DIALECT RECOGNITION IN THE COMMON MYNA *ACRIDOTHERES TRISTIS* ON THE ISLAND OF MOOREA, FRENCH POLYNESIA

KYLE R. INGRAHAM

Integrative Biology, University of California, Berkeley, California 94720 USA

Abstract. Culture, including language, is a set of learned behaviors that are passed from one individual to another, with geographic barriers serving to promote a divergence of cultures. In birds, songs are the result of culture as birds imprint and formulate songs at a young age. Songs and other vocalizations may vary between locations, forming dialects that may inhibit gene flow and promote speciation. This study examined the ability of the common myna, *Acridotheres tristis*, on Moorea to recognize possible dialects by playing common myna calls from other geographically remote locations and observing the birds' behavior in response. Findings indicated that *A. tristis* on Moorea reacted significantly differently to audio recordings from India and Hawaii than they did to recordings made on Moorea. However, differences between reactions to Cook Islands recordings and Moorea recordings were not significantly different, suggesting that the cultures of these two populations of mynas may not be fully distinct from one another. Different dialects were found to exist among *Acridotheres tristis*, but further study, especially into correlative gene flow and genotypic variation, is needed.

Key words: culture; language; dialect; recognition; behavior; phenotype; audio playback; Acridotheres tristis; *gene flow; vocalization; Moorea, French Polynesia*

INTRODUCTION

Culture, or a set of shared learned behaviors, is a word most commonly associated with human beings in reference to language, beliefs, and customs. However, examples of culture can also be found across the animal kingdom among a variety of social species (Heyes and Galef 1996). The key point defining culture is that it includes a behavior that is not instinctive and must be taught. Small variations in instruction between individuals allow for behaviors to diverge, especially when exchange with other normative individuals is inhibited, like through a geographic barrier; gradually differences will accumulate until a new culture is distinctly different from its predecessor. (Heyes and Galef 1996). Given enough time, two isolated social populations will frequently form unique cultures (Danchin and Wagner 2010).

Examples of culture abound in the scientific record (Church 1957, De Waal 2001,

Krützen et al. 2005). Some are unique, surprising behaviors that have evolved in very few populations, such as some West African chimpanzees' use of spears to hunt bushbabies (Pruetz and Bertolani 2007) or the well-known Japanese macaques that learned to wash their food (Kawai 1965). Examples exist outside of simians as well: some bottlenose dolphins have been found to teach tool use (Krützen et al. 2005), and some feeding behaviors of rats have a clear cultural influence (Heyes and Galef 1996). In birds, the learning of songs is the clearest and most impactful evidence of culture (Podos et al. 2004). A bird's familiarity with and execution of its song forms the basis for many of its social interactions, since birds use their song to attract mates and communicate with rivals and family members alike (Irwin and Price 2001, Marler 2004). Because birds learn a song by hearing it from others (Slater 1988), it is quite common for specific dialects of a song or call to form in one region or another (Mundinger 1982). Those dialects can form a major barrier to gene flow.

In a classic example of a pre-zygotic barrier, birds of the same species but different dialects will frequently fail to recognize each other as potential mates (Ellers and Slabbekoorn 2003). This is best demonstrated by the extensive study of white-crowned sparrows (Marler and Tamura 1962), which have been found to not recognize an introduced male if it was from a distant population. However, populations need not be separated by great distance in order for dialects to form; two populations of rufous-collared sparrows just 25 kilometers apart were found to have different dialects and breed out of phase in a 2005 study (Moore et al. 2005). Moore et al. hypothesized that tropical birds, with the potential for a longer and thus more exclusive breeding season, are more prone to developing unique dialects.

The common myna, *Acridotheres tristis*, is one such social tropical bird and is known for its large repertoire of calls and songs (Baker and Jenkins 1987, Baptista and Trail 1992). The common myna is native to central and southeast Asia but is listed by the IUCN as one of the three most invasive species of bird on the planet (Center for Agriculture and Biosciences International 2014). Starting in the mid-eighteenth century, Europeans began introducing the common myna to a variety of tropical locations as a means of biological pest control (Cheke and Hume 2008). In the late 1800's they were brought to Hawaii (Lever 1987), and in the early 1900's Australia. The common myna was first brought to Tahiti between 1908 and 1915 as an intended predator of wasps (Lever 1987); it has since colonized many other islands in the Pacific. Today their range spans from the South Pacific to Madagascar, with sightings seen as far north as France.

Common mynas present a good system for investigation into dialect recognition as, by colonizing the islands of the Pacific, they form a number of discrete populations (Grant et al. 1996) with a decent record of the dates of introduction, allowing for a better understanding of the time it takes for dialects to form. Their large range of complex calls and vocalizations increases the chance for calls to vary between populations since one wrong note may change the meaning of the call entirely (Slater 1989). I hypothesized that,

when exposed to the calls of common mynas from different populations, the mynas of Moorea would show a distinctly reduced reaction compared to the calls of local mynas. However, if the local mynas did react, it would likely be to the calls from the nearest population; any reaction could indicate the possibility of some interaction between the populations, or that the dialects have not fully diverged.

METHODS

Study sites

Observations and experiments were conducted on the island of Moorea, French Polynesia, during the month of November 2015. The primary study sites were at the Richard Gump Research Station and two other sites around Cook's Bay (Fig. 1). Because some birds have been shown to recognize personal or family-specific calls, the other sample sites were included as a control to check if mynas on the Gump Station grounds reacted differently to their own calls.
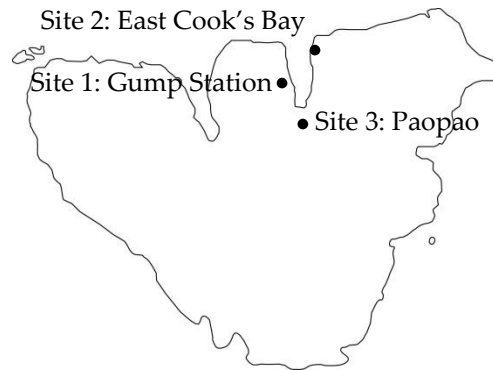

FIG. 1. Map of sample sites on Moorea. Site 1: Richard Gump Research Station (17° 29' 26" S 149° 49' 34" W). Site 2: East Cook's Bay (17° 29' 6" S 149° 49' 1"). Site 3: Paopao (17° 30' 25" S 149° 49' 14" W).

Startle distance

The average startle distance of common mynas on Moorea was first experimentally determined, in order to determine the distance from which to conduct playbacks. After identifying an individual or individuals

holding a relatively stationary position, the tester started at least 20 meters away and walked towards them at a constant speed of 1 m/s while keeping a normal profile. When the bird or birds began to discernably move away, a marker was dropped at the current position and the position of the birds at that time was noted. Walking continued directly towards the bird or birds as they moved, and the marking process was repeated when the birds transitioned from walking to running and finally to flying away. The distance between each pair of markers was then measured and recorded. Other factors, such as time of day, number of birds present, and any other unusual observations were recorded as well. Startle distance tests were conducted a total of 20 times.

Ethogram

To provide a baseline against the mynas' reactions to both local and foreign calls, detailed observation of normal *Acridotheres tristis* behavior was performed. Using the ethogram created by Mohan (2012), also performed on Moorea, as a starting point, behaviors were recorded in segments between two and five minutes in length, varying by how long the subject stayed visible, on a handheld camera phone for a total of approximately 45 minutes. Every behavior from each video was then recorded for total duration or, in the case of vocalizations, total instances. Each total was then averaged across the timespan to determine a percent of time spent performing that behavior, which was then added to Mohan's ethogram to create a more complete picture of the common myna's behavior (Appendix B).

Experimental behavioral profiles

Recordings were first made of local *Acridotheres tristis* calls. Based on preliminary observations and available foreign recordings, four recordings of calls were made: two of short calls and two of longer songs. Recordings were made from a distance of approximately 10-15 meters away from a subject.

For foreign calls, playback recordings were retrieved from xeno-canto.org, a worldwide amateur birding site. Recordings from three locations were obtained: India, Hawaii, and the Cook Islands. Based on sound profile and the initial recorder's notes, recordings were categorized as either short calls, long songs, or miscellaneous noises. Two of the clearest calls and songs from each location were selected to be used for playbacks.

In conducting the experiment, one or more common mynas were identified each time before beginning a playback; in the event that more than one myna was present, one was randomly selected for focused observation. A speaker was placed approximately 10 to 15 meters away from the subject and a recording was played on repeat for between two and five minutes, again varying by the visibility of the bird. Behavior of the subject was then recorded on video and later categorized according to the ethogram. Typically between four and six trials for each experimental vocalization were conducted for a total of approximately 15 minutes each and thus an hour for each of the four locations (India, Hawaii, Cook Islands, and Moorea). Two profiles listing the ratios of behaviors were created from each location, one for each vocalization type, which were then compared against both the baseline ethogram profile and the corresponding profile from Moorea vocalizations. All tests were made in compliance with UC Berkeley IACUC guidelines.

Vocalizations in response

Additionally, vocalizations made by the subject during any trial were also noted and tabulated. Vocalizations in response to playbacks were categorized in the same manner as those used in the playbacks: either short simple calls, long complex songs, or miscellaneous noises. Vocalizations were then summed and calculated as number of vocalizations per type per minute, which could then be compared across location and experimental vocalization.

Comparisons between profiles were performed using a χ^2 goodness of fit test, while those between the response vocalizations were made using a Wilcoxon rank-sum test. The baseline ethogram profile acted as a negative control to ensure that the subjects were, in fact, responding differently to the playbacks, while the Moorea profiles were used as a positive control to examine differences between responses to local and foreign vocalizations. As such, each location was compared to the baseline and each of the three foreign locations was compared to the corresponding local vocalization. No statistical tests were run on the startle distance data.

RESULTS

Startle distance

The average startle distance for walking, running, and flying was found to be 7.36, 5.58, and 5.33 meters, respectively (n=20; s^2=9.05, 8.43, and 9.73). Thus, a distance of 10 to 15 meters was selected as acceptable from which to conduct playbacks and observations (Fig. 2).
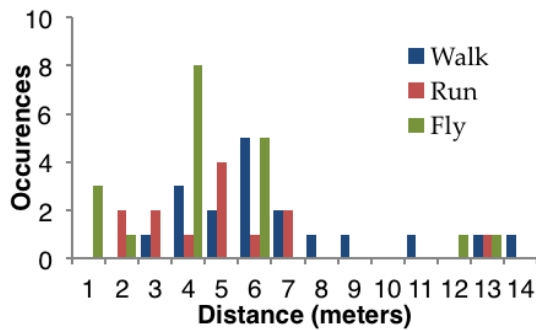

FIG. 2. A histogram of common myna startle distances on the island of Moorea. The walking startle distance was consistently highest but the majority of startled behavior occurred within a distance of 10 meters.

Experimental behavior profiles

Recordings of behaviors yielded seven common behaviors (see Appendix C), establishing a degrees of freedom of six for all tests. The results and significance of the fourteen χ^2 goodness of fit tests from both songs and calls are summarized in Appendix B, Table 1. For reactions to songs, all four behavioral profiles differed significantly from the baseline, and the profiles in reaction to the Indian songs and Hawaiian songs differed significantly from the Moorea song profile while the Cook Islands song reaction profile did not (Fig. 3). For the corresponding reactions to calls, the Moorea call reaction profile did not significantly differ from the baseline (Fig. 4). The Hawaiian and Cook Islands call profiles both differed significantly from both the baseline and the Moorea calls, while the Indian call profile differed significantly from the baseline profile but not the Moorea calls one.

Vocalizations in response

The number of songs, calls, and noises made by the subjects during the trials were compiled and compared using Wilcoxon rank-sum tests. The findings and significance of the 42 tests are listed in Appendix C, Table 2. Calls made did not vary significantly among any of the locations of origin, neither in response to calls or songs (Fig. 5). The number of songs made per minute in response to the local Moorea songs was significantly greater than those occurring either naturally or in response to Hawaiian songs, while no other significance between numbers of songs in response to a stimulus was found (Fig. 6). For noises made in response, the number of noises made in response to the local Moorea calls was significantly higher than those made in response to both the negative control and the other foreign calls (Fig. 7). The number of noises made in response to those in response to the natural behavior and Hawaiian songs tests, but no other significant differences were found.
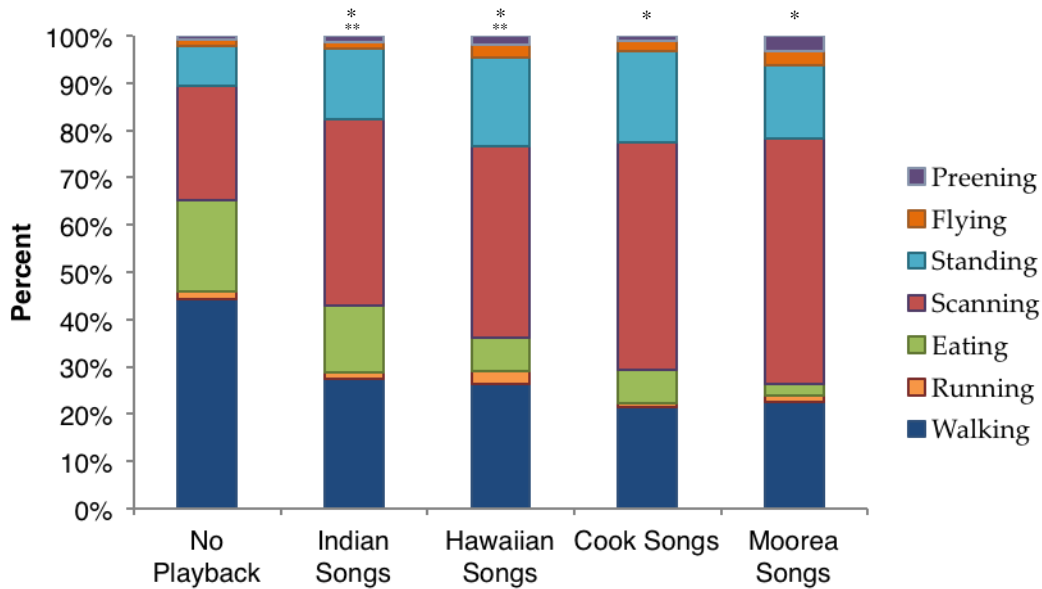
FIG. 3. A summary of the ratio of time spent each behavior in response to audio recordings of common myna songs. In each of the four cases, the behavioral profile differed significantly from the baseline no playback profile, as indicated by a *. Additionally, the Indian song and Hawaiian song profiles differed significantly from the Moorea song profile, while the Cook Islands song profile did not, indicated by a **.
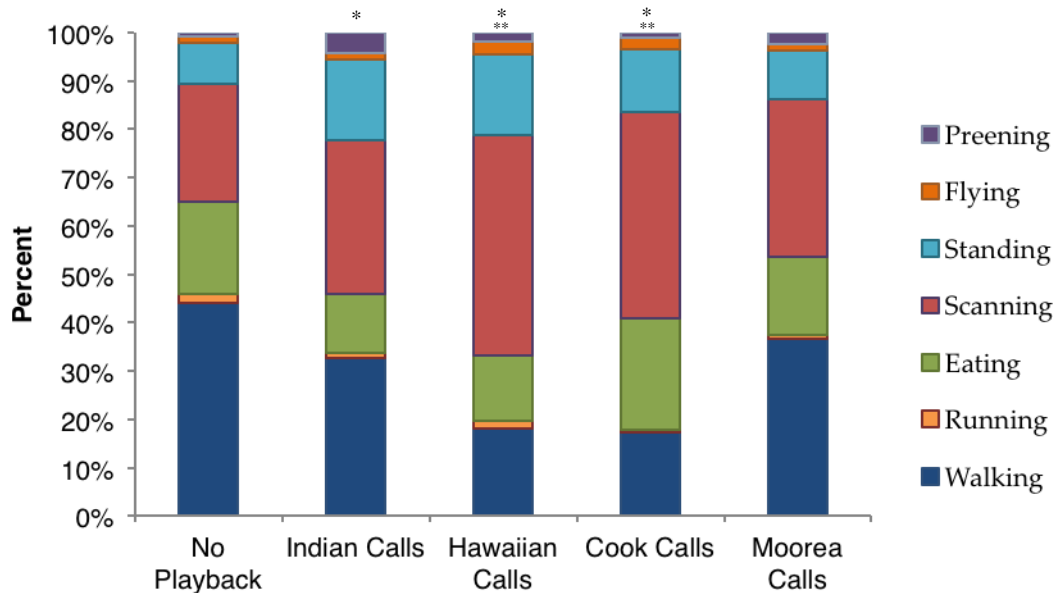

FIG. 4. A summary of the ratio of time spent each behavior in response to audio recordings of common myna calls. The three foreign call profiles significantly differ from the baseline behavior profile, indicated by a *, while the Moorea call reaction profile does not. The Hawaiian and Cook Islands calls reaction profiles also differ significantly from the Moorea calls profile, indicated by a **, while the Indian calls reaction profile does not differ from the Moorea one in a statistically significant way.
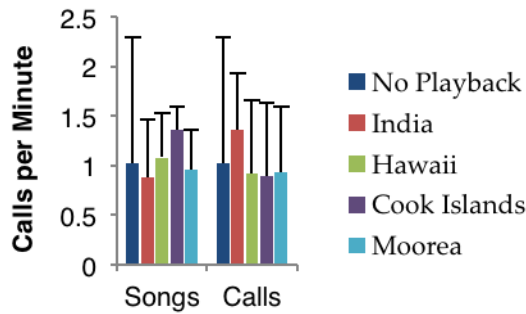
FIG. 5. The number of short calls per minute in response to either calls or songs from foreign locations. No significant differences were found.
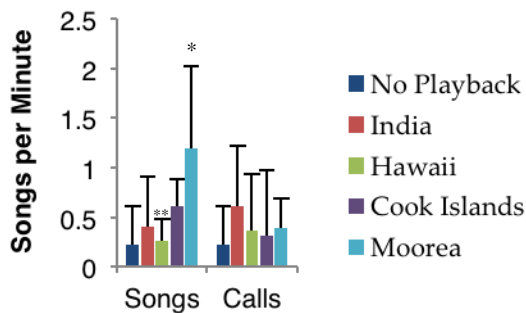

FIG. 6. The number of longer songs per minute in response to either calls or songs from foreign locations. A * indicates a significant difference from the baseline and a ** indicates a significant difference from the corresponding Moorea vocalization. The number of songs made in response to local songs is significantly higher than those made without stimulus or in response to Hawaiian songs.

DISCUSSION

Significance varied greatly across experiments. For the behavioral profiles in response to calls, no significant difference was found between the natural behavior and the behavior when exposed to calls, the only example across either vocalization type in which experimental behavior does not
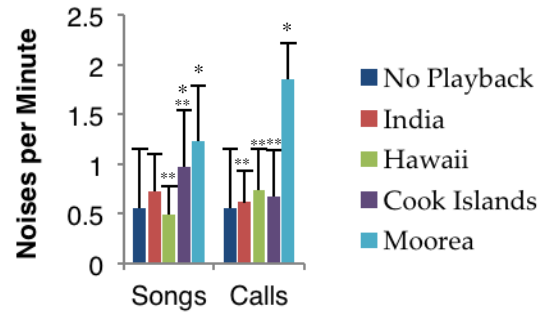

FIG. 7. The number of miscellaneous noises per minute in response to either calls or songs from foreign locations. A * indicates a significant difference from the baseline and a ** indicates a significant difference from the corresponding Moorea vocalization. The number of noises in response to Moorea calls is significantly greater than the baseline and all other responses to calls while the number of noises in response to Moorea songs is significantly greater than only the baseline and Hawaiian songs counts.

significantly differ from the control. This is likely due to the poor recording equipment available; a camera phone lacks a microphone sufficient to picking up bird vocalizations while isolating them from background noise. Since the local call data is likely compromised, it is difficult to draw any conclusions from comparisons to it. However, in the case of the behavior profiles in reaction to songs, significant and meaningful results were obtained. Only the reactions to Indian songs and Hawaiian songs differed significantly from the reactions to local Moorea songs, while the reactions to Cook Islands songs did not. This suggests that the two songs are similar enough to be considered within the same dialect or that enough exchange occurs between the two island groups that mynas on Moorea are able to recognize their Cook Islands counterparts.

Of the seven behaviors observed during these experiments, four are performed most commonly: walking, eating, scanning, and standing. These four behaviors make up the bulk of the behavioral profile and are primarily responsible for the differences between the overall behavioral profiles. Two

trends can be observed. First, scanning and standing are proportional, and to a lesser degree walking and eating are proportional as well (Fig. 8). These two groups of behaviors shall be referred to as "watching" and "foraging." Second, foraging behavior and watching behavior are inversely related, with foraging decreasing and watching increasing as songs get geographically closer in origin. In other words, this means that when the played songs more closely resembled local songs, the subjects devoted more of their time to watching for other birds than going about their own business foraging. This behavior could be a result of watching for rivals or searching for prospective mates, but either way it implies a degree of recognition towards more local songs.
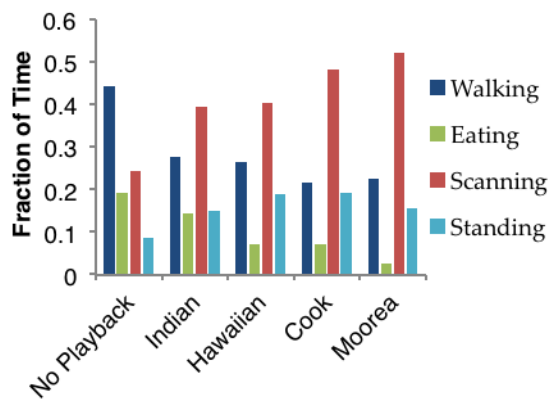

FIG. 8. A visualization of four major behaviors in reaction to songs. Time spent walking and eating decreases as location of origin gets closer to Moorea, whereas time spent scanning or standing increases.

The response vocalization data is harder to interpret. With no significant differences found among call data, it seems as though the number of call made per minute is independent of playback stimulus. This may be because there are other external pressures, like neighboring birds, that cause the subjects to call frequently. Making a bird call is often a form of territorial defense as potential rivals are informed of an individual's activity; this sort of defense would likely be conducted regardless of any incoming calls (Penteriani 2001, Marler 2004). It should be noted that

calls, with few exceptions, occurred more frequently than almost any other response vocalization. For songs, the increased frequency of songs in response to Moorea songs likely shows an increased preference for or recognition towards local calls. Since songs are primarily associated with mating (Marler 1958), the increase in songs in response can most likely be seen as a direct response to the song of a prospective mate or an increase in output in order to compete with a potential rival (Catchpole and Slater 2003). Lastly, the number of noises made increased sharply in response to both local songs and calls. Through observation, it was noted that noises were generally softer clicks or whistles that were not loudly broadcast like calls or songs. Noises also seemed to be made more frequently when the subject was part of a pair. As such, it seems likely that these noises are a form of communication reserved for the subject's mate. When local songs or calls were made, noises between mates increased, perhaps as a way of ascertaining position and safety (Lengagne et al. 1999). Further assumptions should be avoided until a more scientific understanding of the mynas' vocalizations is obtained.

Taken as a whole, the most noteworthy trend is that reactions, either in general behavior or in vocalizations, rarely differed significantly between the Cook Islands and Moorea. In contrast, differences between Moorea and India or Hawaii were much more common, suggesting that vocalizations from these two locations were more foreign to the mynas of Moorea. Whether the lack of difference between the reactions to Cook Island vocalizations and Moorea vocalizations is due to an existing exchange between the two or simply a divergence that is less progressed cannot yet be determined. However, there is clear evidence that different dialects exist among the common myna and that recognition of these dialects is not equal.

One major obstacle to examining the degree of recognition across dialects in this study is the lack of one or more outgroups to compare behavior against. The inclusion of the vocalizations of one or more other bird species would help to determine whether the subjects registered the vocalizations as that of a foreign

myna, a potentially rival bird, or simply some other bird. Until then, the conclusions that can be drawn from the subjects' responses to Indian and Hawaiian vocalizations are limited, other than that they were clearly less recognized than local or Cook Islands vocalizations.

Other avenues for future research range from expanding the scope of this study to better pinpointing data and trends. This study was limited by both the available recordings and the available audio equipment; experience and proficiency with such equipment might allow for better recordings and more distinct response behaviors, while additional playback recordings could be used to further increase confidence in the findings. Additionally, the degree of dialect recognition could be studied in the reverse direction (Cook Islands reacting to Moorea) or among the various islands of French Polynesia. Further study could also be conducted in a lab. This experiment would very likely produce more precise results in a controlled environment with reduced outside stimuli, where other potentially important factors, such as sex of the subject (Nelson and Soha 2004), could be tracked. Sonogram analysis of the various vocalizations could better define each of the vocalizations used. Lastly, this study used dialect recognition as something of a proxy for gene flow and genetic divergence. A true analysis of genetic variation among common mynas and comparison with this data would certainly help to better understand the dynamics of dialects.

In summary, the common mynas of Moorea were demonstrated to lack recognition of vocalizations from India or Hawaii, strongly suggesting the existence of different dialects among the species. However, the reactions to Cook Islands vocalizations were similar enough to those of Moorea vocalizations to suggest that the two populations are not fully divergent or isolated from one another. Given the timeframe of introduction to French Polynesia, it appears that a dialect, and thus the beginnings of culture, may take less than a century to diverge, at least for *Acridotheres tristis*. Genetic analysis is suggested in order to examine to what degree these phenotypic variations corresponds to differences in the genotype. Though the Moorea dialect is still young, this type of difference in behavior is potentially a cultural difference that may lead to partial or total speciation further in the future.

LITERATURE CITED

Baker, A. J., and P. F. Jenkins. 1987. Founder effect and cultural evolution of songs in an isolated population of chaffinches, *Fringilla coelebs*, in the Chatham Islands. Animal Behaviour **35**:1793-1803.

Baptista, L. F., and P. W. Trail. 1992. The role of song in the evolution of passerine diversity. Systematic Biology **41**:242-247.

Catchpole, C. K., and P. J. Slater. 2003. Bird Song: Biological Themes and Variations. Cambridge University Press, Cambridge, UK.

Center for Agriculture and Biosciences International. 2014, June. Acridotheres tristis (common myna). Accessed October 2015. www.cabi.org/isc/datasheet/2994.

Cheke, A., and J. Hume. 2008. Lost Land of the Dodo, an Ecological History of Mauritius, Réunion and Rordrigues. T & AD Poyser, London, UK.

Church, R. M. 1957. Transmission of learned behavior between rats. The Journal of

Abnormal and Social Psychology **54**:163-165.

Danchin, É., and R. H. Wagner. 2010. Inclusive heritability: combining genetic and non-genetic information to study animal behavior and culture. Oikos **119**:210-218.

De Waal, F. 2001. The Ape and the Sushi Master: Reflections of a Primatologist. Basic Books, New York, USA.

Ellers, J., and H. Slabberkoorn. 2003. Song divergence and male dispersal among bird populations: a spatially explicit model testing the role of vocal learning. Animal Behaviour **65**:671-681.

Grant, P. R., B. R. Grant, and J. C. Deutsch. 1996. Speciation and hybridization in island birds. Philosophical Transactions B **351**:675-772.

Heyes, C. M., and B. G. Galef. 1996. Social learning in animals: the roots of culture. Academic Press, San Diego, California, USA.

Irwin, D. E., and T. Price. Sexual imprinting, learning and speciation. Heredity **82**:347-354.

Kawai, M. 1965. Newly-acquired pre-cultural behavior of the natural troop of Japanese monkeys on Koshima islet. Primates **6**:1-30.

Krützen, M., J. Mann, M. R. Heithaus, R. C. Connor, L. Bedjer, and W. B. Sherwin. 2005. Cultural transmission of tool use in bottlenose dolphins. Proceedings of the National Academy of Sciences of the United States of America **102**:8939-8943.

Lengagne, T., P. Jouventin, and T. Aubin. 1999. Finding one's mate in a king penguin colony: efficiency of acoustic communication. Behaviour **136**:833-846.

Lever, C. 1987. Naturalised Birds of the World. Longman Higher Education, London, UK.

Marler, P. 1958. Bird songs and mate selection. Animal Behaviour **6**:254.

Marler, P., and M. Tamura. 1962. Song "dialects" in three populations of white-crowned sparrows. The Condor **64**:368-377.

Marler, P. I. E. B. 2004. Bird calls: a cornucopia for communication. *in* P. R. Miller, Slabbekoorn, H., editors. Nature's music: the science of birdsong. Elsevier Academic Press, San Diego, USA.

Mohan, R. 2012. Aggressive behaviors within and between pairs of common myna (*Acridotheres tristis*). Student Research Papers, Fall 2012, UCB Moorea Class: Biology and Geomorphology of Tropical Islands.

Moore, I. T., F. Bonier, and J. C. Wingfield. 2005. Reproductive asynchrony and population divergence between two tropical bird populations. Behavioral Ecology **16**:755-762.

Mundinger, P. C. 1982. Microgeographic and macrogeographic variation in the acquired vocalizations of birds. Acoustic Communication in Birds **2**:147-208.

Nelson, D. A., and J. A. Soha. 2004. Male and female white-crowned sparrows respond differently to geographic variation in song. Behavior **141**:53-69.

Penteriani, V. 2003. Breeding density affects the honesty of bird vocal displays as possible indicators of male/territory quality. Ibis **145**:E127-E135.

Podos, J., S. K. Huber, and B. Taft. 2004. Bird song: the interface of evolution and mechanism. Annual Review of Ecology, Evolution, and Systematics **35**:55-87.

Pruetz, J. D., and P. Bertolani. 2007. Savanna chimpanzees (*Pan troglodytes verus*) hunt with tools. Current Biology **17**:412-417.

Slater, J. B. 1989. Bird song learning: causes and consequences. Ethology Ecology and Evolution **1**:19-46.

APPENDIX A

Two *Acridotheres tristis* in a tree near the Gump Station. Photo by Kyle Ingraham November 2015.

APPENDIX B

Ethogram of natural *Acridotheres tristis* behaviors, based on Mohan (2012).

Behavior Name	Behavior Description	Frequency
Chasing	Running or flying towards another bird	<0.001
Flapping	Flapping wings at another bird	0.001
Pecking	Beak pecking at another bird	<0.001
Biting	Beak opening or closing at an organism	<0.001
Flying	Flying at a medium elevation with wings flapping	0.013
Diving	Flying downwards steeply towards the ground	<0.001
Walking	Walking at a medium pace	0.442
Running	Running at a fast pace	0.016
Sleeping	Legs folded under body, head under wings	<0.001
Scanning	Head moving and looking around while stationary	0.242
Standing	Not moving while upright	0.086
Preening	Using beak to move feathers, cleaning beak	0.007
Eating	Pecking at ground, food in beak or swallowing	0.193
Copulation	Physical contact of genitalia	<0.001
Crouching	Mating stance, shivering, crouching, mounting	<0.001
Calling	One or more short rhythmic vocalizations	1.022 per minute
Singing	One or more complex, melodic vocalizations	0.225 per minute
Noise	Miscellaneous vocalizations, clicks, whistles, crackles	0.552 per minute

APPENDIX C

TABLE 1. A summary of the behavioral comparisons when mynas were exposed to playbacks of other vocalizations. With seven frequently observed behaviors, the degrees of freedom for all comparisons is six. A * indicates significance at the 0.05 alpha level.

	Against No Playback		Against Corresponding Moorea Vocalization	
	χ^2 value	p-value	χ^2 value	p-value
Indian Songs	22.33	<0.01*	61.5	<0.01*
Hawaiian Songs	49.07	<0.01*	14.732	0.02*
Cook Islands Songs	68.16	<0.01*	11.13	0.08
Moorea Songs	73.56	<0.01*		
Indian Calls	32.89	<0.01*	8.29	0.22
Hawaiian Calls	57.71	<0.01*	20.79	<0.01*
Cook Islands Calls	57.99	<0.01*	51.52	<0.01*
Moorea Calls	11.25	0.08		

TABLE 2. A summary of the differences in the number vocalizations made in response to songs or calls. A * indicates significance at the 0.05 alpha level.

		Against No Playback		Against Corresponding Moorea Vocalization	
		Z-score	p-value	Z-score	p-value
	Indian Songs	0.401	0.689	0.353	0.726
	Hawaiian Songs	-0.067	0.944	-0.353	0.726
	Cook Islands Songs	-0.93	0.352	1.717	0.087
Calls	Moorea Songs	0.167	0.865		
	Indian Calls	-0.868	0.384	1.155	0.246
	Hawaiian Calls	0.033	0.976	0.241	0.810
	Cook Islands Calls	0.267	0.787	0.000	1.000
	Moorea Calls	0.290	0.772		
	Indian Songs	-0.935	0.352	1.766	0.077
	Hawaiian Songs	-0.401	0.689	2.296	0.021*
	Cook Islands Songs	-2.047	0.040*	-1.756	0.078
Songs	Moorea Songs	-2.471	0.014*		
	Indian Calls	-1.085	0.276	-0.222	0.826
	Hawaiian Calls	-0.134	0.897	-0.422	0.667
	Cook Islands Calls	-0.801	0.424	-0.626	0.529
	Moorea Calls	-1.304	0.194		
	Indian Songs	-0.434	0.667	1.810	0.070
	Hawaiian Songs	-0.067	0.944	2.649	0.008*
	Cook Islands Songs	-1.457	0.144	-0.817	0.412
Noises	Moorea Songs	-2.07	0.038*		
	Indian Calls	-0.465	0.638	-3.510	<0.001*
	Hawaiian Calls	-0.902	0.368	-3.416	0.001*
	Cook Islands Calls	-0.134	0.897	-3.416	0.001*
	Moorea Calls	-3.259	0.001*		