emerged over the last two centuries, evolving both conceptually and methodologically. For example, Darwin, Huxley, Haeckel, and others recognised that man is also an animal. Lorenz, von Frisch, and Tinbergen founded the field of ethology, where a major challenge remains: that of accepting that animal communication is pertinent to the realm of signification rather than merely the realm of information transmission.

Aims. This paper aims to extend the range of contexts in which musicologists contribute. The paper proposes a methodology and a rationale for the study of birdsong by musicologists that, in addressing both sound and musical behaviour, could be relevant to a range of issues on the natureculture continuum.

Main contribution. Results to date of our systematic exploration suggest that pied butcherbird song and human music share many characteristics and the divide between them is therefore narrow. While some musical elements might be species-specific, many others appear to transcend the species boundary.

Implications. Eurocentric and anthropocentric musical assumptions and preoccupations have resulted in a paucity of studies of the sonic constructs and concomitant behaviour of other species by musicologists. When sonographic analysis of birdsong recordings became possible, biologists occupied this area of research, although not with a trained ear so much as a trained eye. Much of the biologists' focus has been on the functional significance of birdsong, but we should not assume that function and aesthetics are mutually exclusive. Any claims that music is a uniquely human activity must be considered provisional without further research into the potentially musical practices of other animals, and we expect such research to yield substantial surprises.

Keywords: birdsong, natureculture, zoömusicology, Australian pied butcherbird, sonogram

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1 Introduction

This paper proposes a methodology and rationale for the study of birdsong by musicologists. Songbirds learn their songs, which constitute complex song traditions that are culturally transmitted (Mundinger 1980, 183; Slater 1986, 94; Lestel 2001). (While the social sciences do not have a unified view of *culture*, the working definition of culture employed here is the non-genetic transmission of traditions across generations. Culture, in humans and in animals, is learned and not inherited.) The Australian pied butcherbird (*Cracticus nigrogularis*) is a songbird whose name derives from its habit of impaling prey on twigs and thorns for later consumption (Serventy and Whittell 1976, 449). The species is non-migratory, and its territory includes much of mainland Australia. Most of what is written about pied butcherbirds refers to their voice, which is variously described as rich, clear, mellow, beautiful, magnificent, and superb. While their voice is considered “well known,” this assumption is merely the result of anecdotes from those who have overheard their song in the wild or on several commercial recordings. Prior to this research, no peer-reviewed article had examined the pied butcherbird’s vocalisations.

French composer François-Bernard Mâche coined the word *zoomusicologie* in 1983. Martinelli imagines the field as the study of the “aesthetic use of sound communication among animals” (2002, 7). The discipline is still a pioneering enterprise that requires pulling together concerns and methods from a number of areas as well as real expertise in several others. Since musicologists have rarely applied themselves to animal song, whether recording animal vocalisations in the field or analysing the recordings of others, pre-existing case-studies and models for such research were either absent or at best insubstantial. In addition to training in both musicology and zoology, the tasks at hand required the observation and recording of birds in the field, the collection of extant recordings, sonographic examination, the transcription of animal song into music notation (still a powerful tool, when appropriate), and musicological analyses (both traditional and novel). Our research made use of software applications for sound editing (iZotopeRX and Audacity), sound analysis (Sound Analysis Pro and SoundID), sonographic examination and preparation (RavenPro1.3 and Amadeus II), music notation (Finale2006-2010, Melodyne Assistant), and data organisation and analysis (Excel), plus a trained ear.

This paper follows Merriam’s suggestion that music can be studied on three analytic levels: the sound itself, behaviour in relation to music, and conceptualisation about music (1964, 32). First, we review the timbral properties, sound classes, vocal techniques, and stylistic operations exploited by the pied butcherbird. Next, we discuss a suite of music-like activities and behaviours exhibited by this avian species. Finally, the success of the species in creating and renewing a musical culture that has compelling and intriguing links to human music provokes epistemological questions concerning the classic natureculture debate. Our research suggests that the debate’s central issue is not so much one of “nature versus culture” but rather “*culture* versus culture.”

2 Acoustic analysis: timbral properties, sound classes, vocal techniques, and stylistic operations

In the analysis of Western classical music (a very small class of musical phenomena), comparative musicology has traditionally been called upon to scrutinise music with simple, regular, bounded rhythmic structures. A regular beat resulting in a quantifiable meter is less obvious in birdsong, particularly because of its start-and-stop nature. In those songbirds known as “discontinuous singers,” which includes pied butcherbirds, a short phrase is followed by an inter-phrase interval of silence. For this species, the mean phrase duration is 2 seconds and the mean inter-phrase interval is 9 seconds (Taylor 2008b, 168). Whilst Berwick and colleagues argue that: “it remains an open question whether birdsong metrical structure is amenable to the formal analysis of musical meter, or even how stress is perceived in birds as opposed to humans” (Berwick et al. 2011, 118), this in no way means that birdsong rhythms cannot be notated, but merely that formal analysis of birdsong is unlikely to prioritise a search for *meter*.

A number of acoustic elements come together to influence our (and perhaps birds’) perception of rhythm and our notation of birdsong, including relative note length, melodic leaps and contour, relative loudness (melodic accent), repetition, and silence. A zoömusicological inquiry into birdsong does not lack for material. In fact, music with a regular, predictable, and obvious meter of three or four beats per bar would be of scant interest to numerous human musical cultures that favour a more complex and dynamic approach to rhythm. Ethnomusicologists writing about such cultures, far from bemoaning the lack of simplistic metrical frameworks (which makes its notation relatively straightforward), find ample parameters to research and report on (see, for example, Jones 1959; Pressing 1983; Agawu 1987; Iyer 2002).

Furthermore, the analysis of pitch in Western classical music has typically dealt with discrete pitches amenable to scalar organisation. Although pied butcherbird song seems to consist largely of such pitches, close examination reveals that portamento is pervasive, making notation problematical. Sometimes termed a “frequency-modulated tone” or “slur” by biologists, portamento is also often mistakenly called “glissando,” which implies production on an instrument with fixed semitones, such as the piano or harp, while portamento does not distinguish the intervening notes in its glide (Boyden and Stowell 2007).

Burton encountered similar difficulties in notating Native American songs with portamento, bemoaning the “vagueness in the Indian’s frequent slurring from one tone to another” (1909, 22). Likewise, Bartók found notation lacking:

The recording of songs on the phonograph is extremely helpful as a method for the gathering of songs, because sometimes—in our attempt to accurately transcribe a folk song—we lack the appropriate musical signs corresponding to those whimsical gliding effects from one series of sounds to the next, which are known in music as *glissando*, and can be properly interpreted only through phonographic reproductions (1997, 1).

The template for the analysis of Western classical music has favoured the relational aspects of pitch that ensue after measuring individual notes, from the simplest inter-tone relationships to the hierarchical relationship among the tones, including such parameters as intervals, scales, melodic contour, tonality, harmony, and structure. Such key components of typological research recede when the pitch reference points are not all fixed, forcing the musicologist to re-think the analytic project. Even within the academy, some musicologists are engaged in a dialogue of how to revise analytical scrutiny. Lochhead argues that “[t]he motivating question of analysis—*how does it work?*—remains viable in a very general way, but its underlying assumption needs interrogation and reforming” (2006, 234), while McClary claims “I had to learn to resist the easy solutions my tonal theory training had given me” (2000, x).

Ethnomusicologists have encountered numerous cultures whose music exhibits pitch bends, portamentos, microtones, blue notes, and arabesques of ornament and decoration. Like its simple approach to rhythm, Western classical music’s equal-tempered system and fixed pitches would probably be found wanting in these cultures. Even Percy Grainger expressed this longing for a musical freedom reminiscent of the irregularity of nature:

...just as a sculpture went through a stage of very restricted and artificial representations of human and animal forms ...and gradually evolved to the Greek technique that could present bodies from all angles and in all phases of arrested movement, so music, apparently, is engaged in disentangling itself from the limitations imposed by scale, harmony, rhythm and arbitrary forms until it is able to copy accurately all the irregular sounds heard in nature (including human life, of course) and out of these liberated sounds evolve a musical language that can voice the surging instincts of man’s musical soul and mirror the flights of his spiritual fancy. In this kind of progress, sliding intervals, intervals closer than the half-tone, irregular rhythms and the toleration of more and more discordant combinations of sounds play a leading part (in Blacking 1987: 158-159).

Game theory suggests that the best approach in strategic situations is to have a mixture or range of strategies from which to choose, some being employed perhaps more often than others, rather than a single strategy (Siegfried 2006). We used a broad interpretation of game theory in developing our analytical template. In light of the relationship between birdsong and rhythm and pitch as experienced in Western classical music, and the lack of an “off-the-shelf” musicological template for birdsong study, our methodology was to embrace several concurrent paths of description as the most promising way forward.

Note morphology

Each animal species has a repertoire of characteristic sound-types (Marler and Hamilton 1966). Figure 1 illustrates the basic morphology of pied butcherbird sound-types. This level of analysis is facilitated by a comparison of sonograms of different sound-types. *Frequency* is used to denote a physical measurement of the number of cycles per second of a sound. One vibration per second equals 1 Hertz (Hz). *Pitch* is the subjective assessment of frequency, and is the word more commonly employed in musicology. Therefore, whenever possible, *pitch* is utilized. More detailed descriptions and measurements of these calls are catalogued online (Taylor 2008a).

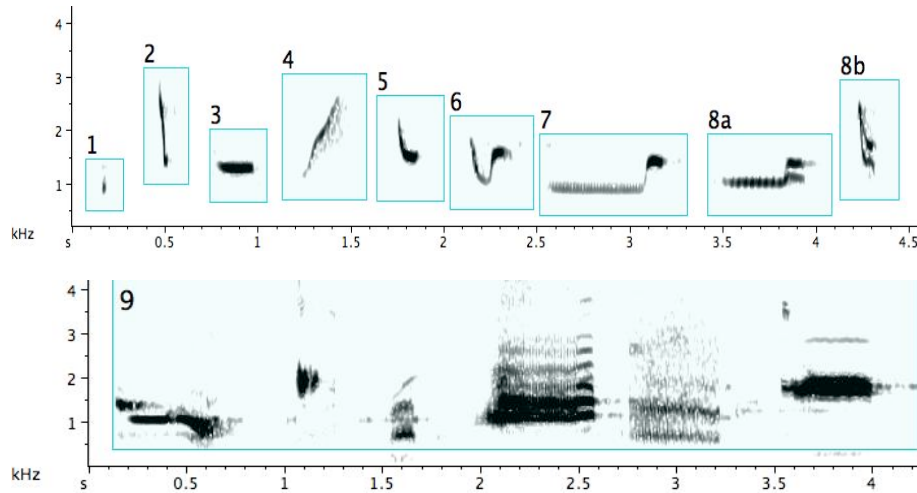


Figure 1. Basic note types of the pied butcherbird: 1. a very short note (less than 0.1sec) within a narrow frequency span (extremely short notes sound click-like, whatever their frequency); 2. a very short note covering a wide, but not simultaneous, frequency span; 3. a note with an almost constant frequency; 4. a note with an upward inflection; 5. a note with a downward inflection; 6. a warbling note; 7. two or more notes joined together by a tail; 8a/8b. simultaneously produced notes from one bird; and 9. complex, buzzy, or “noisy” notes.

Briefly, in the interrogation of note types, we examine note length and direction, including examples where two or more notes are simultaneously produced by one bird, and complex, buzzy, or “noisy” notes, where the energy is distributed over multiple frequencies at the same time. The catalogue of basic note types expands to include a wide variety of short, repeated notes such as trills and rattles (a rapid succession of short and harsh or hollow sounding notes), which the pied butcherbird uses to increase signal diversity (Figure 2). For example, rattles may be delivered within the approximate range of an octave, and may ascend, descend, or remain stable in pitch. Likewise, the individual notes that make up the rattle may ascend, descend, or remain stable in pitch (this affects the timbre). The speed of note delivery varies. Some rattles begin or end with a note considerably longer than the others.

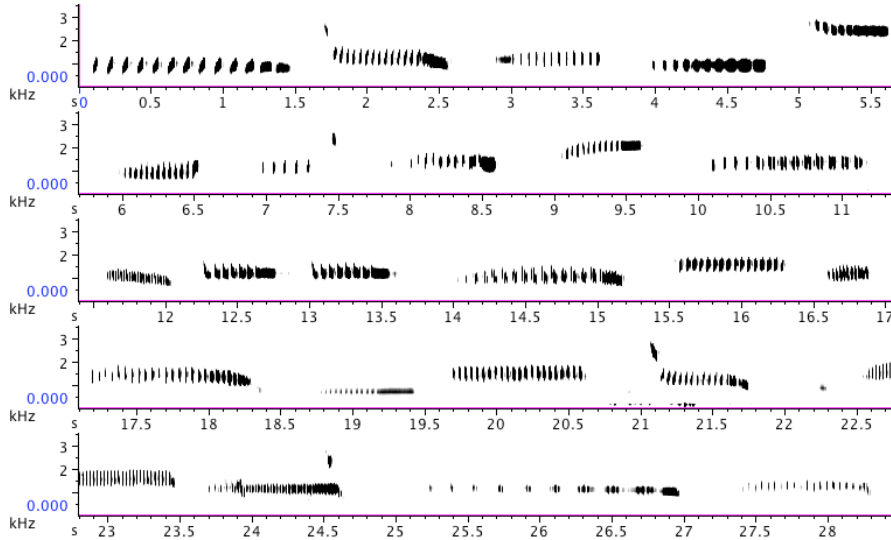


Figure 2. Pied butcherbird rattles and trills.

Some notes suggest mnemonic catchwords to the human listener, such as *blip*, *blop*, *chip*, *tok*, *wow*, *whoop*, and the like (Figure 3). While these catchwords are subjective - part acoustic and part psychoacoustic - at minimum they indicate a change in timbre. The catchwords demonstrate both the extent to which pied butcherbirds are able to physically produce a variety of sounds and their interest in including elements of varied timbre in their song phrases.

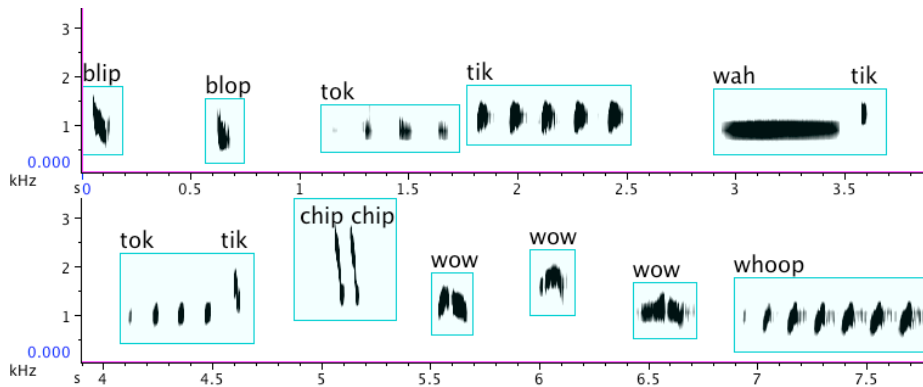


Figure 3. Pied butcherbird notes suggesting mnemonic catchwords, such as *blip*, *tok*, *tik*, *chip*, *wow*, and *whoop*.

Other inventoried sounds of timbral interest include rapid, often steep, frequency sweeps or “portamenti” (Figure 4) that sound more like an electronic signal than the deliberate whistles one typically associates with birdsong.

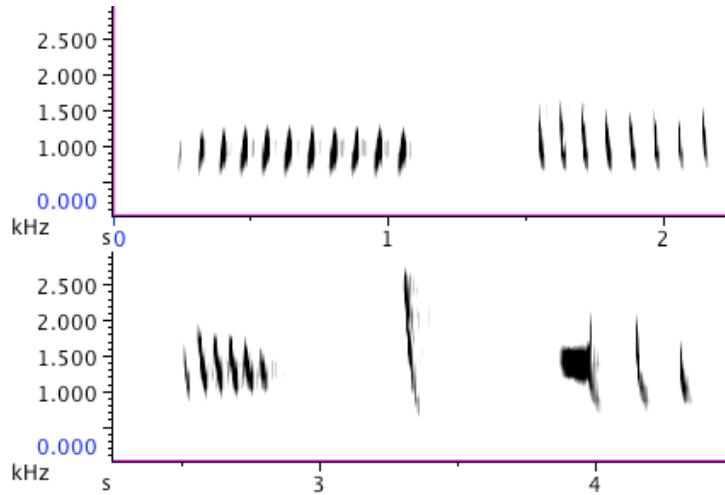


Figure 4. Pied butcherbird notes displaying abrupt linear frequency sweeps.

Call notes

While songs are learned, calls tend to be simpler and innate. Some calls, such as alarm calls and those indicating the discovery of food, are considered to have semantic content, functioning similarly to words insofar as they refer to items in the environment (Marler 1957; Collias 1960; Evans and Evans 1999; Seyfarth and Cheney 2003). (The genesis of both music and language are thorny fields when considered separately *or* together; the argument for parallels between birdsong and human speech behaviour are outside the scope of this inquiry. This is not to contend that birdsong has no parallels with language and its acquisition, but merely to assert that the parallels between birdsong and the human animal's *music* amenable to analysis by a musicologist are the focus herein.) Figure 5 details a number of pied butcherbird calls and their apparent context and motivation, including a pair of beak claps that are used in aggressive encounters with other birds.

Other contexts exist where the pied butcherbird could call. In most cases, the call illustrated by Figure 6 is diagnostic for the species, meaning that the bird can be identified by it, whether or not it has been sighted. Because there is no common motivational basis for this call, the term “species” call was coined (Taylor 2005). This call is generally stereotyped across the continent in groups separated in both time and place: 3-5 notes are delivered within the F⁷ (2794 Hz) to G^{#7} (3322 Hz) range, an octave above the standard singing register, and are sometimes preceded by a steep ascending “zip.” (Elements of the call, including the “zip”, may or may not be made up of or appear on the sonogram with upper harmonics.)

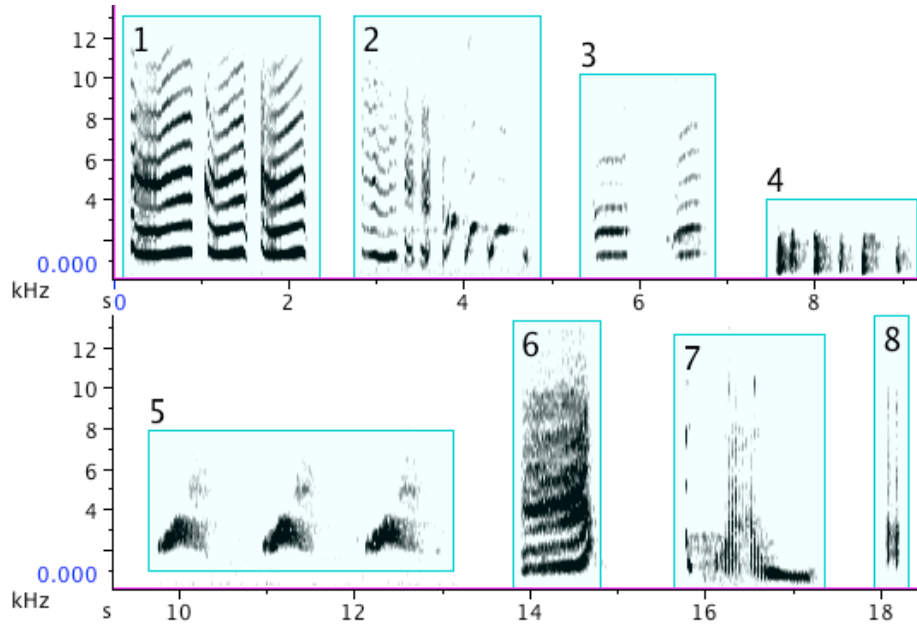


Figure 5. Pied butcherbird call notes: 1. a food begging call from a nestling; 2. a food begging call from a nestling; 3. a food begging call from an adult; 4. a scolding agonistic call given to a conspecific; 5. a bark-like agonistic call; 6. a scolding call given to a cat; 7. an agonistic “prew” call; and 8. two aggressive beak claps.

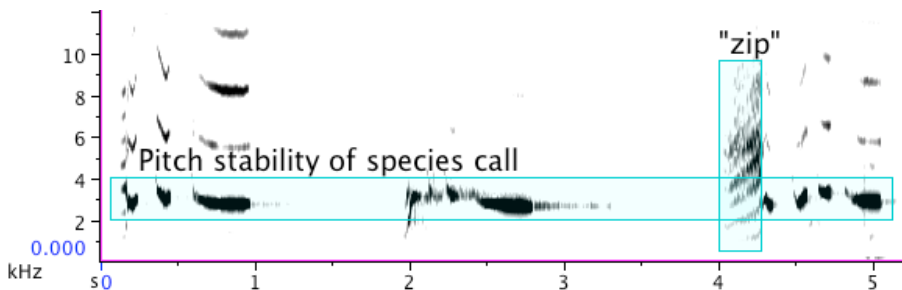


Figure 6. Typical pied butcherbird species calls displaying pitch stability in three different birds (at 0 sec, 2 sec, and 4 sec). The call is sometimes preceded by an ascending “zip,” as in the third example.

Birds will often join together to mob other species perceived to be a threat to their physical safety or food supply. Figure 7 itemises the calls delivered in two such cases. The upper part of Figure 7 consists of a series of species calls provoked by the arrival of a wheeling flock of black kites (*Milvus migrans*); the lower part of Figure 7 illustrates U-shaped portamento notes that sound similar to the “zip” portion of the

species call and that are being used to mob an Australian raven (*Corvus coronoides*). Like the species calls used in previous contexts, the pitch of the species calls used in mobbing is stereotyped within the F⁷ (2794 Hz) to G^{#7} (3322 Hz) range.

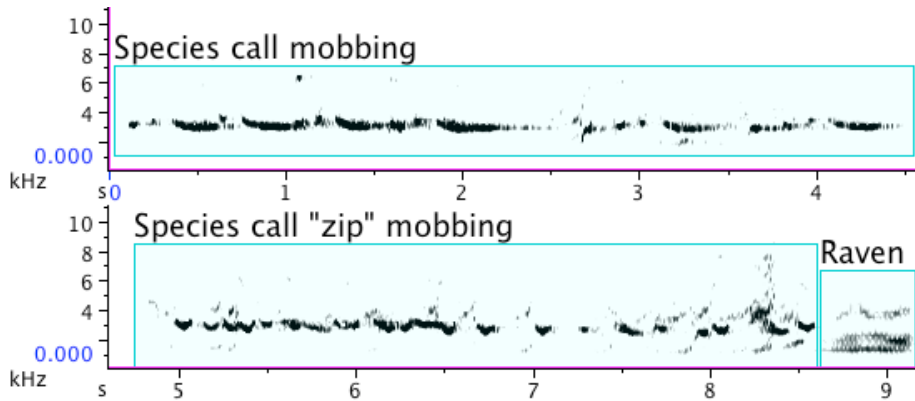


Figure 7. Above, a group of pied butcherbirds issue a series of species calls provoked by the arrival of a wheeling flock of black kites (*Milvus migrans*); below, pied butcherbirds mobbing an Australian raven (*Corvus coronoides*) with a portamento note that sounds similar to the “zip” portion of the species call.

The birds possess a repertoire of techniques for varying the species call—it is part of their “bag of tricks.” Unlike the pitch stability found in the call proper, when delivered as a motif in either antiphonal or solo song, the pitch of this bio-cultural hybrid is no longer stereotyped. Nevertheless, the pitch normally shifts upwards significantly, generating a **falsetto** effect (Figure 8). The ability to transpose has not been widely recognised in songbirds, with the assumption being that the capacity for transposition evolved after mammals diverged from the avian clade (Hauser and McDermott 2003: 666). However, recent research points to transposition in urban songbirds who must compete with traffic and other anthropogenic sounds (Hu and Cardoso 2010; Brumm 2006; Slabbekoorn and den Boer-Visser 2006; Slabbekoorn and Peet 2003). The pied butcherbird’s widespread ability to shift an acoustic model up or down without distortion suggests that the species could be a fruitful candidate for further studies into transposition. In addition, should this study indicate that the birds revise the call based on the context in which it is placed in the song, this would have potential interest to linguists in particular, since “it would suggest a level of syntax routine in humans but (arguably) absent in other animals” (Andy Horn, e-mail to Hollis Taylor, November 11, 2005).

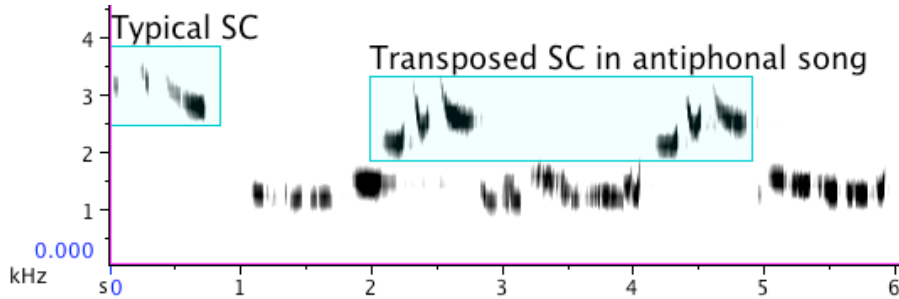


Figure 8. A species call (SC) delivered on the typical pitch, then transposed in antiphonal song.

Species call (SC) variations (Figure 9) also point to flexibility in the innate versus learned material of pied butcherbirds. The first, “Truncated SC,” is an example of truncation. It consists of the first two notes of what is normally at minimum a three-note call: $F^7 G^7$, but then lacking the standard resolution back to F^7 . The second example, “Transposed/deflected SC,” sees substitution by way of deflection: three notes, $F^7 F^7 G^7$, of an apparent four-note call are not resolved to the final F^7 but instead see a two-note substitution, a downward deflection to $A^6 Bb^6$. The final example, “SC variations from one group,” hails from this same site and illustrates three variations recorded in a period of several minutes, indicating that either one bird possesses three versions of the call or that variations exist among the conspecifics at this site. The pitches of these three calls, excerpted and grouped together for purposes of comparison, are $F^7 G^7 G\#^7 A\#^6$ (at 3.6 sec), $F^7 A\#^6$ (at 4.7 sec), and $F^7 G^7 A\#^6$ (at 5.5 sec).

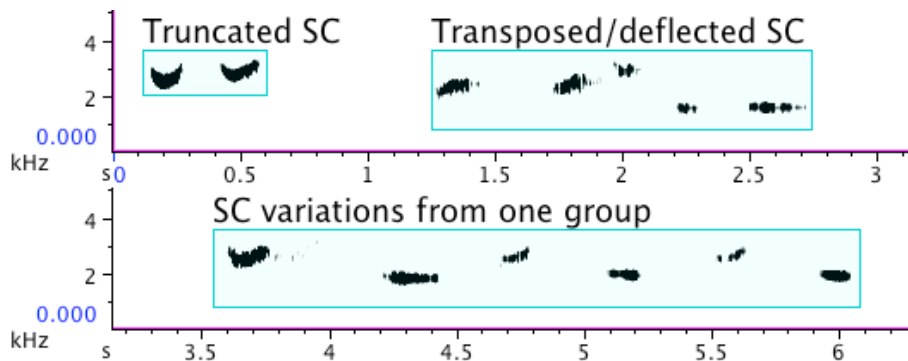


Figure 9. Species call variations: truncation; transposition and deflection; and three variations from one avian group.

Songs

In this section we itemise and explicate selected features of pied butcherbird song, many of which are well known in Western classical music. This highly abbreviated

sampler of songs and singing patterns from various contexts traces how pied butcherbirds vary and enrich their songs.

In Figure 10, a relatively “pure” note, with no harmonics, a sort of **ostinato**, shares the broadcast space with a grey shrike-thrush (GST) (*Collurincia harmonica*). While it is unknown if either bird intends that their pitches work well with the other’s (or indeed whether one would alter its pitch should the other), nevertheless the pied butcherbird’s E⁶ and the grey shrike-thrush’s E⁶, G^{#6}, and E⁷ combine for a striking effect.



Figure 10. A pied butcherbird (PBB) performs an ostinato whilst a grey shrike-thrush (GST) rings out its phrase (music notation of the first 10sec.).

The pied butcherbird almost never sings as simply as the ostinato in Example 10. In contrast, Figure 11 illustrates a group of phrases delivered by a bird whose song displays extreme timbre differentiation, reminiscent of **Klangfarbenmelodie**. The acoustic palette is remarkably wide-ranging for one bird, with strong fluctuations in parameters such as note duration, dynamics, and texture, as well as juxtapositions of pure tones and noisy sounds.

Duets, which we will discuss in more detail shortly, normally see singers alternating so rapidly, without overlap between their contributions, that the dovetailing figures form a single melodic line—a **hocket**. The duo in Figure 12 is intriguing on several accounts. In delivery, it sounded as if it issued from one bird, and it was only by observation that its status as a duet could be confirmed. With a letter is assigned to each motif, the duo approximates an ABBA form. The birds alternate their motifs, indicating that they are in command of each other’s part. Bird #1 delivers the three pitches of Part A (D^{#6} E⁶ F^{#6}) in ascending motion, while Bird #2 reverses the order of the first two notes (E⁶ D^{#6} F^{#6}). (Bird #2 completes motifs in both Parts A and B with a descending portamento flourish.) The second motif (Bird #2) is revised upwards an octave by Bird #1 in the third motif (from D⁶ D⁶ C⁶ C⁶ to D⁷ D⁷ C⁷). Such

preservation of contour, interval, and chroma in Part B suggests that the pied butcherbird may possess octave generalisation, an ability previously attributed to white rats (Blackwell and Schlosberg 1943), and rhesus monkeys (Wright, et al. 2000), although efforts to find it in the European starling failed (Cynx 1993), and it has not been confirmed in songbirds. Observation and sonographic analysis of pied butcherbird song provide strong evidence for absolute pitch, and numerous cases of the transposed species call also indicate relative pitch, but since this research does not involve laboratory or banded birds, their perceptual abilities can only be speculated on. Additionally, it is unknown whether the discovery of sonic material that suggests abilities such as octave generalisation, absolute pitch, and transposition is more a case of the pied butcherbird potentially being a species of note in these areas or whether musicologists are more likely than biologists to spot those species best suited for such research.

Huron describes a **chimeric melody**: “A pitch sequence constructed by linking together two different melodies. A tune that begins with one melody, but then shifts to another melody” (2007, 411). While this technique occurs in cut-and-paste operations of the pied butcherbird’s own motifs, we also find motifs from an alien species that are decontextualised and absorbed into a pied butcherbird phrase. Figure 12 details three such examples (phrases with motifs reminiscent of a peaceful dove, a honeyeater with a noisy song, and a reversing truck alarm) in sonogram form.

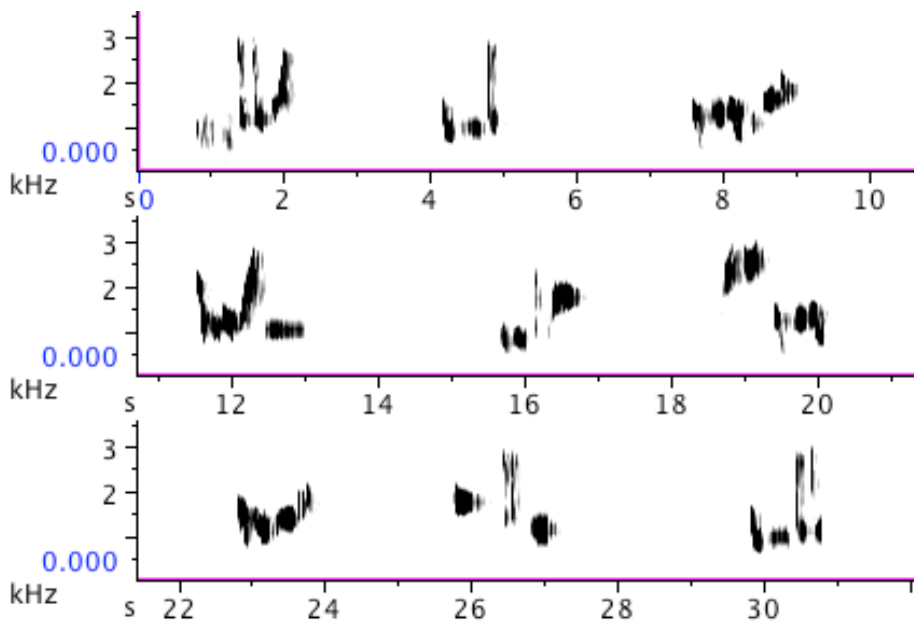


Figure 11. A remarkably wide-ranging acoustic palette suggestive of Klangfarbenmelodie.



Figure 12. A pied butcherbird duo with the attributes of a hoquet. Part A's are circled; Part B's are connected by lines.

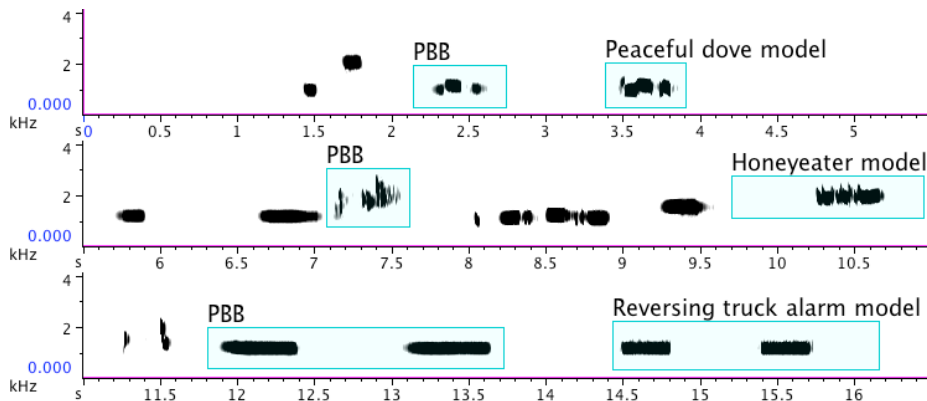


Figure 13. Chimeric melodies, where a pied butcherbird has absorbed into its own song the motifs of a peaceful dove, a honeyeater with a noisy song, and a reversing truck alarm. The relevant part of the pied butcherbird song (PBB) is followed by a boxed example of the probable model, recorded at the same site and inserted for comparison.

Phrase endings

A phrase is a recognisable and orderly group of notes separated by a pause, which is generally of the order of several seconds in pied butcherbird song. Schoenberg sees a musical phrase as possessing a sense of completeness and yet being well adapted for recombination with other similar components (1967, 3). He suggests phrase conventions for the composer and/or analyst to consider:

The end of the phrase is usually differentiated rhythmically to provide punctuation. Phrase endings may be marked by a combination of distinguishing features, such as rhythmic reduction, melodic relaxation through a drop in pitch, the use of smaller intervals and fewer notes, or by any other suitable differentiation (ibid.).

We have catalogued many such examples of phrase endings in pied butcherbird song with rhythmic reduction, a drop in pitch, smaller intervals, and other suitable differentiations familiar in Western classical music (Figs. 14-17).



Figure 14. Phrase endings with rhythmic reduction (circled). “W” denotes a *wow* sound and “ES” an almost electronic sound.



Figure 15. Phrase endings with a drop in pitch (circled). “CH” denotes a *chip* sound, “QR” a quasi-rattle, and “ES” an almost electronic sound.



Figure 16. Phrase endings with smaller intervals (circled).

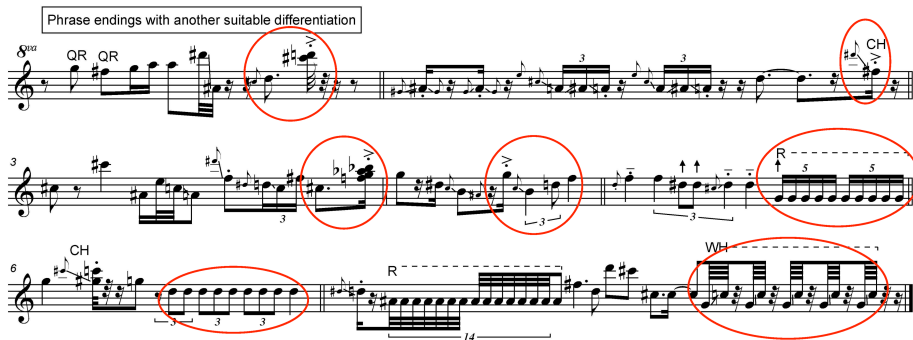


Figure 17. Phrase endings with other suitable differentiations (circled): bar 1: an accent, large leap, and two-note chord on the final note; bar 2: an accent and a large leap followed by a steep portamento creating a *chip* sound on the final note; bar 3: an accent, an upward leap, and a note of wide harmonic content on the final note; bar 4: a structural accent in the outline of a G dominant seven chord filled after a leap; bars 5-7: extended repetition of the final note or motif. “R” denotes a rattle, “QR” a quasi-rattle, “CH” a *chip* sound, and “WH” a *whoop* sound.

Time does not permit a full account of the cross-species analogies between pied butcherbird song and human music. The list would include structural features such as **canon, fanfare, augmentation, variations on a theme, inversion, additive and divisive rhythms, accelerando, crescendo and decrescendo, melisma, sotto voce, étude**, and cross-cultural consistencies of what constitutes **shape and balance**. (The list would also include apparent commonalities in functional outcomes to be taken up in the next section, such as territorial song, which is akin to a **national anthem**, while a male's song directed towards a potential mate is a **serenade**. **Performed by the composer** is also applicable.) Thus, results to date suggest that while some musical elements might be species-specific, many others appear to be trans-specific.

3 Musical activities and behaviours

Learning behaviour

Birds' ability to learn songs allows for a variety and complexity not possible in songs that are innately acquired. Learning is accomplished via cultural transmission and is designated as vertical—via parents, horizontal—via members of the same generation, and oblique—via unrelated birds of different generations (Marler and Tamura 1964; Lynch et al. 1989, 634; Baptista and Gaunt 1997, 24-25). Songbirds devote considerable time and attention to the development of singing facility. In this research, a number of apparent singing lessons have been recorded, as well as **practicing** by both mature and immature birds. Issues of **talent** and **motivation to improve** seem to be pertinent.

Vocal play and imitation

Speculation on the function of avian mimicry is inconclusive. For pied butcherbirds, the literature catalogues 45 mimicked species, including other songbirds, but also a cat's meow, a dog's bark, a lamb's bleat, and a horse's whinny, as well as a human's whistle and speaking voice, a frog, and the reversing alarm of a truck (Taylor 2008b). Musicians know mimicry by a myriad of names, including imitation, borrowing, quotation, appropriation, bricolage, modeling, pastiche, parody, montage, crossover, and plagiarism. Whatever the label, the mimetic powers of pied butcherbirds betray their oral absorption of the exterior world and suggest that their hearing, while not identical to ours, is akin to it.

Whilst we occasionally encounter motifs from an alien species absorbed into pied butcherbird song, more often we find the songbird stringing together a pastiche of imitations in a mimicry cycle. Then, assumed constraints in motor ability or species-specific song learning are shown to be plastic: mimicry cycles are often quieter, the vocal range extends in both directions, singing is continuous for fifteen minutes or more, and other techniques not found in standard song are displayed. The full-on effect is one of a **DJ cut-and-paste session**. As Hall-Craggs asked of the inter-specific copying of blackbirds, "why should a bird already so richly endowed with

song commit to memory and reproduce such a wide variety of alien sounds?” (1984, 1). One assumes this degree of complexity and elaboration would be well beyond what is necessary for survival and reproduction (Hartshorne 1973, 56; Jellis 1977, 204). Furthermore, “as soon as there is the possibility of mimicry, there is a potential for narrativity. An animal at play is already telling a story” (Lestel 2002, 42).

Musical activities for certain hours, seasons, places, and situations

Songbirds work within the constraints and cycles of habitat, season, daylight, and weather. Additionally, pied butcherbird song phrases vary with the individual, the time of day, and the context (Taylor 2008b). While antiphonal song comes and goes throughout the day, mostly abundantly in late summer through autumn, some vocalisations are bracketed off from ordinary life, most notably the pre-dawn spring song. Here, especially on moonlit nights, a bird will sing up to six hours with scarcely a break. These formal songs, while displaying some elements of the local commonly held antiphonal song, are unique to each bird right across the continent and vary annually (*ibid.*), providing the musicologist with an abundant and renewing source of data. Music relates to the site of its production, and pied butcherbirds appear to take into account acoustic constraints and potential amplifying benefits of an environment. For example, in working with reflection, dispersion, and refraction of sound in a gorge as opposed to a forest, a bird must take on the task of an **aural architect** (Blessner and Salter 2007, 5). Additionally, pied butcherbirds typically sing from a favourite songpost, the songbird’s counterpart of a theatre’s **raised platform or stage** set aside for performance.

Social and physical behaviour

Female songbirds sing much more than is normally acknowledged among biologists (Smith 1991, 248): they sing in both solos and duos (Langmore 1998), and will sing to attract mates (Langmore 1998; 2000). Their repertoire may even exceed that of a male (Brown and Farabaugh 1991, 270-271). The function of a *duet*, like that of female song, remains puzzling, although various hypotheses have been explored, such as pair bond maintenance, mutual stimulation, contact, cooperative territorial defence, reproductive synchronisation, and mate guarding. Since in pied butcherbirds the sexes are anatomically indistinguishable in the field, the female contribution can only be speculated on.

Antiphonal song arrives in trios, quartets, and even larger choirs, and includes frequent doubling. When singing, pied butcherbirds alternate an upright posture with a raising and lowering of the bill, which assists in identifying both the part segmentation and the individual singer. These multi-individual engagements are relevant not only to social behaviour, but also to physical behaviour, as various postures and whole-body motor performances enhance the audio for a multi-media package. After working one antiphon for several minutes or more, pied butcherbirds typically move to another, working through ten or more group songs. Some antiphons appear to be codified, while others betray a looser construction.

The processes of composition and improvisation

Some species, and some individuals, display special singing abilities. Certain pied butcherbirds develop skills and songs that, while appropriate for the species, far exceed that of their conspecifics. On one occasion, a single bird delivered 1,123 phrases in a diurnal song of nearly 3½ hours. Variations are found at all levels of song organisation. Phrases were assigned letters in the order of their introduction to facilitate a distributional analysis. The twelve main phrases are all subject to permutation, several having over 100 variations each, and many are hybrids of two or three phrases. Memory is probably the most important human cognitive capacity (Bolhuis and Gahr 2006, 347). The human brain builds shortcuts such as “chunking” in order to manage bits of information and recall them as a group (Levitin 2006, 213). In an inquiry into how the human brain’s tendency to chunk might correspond to the avian brain, we find that the continual paring down of the motifs and figures in Phrase E of this song hampers a search for the minimal units of production (Figure 18). Phrase E’s length is unstable, and variants include rhythmic innovations and cut-and-paste hybrids. The conventions of phrasing permit repetition or elision of most figures, which are energised by leaps and which accommodate a number of entry and stopping points (Taylor 2010, 80).

Reminiscent of modular snap-together beads, the segmentation and recombination of phrases in this Olympian performance raise the question of what it might be called had it been performed by a human. In the following year in the same territory, some of these figures were re-worked with significantly different results. Such modifications, transformations, and recombinations in birdsong are consistent with Merriam’s observation that “[o]ne of the most frequently mentioned techniques of composition is that which involves taking parts of old songs and putting them together to make new ones” (1964, 177).

Two additional musical activities of note have been observed in pied butcherbirds: **vocal contests**, in which two nearby birds preferentially sing phrases from a common repertoire, and **warming up**, in which birds begin more softly, with less clear tone, with simpler song phrases, and/or longer inter-phrase intervals than they will deliver for the duration of their song.



Figure 18. Eleven of 110 variants of phrase “E” from a pied butcherbird diurnal song. Boxes and lines trace some of the repeated figures and motifs.

4 Behavioural-ecological analysis and functional interpretation

As is the case with translating a foreign language text, crossing a boundary between musical genres can present problems of understanding:

Even if we know the grammar and the vocabulary of the foreign language, meaning may escape us because we are unable to recreate the context of the text, the author's purposes, or his intellectual environment, or because it may not be clear to us "what game is being played" (Becker and Becker 1982, 30).

Birdsongs are problematic. No one contests the richness, complexity, diversity, and dynamicism of certain birds' songs—the problem is at the level of interpretation (Lestel 2009): identifying structural versus functional similarity. Or perhaps this is not even necessary. Goehr argues that

[t]he belief that works of fine art are self-sufficient, that they bear no external relation to anything else, was finally confirmed [around 1800] as theorists proclaimed that art is an end in itself. ...Applied to music the point can be put this way: music traditionally conceived as a vehicle, as functional, vastly underplayed its expressive form. Function made the musical medium essentially transparent by giving priority to that which was being expressed or imitated (1992, 171).

In a similar vein, Nettl concludes that "Ethnomusicologists probably agree that people everywhere use music to accomplish something" (1983, 148). Numerous other musicologists and ethnomusicologists, including Merriam, Blacking, and Sachs, have visited this subject with similar conclusions. More recently, in his consideration of the function of pleasure and its repercussion for musical aesthetics, Huron claims "that pleasure is more complicated than aesthetic philosophers have assumed, and that pleasure is more pervasive and fundamental to the arts than many arts scholars would care to admit" (2007, 374). Quite simply, most human music through the ages has been functional.

Ethologists regularly propose a functional reading of birdsong: birds sing to maintain a territory and to attract a mate. Even the apparently straightforward concept of territory is multifaceted, as evidenced by Birkhead's chapter on the history of birdsong territory as understood by ornithologists (2008, 205-236). Holding territory could be relevant to avoiding disease, regulating population, ensuring an adequate food supply for the young, mating without interference, possessing a headquarters for the male bird to sing in, something else entirely, or several or even all of these. Anecdotal and documented evidence shows that Australian aboriginals used songs in a similar way to birds, in affirming territorial boundaries (Marett 2005; Stubington 2007).

While the concept of territory is nuanced and a large body of research indeed confirms that birdsong in male seasonal singers is relevant to maintaining a territory and attracting a mate, Kaplan reminds us that Australian magpie (*Cracticus tibicen*) vocalisations do not fit this current conceptualisation of song. In that species, both

sexes sing throughout the year, and one finds “no specific song for breeding enticements” (2008, 51). One of the Australian magpie’s most closely related species, the pied butcherbird sings more diurnally in the autumn than in the spring (Taylor 2008b). At that time of year, song is frequently antiphonal, and therefore motivations other than competition also seem pertinent—in particular, cooperation.

Birdsong could serve as a group password, a tool for social bonding, a participatory experience (Cross 2007, 661), a signature for both an individual and a species, a self-rewarding activity (Morris 1962, 145), a heightened experience for both producer and listener, a challenge that provides a sense of accomplishment, an indicator of fitness and strength, and/or a vehicle for various sorts of domestic communication. If we insist on distinguishing “use” from “function,” we still have a list that could be highly pertinent to songbirds, in functions such as emotional expression, aesthetic enjoyment, entertainment, communication, physical response, and contribution to the integration of society. In any case, aesthetics and function are not mutually exclusive; on the contrary, we could consider them mutually enhanceive. Not unlike in pied butcherbird song, in human music we find a hybrid of aesthetics and function, since humans are also known to affirm their territory, their personal taste, and their group through music.

This brings us to “the vexed problem of inventiveness in song” (Thorpe 1961, 90). Reductionist views concerning birdsong’s *two* functions derive not from science so much as from popular receptions of science. Ethologists admit they are far from understanding the nuances of “emancipated singers,” birds who are not bound to a species-specific song template (Björn Merker, e-mail message to author, August 7, 2009). With a few notable exceptions (Craig 1943; Hartshorne 1953; Sotavalta 1956; Hall-Craggs 1962; Armstrong 1973; Gray et al. 2001; Baptista and Keister 2005), scientists avoid musical concerns, which is to be expected given their preoccupations and methodological constraints. However, the literature contains numerous asides on the apparent aesthetic use of sound by birds: [this] “leaves us to puzzle over the resulting richness and variety” (Catchpole and Slater 1995, 191); “Sometimes it is clear that birds indulge in a process of improvisation, first memorizing and replicating a theme, and then subjecting it to a series of systematic transformations, as though assuaging an appetite for novelty” (Marler 1981, 92); and “but the far more complex songs of versatile songsters, the songs of songsters which possess large individual repertoires, sometime appear to be so variable as to dramatically violate the requirement of song invariance for species distinctiveness” (Boughey and Thompson 1976, 5).

While birdsong has inspired musicians, artists, philosophers, and casual eavesdroppers for centuries, when technological advances such as the tape recorder and the sonogram became available, it was biologists who led the way, taking advantage of unoccupied and undefended territory much like a bird might. Thus, we find ourselves in the peculiar position where biologists, who study birdsong with a trained *eye* and who specialise in collecting data that can be presented as numbers, are allowed to define “music” and pass judgment on whether birds produce and perform it, rather than musicologists.

Any definition of music must take noise into account. Merriam points out the “distinction, implied or real, made between music on the one hand, and noise, or non-music, on the other” (1964, 63). Pied butcherbirds possess the ability to go to the borders of their territory and screech. Their powerful voice would carry far and wide, and this would seem to suffice to register that the singer is holding the territory. In a contemplation of music versus noise, the songbird preference to sing rather than screech in territorial song is intriguing and not an obvious choice if one considers it only in functional terms.

A large part of what constitutes music today would have simply been rejected not long ago. Today, music is what we say it is. Clearly, like language (Evans and Levinson 2009, 477), the possible design space for music remains much larger than that actively explored to date. Eurocentric and anthropocentric musical assumptions and preoccupations have resulted in a paucity of studies of other species’ sonic constructs and concomitant behaviour by musicologists. It is not central to our argument that birdsong, even with its striking commonalities with human music, be considered music, “music,” or even proto-music. We feel a strong case can be made for musicologists to participate in birdsong research because of the skills and sensibilities they bring to the tasks at hand, and we believe zoömusicologists will play an increasingly significant role in the analysis of animal song. Nevertheless, zoömusicologists should expect questions of function and not musicality to dominate receptions of their work. Therefore, part of any zoömusicologist’s research toolkit will necessarily be a response to questions of function.

5 Conclusions

Birdsong may be relevant to inquiries into a range of issues on the nature/culture continuum, including memory; music cognition, perception, and auditory processing; music’s evolutionary origins and biological basis; the search for universals; and the comparison of the faculties of music and language. The study of birdsong could give us alternative models to reconceptualise music and even language. However, at the moment, animal abilities remain largely unstudied and underestimated—what Lestel terms the “*terra incognita*” of animal intelligence (2007, 9). De Waal criticises the “anthropodenialist” approach, arguing that most claims that “single out distinctly human capacities” do not hold up to scientific scrutiny for more than a decade, “such as claims about culture, imitation, planning and the ability to adopt another’s point of view” (2009, 175).

Music is considered an ideal subject for the study of human cognition, but will the sample be polluted by global exposure to Western music? In light of the spreading musical monoculture, researchers are already ringing the alarm bell concerning whether we will be able to examine innate cognitive dispositions in the human animal. This makes birds and birdsong all the more attractive. Ultimately, the divisive question “Is birdsong music?” is not the only line of questioning that can be pursued.

The questions we find compelling are “What can musicologists tell us about birdsong?” and “What does birdsong tell us about the human capacity for music?”.

As musicologists begin to contemplate and illuminate other sonic cultures, both through studies of individual species and eventually interspecific comparative investigations, they will tap a deep vein. In particular, we expect that the work of *field* musicologists—those who actively observe and record animals in their natural environments—will be the most productive and enlightening. Research benefits could be more than theoretical—with new knowledge, birdsong might be integrated into human musical practice in heretofore-unimagined ways as we exploit their novel repertoires. Likewise, zoömusicological analyses might impact on musicological methodology. Scholars such as Cross have called for a broadening of research into “possible continuities between the capacities of non-human animal species and human musicality that are raised by an evolutionary perspective on music” (2009, 12). Pied butcherbird research is in its early stages. Huron’s research into the psychology of expectation could find birdsong a fruitful area for investigating the statistical regularities of melodic organisation such as “pitch proximity, step declination, step inertia, melodic regression... melodic arch” (2007, 74) and the like. Any claims of human uniqueness in music (or other domains) must be considered provisional without animal research, and we predict such studies will yield substantial surprises. In the words of entomologist Edward O. Wilson, “Every species is a magic well” (1984, 19).

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