Generalising Personalised Exploration and Organisation of Sonic Spaces: Metacultural Approaches

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Abstract

Personalised creative computational or manual/performative exploration and perceptual experimentation with the basic sonic and structural materials of music can initiate novel expression. We propose a generalised metacultural approach that can encourage this process, while secondarily readying its users for intercultural music-making. Amongst such basic mutable musical elements we distinguish six: rhythm, pitch, timbre, dynamics, hierarchical structure and creator-interaction, each with their attendant structuring processes that anyone in any culture might consider as tools of expression. Formed cultures differ in their ranges of expectations as to stylistic fixity or flux; metaculture can freely choose its type and degree of variability. We propose five general exploratory principles, converting: discrete categories into usable continua; linearities or sequences into non-linearities or re-orderings; separations into overlays or vice versa (in space, time and other respects); or using: partial randomisation; and novel hierarchies. All the approaches we propose are susceptible to computational application, while most are underutilised. We present brief surveys of cognition of each of the sonic materials, illustrating that much remains only partially researched (whereas some dogma is often meekly accepted). This in turn supports the view that practical exploration by musicians can provide perceptible and usable creative innovations. We discuss briefly the sociocultural implications of such a novel generalised exploratory metaculture, likely requiring corresponding cognitive learning and adaptation. We conclude that in any current environment one could strive both to respect traditions and cultural sensitivities, and to evolve new musics.

> Black survival depends upon forging a new means to build alliances above and beyond petty issues like language, religion, skin colour, and to a lesser extent gender. The best way to create the new metacultural identity which the new black citizenship demands was provided by the abject condition of the slaves and ironically facilitated by the transnational structure of the slave trade itself. … [my argument] … locates the Black Atlantic world in a webbed network, between the local and the global. (Gilroy, 1993, p. 29)

1 Introduction

Our key argument in this article is that by systematically interrogating in a novel and personalised way the basic sonic materials, their attendant structuring potentials, and the processes with which organised sound such as music can be made, we can find new modes of construction in

improvisation or composition, human- or machine-driven. Furthermore, this interrogation requires new empirical perceptual and cognitive work that is not solely reflective of the current research tenets or musical practices of our immediate environments. So our primary thesis is that new approaches to music creation can emerge from this interrogation in any environment, perhaps somewhat as they did many times while music originated, presumably independently and asynchronously in thousands of different sites around the earth. We suggest that a metacultural approach can help to generalise and enhance the personal approaches. By metaculture we mean essentially a process that freely questions and evolves any aspect of pre-existent cultures. (The concept of metaculture will be further discussed later in this Introduction.) Consequent on this, we argue that experience in exploring the basic sonic materials and processes, performatively or computationally, can also aid intercultural music making and appreciation, since it can reveal the continuities between seemingly disparate traditions, for example of tuning or rhythm, allowing learning and thereby aiding their reciprocal usage perceptually and cognitively. In the case of (computational) creative music systems (the core target of this journal), an exploratory tendency has always been strong but can still benefit from a comprehensive approach such as metaculture encourages. In addition, computational systems allow any form of real-time sonic analysis (machine listening), potentially complementing human perception and cognition, otherwise limited by experience and sometimes also by research dogma, such as that concerning the 'necessity' of the octave for structuring the use of pitches. We will also discuss some novel viewpoints potentially afforded by machine learning (AI) systems, but we here note as a computational analytic example the distinctive perspective of wavescapes (using a Discrete Fourier transform of equal temperament pitch sets) on melodic and harmonic structures across a piece (Laneve *et al.*, 2023). Such viewpoints can surely be used for creative purposes, and be extended to other pitch systems.

It seems desirable to delineate here the key features of the five exploratory principles we propose as central, before returning to the broad argument. Probably the most transparent is that of converting categories into usable continua. Many musical features (such as pitch and rhythm) are commonly constructed with arbitrary categories (such as equal tempered pitches and metres comprised of equal, isochronic subdivisions). In virtually every case, these features can instead be treated as continua, so that any value is available, though ultimately, very small differences may become indistinguishable to human perception. The second exploratory principle we describe loosely as converting linearities into non-linearities or re-ordering sequences. While strict mathematical definitions of non-linearity apply widely in the brain and are central to pitch perception (see later), we also use the term to refer to the concept of a sequence of events suggesting a logical or most likely successor (such as a-b-c to d) but that sequence being systematically reordered (often rendered non-sequential). This is a sense in which the term non-linearity is widely used in discussion of narrative in film and multimedia. Quite closely related to this approach is our third principle of replacing separations (a succeeded by b) by overlays (a coexisting with b simultaneously), or the reverse process (as in decomposition of polyphony into sequential monophony, or the processes of phase shifting in the music of Steve Reich and others). By partial randomisation (our fourth principle) we mean the idea of their being multiple elements in a piece, and rather than adjusting their sequence in a logical manner as mentioned already, treating all elements as coequal and subjecting them to some form of value or order randomisation. So a pattern of pitches might have some elements randomly transposed, or a sequence of events be re-ordered at random. We use the adjective partial simply to indicate that it is unlikely that the process would be complete, since totally random music has limited interest for most people. Our fifth principle, creating novel hierarchies, though potentially operating on the more complex aspects of a piece (e.g., (post)-tonality, (post)-metricality), is probably the most intuitive. We are all aware of the dramatic changes in the usage of musical forms over its evolution (for example, the virtual disappearance of sonata or symphonic form in new music, the dominance of simpler song forms in popular music, the penetration of African American and Asian styles within Western music and vice versa). Allowing ourselves the opportunity to create novel hierarchies within/for pieces is a natural continuation.

To develop our broad argument and apply these exploratory principles, we use a modest extension of the GENEPLORE (generate-explore) model (Finke, 1996) of creative processes as the basis for a systematic perusal of potential structuring opportunities provided by each of the main musical materials: this also suggests gaps in prior perceptual and cognitive studies that may be worthy of study. The extension, GEMSI (generate-explore-maintain diversity-select/assess-iterate: (Dean, 2017) has been formulated for the purpose of structuring music compositional (and improvisatory) processes. As we proceed, we briefly mention examples of creative explorations, as illustrations of components of this process, and to complement the empirical suggestions they give rise to.

We have chosen to delineate six key sonic materials: rhythm, pitch, timbre, dynamics, ordering and hierarchical structure, and creator-interaction (where the creators might in principle be either human or machine). In each case, but particularly the first four categories, there is an interaction between psychoacoustic features and the process of (statistical) familiarisation and learning (Saffran *et al.*, 1999) that contributes to enculturation: certain aspects of sound produce inevitable neurophysiological responses, but we can learn how we will emphasise, interpret and use these. In essence, the physics of sound and of the ear, together with the organisation of our nervous system, demand certain registrations of sonic inputs in the brain (for example, a pair of simultaneous sine tones repeated every two seconds will produce a recurrent neural pattern every two seconds which contains the sounded frequencies, but also a range of non-linear transforms). However, the impact and interpretation of this process can be modified drastically by repeated exposure to particular sonic environments (linguistic, domestic, social, musical), in the process of statistical learning, and eventually of enculturation. There is a sense in which almost everything we hear can be appreciated via any combination of psychoacoustic and learned features, according to experience. This points to the possible flexibility of interpretation we all have. This flexibility is important in aiding musical exploration, and in allowing understanding (perception and cognition) of the results of exploration.

Examples of such influences of experience include the way individuals differ in their cognition of speech tones, according to their upbringing: during early exposure in particular, phonemes or other speech components may both be learnt and unlearnt. In this context "unlearning" means a desensitisation to a particular set of aural contrasts in favour of sensitisation to an alternative set, usually characterising different languages in a child's environment (Cutler, 2012). Correspondingly, there can be differences in perceptions and preferences amongst tuning and instrument systems. The Balinese or Javanese gamelan musician has very different tuning traditions, instruments and pitch sets in mind from that of the pianist trained in Western classical music since 1700, or of a person solely familiar with current day pop music, but they can adapt (Kessler *et al.*, 1984). Statistical learning due to exposure thus allows anyone to adjust to different kinds of musical materials and to interrogate and appreciate them more fully.

For each of our six sonic features, we will provide a very brief historical background of relevant perceptual/cognitive studies, and musical usage (the elements, and their associated structuring potentials). This will allow us then to raise possible new (or little used) approaches to the application of the features in creative work, pointing also to perceptual issues that are of complementary interest and under-researched, and might potentially advance the development of further novel usages. The reader will appreciate that in an article such as this focussed on a generalisable creative approach, the review of sonic features and what is understood of their perception cannot be comprehensive. We have therefore chosen references with the intent that they be convenient pointers to the available plethora of literature. But we are in no doubt that extensive scientific questions remain wide open, and in most cases the corresponding musical exploration has at best been incomplete.

The flexibility of interpretation in language and music mentioned above indicates that we should not be bound by the traditions of our own musical culture and experiences: an interrogation of cultural interfaces should or could be embedded in any individual's attempt at a generalist view of each sonic feature and its potentials. For this reason, we present our ideas in the broad framework of metaculture. Paul Gilroy's bracing quotation above reminds us that any cultural analysis, and equally, virtually all cultural change, is bound up with power structures. This article will keep such power structures in mind, and aims to bring out some of the sensitive issues musicians face in dealing with inter-cultural situations, and researchers in dealing with cross-cultural studies.

Metaculture, referenced by Gilroy, comprises "cultural reflection or practices conceptualizing cultural reflections or practices" (as expressed by cultural historian Joep Leerssen (Leerssen, 2021)). "Conceptualizing|" here often involves perceptual and/or cognitive flexibility and adaptation, as just described. We see metaculture also as explicitly discussing its own generative mechanisms, and thus providing both tactical and strategic cultural tools, that can ultimately partially free us from the constraints of our prior cultural experiences, since eventually every idea can interact with every other (through trade, performance, discourse), but yet they need never be located in a single individual. Consequently, a metacultural approach to music might consider all aspects of musical culture as not only mutable, but also as subject to intentional impacts from all its participants. Our argument is that such a metacultural approach is not only useful for facilitating personalised exploration and creating novel musical expression from within any culture, but also that it can be valuable as a training ground for enhancing intercultural musical participation: and when desired it can be used in such contexts with due respect

for the continuation and utility of prior expressive styles.

Paul Gilroy does not elaborate further on his meanings of the word "metaculture" than the quoted passage, either in "Black Atlantic" (where it appears just once) or in most of his later work. Subsequent delineations by others include the early books of Greg Urban (who particularly emphasises the commercial transfer and transmutation of culture across global time and space, and cultural flux more generally (Urban, 2001)), and Francis Mulhern (Mulhern, 2002b). For Mulhern, "'Metaculture' names a modern discursive formation in which "culture", however understood, speaks of its own generality and historical conditions of existence. Its inherent strategic impulse … is to dissolve the political as locus of general arbitration in social relations" (Mulhern, 2002a). Implicit in this is also the idea of reducing or allowing for power imbalances, and permitting, if not encouraging, change.

Anticipating aspects of our argument here, Urban and Mulhern (referring to Bourdieu and others) indicate that taste is not just something in listeners, but also in sound makers: hence musicians evolve the musics or any particular musical style and context, but these can also be driven commercially or by mediation more broadly. "Culture moves through the world" responding to both "inertia" and "accelerating forces" Urban suggests. Tomlinson provides fascinating analyses of metaculture in action in both religious rituals (Tomlinson, 2014) and a political coup in Fiji (Tomlinson, 2004). More recently, Born and Haworth elaborate for several recent music genres that "in addition to their characteristic sonic properties, a constellation of distinctive non-sonic mediations —discursive, visual, social, material, and technological — characterizes each genre …" (Born & Haworth, 2017). All these comments cohere with our view that metacultural approaches can aid music creation, and function even in the absence of explicit intercultural musical processes: an intercultural event being but one example of metaculture in action, normally taken as one in which participants arise from separable musical cultures. In the Discussion, we consider how the breadth of metacultural results can be harmonised with intercultural processes that are sometimes initially narrower.

Implicitly or explicitly, most authors assume the "parallel etic/emic processing at stacked levels of complexity" of cultural signals, as expressed by Leerssen, who following anthropological traditions indicates that "the *etic* is the "hardware" level of the bare substance of the cultural signals, and the *emic* is the symbolic or social function (meaning) of those signals" (Leerssen, 2021, p. 6), the result of perception and social cognition.

So for us, metaculture, consistent with these prior delineations, can have clear parallels with metacognition, in which the meta- term implies our human potential to develop controls or directions (sometimes new ones) in cognition (or culture), but metaculture allows far wider inputs. We argue that metacultural approaches to music can thereby potentially impact both the etic and emic "levels of complexity" just mentioned. This potential is substantially modulated by power, economics and numerous other social and historical factors. In one sense, humans control perception even more extensively than cognition, often largely disregarding fixity and only emphasising or being conscious of salient change. In brief summary, one can view metaculture as the cumulation of possible approaches to changing and appreciating culture, including cultural artefacts such as music. We note again that these occur at much broader levels (commercial, community, political) than just those of an individual music maker, in several respects encouraging individual freedom of exploration and application.

Perhaps it is also useful to describe alongside metaculture some of the other relevant and seemingly transparent terms here. We use the word "describe" (rather than define, or even delineate) to emphasise the non-fixity of many of the terms involved, which clearly depends not only on precision and comprehension, but history, intellectual change and fashion (or statistical dominance). Granted such fluxes, we may consider "culture" as "symbolic|" or meaning-bearing activity in all its forms" (Mulhern, 2002b, p. xiii). To illustrate the controversies within and beyond this claim, we mention three recent "propositions" about culture (Leerssen, 2021). "1) Culture relates to nature as choice relates to conditions".(We might suggest that relevant |"conditions' include not only biological and evolutionary factors, as he usefully discusses, but also still include political ones, as more often targeted by other authors and mentioned above.) "2) Cultural developments are nonlinear, multidirectional and multicausal. 3) The operation of culture involves sentient self-reflection among its participants". It is the 3rd of these with which we will particularly engage, supportive of the second, consistent with the first, and emphasising the sensory-perceptual-cognitive steps involved. An extrapolation of 1) is to point out that (human-initiated) computational processes, real-time and preformed, may provide novel metacultural inputs into creative developments, music included. Leerssen's usage of "non-linear" is broad in a similar sense to that we outlined above.

We will use cross- , inter- and trans-cultural processes as each being part of the broader concept of metaculture. The word 'cross-cultural' is usually applied to analytical work that seeks to responsibly and reflectively compare the artefacts and processes of different ethnics and cultures, at particular places and times; while we note that most cultures evolve quite rapidly in relation to both features, given arguments such as those of Gilroy.

We might ask here what has been established empirically concerning cross-cultural cognition? The idea of intrinsic musical cognitive 'universals' (as opposed to the shared neural traces mentioned elsewhere) has often been difficult to sustain (e.g., (Smit *et al.*, 2022)), particularly in relation to affect-causing universals, and this may partly flow from cross-linguistic inconsistencies in the way affects or other processes or concepts can be described (see below). For sets of "Western, Educated, Industrialised, Rich and Democratic" (WEIRD) participants, as most commonly studied, ratings of 'tension' or affective 'arousal' in a stimulus may be very closely related, but quite likely not for those of "Worldwide, In situ, Local, and Diverse" (WILD) participants (Newson *et al.*, 2020). Even simple tones or chords may produce different responses in different cultures, but particularly when one deals with more complex responses, such as narrativization (roughly, finding a verbalizable story in a musical progression) there are substantial differences: in this case, it has been shown that both Western and Chinese participants can narrativize (when encouraged to do so), but the effective music is, broadly, that to which they are enculturated (Margulis *et al.*, 2019). On the other hand, bi-musical individuals (Wong *et al.*, 2009), in this case seeped in music from both South Indian and Western traditions, nevertheless showed little of the 'in-culture bias' (in neither melody recognition nor affective tension perception) that their mono-musical counterparts did, again supporting the idea of enculturable (that is, learned) flexibility through exposure. Consistent with such suggestions of statistical learning, a 'cultural distance' hypothesis describes the statistical differences between musical features and patterns in different cultures (primarily in symbolic music data): most recently this work has used IDyOM (Pearce, 2018), an information theoretic approach, to indicate that such information theoretic distances correlate significantly with observed intercultural differences in melody and other perceptions, within note-based music (see the detailed review article by (Morrison *et al.*, 2019)). Such correlation is supportive of a key role of statistical learning in cross-cultural differences in music cognition (and in actively developing self-aware cognitive flexibility).

Returning to the subdivisions of metaculture, the terms inter- and trans-cultural are commonly used more or less interchangeably, and to refer in music to a continuum between activity that makes some minimal reference to that of another culture, and activity that overtly involves a reciprocal interaction between two or more musical cultures that have emerged from different conditions (locales, ethnics etc), for example because it involves performers/creators from each culture. Leersen (Leerssen, 2021, p. 6) suggests that cultural 'exchanges' are never 'unidirectional': this is probably more than a tautological claim. When one considers the contrast between the terms interaction and transaction, in which the former involves at a minimum, juxtaposition, the latter at a maximum, reciprocal transfers, there would be a logic in using inter- and transcultural in an analogous way. So 'intercultural' would refer to the continuum in which there is any level of co-existence of elements of two or more distinct cultures while 'transcultural' would be the sub-portion of this activity continuum in which the co-existence also involves some degree of exchange, reciprocation. This distinction would potentially be valuable in investigation and segmentation of intercultural *performance* and *presentation*. But we are concerned here with the whole spectrum of intercultural music *creation*, and so we restrict ourselves hereafter to the term intercultural. So intercultural musical work may solely involve using *ideas* from two or more cultures, and/or involve *musicians* from two or more cultures creating music together. Metacultural work is, then, the reflection upon, or guided and developed control of any and all of the preceding interactions by individuals and groups.

After the present section, we continue with a brief description of some examples of intercultural music making, to illustrate the diversity of metacultural music exploration in play in one particular locale (and to imply the generality of this observation). Then the main article section (3) describes approaches to the metacultural investigation of several of the major categories of sonic material and process. In the final discussion and conclusion sections (4,5), we briefly consider some of the potentially important creative and social impacts, both benefits and obligations, that might ensue from metacultural work.

In advance we want to elaborate here one recurrent aspect of the sonic interrogation we are emphasising: feature continua. If we consider the instruments commonly used in any one musical culture, we see that some necessarily prioritise a limited set of fixed pitches (e.g., the pi-

ano), while others (e.g., the trombone, or unfretted string instruments) have generative mechanisms (respectively the slide, the string stopping positions) that permit essentially any pitch within the audible range to be sounded. While jazz, for example, primarily uses the pitches of the piano, it does so with minor and major pitch deviations, that are core to the styles of individuals and of some genres, such as performing blues (Curry, 2017). Some other musical cultures tend to eschew pitches other than those of 12-tone equal temperament (essentially that of the current piano). In other words, the musical feature at hand (here pitch) can be used across the continuous audible range, but is often instead treated as if ordinal (step-like) or categorical in nature within this much larger range. Correspondingly, this feature is commonly found not only in music creation but also in studies of music perception, when there is clearly no obligation for this. This use of (debatable) categories and neglect of the spaces between them turns out to be a common practice in relation to many aspects of the musical materials we will discuss, and hence the interest and utility of making, using and empirically studying overlapping continua between the categories will become a common theme in our metacultural argument. Tomlinson makes a related point when he advocates metacultural 'fractal recursivity', in which concepts are repeatedly broken down into smaller sub-concepts (Tomlinson, 2014) that ultimately could become a continuum: this is immediately applicable as much to studies of perception as to the creation of music. So we find it useful when possible to consider continua rather than binary contrasts. One can think of this as attempting a general enhancement of nuance, but at the same time, it is encouraging novel expressive outputs.

This points to another possible interpretation of the word metacultural within music: as an indication that everything sonic is possible (etic) and of potential emic (cognitive) value; such an interpretation coheres well with ideas of metamorphosis, metaphor and the metaverse, and also with the aesthetic and processes of a figure such as John Cage (Hope & Vickery, 2024). Metamusic (which tends now to be seen as the complete possible set of algorithmic approaches to music-making) is a logical part of this interrogation and interpretation of musical materials and processes (Xenakis, 1970).

2 Intercultural music: brief commentary and examples

Intercultural music making, positioned above as a subset of metacultural work in music, can almost coincidentally interrogate many of the sonic features we are discussing, often while emerging from apparently discrete categories of music. This can form strong expression, though subject to political and power imbalances in performers and audience, as with all presentation. As we are suggesting, broader metacultural approaches to music creation may reduce these imbalances during the creative process at least. We next provide an illustrative survey of intercultural music making, in the jazz and improvisation contexts of one selected country (Table 1). We choose this example to suggest that given reasonable familiarity, one finds that through intercultural activity most locales and genres of music creation are already exposed to a vast array of interactions and juxtapositions: we believe the diversity reported below is readily observable in many social contexts. Our thesis remains that we can benefit creatively by generalising and transforming our approaches to the use of such diversity. A brief indication of places associated with key musical traditions in each example is given, but this is not necessarily reflective of all the musical traditions, nationalities or ethnicities of the musicians involved. A place is not given for 'jazz', but as stated earlier, the African American source is acknowledged; 'improvised music' is here used to emphasise a post-1960s international activity distinct from composition rather than the numerous individual traditions of improvisation across the world. Diversity in the evolution of both practices world-wide is acknowledged.

Table 1. Selected Intercultural work within Australian jazz and improvised music 1990-2020

Work, Release year	Primary Creator(s)	Key musical traditions by	Recording Identifier

		country or region	
Wild Honey Dreaming 1993	Matthew Doyle and Riley Lee	Indigenous Australia, Japan	New World Productions NWCD710
Wanderlust 1993	Wanderlust led by Miroslav Bukovsky	Jazz, Latin, Africa, Eastern Europe, Indigenous Australia (guest artist Alan Dargin)	ABC 518 650-2
Slivanje (1995)	Linsey Pollak, Ashok Roy, Satsuki Odamura, Hermann Flores, Blair Greenberg and Dorinda Haefner	Macedonia, North India, Japan, Africa, Latin America	BEMAC 002
Bitama (c.1996)	Robert di Gioia, Biboul Darouiche, Adrian Mears	Jazz, Africa, Cameroon, Germany, Italy	Enja 9093
Sliding (1998)	Miya Masaoka, Jon Rose	Improvised music, Japan, Australia	Noise Asia NAIM 02
Rectangle (1999-2001)	Nick McBride, Deva Permana, Epizo Bangoura	Jazz, Africa, Indonesia	JazzGroove JGR002
Sezoni	Mara! and Martenitsa Choir	Bulgaria, Jazz	Rufus Records CD RW 78 Real World Records CDRW87

(1997 and 1999)			
Into the Fire (1999)	Australian Art Orchestra, Sruthi Laya Ensemble: Three works for improvisers: Karaikudi R. Mani with, respectively, Adrian Sherriff, John Rodgers and Niko Schauble.	Jazz, South India	ABC 465 705-2
Crossing Roper Bar Volume 1 (2010)	Australian Art Orchestra | Young Wägilak Group Paul Grabowsky; David, Benjamin and Wesley Wilfred; Traditional Wagilak songs (S.E. Arnhem Land).	Jazz, Indigenous Australian	AAO 9324690038060
Djan Djan (2010)	Mamadou Diabaté, Bobby Singh, Jeff Lang	Mali, North India, blues	ABC 2723504
The Wide Alley (2010)	Eric Griswold with Vanessa Tomlinson and Zou Xiangping.	Jazz, improvised music, China (Sichuan)	Clocked Out
Cosmic Waves (2012)	Sandy Evans, Guru Kaaraikudi Mani and Sruthi Laya	Jazz, South India, electronic	Underscore Records – 12EX001ACD
Chiri: The Return of	Simon Barker, Scott Tinkler, Bae Il Don	Improvised music, Korea	Kimnara Records

Spring (2010)			
Improvisa-tions (2013)	Rasa Duende: Adrian McNeil, Damien Wright, Bobby Singh	North India, Flamenco	ABC Music – 3737066, Univer-sal Music – 3737066
Tarhu Con-nec-tions(2016)	Ros Bandt	Australia, Crete, Turkey, Iran and others	Hearing Places
Yakiya (2017)	Tripataka:Adrian Sherriff, Jonathan Dimond, Adam King	Jazz, North and South India, Bali, Brazil, Cuba.	TP242
Transition (2018)	Zela Margossian Qunitet	Armenia, Jazz	Art As Catharsis
The Blue-bird, the Mystic and the Fool (2018)	Joseph Tawardros	Egypt, Jazz	MGM JT2018A
Kohesia (2018)	Kohesia Ensemble: Kate Pass	Jazz, Iran	Self released
Afternoon Tea at Six (2020)	Eishan Ensemble Project: Hamed Sadeghi	Iran, Jazz	Art as Catharsis

Items in the Table are either released on LP, CD or for digital download. Relatively few were found from the LP era. Note that many works (not listed above) involve 'unilateral' efforts, in

which the culture of an 'other' (Born & Hesmondhalgh, 2000) is applied by the originator of the work to the context of their own culture.

If one thinks of intercultural music activity within jazz and improvisation world-wide and were to construct a list of musicians whose intercultural work is well known in many continents (and not just their own), a selected list might include: John Coltrane; Miles Davis; Ravi Shankar and his family; Charlie Mariano; numerous musicians from the ECM label; Angelique Kidjo; John McLaughlin, in Shakti and in separate work with Trilok Gurtu; Joe Harriott; and many others. The Table and list could also readily be paralleled with respect to Western composition or other fields, just as well as to jazz and improvisation.

The nature and degree of intercultural exchange in these projects probably varies considerably. With Indian musicians, obvious exchanged and then shared features are often the rhythmic and pitch schema. In contrast, author SJE describes playing saxophone with a Balinese player of the suling (Balinese flute) who chose continuously to play pitches adjacent but not overlaying the saxophone, producing the kind of relationships intrinsic to most Balinese gamelans, in which pairs of keyboard instruments covering a closely similar range are regularly tuned a few Hz apart (Sethares & Vitale, 2020).

One possible limitation to intercultural exchange is the mediation of the encounters by language. More fundamental than the question of which language(s) are employed and how familiar they are is that of how musical ideas are conceived and construed in different cultures and languages, and hence whether a common expression of them across participants can be achieved even when sonic and linguistic demonstration, translation, observation and discussion are all employed. For example, Feld's observations (Feld, 1981) that in Papua New Guinea metaphors in Kaluli music theory may not embody the understanding many readers would bring to them, point to such fundamental problems. Author RTD, in discussions with Indian musicians while performing there, observed that they described subdivisions of rhythmic patterns in different ways from those he expected (with little distinction between the iso- and non-isochronic). This could have suggested a different focus musically or could be an example of language differences. There seems to be a need for more intensive systematic investigation of this issue of the specialised linguistic expression of music-technical features in different cultures. (In practice, very complex rhythmic notations, such as a putative New Complexity score indicating 35 equal subdivisions of say 3 crotchets (quarter-notes), sometimes have to be interpreted in a similarly loose way, with acceleration and deceleration to maintain coordination. Composers of such music are often accepting of this.)

Author SJE has extensive involvement with Carnatic, Hindustani, Balinese and Japanese musicians (S. J. Evans, 2014). This has affected her approaches to rhythm, pitch, timbre alongside the more broadly metacultural influences on these materials employed in particular pieces or periods of work (some included in Table 1). It is relevant to note the African American influences that jazz has transmitted world-wide, and also the direct relevance of African multi-layered rhythm cycles in both research of some musicians (Pressing, 2002; Pressing *et al.*, 1996) and their own music making (Pressing's World Rhythm Band). In short, intercultural music-making in our lifetimes has taken very different forms in different locales, but even brief selective listings show its potential permeating influence.

We will return to the relationships between intercultural exchange and the broader direct metacultural interrogation of musical materials in the Discussion section after our consideration of realised and potential exploratory approaches to both music perception and creation.

3 Musical Materials and their exploration

We next discuss sequentially the six musical elements listed already. We aim to make the key point that treating the elements as continua, every part of which may be of special interest, can potentially broaden our musical outlook. Computational systems can readily provide tools for creating such continua: for example, for converting the pitch set of a physical synthesis piano from 12-TET to continuous pitch. We do not aim to give comprehensive descriptions of the nature and possibilities of each element, perceptually or creatively, nor to define all the apposite computational or performative tools, but rather to provide sufficient pointers that an interested reader may pursue these further if so desired. But we do suggest that the ideas we raise, of

metacultural exploration, are of widespread relevance.

3.1 Rhythm

Any sequential temporal organisation of sonic events can be construed as constituting a rhythm, but most music uses recurrent pulse cycles that are roughly fixed in overall duration and internal pulse length and on top of which hierarchical integer duration relationships forge meter. Meter is cognitive (i.e., not always audibly expressed, and dependent on user perception and analysis), and expressive timing as well as imprecision may bend the durations of pulses and of pulse-aggregates (Levitin *et al.*, 2018).

From a listener and perceptual standpoint, it is notable that most studies, such as the large body of work concerning both perception and production of rhythms through tapping studies, focus on constant (isochronic) pulses and relatively simple rhythms (Repp & Su, 2013). The consequent tapping production (requiring rhythm perception) is generally highly accurate (commonly >90% in relation to most of the possible criteria). On the other hand, even a survey of just 91 diverse rhythms each based on 2-5 cues within repeating cycles of 3-13 isochronic pulses, found many rhythms that attracted much poorer performance (such that accuracies for all rhythms taken together were only ~58% : (Dean *et al.*, 2021)).

So this points to the question, what are rhythmic preferences in our and other cultures? A few authors have made significant efforts in this direction, to some degree stemming from the classic studies of Fraisse (Fraisse, 1982), who measured distributions of preferred tapping rates in various circumstances. The distributions tended to centre around pairs of rates at 2:1 time ratios, interpreted as indicative of preference for binary subdivisions; similar evidence can be found for ternary subdivisions, but more rarely for division into 5, 7 etc. With a Bayesian statistical eye, one can ask how many of the performances in the distribution are actually within a region of practical equivalence to the central rate (and thus not requiring to be considered as potentially distinct): this is rarely as much as 50% of the data (depending on the precise criterion adopted), suggesting that the emphasis on the near-central integer ratio of the distribution is excessive, and leaving scope for further understanding the true preferences of those producing the remaining majority data.

One of the first articles to re-address this question in the present century (Sadakata *et al.*, 2006) revealed significant proportions of tap timing distributions outside the dominant peaks of 1:2:3 durations. Similarly, in 'cue iteration' studies, repeating rhythms comprising 2 or 3 initially randomly disposed events were heard, and participants could adjust their relative timings to taste. While these studies (e.g., (Jacoby & McDermott, 2017)) showed strong clustering of data around 1:2:3 duration ratios, both with Amazonian and US participants, the distributions differed, and significant masses were seemingly outside reasonable areas of practical equivalence, such that their true target might bear further investigation. Interestingly, speech rhythms show quite different characteristics.

Considerable ambiguity therefore remains about the rhythmic propensities of participants in music-listening and -making: they may well be broader than commonly imagined. What of the corresponding rhythmic usage in different music genres and cultures? In some cultures, most meters are binary or ternary, so that the number of pulses in a cycle is divisible by either two or three, or by both, but more complex meters, polyrhythms, irrational patterns and polymeters may be superimposed forming rhythmic hierarchies. Some solo performers (e.g., our colleague Cameron Undy) use a fixed period of time with two simultaneous distant subdivision rates (e.g., 2 and 13, performed and/or computationally generated) to create interesting new patterns. Some cultures quite often utilise asymmetrical meters, such as the Balkan aksak and some Indian tala that comprise combinations of two- and three-pulse units, such that the resulting total number of pulses in a cycle is not divisible by 2 or 3. African overlain additive techniques in time cycles provide alternative approaches: but the hierarchies tend to operate on short time scales. Even within symmetric meters, asymmetric rhythms can be produced: for example, rhythmic 'cadences' in Indian musics, signalling the end of structural sections, may be consistent or inconsistent with the symmetry of the surrounding meter as in the Hindustani tihai.

Along the possible paths to continuously variable pulse duration and rhythmic patterning, we can think of Reich's Clapping Music (Duffy & Pearce, 2018; Sethares & Toussaint, 2015) where patterns are progressively shifted by integral steps with respect to each other; and his 'phase' pieces such as *Piano Phase*, in which the pattern is requested to be moved by one of two players in almost continuous minute steps until the integral step is achieved, and then minutely again in a repeating cycle (Cohn, 1992). Subsequently in our work (LYSIS, *The Wings of the Whale – You Yangs*, Soma 784, 1991), performers explicitly improvised sections of pieces in which there

was to be competition between two or more pulse rates and meters (chosen autonomously during the performance by each musician at the instant of commencement) that eventually resolve with what we called a 'time-shift' away from the preceding pulse and metrical stability. This was a little like the composed metrical modulation of Elliott Carter, and it complemented the transitions that free jazz improvisers after the mid 1960s often effected between time-based (pulse and meter based) and free-time (sparsely-pulsed or pulse-free) sections. Free-time in turn has very longstanding antecedents in many cultures (e.g., Louis Couperin's Fantasias (Gingras *et al.*, 2016)). But music 'without pulse' (a purposefully loose perceptual description) seems much stronger in Indian alaap than in almost any Western music. As Amit Chaudhuri comments about alaap (Chaudhuri, 2021): "the singer proceeds in free time, heedless of the tala ... [which] in a feat of dual awareness ... the singer largely ignores". In many of these approaches, event durations are no longer in simple linear integer relations to each other.

French spectralist composer Gerard Grisey's efforts to create distinct states of timeful- and timelessness are somewhat unusual within Western composition (Noble *et al.*, 2020). But note that the achievement of timelessness is probably related to a concept of free improviser Derek Bailey (Bailey, 1980), that has been subsequently termed 'non-sensory' improvising (Smith & Dean, 1997), and could be considered as seeking independence from other local (e.g., musical) events. In this state, a group of improvisers may proceed each with rhythmic autonomy, as a consequence of a much broader autonomy due to avoidance of sensing or cognising aspects of the surrounding musical events, such that little or no overall metrical sense pervades.

Machines and algorithms are in some ways better at rhythmic disregard or shifting than human performers, particularly in the case of minutely continuous phasing. And irrational duration ratios during computer-generated precisely repeating algorithmically generated metrical cycles can consequently produce deeply non-isochronic rhythms. Software is available already for these purposes (Xronomorph : (Milne *et al.*, 2016)), and exemplifies our recurrent theme of converting a discontinuous space (integer metrical structures) into a continuous one, where both the duration ratios of pulses that recur in the pattern, and the overall duration of the metrical cycle can be varied continuously by computational control. Such software is also highly stimulating to improvise with, and we have written and performed pieces that systematically survey wide ranges of these rhythmic spaces. It is clear that considerable empirical work, such as some mentioned, will be needed to fully investigate the continuous spaces of rhythm. Amongst the personal perspectives and benefits of exploration here that may appeal to some music-makers are the creation or dissolution of rhythmic impetus, complemented perhaps by that of stasis. There are also fascinating possibilities for illusions of continuous acceleration and deceleration (Madison, 2009) based on multiple temporal levels. A variety of computational models of rhythmic performance have been advanced, but several approaches, such as time series analysis, and point process models(Cannon, 2021), have been largely neglected as sources of rhythmic creation. Computational randomisation of durations is quite widely used, and convenient in both live coding and live algorithms within *MAX* or *Pd*.

This discussion of rhythm has touched on each of our exploratory principles. Given the analogies between rhythm and pitch, as pointed out by Henry Cowell (Cowell, 1926), as found in ancient Roman, Greek and other cultures, and as revealed in Stockhausen's famous demonstration of a repeating but accelerating percussive rhythm, we turn next to the result of his demonstration, perceptible pitch.

3.2 Pitch (tuning and harmony)

It is often noted that reasonably uniform strings and tubes generate sounds with harmonics at integer-related frequencies, and hence suggested that such discontinuous frequency sets are 'natural' (with an assumed subtext in some cultures being 'should be emphasised'). But many tubes and strings in nature are not so uniform: for example, the human vocal tract, and the didgeridoo (Tarnopolsky *et al.*, 2006) both of which show strong formant structure that can be controlled by the performer, and that is usually quite distinct from a harmonic spectrum. So we can ask to what degree do studies of pitch perception to date support any suggestion of preference for harmonic tones and discontinuous pitch structures? What are the limitations to pitch discrimination? And how do these apply in complex musical fabrics, with numerous instruments sounding simultaneously? As always, we soon reach unresolved (or unstudied) questions, suggesting that the scope for creative extension, computational or performative, should not be underestimated. So we pursue here our general suggestion that creating continua from presumed categories may be stimulating and productive for a music maker.

It is clear that closely similar individual pitches cannot be reliably discriminated in two-alternative (successive presentation) tasks unless they are at least about 10 cents (i.e., about 0.8% of an octave) apart. But once we move to more musically relevant situations, there are many open questions. For example, it is little understood whether, when several tones are sounded simultaneously with a 'deviant' tone separated from one of them by only a small frequency distance, the combination will be detected as different from the corresponding combination of tones bar the deviant (because of spectral differences, beating and other potential factors). Related to this, octave perception (the assumed dominant 'natural' 2:1 frequency ratio) is far from precise, and the piano is commonly tuned by design with stretched octaves. Octave equivalence (the idea that a contour of pitches centred on frequency n is almost equivalent to one centred at 2n or 1/2n) is also in competition with the influence of pitch height, which is often very strong. In any case, octave equivalence is only strong at the neighbouring octave and not beyond (Wagner *et al.*, 2022). Current studies of pitch perception suggest that it is fundamentally a phenomenon of pattern learning and detection (i.e., it is spectral), rather than the detection of a smaller number of vibration frequencies (de Cheveigné, 2005). Periodicity detection may be important (Stolzenburg, 2015), but the periodicities of a multi-note chord bear a complex relation to those of the constituent pitches.

In spite of such uncertainties in our knowledge of pitch perception, and of the possible roles of psychoacoustics (intrinsic) and statistical learning (extrinsic), it is notable that pitch hierarchies may be found even in response to randomly enunciated pitch sets in extremely unfamiliar microtonal tuning systems (e.g., 22 tone equal temperament {Hearne, 2019 #2913) as well as to musically realistic situations in which pitches occur with different statistical frequencies within homophonic or polyphonic melodies or harmony.

So need we depend on having tuning systems containing (intended) octaves, or on other arbitrary but common features such as equal temperament? The Bohlen-Pierce (BP) system instead normally uses 13 equal-tempered pitch steps (each frequency derived from that below by a common multiplier; though a just tuned counterpart also exists). The thirteen steps repeat at the tritave (octave and a fifth: a frequency ratio of 3:2). Octave equivalence likely depends partly on the fact that on a given sound source, a pitch an octave above an original often contains all the harmonics of the original at an octave higher, and is thus probably the next most similar spectral pattern. By the same token, the tritave could well be the third in closeness, thus repeating a pitch set at that interval may be particularly rational. Perceptual studies on Bohlen-Pierce have said little empirically about tritave equivalence, and found it more difficult for non-musicians to appreciate than the diatonic equal tempered octave-based scale {Mathews, 1988 #3000}, but still able to support learning of pitch grammars in narrow pitch ranges within 30 minutes (Loui *et al.*, 2010). Such grammars necessarily involve both contour as well as specific interval relationships, so that both may contribute to learning. On the other hand, more recently, affective responses to BP chords were successfully modelled by a combination of intrinsic spectral features (roughness, harmonicity, spectral entropy) and the extrinsic feature (that is, one dependent on statistical prevalence in prior exposure) of dissimilarity to 12-tone equal temperament chords (Smit *et al.*, 2019). Thus both intrinsic and extrinsic factors seem relevant to pitch perception, suggesting that many other tuning systems will be viable, consistent with the coexistence of very large numbers of such systems. There is remarkably little music available using the BP system, illustrating our claim that even with pitch, perhaps the most studied and familiar aspect distinguishing different pieces of music, vast swathes of possibility remain open for exploitation.

Extending these tuning systems from a creative point of view, there are a few tuning systems not only without octaves or tritaves, but without the normal multiplicative equal temperament i.e., with no recurring frequency ratio intervals. The steps instead may be additive, based on sequential prime numbers, and a wide range of different sized steps are included (Dean, 2009). It seems that extremely few creative systems have yet used such a non-multiplicative tuning system. Going further, even the sonority of the grand piano can become the basis of a virtual instrument (using physical synthesis techniques) that exploits continuous pitch, like those intrinsic to sliding on the violin or the trombone, and then piano-sliding can be effected for example on a touch-pad (Dean, 2022).

Correspondingly, the spectral structures (and hence frequency ratios) with which any given tuning system might be compared are not limited to sounds containing relatively simple integer-ratio harmonic series. For example, as mentioned the vocal tract, clearly an important source of sounds in the numerous historic conditions in which musical preferences were first formed, is a much more complex non-uniform tube that is not so closely or inflexibly bound to the familiar harmonic templates of brass instruments or the piano. Spectra of pitches on most instruments contain considerable complexity, that has been enhanced by means of many 'extended' playing techniques, and differentially in different cultures and periods. Computational manipulation of the frequency ratios between successive major energy peaks in an initially pitched sound is readily accessible, and stimulating. The multiple strings of many bowed or plucked instruments can be almost instantly retuned so that the normal systems of the instrument can be changed readily. In this case, performative flexibility is almost as great as that of relevant computational creative music systems.

Cross-cultural comparisons have provided many implications and triggers for the development of such pitch and tuning systems (McBride & Tlusty, 2020) as have theoretical concerns such as Xenakis's interest in the rationales of certain Greek tunings (Xenakis, 1971), octave-free systems such as BP, and other microtonal systems. The use of occasional pitches beyond those most common in an ongoing system has also been well established: the so-called blue notes of jazz, or more generally, signifiyin' on a note (Walser, 1995), can be viewed in this light, as can compositional uses of natural harmonics (e.g., of the French horn in Britten's Serenade, or of high harmonics on string instruments) that are perceptually separable from a surrounding equal-temperament pitch set.

Pitch systems offer a convenient testing ground for statistical learning of new musical systems: as we have pointed out above, prior preferences may be rapidly changed by statistical exposure, and this is particularly relevant both to childhood development, and to modification of prior enculturation in adults. Thus one can detect real-time learning of new pitch-based tones in tone languages within minutes (Peña *et al.*, 2002), and also of pitch structures other than our normal 12-tone equal temperament in use in melodies, though usually a little more slowly (Kessler *et al.*, 1984). Some systems are more difficult than others to learn, including the non-octave, additive-interval prime number scales. Nevertheless, with pitch, as with musical materials at large, learning to recognise recurrent sonic elements that provide the perhaps novel organisational basis of a new or unfamiliar piece, can readily occur quickly enough for melodic and structural recognition to occur (that might be termed 'real-time semiosis'). Again, it seems that continuous pitch structures allow one to choose a range of pitch sets that might be compositionally applicable, but not commonly used.

Pitch can be seen as a subset of timbral features, as can harmony, often conceived as the vertical simultaneous combination of pitches, distinct from polyphonic interweaving of melodies. It is treated very differently in different musical cultures, for example ranging from systems in which a single tonal hierarchy (implying at least two levels of importance or 'stability' for different pitches) pervades the whole of a piece or large section, to others (such as much Western music) in which modulation between different hierarchies seems an important part of the musical process.

In the metacultural exploratory stance we are taking, what are the potentially interesting perspectives on pitch within harmony? Obviously the adoption of a new or unusual pitch/tuning structure invites the formation of personalised new systems for creating tonal hierarchies, besides the statistical or emphatic presentation approach in which any tonal centres can probably be created within the pitch set. Imagine a novel or unusual pitch pattern that repeats at some arbitrary interval but that has all but one pitch bunched close together, with a big gap between the bunch and the remaining pitch. There may be a tendency for one pitch (or chord) to be at a higher perceived stability level (perhaps the isolated pitch); while the normal devices of frequency of occurrence, and differing degrees of dynamic and rhythmic accentuation might readily foreground any other individual pitch or create more than one level of tonal hierarchy. Thus exploration of the tonal centring of different pitch systems in their harmonic application can be of considerable interest (both compositionally and perceptually). Multiple pitch systems might be intermittently combined.

Earlier ideas about how the spectral structure of the tones used in a pitch system might be 'best' adjusted to that system (Carlos, 1987), and about doing so dynamically with computational systems (Sethares *et al.*, 2009), could be developed in broader terms according to the music-maker's responses to them. For example, differing spectral structures might foreground different pitches amongst the set, while those spectra might also be the objects of change, as they can be in instrumental performance, while yet preserving the pitch set. The nature of harmonic processes could undergo fundamental change, both in its melodic and chordal application. For example, one might be particularly interested in the affective and perceptual impacts of roughness and inharmonicity (which are thought to be influential in several empirical contexts (Johnson-Laird *et al.*, 2012)): a harmonic composition could focus its harmonic construction in part on producing temporal gradations in these features, just as might be more common in spectral electroacoustic music.

This discussion of pitch has emphasised continua and hierarchies, consistent with our exploratory principles, but also implied various forms of non-linearity and reordering and overlays. Randomisation of pitch in response to a given electronic keyboard input is also stimulating: in extreme cases, where randomisation is complete, it requires very rapid adjustment of a performer's musical trajectory.

Composition or improvisation in which pitch is still present, yet pitch structure is of deeply subordinated import, perhaps because of such randomisation, is another field open for broader exploration. Note the potential contradiction, or boundaries here: the spectral content of a sound that constitutes initially a clearcut pitch can eventually be changed so far that the pitch is also changed, as well as its stability within the ongoing system. But this can be seen as a positive avenue in the expansion of harmonic possibilities rather than as a problem. Eventually, however, spectral control moves beyond harmonic impact into the centre of issues of timbral control, most obviously when pitch largely disappears (as in some percussion, and some computational sound-based music).

3.3 Timbre

We all recognise that individual speakers have individual tones, and we are good at identifying them at least if they come from our primary language and culture. In the remarkable tradition of konggap, individuals in some areas of Papua New Guinea each also have their own personal identifying melody that can be enunciated by themselves, or by others referring to them (Amha *et al.*, 2021). In something of a complex parallel, in some musical traditions such as that of jazz, the cultivation of an individual 'sound' (i.e., timbral set on any instrument) seems almost a prerequisite: for example, compare tenor/soprano saxophonists John Coltrane and Evan Parker (see also (S. Evans, 2014)).

Given this pre-existent level of personalisation of timbre, what is the scope for our thesis that exploring the continuous space of a feature, here timbre, is potentially rewarding? Is this timbral differentiation more widely applicable? And how flexible is it? Let us again very briefly summarise the perceptual issues first. Since pioneering work on instrumental timbres (Grey & Gordon, 1978), perceived 'distances' between timbres have been used through multidimensional scaling techniques to provide two- or higher-dimensional maps of the relative 'positioning' of timbres (Risset & Wessel, 1999). The resultant timbre spaces have been explored as a 'musical control structure' (Wessel, 1979), revealing that timbral analogies can be conceived, when sounds a and b occupy relative positions in the space similar to the relative positions of x and y (McAdams & Cunible, 1992). On the other hand it has long been suggested that such timbre spaces do not represent the dynamism with which timbral relationships may be learned and construed; consistent with this the possible utility of temporal network analysis in understanding such changeable relationships between timbres in the construction of organised sound has been demonstrated recently (Dean *et al.*, 2023).

Returning to the creative issues, timbre exploration is not only part of instrumental performance, but even more centrally, of computational electro-acoustic work. Morphing between pairs of sounds has been a powerful driver since the painstaking tape work of Xenakis and Stockhausen, and the first slightly more convenient digital morphs of Michael McNabb and others. Major contributions in music and musical thought were made by Denis Smalley with his concept of

spectromorphology (Smalley, 1992) as a multi-dimensional transformational compositional process and Trevor Wishart (Wishart, 1985; Wishart, 1994) who particularly emphasised spectral continuities, applying this to creative impacts at every socio-political level.

Until recently, morphing and transformation was necessarily mainly between the digital acoustically-theorised representations of spectra, or in varied performance techniques on analogue instruments while directly observing the audible sound. The continued viability of the approach has been re-asserted recently by (amongst others) the efforts of the well-resourced Google and its Magenta project, for example producing its *NSynth*, which instead permits morphing across a machine learned representation of a digital space (expressed usually in the 'hidden layers' of a multi-layered, deep learning neural network), as opposed to morphing across its acoustic spectral space. This is morphing by means of metasound (descriptors rather than digital acoustic signals), as previously discussed (Dean, 2003) in relation to earlier work such as that of the networked ensemble the Hub. It points to the fact that because digital space (in spite of its name) is effectively continuous and all embracing, there are potentially many different ways of exploring it, each based on distinct continuous representations in multiple dimensions. Such representations can incorporate gestural mappings as a minor or major determinant of the dimensions. They can also bring them to bear on unexpected sonorities: for example, the magnetic resonator piano of Andrew McPherson (McPherson, 2010; Pitkin, 2021). We can really survey unexplored or hidden spaces now if we wish, as Sun Ra might have said in an update of his cry 'Space is the Place'. In our own experience, timbral explorations using the DX7 in the 1980s (e.g., (Collier, 1987)) have given way, via 'noise' improvisation (Dean, 2003), to such digital transformations using algorithmic or machine learned approaches. In one intercultural usage, digitally transformed drones were used by author SJE within an Indian intercultural performance: while the mildly transformed drones did not produce particular comment or concern from the Indian collaborators, timbral perception differences across cultures (Dolan & Rehding, 2021) nevertheless suggest that in many cultures, novel personalised musical expression might be achieved through intensive approaches to timbre transformation. Continua, overlays, precise or loose non-linearities, as well as spatialisation of spectra ((Normandeau, 2009), with the appealing alternative cry 'the medium is the space') are all potentially expressive tools in relation to timbre, and thus all worthy of further creative and perceptual investigation and modelling. Partial spectral randomisation can readily be achieved within computational sound generation, and cumulatively all the exploratory features can contribute to novel-hierarchies within and between timbres. For example, timbral (as opposed to instrumental) groupings can possibly be created simply by assigning a particular spectral feature to several different timbres, which maintain distinction, yet become related because of the shared feature. Adding a percussive element, with transient initial loudness (dynamics), to a temporal spectrum is an obvious possibility. We turn to consider dynamics more broadly.

3.4 Dynamics

By 'dynamics', we mean the variation in acoustic intensity (and hence perceived loudness) with which music is conveyed. Acoustic intensity flux with time is a very strong cross-cultural perceptual and affective signal (Balkwill *et al.*, 2004; Balkwill & Thompson, 1999): it is probably a general and powerful influence on the continuous perception of affect in music (Dean *et al.*, 2011), somewhat related to its role in automatic scare and 'fight or flight' responses in the animal kingdom at large. There are apparently archetypal organisations of intensity change, whereby the relative lengths of a rise-fall archetype follow largely consistent rules: the duration of crescendos are shorter than their corresponding decrescendo, over a wide range of intensities and time scales (Dean *et al.*, 2013). These archetypes may have a good psychological explanations in relation to attention and arousal, as suggested in earlier studies based on score descriptions as opposed to measured intensities (Huron, 1990, 1991, 1992). One possibility is that the delayed decay of a peak dynamic allows the prolongation of its affective impact, likely in a personalised way. Empirical acoustic measurements suggest that this rise-fall archetype is shared across quite wide ranges of music, acoustic and electroacoustic, and from Haydn to jazz and free improvisation (many others remain to be investigated). Informal observations suggest that certain inanimate and animate environmental scenes provide a similar rise-fall, which requires proper study, and which may imply an evolutionary/biological origin for the archetype, suggesting it might apply much more widely than yet studied.

We should also note that perceived loudness can be influenced by several other musical factors beyond simple acoustic intensity: different pitch ranges show different dependencies of loudness on intensity, and performance features such as timing, articulation (Myers & Finnegan, 2015), accentuation, and event density may have impact.

Acoustic intensity and loudness profiles from most sources are inevitably continuously variables, so it might seem that these perceptual features would imply that the full continuum of loudness impacts is already under comprehensive use, normally changing gradually. When one adds to this the abrupt acoustic intensity contrasts that characterise the work of an improviser such as Cecil Taylor, together with the very slowly moving changes of some drone and noise music, this impression might be confirmed. These two examples can be viewed as cases of evading the normal slow continuous adjustment of dynamics, but other forms of systematic reversal of familiar loudness patterns may also be rewarding. For example, while in contrast to the rise-fall archetype of gradual dynamic continua (rises generally taking longer than falls), a rise-fall archetype in the opposite sense (rise faster than fall, coinciding with that originally observed in scores) may well be expressive. Furthermore, many pieces hierarchically correlate a start-deviate-return pitch, harmonic or timbral structure over a significant time period with a simultaneous convex dynamic rise-peak-fall return. But many more patterns may be effective, such as convex-concave; or convex-concave-convex where the last of the three might be over the whole practical dynamic range, the preceding two only over its top or bottom halves respectively.

Consistent with these ideas on continua, each of our other exploratory avenues has potentials in relation to dynamics. Normal gradual and fairly smooth dynamic changes might be replaced (especially in electroacoustic music) by alternative algorithmically specified unsmooth patterns. Within limits, it is also perfectly feasible to have coexisting overlays of different dynamics: especially when these are also spatialised. Enunciating event sequences with randomised or systematically varied loudness sequences, especially in multiple layers, is appealing, and can create the impression of transiently shifting dynamic hierarchies.

Overall, as with pitches, tonality and timbre, hierarchical, spatially varying, and overlapping structures in loudness, whether rendered computationally or by instrumentalists, may still provide little-tapped avenues. Think of Charles Ives' multiple instrumental forces walking noisily towards a centre point from four directions, and translate this with variation into a 3D electroacoustic dynamic structure! Dynamics can be used as part of a musical struggle for leadership, whether composed or improvised, such that the louder or the softer might ultimately prevail. We discuss hierarchical organisation more fully in the next section, and seek to do this in widely applicable terms with which the reader can reflect back on sections such as this.

3.5 Hierarchical structure

By now in our argument, the widespread logical possibilities for exploiting continua rather than categorical approaches (where these pre-exist), for inverting conventional usages, and for introducing non-linear or overlapping features, should be apparent. Do our exploratory principles have anything further that is useful to suggest for overall structural processes in music, and the closely related concept of musical form? First we again ask briefly how far the perceptual study of these issues has addressed the possibilities.

Listeners can often recognise short 'plinks' (300 or 400msec sound extracts (Krumhansl, 2010)). It is difficult to judge as yet what implication this has for identification of those structures that form a musical narrative or argument. Given that most popular music works, or music items of any genre projected by Spotify's own recommendation processes only last around 2-5 minutes, such short scale time structure is presumably what most listeners are used to. Correspondingly several studies have shown that perception of somewhat longer term tonal closure (Cook, 1987), or even of the appropriateness of the sequencing of materials from a composed classical music piece (Eitan & Granot, 2008) are rather weak or inaccurate, suggesting that large scale features may often go unnoticed, or at least, bear only modest impact. It will be an important psychological project to understand beyond familiarity what if anything does facilitate the appreciation of large-scale structure, say in an 'inexorable' Bruckner Symphony; and equally, what aids the process of familiarisation? These may not be the same factors as influence

memorability and popular success. It is also useful to think again of machine listening as a potential source of distinctive, perhaps post-human, analyses of the structure of an ongoing piece, and hence as a trigger for additional composed or improvised directions that might transform that structure and its hierarchies as perceived both by performers and listeners.

Long term musical structure may often be impelled by convex arcs in the time-averaged dynamics (as with considerable portions of Bruckner). In a sense the endpoint can then be a return to the low dynamic of the outset. But this structure could be made complete, i.e., circular: and not only in the dynamics mentioned in 3.4 where a convex arc is succeeded by a comparable convex one. In addition, polyphonic and harmonic approaches to circular music have been well developed: consider Charles Ives' *All the way around and back*, and the recent dedication of several composers such as Jurg Frey to 'circular music' and William Basinski to 'looped' processes. The circular can transform into more complex web forms, less obvious and probably less common, but offering an infinite range of structural possibility for music making.

One of the dominant features of music, apparently in every culture and relevant to familiarisation is its extensive short- and long-term repetition (Huron, 2006; Margulis, 2014). These repetitions occur both without and with modification of the material at hand. In note-based music (which can be contrasted with sound-based (Landy, 2009)), most often the variations are in the pitch structure or harmonic position of melody. These features are related to those that determine the perception of phrase structure in music, and differ between note- and sound-based music (Olsen *et al.*, 2016). Some composers have made a feature of timbral changes within and across repeating melodies (such as klangfarbenmelodie). What else can be considered as candidates for influential fixity or flux in such repetitions? Acoustic intensity is probably underestimated in this (most melodies are used within a fairly narrow intensity range unless substantially modified in pitch, harmony or rhythms), and spatial distribution almost certainly so. Electro-acoustic looping of patterns need not be unchanging: on the contrary, Evan Parker and his Electroacoustic Ensemble have in several pieces emphasised its large scale 'reconstructive' potentials, where the reconstruction is not simply regenerative, but rather transformative or deconstructive. Systematic morphing has also long been part of electro-acoustic music making; and in ensemble performance this may not only constitute timbral, but also hierarchical structure transformation. We do not propose to argue here through a catalogue of possible personally-appealing modifications, rather simply to point out the general opportunity.

Thinking hierarchically, we can ask what structures do the repetitions create, and how might these be manipulated further? In some music, it might seem that no hierarchical layers are created: but are we simply not perceiving them, as we often fail to do when recognising foreground change but not background change in our environments? In conventional historic sonata form, at least after developing familiarity we can recognise features of material statement, repetition and development, and often recurrent repetition before closure. These normally occur in sequential blocks: but need they do so, especially given the evidence cited above that listeners' perceptions of appropriate sequencing are not highly critical or accurate? In many arts 'non-linearity' in the sense of non-sequentiality (or reordering more broadly) has become important if not dominant in the last half century: is music overall lagging behind, in spite of randomised or discontinuous sampling, looping and the pioneering work of John Oswald? There is no doubt that reordering, or its complement, overlapping sections of distinct material and process, makes for more difficult (or perhaps better and more concentrated?) listening, even if it might necessarily be less comprehensive listening. This can allow listeners a greater multiplicity of paths and experiences through a piece, with or without overt musically rhizomatic structure (Deleuze & Guattari, 1996). And for a music creator, a structure comprising just a few hierarchical dimensions might be converted into a highly multidimensional one. In turn this may relate back to previous identifications of different modes of creation of improvisatory structures, such as George Lewis's nuanced delineations of Afrologic *versus* Eurologic (Lewis, 1996). In addition, audio-visual works can contain music that clearly coheres with the visual process, or alternatively, bears any other relationship to it (diegetic vs non-diegetic in Chion's terms (Chion, 1994)). By extension, we can readily envisage different streams of sound forming a similar function, as perhaps did Ives and others. Integral serialism is an example of an intrinsically hierarchical musical generative mechanism, linking the forms of every aspect (and potentially every stream) that is specified by it: normally pitch, rhythm, dynamics, but potentially any aspect that could be considered in a symbolic way (e.g., timbre,

spatialisation, performer interaction). In some cases, the normal implication of the word 'serialism' may usefully disappear (Salem, 2023).

Looking cross-culturally again for a moment, it might seem that Western music changes in the last century have substantially addressed large scale form (as well as musical material), while perhaps Javanese, Balinese, Carnatic and some other musics have not changed so much in large scale form. We will touch upon questions of fixity and flux, preservation, authenticity and appropriation in the discussion section, but here let it suffice simply to point out that opportunities for structural change always exist, and may be of occasional interest, both for work that is intentionally hybridising (such as we briefly mentioned in Section 2 above), and beyond.

Computational devices provide many novel means for creating hierarchical structure. On the one hand, there are knowledge-based approaches, meaning code is written for the purpose of creating music and musical structure that depends on the prior knowledge and intentions (McLean & Dean, 2018) of the coders (e.g., IRCAM). On the other, machine learning (ML) using deep networks (several so-called 'hidden layers' of computational units, with millions or billions of adjustable/trainable parameters), works on a hopefully apt representation of acoustic or symbolic music (or on audio signals directly). ML then learns its features in one of many quite different ways, such that when perturbation of those layers is used to generate fresh musical output, different outcomes from those of the knowledge-based human approach could emerge. There is a sense in which ML might be used not only to represent musical knowledge in a different way from those of music analysts, but also to explore the spaces within, between and around its latent knowledge (potentially post-human) to complement the comparable exploration of human-defined musical spaces (Dean & Forth, 2018).

Most ML music generation has nevertheless sought to create further exemplars of familiar kinds of music (ultimately for commercial purposes), but this need not be the case. A variety of techniques such as reinforcement learning and generative adversarial nets can in principle select for 'successful' generative outputs with success defined in any way one chooses, or on the basis of extreme compositional exemplars (Chollet, 2021). Of particular interest to author RTD is the idea of using layers of ML in which extreme or very speialised data condensation occurs. Embedding layers are a site at which many of the generalisable relations between the encoded elements of the complete material (e.g., words) may be summarised, and in a variety of different ways. Thus directly manipulating the information in such layers during the generative use of a trained model offers a promising approach to the generation of controlled, hence personalisable, diversity. In a sense, human knowledge and preference can be temporarily downplayed (during the machine training), and then readily brought back into play, to allow an interaction between algorithmic (knowledge driven) and machine learned processes. Currently it is considered that the limitations of ML in generating music are particularly to do with a lack of large-scale structure: an attempt to overcome this uses 'attention' within networks (in which predictions of the next event take weighted account of all prior events), and while this is successful with language it seems less so with music. But this problem of temporal scale can clearly be overcome, for example by including hierarchical structure generator systems within the ML computation, and selecting amongst these by different criteria from those used to select the basic material itself (notes, sounds).

In this section we have touched on continua between hierarchical features, and their reordering or overlaying, and generation of novel hierarchies. Our remaining exploratory feature, partial randomisation, is also applicable, especially in composition, and with more difficulty in acoustic or electroacoustic improvisation: but computer-mediation can assist. Each of these aspects is one to which a music maker can apply their own affective and perceptual preferences.

3.6 Creator interactions

So far we have largely discussed the material outputs of music, but of course musicking (Small, 1998) is a process involving people and their interactions with each other and with components of their environment, usually at all stages, but certainly at some. People happily are full of continuous variables, even though discontinuities can occur. Is there remaining scope for consideration of our emphasis on exploiting continua and unconventional approaches, even within the

music creator's interactions?

Inter-performer interactions have now attracted fairly substantial study, most based on performance reproduction of scores, but some on improvisatory creation. Music learning can benefit from 'shared, in-the-moment, musical experience', both with people and machines (Schiavio *et al.*, 2020), and such experience may also have pro-social benefits (Dingle *et al.*, 2021). Keller and colleagues have focused on inter-personal entrainment, and related cognitive and neural mechanisms (e.g., (Clayton *et al.*, 2020). Not surprisingly, little has been done on creator-creator interactions in composition because of its relative rarity and its long time scales, though intermedia collaboration is an important field for composers.

Some relatively unexplored creative possibilities will probably be obvious, so we will merely comment on a small number. In many musical contexts predictable responsiveness is the ideal: for example, in coordinated timing in producing a shared event. But a composer seeking a mobile note texture may instead want uncoordinated events, both in timing and pitch. More extremely, can one improvise music in a non-responsive way, as suggested by Derek Bailey? It seems from our experience to be difficult, but certainly of interest, to pursue one's own path in a piece, with as little regard as possible for other occurrences. Distant, mutually inaudible performance by groups of musicians is also of interest. Once one is a machine, non-responsiveness becomes rather easier. A machine may or may not be endowed with any listening capacities. In addition, everyone (and every machine) has 'perceptual', analytical and capacity limitations, so for example, identifying the degree to which another entity is interacting with oneself becomes near impossible in larger groups. This should mean that we can all become used to functioning in the presence of "non-responders" and might facilitate our acting as one if we so wished. In a computer music performance group (or a large-scale computer composition) this could be modelled/controlled statistically: for example, a programmed (or randomised) progression from each computer's sound being available to its user or audience, towards a condition where only the sound of one computer could be, is entirely feasible. This "non-response" condition can even be achieved similarly with acoustic instruments and microphones, given a physical separation between two groups of performers and one group of audience members. We have used a variant of this process to control a variable delay with which improvised sound from one performer is made available to others and/or to the audience. While computer music has commonly been quite exploratory, it probably lags significantly in respect to computational control and mimicry of interaction. Note also that music creators may interact not only with other people or with active machines, but also with any preformed artistic objects or media. Again one might argue that music has lagged behind text or visual media in exploiting and generalising such possibilities, in spite of genres such as opera.

On a different interaction continuum, intercultural music making may reveal significant contrasts between creators or audience members and their backgrounds in what is predictable. This can be both informative, instructive, and sometimes drive social cohesion (see further comment in the next section). More generally, can we learn to respond to events in very different ways, according to context or preference (coherence or subversion)? No doubt, and this is one of the obvious cognitive routes towards maximising the potential of a creator's interactions, whether with other human or machine creators, or whether the interactive force working on a creator is an environment, a process, another pre-formed sound or another medium. All of the exploratory routes we advocate are accessible in principle.

4 Discussion

We have indicated in 3.2 (and see (Dean & Bailes, 2006)) that as sound was first organised by humans (in a proto- or pre-cultural fashion), and as music originated, there was already an infinite set of possibilities, notably in harnessing the vocal tract, that it could have used. Subsequently, metacultural knowledge began to accumulate and be distributed, some using tools as additional sound sources (Dean & Bailes, 2007). Can it provide us the same freedoms now? Or are there necessary limits, like those of communicating across languages, as we have raised above? Can exploratory processes such as we have described overcome those language disparities and discontinuities? Are all cultures in flux, or can some really display fixity in spite of all cultural, commercial, political and social influences? How *should* a musical exploration interact with a prior tradition with which it shows overlaps? Should such exploration be reminiscent of the genre of hauntology, which attempted some decades later a further exploration of unfulfilled musical ideals within some subcultural genres amongst 1960s Britain (Born & Haworth, 2017)? These questions all bring up perceptual, cognitive, philosophical and socio-cultural issues, that mostly await full experimental/empirical dismantling. We will suggest some aspirations that

seem to us equitable bases for seeking positive rather than destructive outcomes from the exploratory and creative interrogation of all musical spaces.

First, we assume that it is reasonable for a trained musician in any culture to be free to choose whether and in what forms (computational, instrumental/performative etc) to engage with either metacultural or intercultural creation and performance, always depending on the reciprocal willingness of intercultural collaborator(s) when involved. This indicates that we should ideally be able to respect and develop some appreciation of the traditions of music in which we are not versed but to which we become exposed, and to gain some reciprocation. This reciprocal respect can extend to mutually assessing the degree to which an intercultural collaboration will indeed be reciprocal.

Many questions flow immediately. There is no doubt we should respect the collaborative intents and limits of our partners. But what if those intents are disparate, within an occasion or beyond? And what of the use of materials from another culture that have been recorded and may be accessed without contact with a collaborator? Some cultural corpora make their terms of use very clear, others imply no usage limitations, more in keeping with current day 'open access' to knowledge and data, however disputed or exploited it may be in commercial contexts. Compare the diverse access terms for Freesound (an acoustic sound corpus) and CompMusic (a developing cross-cultural symbolic corpus) both from Universitat Pompeu Fabra in Barcelona; the recommended terms of study of the materials of the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS, Canberra); and those of the Pacific and Regional Archive for Digital Sources in Endangered Cultures (PARADISEC), derived from three Australian Universities. Without a collaborative contact, access could often be deemed one of appropriation rather than collaboration or intercultural effort. There seems no obvious solution to this conundrum beyond trying to retain the objective of achieving something positive in a musical output, while not inflicting damage. But an individual cannot securely judge that from their own position alone. That task becomes impossible, and we have to accept potential limitations, once raised. It has often been observed (and is confirmed first-hand by author SJE) that some Indian musicians may perform and expect at one point a very traditional style (which they may refer to as 'classical') while at other points they accept intercultural inputs (whether delivered by a live collaborator or previously acquired) and produce more varied outputs (which they may describe as 'fusion', or even 'jazz'). Their expectations may also be just as varied and sometimes even more restrictive when it comes to playing with musicians from other parts, communities or castes of India than their own.

Is there a huge danger in data mining the musical methods of another culture, especially without contact with its current protagonists? Or even of another period of one's own culture?? (Composer George Rochberg could not have known Ludwig van Beethoven, yet in some sense he deeply mined the data of some Beethoven string quartets.) Possibly there is such a danger, but it should not be extreme if we encourage and respect the continuation of that culture, and seek to use our new-found knowledge to make new musical forms rather than recreate old ones (which is likely the intent of Rochberg and his powerful works).

Cultural features such as languages are disappearing at drastic rates, even if some are being documented. Their practice is being lost. On the other hand, some at least of their artefacts can be preserved, and appreciated in the future. If we continue to seek to understand musical others, albeit from a necessarily different viewpoint, we can also contribute to the preservation of particular earlier traditions. To some degree, earlier traditions suffer the same distancing with time and place whether they derive from our own or another culture. We have no solutions to this fundamental problem, beyond taking as much care with the influence of surrounding power structures as possible. As a consequence, we propose that creative usage of the fullest possible range of musical materials, as we have argued in the article, is the most positive response.

As mentioned, both acoustic and symbolic libraries of musical corpora from many cultures already exist, and they are being mined by ML as well as by music information retrieval and more traditional music-analytical tools. Probably the only pragmatic approach to this fact is to encourage users of these corpora to consider how best to make their usage constructive, positive and as we have suggested, to minimise its destructiveness. For us, using it to create, rather than to recreate (unless for a purely scientific experimental purpose, rather than an expressive cultural one) is one of the paths towards making the usage respectful, constructive and acceptable.

Urban emphasised the commercial fluxes that have caused global cultural change (Urban, 2001). But musical commerce has changed drastically in recent decades, partly as a consequence of digital streaming: the monetary value associated with the playing of a composition on Spotify is almost undetectable, so that few music creators now make significant parts of their livelihood

from creating the works. A few can do so from performing them. This 'disintermediation' (Born & Haworth, 2017) should make it if anything easier for us to maintain metacultural approaches to musical exploration that are at least respectful (if not highly remunerative). The drastic limitations that public broadcasters and streaming services such as iTunes and Spotify place upon the presentation of unfamiliar music, and the contrasting greater openness of presentation by musical creators and performers has been demonstrated recently (e.g., (Chambers, 2023, 2024a, 2024b)).

The effects of intercultural music making have been investigated in depth in a few contexts, such as within the highly multi-cultural and adventurous Norwegian music education system around Oslo (Skyllstad, 1996). In this study, students listened to and undertook musical activities related to various musics from Asia, Africa and the Americas, interacting with each region for a year, over a three-year period. Several significant benefits for both musical and inter-personal understanding, and social cognition and cohesion were observed. As Bhabha has argued (Bhabha, 2012), processes of 'performance' (in a broad sense), may often be important pro-social factors, as seems to be the case in Skyllstad's study, and many others.

There are several respects in which the broad metacultural musical exploration we advocate can interact with these necessarily narrower intercultural processes. Some of the techniques a musician can develop while exploring can not only enable novel creative techniques and expressions, but also facilitate intercultural participation. To take an extreme example, the use of continuous pitch flux, in contrast to the normal discontinuous systems, should make it easier for musician (A) to understand and perform with another (B) whose different cultural background involves strong use of continuous pitch, but also with another (C) who uses a very different discontinuous system from that of A. In turn, this could enhance the educational and sociocultural benefits of intercultural music making. Similarly, musical exploration may bridge the gaps between certain music systems, achieving a reciprocal and mutual enabling of access. For example, the acoustic 'roughness' (a physical measure of the overlap of spectral peaks in a sound) of the Balinese gamelan can be shared by appropriately prepared vibraphones or pianos, or by virtual computational instruments.

5 Conclusions

The image of metacultural creative exploration in music that we have been presenting has much in common with that of the post-Deleuzian philosophical tradition, heavily influenced by the concept of the rhizome and of the inevitability of processes of both territorialization and deterritorialization. We note that the idea of an 'ocean of sound' ((Toop, 1995) can be seen as proposing that any sound is usable in processes of sonic organisation and music making, akin to Xenakis' ideas of metamusic. A strong and appealing metaphor has been developed from this by Swiss musician and philosopher F.J. Bonnet who describes music and 'the music to come' as potentially comprising a mutable 'sonorous archipelago' (Bonnet, 2019). One can envisage islands of activity popping up in the grand ocean, later deterritorialised by the sea as another set of islands partially take over, in a global metacultural process. In a subsequent stimulating polemic, Bonnet argues (p.9) that "music remains to be discovered, that it is still hidden. ….. what we have hitherto referred to as 'music' is only a preliminary, a prodrome". He moderates this forceful claim by ambivalently concluding that "Music is always yet to come" (p.49) (Bonnet, 2020).

Our discussion indicates that there may be no simple solutions to balancing exploration and cultural diversity and distinctiveness. But we remain optimistic that maximising the breadth of musical expression is desirable, and that exploration of the sonic materials is an important part of the future of that expression. Humans, algorithms and machine learning, or eventually even the future achievement of genuine artificial general intelligence (Chollet, 2019)) will all contribute. ML can already provide machine improvisers and composers that can avoid mimesis, and yet be memetic (show repetition and transformation over a reasonable time frame). But so far these ML systems mostly remain shallow, largely because they are not focused on novelty generation: an exciting set of developments awaits us.

Meanwhile we should not neglect the profound potentials of intermedia usage of music, both for its own development, and for its impacts. Sound is a dramatic influence on the perception and cognition of image, in artistic (Smith, 2007) as well as routine environments. An artistic form of algorithmic synaesthesia between sound and image has even been proposed (Dean *et*

al., 2006). And musico-literary 'miscegenation', as Smith constructively dubs this potential interaction between sound and word (Smith, 2016), can be of comparable creative import given our current technical opportunities, as in the field of electronic literature.

Evaluation of whether any of the proposed metacultural approaches aid generation, perception and cognition of expression/meaning/affect will be just as complicated as evaluating those aspects of any piece of music. And this needs to be done in a non-biasing context in which several different works are comparatively assessed, which is not easy to achieve experimentally. On the other hand, as always, an individual can choose their own music, and musicians themselves can be amongst the best people at promoting and maintaining diversity in the music that is mediated to the public (unlike most broadcasters, or playlists, as described above). Evaluation of prosocial impacts of intercultural music, of the metacultural interrogation we propose, or for that matter of music at large, is also extremely difficult (notably because of the requirement for long term observation). At least some prior case studies are positive and hence continue to encourage interest in the prospects we raise, for society at large as well as for individual music creators and their collaborators.

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