VIII

François Bernard Mâche
and zoomusicology: a gigantic heritage

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1. Introduction

To assess François Bernard Mâche's contribution to, and impact on, zoomusicology is not unlike assessing Darwin's contribution to the theory of evolution: an incalculable task. Without him, quite simply, zoomusicology would have not happened, or – in a more optimistic estimation – would have happened far later than it did.

Although repeated cases of "proto-zoomusicology" occurred in the thoughts and the writings of many scholars (particularly philosophers) throughout the centuries, the modern idea of this discipline originated in 1983 in his *Music, Myth, Nature*. It was on that occasion that Mâche announced that zoomusicology was "not yet born", thus establishing in actual fact its birth. He wanted to "begin to speak of animal musics other than with quotation marks" (Mâche 1992: 114)[1]: thanks to him and to those who followed in his footsteps, we can safely say that, yes, the quotation marks are gone, and we can speak of animal musics in a scientific sense.

There was also a specific *raison d'être* for the enterprise Mâche embarked on:

1. The excerpts quoted in this book are all taken from the English edition of Mâche's work, published in 1992, and not from the original French version issued in 1983.

> if it turns out that music is a widespread phenomenon in several living species aside from man, this will very much call into question the definition of music, and more widely that of man and his culture, as well as the idea we have of the animal itself. (Mâche 1992: 95)

That still remains the big (biggest, perhaps) challenge of zoomusicology, and it has been crucial to address it from the very start of the journey.

Zoomusicology approaches nonhuman animals from the direction of human sciences, and music from the direction of biological sciences. This change of perspective was quite helpful for a more complete overview of the phenomena analyzed. The basic innovation provided by zoomusicology is the assertion that music is not an exclusively human phenomenon, but rather something that concerns the identity of "animality":

> If we had at our disposal sufficient studies of the neurophysiological links between biological rhythms and musical rhythms, I would probably have been able to draw up arguments which reinforce the conception I am defending, that of music as a cultural construct based on instinctive foundations […] But if the animal world reveals to us precisely this emergence of music from the innate, this should enable us to compare it with what happens in man. (Mâche 1992: 95)

As a consequence, to adopt the zoomusicological paradigm means to put seriously into discussion the present definitions of music, starting from its strongly anthropocentric connotation. At the same time, the whole conception of the nature-culture dichotomy is to be revised. Mostly, one should wonder – as Peirce already did in speaking of synekism – whether we really have to consider it as a dichotomy:

> It therefore seems somewhat ill-founded to continue to define the cultural domain in radical opposition to the natural. This view appeared legitimate and even exciting to Michelet, who made it the basis of his philosophy; but it is hard to see why so many intellectuals show themselves to be still so attached to it. Individual liberty today appears inscribed in nature, and not won in spite of it. If invention can reveal itself as being as important in the individuals of other species as in man, it is time to get rid of the image (three centuries old) of animal-machines. Of course, the limits of this invention are

> much narrower in the animal, and nothing obliges us to admit our natural limits as long as their border lines can be contested, but it seems vain to refuse its existence in principle, since so many facts are not well integrated into the conception which sets nature as the world of implacable determinism against the liberating culture of which man would be a privileged recipient. (Mâche 1992: 158)

Another thing that Mâche understood immediately is that research of this sort is of extremely wide concern (possibly among the widest, considering the millions of animal species existing on earth):

> Obviously, the study of an animal species cannot be exhaustive. Just as the best singers are at the same time those in whom one finds the greatest individual variations, one must have access to numerous hours of recordings of a great number of different individuals, throughout their entire habitat, in different seasons and over many years. It is not surprising that the number of species for which this kind of work has been done remains minuscule. Generalizations still depend largely on the familiarity of the describer with the species described. (Mâche 1992: 98)

The "size" of the theoretical challenge is behind the observation, supported by both Mâche and several of his followers, that ethnomusicology and zoomusicology share a common historical destiny. Almost everything happening or about to happen nowadays in the study of nonhuman animal music has happened (and even happens today) in the study of non-Western human music. The problems which zoomusicology is supposed to solve in order to demonstrate that music is not exclusively human are in principle the same problems ethnomusicology was supposed to solve in order to demonstrate that music was not exclusively Western. For this reason, research strategies in the two disciplines are very similar. The first of these strategies – as we have seen already – was to put up for discussion the traditional definitions of *music*, or more precisely, to stress that a unique definition of it does not in fact exist. Traditional definitions normally end up excluding certain sound manifestations that instead should be considered in all respects. Also, ethnomusicology led to a theoretical reconfiguration of musical traits and behaviors, mostly emphasizing and then distinguishing the cultural components from the anthropological ones. In turn, zoomusicology is now emphasizing

the zoological ones. The question of universals, discussed at length in ethnomusicology, is thus crucial in zoomusicology as well, and it is no surprise that Mâche was at the center of this discussion, providing important insights for both ethno- and zoomusicology.

Famously, Kwabena Nketia (1984: 15) distinguished between *absolute universals* ("unrestricted, unconditional universals") and *universal consequents*. As he points out,

> tuning, tonal and metric systems, for example, developed in music through time and cross-culturally, are myriad, but that does not mean that the musical working out of the consequences of such properties will also be myriad in number. Consequential relationships of a universal nature imply common tendencies in both the response to and development of musical materials, not a commonality in the choice of the material themselves.

Further, he observes that an artistic world view of music is of qualitative, rather than quantitative type. Diversity is certainly inevitable in music, but

> it is accommodated in creative and conceptual terms through (1) the postulate of an archetypical source; (2) the concept of music as a worldwide art of which individual cultures are particular expressions; (3) the notion of complementarity and alternative modes of expression; and (4) the universality of aesthetic experience." (Kwabena Nketia 1984: 6)

Mâche found good reasons to back this position. We cannot call universal only those musical traits displayed by every single musical culture, human and nonhuman. Otherwise the search for universality in music becomes a quite hopeless task. As he reminds us:

> It is all too easy to show that music is not a "universal language", since the learning of its diverse dialects is always laborious: it involves passing from excessive ethnocentricity to an accepted and perpetuated anarchy. No one has ever imagined… that all musics are alike. It is not essential for data to match up in every detail, without exception, for them to be qualified as universal. It is enough that they should appear in independent contexts, and that their functioning presents analogies too precise to be put down to chance. (Mâche 1992: 42)

In classifying universals, zoomusicology adopts the same basic and well-formulated tripartition proposed by ethnomusicologists:

1. *Structures* – the musical traits in themselves. Analysis of this level implies a large use of sound material, such as recordings and spectrograms, and aims to define the organization of sounds in the species observed – range of sounds covered, recurrent intervals, timbres, and so on. It is safe to say that Mâche has been mostly interested in this typology of research. However, as we shall see, important insights occurred also in the other two areas listed.

2. *Processes* – acts and behavioral patterns related to the structures, in the fields of emission and reception. This is the realm of the paramusical, and it includes the whole cultural dimension of making music, with its rituals, social rules and so on. In zoomusicology, this level constitutes the best-known part of the research, with many of its aspects having already been investigated by ethology. A type of analysis based on processes can be found in Sebeok's *Play of Musement* (1981), in the chapter entitled "Musical Signs."

3. *Experience*. This is the level that musicologists like Stefani (e.g., 1998) or Delalande (1991) have proposed in their discussions of musical universals. Since musical experiences may be considered a general experience that takes place between a subject and an object (musical event), they advance the idea that a universal feature in each experience is the restatement of particular conducts and competences. This view may be used for zoomusicological purposes with similar presuppositions. If the first level (structures) was that of the objective, and the second (processes) of the cultural, the investigation of music as an experience lived by an individual is surely the level of subjectivity, although it is clear that many of these experiences follow general rules.

2. Misconceptions and delicate topics

However, and before proceeding with the above-mentioned case-study, there are more of Mâche's reflections to be emphasized at a paradigmatic and epistemological level. Mâche was also helpful in clearing the field from general misconceptions, potential risks and he also did not restrain from facing delicate issues.

For instance, he was very firm on the fact that, yes, it makes sense to analyze animal sound events from a musicological perspective, but

only on condition that the human point of reference does not nullify those not recognizably human, but still musical, traits. Let us take an example: the establishing of so-called significant or pertinent sounds. In the traditional Western notation system, notoriously, twelve sounds are considered significant (i. e., a full chromatic scale). Even if, from a physical point of view, we recognize the existence of commas within a semitone, we usually do not give them much musical significance. A frequency that is one comma lower than C is considered nothing more than a C slightly out of tune, and such a thing, to a well-trained musical ear, is even unpleasant. Such a presupposition, which is certainly valid in a Western traditional musical context, should not affect zoomusicological analysis, starting with the possible transcriptions of animal sounds. A range of diverse and even discreet sounds – four, for instance – included within a human semitone, uttered by a given animal (so that the first is an exact E and the last an exact F) should not be interpreted as an utterance of two sounds, E and F, with little or no consideration for the pitches in between. As a matter of fact, four sounds were uttered, all of which might prove significant to that animal. If one or two sounds turn out be of no significance, it is not the human-tempered system that allows one to establish that fact:

> The bird [a canyon wren, Catherpes mexicanus] covers a scale of 25 steps descending by intervals of half or one-third a tone. It descends from G7 to A5 in four and a quarter seconds. Simultaneously, it makes a rallentando that passes from 20 to 4 sounds per second, approximately, and an initially rapid crescendo over half a second, then slower over one second, followed by a slight decrescendo over the rest of the scale. The fixity and precision of the ambitus and the intervals are almost total from one song to the next. Moreover, the notes are increasingly modulated according to the same "neume" (a torculus resupinus) which comprises one ascending glissando, one descending, then another ascending. (Mâche 1992: 103)

Such an observation, in itself, should not be surprising, since tempered pitch is a species-specific human invention (and a very recent one, phylogenetically speaking) that is not even typical of the whole human species (in that it is a Western invention that less than half of this planet has adopted as a rule). The danger is that this species-specific, culture-specific criterion might be erroneously projected onto nonhuman species. According to Mâche, there should not be any

doubt about this fact, particularly when the same pitch is repeated in succeeding performances.

The second example I would like to offer concerns a delicate topic that, in times of gender studies, may look a bit awkward – especially in the terms proposed by Mâche. Many animal species, indeed, distinguish musicians on a sexual basis: males are the specimens devoted to singing. At least, this seems to be the picture emerging from biological research. Two elements are demonstrated: in all species, both males and females utter sound signals, and at least males sing. Whether females are also singers has not yet been determined. Statistically speaking, it is nevertheless apparent that males sing more than females do. Now, sexual distinction does not make musicians part of an elite (discriminatory) group, but surely it marks a role. Among other things, what we know is that males sing, but not that all males sing. In addition, within those species with exclusively male performers, females choose the "best singers" as partners. Such a picture gave rise to most theories on the social function of singing – courtship, territory maintenance, sexual competition. The problem is when we formulate the hypothesis that this, too, is a form of musical universal – or, in other words, human beings too may have a tendency to delegate the "role" of the musician to men, rather than women. Can this be accepted? Here is what Mâche has to say about this issue:

> [T]he females are, quantitatively and qualitatively, less musicianly than the males, although in the case of absence or death they can sometimes replace them very well by reproducing their song. In spite of the progress in the equality of the sexes, it seems that in the human species the number of women tempted by a career as a composer remains very low, both in relation to men and in relation to what is the case in other activities like literature or painting. If this imbalance is not simply due to social conformism, it may be that it has its sources in these archaic, innate aspects of musical activity, which we should reveal and take into account rather than deny. Animal musics and the conditions in which they manifest themselves seem indeed to be a state of close convergence with human musics. (Mâche 1992: 155)

If, and only if, human males are really biologically more prone to singing than are females, and if it is true that the same applies to most other species, then musical "sexism" in many species is not only

normal, but in fact encourages us to think that we are dealing exactly with musical manifestations[2].

Thirdly: as a musicologist in the strict sense, Mâche (unlike myself, among others) is far from persuaded by the semiotic hypothesis that music should be considered a "communicative" form of expression. Some passages in his work, indeed, seem to indicate that music is interpreted as a nonsemantic structure, and in fact, that semantics is even in opposition to the aesthetic dimension.

> As for [human] languages, prior to de Saussure's creation of the bases of structural linguistics, it is quite well known how the message [in nonhuman animal communication] is sent and received, but its internal study is comparatively neglected: when it exists, it is always in relation to the finality of communication and is under the sole control of ethology. This position makes sound signals a simple variant of other systems of communication which are henceforward studied under zoosemiotics, and it is generally accompanied by a de facto rejection, or even a conscious refusal, of the aesthetic hypothesis. […] Only prejudice and a lack of general knowledge throw up more difficulties in considering animal vocalizations as rudimentary music rather than as a rudimentary language although they offer conjoint and still undifferentiated characteristics of both. (Mâche 1992: 97)

And this, normally, is also the stand taken by other musicians/musicologists, such as David Rothenberg (2005). In general, the point is this: *If it is music it is not language, if it is language it is not music*.

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2. Having said that, however, it must be also said that exceptions are many. It is fair to say that in most species males are the ones who take care of singing, but it would be misleading to assume that females are completely alien to music (which, by the way, is exactly what happens among humans). Especially among birds, Doolittle (2007: 111-12) reports a rather extensive list of singing species where females are no less singers than males – not many, but far from being few. Among mammals, there are species, such as dolphins, where the musical production of the females is just as abundant as that of the males. Moreover, another consideration is to be made. As shown by Françoise Dowsett-Lemaire for the species *Acrocephalus palustris* (1979: 453-68), it is not rare that the female is by all means competent in singing matters, but she does not exceed one minute of performance, as if she did not really need to sing. Whether this can be explained as lack of interest or lack of appropriate hormones, what counts is that the role of the singer is indeed left to the male specimens.

3. Setting the paradigm for the study of zoomusicological structures

As mentioned, out of the many insights Mâche offered to the zoomusicological field, the area of "structures" seems to be the one he has been mostly interested in: also, it is the area that makes it very explicit that zoomusicology is a "musicological" discipline in all respects. If Mâche managed to remove the quotation marks from the expression *animal musics*, he also achieved the same result when it comes to the scientific study of them. Thanks to him there is not such a thing as a "musicology" of the animal sounds: quotation marks are removed from that expression, too.

A musical structure, as we have seen, is a musical trait as such – the very substance music is made of. We can ascribe quite variable meanings and functions to structures within animal and human musical cultures. Songs, instead of being of simple duration, vary in abruptness of beginning and ending, repetitiveness, rate, rhythm, and in other subtleties of sequence. Instead of simple pitch, they vary in timbre or tone quality, in vowel quality, in approximation to noise, in noise quality and in changes of all these over time. Instead of simple volume, they vary in the dimensions of volume, the rate of change of volume, and the rate of change of change of volume. In meaningful sounds, these factors can be combined to yield higher order variables of staggering complexity (see Thorpe 1972: 164). What are more universal in animal music are the regulation, forms, and conventions of such structures. In short, there are thousands of diverse musical scales in all species, but all of them are scales. In general, there are two main modalities of structural categorization in animal musics; one is related to the quality of sounds, and the other to their organization. We can subdivide these two macro-wholes into five main parts:

(1) organization and form, which deal with organizational modalities of musical phenomena, basically a game of rules;

(2) repetition and variation, a dichotomy that concerns the important distinction between musical and "ordinary" language;

(3) intervals and scales, which deal with musical structures par excellence, i. e., the primary and most immediate form of sound organization;

(4) rhythm and tempo, which deal with everything related to musical phenomena as horizontal, temporal entities; and

(5) sounds and timbres, which deal with the quality or color of sounds. Due to the limited space allocated to this essay, I shall only take the first two categories as examples of Mâche's contribution to the discussion.

To deal with form and organization in music principally means to accept the concept that music is a game of rules. Such rules may be universal, cultural, or individual, but still they are rules. Many arise from conventions or habits within a given community; others derive from social and historical interaction; others, perhaps most of them, are related to instinctive and emotional causes (see also Nettl 1977: 5).

A demand for organizing, controlling, measuring, pitching, etc. music is present in practically all species, each with its own characteristics and degrees of complexity. Two main levels of musical organization can be distinguished: a primary level, which concerns the organization of simple and basic sounds; and a secondary, more complex level, which deals with the organization of sound wholes. In other words, not only do musical cultures create rules for sound functioning, but they also create sorts of geographical maps in order to manage the musical mass. As for the primary level, Francesco Giannattasio (1998: 129) remarks that all forms of musical activity, in practically all human cultures, imply the presence of three basic rules: 1. Discreteness of the sound continuum (intervals, scales, timbres, etc.); 2. Hierarchy of values and functions of sounds belonging to the diverse ranges, which determines the "modes" for melodic construction; and this latter is in relation to 3. Intensive (piano/forte, dynamic contrasts, stresses) and temporal (rhythmic) organization of sounds, generally measured in relation to a periodic point of reference (beat, meter). These rules are widely used in most animal species, with very few exceptions. There is also a secondary level of musical organization, i. e., another set of generally cultural conventions, which concern the "form" of a musical piece. Such conventions deal with groups of sounds that are already organized within each group, and thus can regulate the final structure – the architecture of the piece. Such an aspect is particularly overt in Western music, but is present in all musical cultures and quite evident in nonhuman music as well. Indeed, musical organization (in birds, mostly)

> encourages us to credit the animal with a sense of sound architecture […] If the bird has the sense of balance between nonvariation and variation at the

> level of syntax of sequences, it can also manipulate with order, at the higher level, the temporal proportions of sequences or of the strophes between them. To know if this architecture is itself innate or if it forms part of individual learning, we would need to study for each species a large quantity of analyses which are still far from being achieved. From what I have been able to establish about larks, it seems that the role of ontogenesis, of individual development, may be considerable. (Mâche 1992: 141)

Musical cognitive categories that correspond to what we call parts (introduction, theme, ending, etc.) can be easily traced in several species. Olavi Sotavalta (1956: 7-8) found that songs of the thrush nightingales are usually organized into six main parts: Introductory, Antecedent, Characteristic, Postcedent, Finale, Cadence. Rhythmical patterns are variable. Of course, one may ask if such organization is really significant to the bird. Mâche attempts to answer this question as follows:

> Whether these variations are conscious and voluntary, in the animal, or whether they are as insignificant as the number of bounces of a ball, everything happens as if, on a deeper level than that of acoustic characters, a grammar was acting to organize the sequence locally. Sometimes one has the impression that a concern for development governs the oppositions evoking the alternating couplet-refrain: AA BB C D E F EE AA BB C D G E F C E F E A BBB […]. To a certain extent ABCD plays the role of a refrain, shortened at its third repeat, which embraces two couplets, of which the second is, however, slightly developed. (Mâche 1992: 130-31)

The latter quote, which discusses instances of repetition and variation in a song's form, is a good link to the second group of musical structures that we have mentioned. Although in clear opposition to each other, repetition and variation are nevertheless in a reciprocal relation – a typical example being the pragmatic interaction among strophes, refrains, and middle eights in popular music, which one can easily read in Peircean terms. For example, refrains are the reassuring redundancy that is doomed to catch the listener's attention, and therefore has clear qualities of firstness. Strophes – the dimension of secondness – provide the narratives, the development and the evolution in a song, enabling the listener to perceive the thematic environment of the song. The middle eight, that generally appears just once in the

song, provides a strong variation – both musical and lyrical – and is often offered in a different musical key. The art of songwriting must always keep this difficult balance between storytelling qualities and charming repetition. One is a justification, when not a direct cause, of the other. In the case of nonhuman animals, the category of repetition and redundancy are definitely more prevalent than that of variation. The concept of redundancy is often used by specialists as a broad behavioral category to explain several forms of sound organizations that are otherwise hard to classify in extra-musical terms. As Mâche points out,

> When, for example, we define the repertoire of the blackbird by saying that it possesses seven calls and one song, that of the robin six sound signals, the rock partridge fourteen cries, etc., the only criterion used, that of behavior, in no way acknowledges the extreme variety of the motifs of the robin's song. In this case, zoologists are currently satisfied with noting that redundancy, defined by the same reactions produced by different signals, is very large, which assures a wide intelligibility of the signal. But the same intelligibility is still better obtained with totally stereotyped signals, like that of the gecko or the quail; simply, this apparent waste of energy and imagination does not enter into the behaviorist schema of utilitarian explanation. With the term redundancy one glosses over an extraordinary diversity, which would only cease to seem a waste if we recognized in music, i. e., in aesthetics, the fundamental character of a partly autonomous biological function. (Mâche 1992: 114)

In other words, redundancy does not stand for mere repetition. And, more importantly, its biological value goes far beyond any interpretation of the "Morgan's Canon". In fact, the idea that animal species, birds in particular, perform just one or two kinds of song is not true. More than 70 per cent of bird species have repertoires consisting of several different songs. Mammals are anything but repetitive singers and the astounding case of humpback whales is prototypical in this sense. Finally, repetition and variation are widespread musical practices among insects, too. To nonspecialists, what the choruses of crickets and cicadas display is pure and endless monotony, but more careful – and not necessarily specialist – attention reveals much rhythmical creativity, up to sheer anticipations and rubati.

There are possibly three main analytical categories pertaining to musical repetition:

1. Presence of refrains. As Sotavalta (1956: 14) notices in sprosser nightingales, "[A] certain characteristic as a significant motive, and in most cases a whole period, recurred sooner or later, thus giving the song a cyclic impression". The same elaborations can be found in practically all songbirds and in many mammals.

2. Repetition of certain patterns. "No regularly recurring fixed cycles of succession were found in the song of the bird, but shorter or longer "semicycles", regular patterns of succession of certain characteristics were common" (Sotavalta 1956: 16). To mention another peculiar example, song thrushes (*Turdus philomelos*), display a clear tendency to double most parts of song motifs, "just like Debussy" (Mâche 1992: 115).

3. Continuous melody. Several species do not isolate their musical elements as separate entities, but rather tend to practice a kind of continuous melody. It is obviously the case with many insects, but also with some canids, primates, and cetaceans, and – unpredictably enough – with some birds, such as the grasshopper warbler or the nightjar of Europe. This, Mâche remarks (1992: 105), does not imply "either the monotony or aleatoric disorder that one might expect".

As for the concept of variation, within an evolutionary framework, it is considered a useful advantage in natural selection, especially in mating-related contexts. For sure, there are examples of preferences for behavioral novelty in animal courtship displays. Bird song is a typical case, being evolved through female choice and showing a rather high degree of complexity and diversity. In several species, females prefer males that demonstrate larger and varied song repertoires. Novelties in bird songs are generally introduced from time to time. The novelties attract the attention of the female and spread through populations of males in patterns of appropriation, modification, and diffusion, in a similar manner as in human musical, or linguistic, or oral traditions. Rather importantly, songbirds'brains are about twice as big as nonsinging species. This is possibly because both sender and receiver of the song – generally, the male being the former, and the female the latter, although this is not a rule – must be able to process a higher amount of information as compared to nonsinging species. The presence of variations makes this information not the easiest one to codify and decode. As for mammals, whales and dolphins display mating songs that require particular creativity and innovation, and certainly the case of the incredibly-varied songs of the humpback whales *Megaptera novaeangliae* is paradigmatic. For a lot of species, in general, one must

also underline the role, just as articulate, of dancing, which is often a compulsory complement to singing. In this field, too, variation and stylistic richness seem to be necessary. The evolutionary conclusion to these observations is that courtship displays in some birds and mammals are driven by an intrinsic perceptual bias in favour of complexity and novelty. But there are also alternative interpretations, and once again Mâche paved the way:

> Whatever the motivations which cause an animal to sing, it is apparent that it operates [by] instantaneous choices from amongst the formulae of its repertoire, or instantaneous realizations of one of its operative models, and that for whatever reason certain species, those that we consider to be the best singers, tend to prefer the law of maximum variety (compatible with the affirmation of the species) to that of the least effort. The musician's imagination works the same way: the desire to establish the identity of a sound proposition (of an "idea") is normally accompanied by the opposing concern to bring into play diverse variables of this proposition. Among all the possible solutions, whose number is probably not infinite, a composer can encounter those which one or more animal species frequently apply. (Mâche 1992: 124)

Such a process, to which anyone who has ever composed some music can easily relate, is witness of the important role played by variations in animal music, and yet another confirmation of the basic differences between musical and other types of communication.

4. Conclusions

So, can we calculate the incalculable? An accurate assessment of what exactly Mâche has done for zoomusicology, and by consequence to the study of music in general, is yet to happen, mostly because it has been only a little longer than 30 years that his theories have been around, and that – scientifically speaking – is a rather small amount of time. Having said that, and considering that my perception of Mâche's work counts as nothing other than my perception, I believe it is not inappropriate to emphasize at least the "areas" of musicological discourse in which Mâche's input has been (and will be) very significant, if not crucial:

1) Mâche has defined zoomusicology. Simple as that: he has introduced this discipline to the modern world, he gave it a name, and a reason to exist.

2) He has emphasized the interdisciplinary implications of the field, and created – for the first time – an important link between musicology and biological sciences.

3) He has contributed to extend the notion of musical universality from the anthropological to the zoological level, therefore putting into discussion the definition of "music" itself and of the "nature-culture" dichotomy.

4) He has not surrendered to the temptation to "trivialize" the musicological analysis, *just because these are animals and not humans*, as many scholars tend to do in their respective fields. On the contrary, he has pursued a theoretical rigueur that has immediately made zoomusicology a "serious" area of inquiry.

5) He has given impulse to nearly *all* the branches of zoomusicological research, particularly the area of musical structures.

6) He has (re)stated the centrality of the subject in the study of non-human animal behavior, resisting another temptation: differentiating animals only by species, rather than by specimens. His work, on the contrary, takes into account individual variations in animal musical cultures.

7) He has not been afraid of adopting what Luisella Battaglia (1997) came to define as "critical anthropomorphism", that is, a form of interspecific "recognition" that, as human animals, we can employ to acknowledge our biological continuity with other species, rather than emphasizing our (supposed) distance with them. In listening to and analyzing animal sounds, Mâche acted as a (human) musician who has the ability and the authority to recognize other musics.

Nowadays, zoomusicology enjoys increasing popularity, and it is certainly "comfortable" (when not even "trendy") for a scholar to adhere to such a paradigm. Mâche, on the contrary, had to swim alone in an ocean of scepticism and hostility, as all pioneers and revolutionaries have to do.

But, indeed, it is pioneers and revolutionaries who eventually change the world.

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